The following supplement accompanies the article

Benthic food-web succession in a developing salt marsh

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Supplement. Additional site information and isotopic analysis data

Study site

The Mission Bay marshes (Fig. S1) are subject to California's mixed semidiurnal tidal regime with 2 high and 2 low tides (of differing amplitude) each day. Additionally, there are weekly and seasonal patterns of greater (2 sets, spring) and lesser (2 sets, neap) amplitude tides per lunar cycle, and greatest tidal amplitudes around the December and June equinoxes. Our sampling was concentrated to intertidal, low-marsh habitats dominated by *Spartina foliosa*.

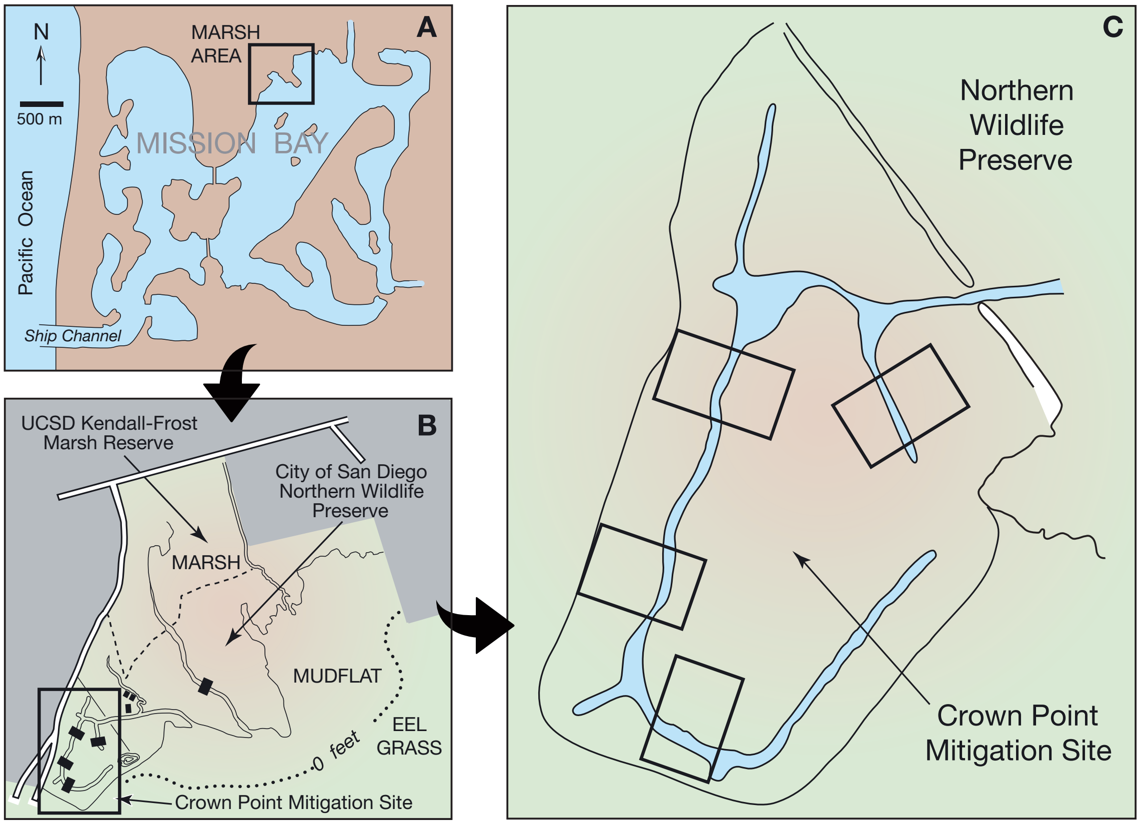

Fig. S1. (A) Location of the Crown Point Mitigation Site (created in December 1995) and the adjacent natural marsh (Northern Wildlife Preserve) in Mission Bay, San Diego, CA. (B) Black rectangles show 4 sampling plots in the natural marsh and in the created marsh, with (C) a close-up of the latter (modified from Currin et al. 2011).

Isotope sample collection and processing

Primary producers and consumers in the natural and the developing marsh were collected, pretreated and analyzed for natural abundances of carbon and nitrogen stable isotope ratios as described in Currin et al. (2011). In brief, we collected infaunal invertebrates by coring, and epifauna, macroalgae and plants by hand. Fishes were collected in marsh creeks using unbaited minnow traps and throw nets. The infauna were sorted live, identified and stored in filtered seawater (<25 μm) overnight to allow for clearance of guts. Samples were acidified (1 N HCl) for removal of carbonates. Fishes (Fundulidae, Gobiidae) and epifauna (Gastropoda, Bivalvia, Decapoda) were dissected for muscle tissue. Samples consisted of a single individual, unless pooling of several individuals was necessary to achieve required sample mass.

Stable isotope ratios (^{13}C:^{12}C or ^{15}N:^{14}N) were expressed relative to international standards (V-PDB for carbon and atmospheric N_2 for nitrogen) using δ notation, e.g. $\delta\,^{13}C_{sample}$ (‰) = $[(^{13}C/^{12}C_{sample})/(^{13}C/^{12}C_{standard})–1] \times 10^3$. The corresponding analysis was conducted on primary producers and consumers collected during the stable isotope enrichment experiments (Table S1).

Table S1. Trophic links to marsh consumers identified during stable isotope enrichment experiments. Maximum and, within parentheses, mean incorporation of stable isotope labels are shown. Values in brackets show late incorporation with no early samples (t_{24}–t_{144}) available

		Year	**2001**		**2002**		**2002**		**2002**		**2002**	
		Basal group	**Microalgae**		**Microalgae**		**Cyanobacteria**		**Bacteria**		***Spartina foliosa***	
		Heavy isotope	^{13}C		^{13}C		^{15}N		^{13}C		^{15}N	
		Labeled value	n/a		+26 to +101		+71 to +576		+1 to +21		+345 to +860	
		Background value	n/a		-17 to -13		-0.3 to +3		-24 to -28		+4 to +6	
Taxa, trophic group			Natural	Created	Natural	Created	Natural	Created	Natural	Created	Natural	Created
Poduridae	Collembola	Herbivore							4 (3)		100 (54)	
Orchestia traskiana	Crustacea	Herbivore							-2		154	
Corophium sp.	Crustacea	Microalgivore, detritivore		26 (17)								
Tanaidacea	Crustacea	Microalgivore, detritivore		[12]								
Ceratopogonidae	Insecta	Microalgivore	15 (9)	61 (32)	13	79 (78)	[11]	118 (59)		8 (7)	[11]	14 (13)
Dolichopodidae	Insecta	Carnivore		2		61		75		8 (5)	[25]	9 (7)
Chironomidae	Insecta	Microalgivore, detritivore	26 (13)	46								
Psychodidae	Insecta	Detritivore	0								[39]	
Staphylinidae	Insecta	Carnivore				[11]		1				
Nemertea	Nemertea	Carnivore		4		7		1	-6	14	-1	0
Enchytraeidae	Oligochaeta	Detritivore	2	1	0		4		15 (10)		26 (15)	
Tubificoides brownae	Oligochaeta	Detritivore									[33]	[28]
Polydora sp.	Polychaeta	Microalgivore, detritivore		13 (8)		14		-3		49 (26)		28 (20)
Capitella sp.	Polychaeta	Detritivore	-2	8 (4)						19 (12)		42 (28)

- no/negligible moderate incorporation, <10‰
- moderate incorporation, ≥10‰
- very high incorporation, ≥25‰
- late uptake
- No data available for trial/no late uptake

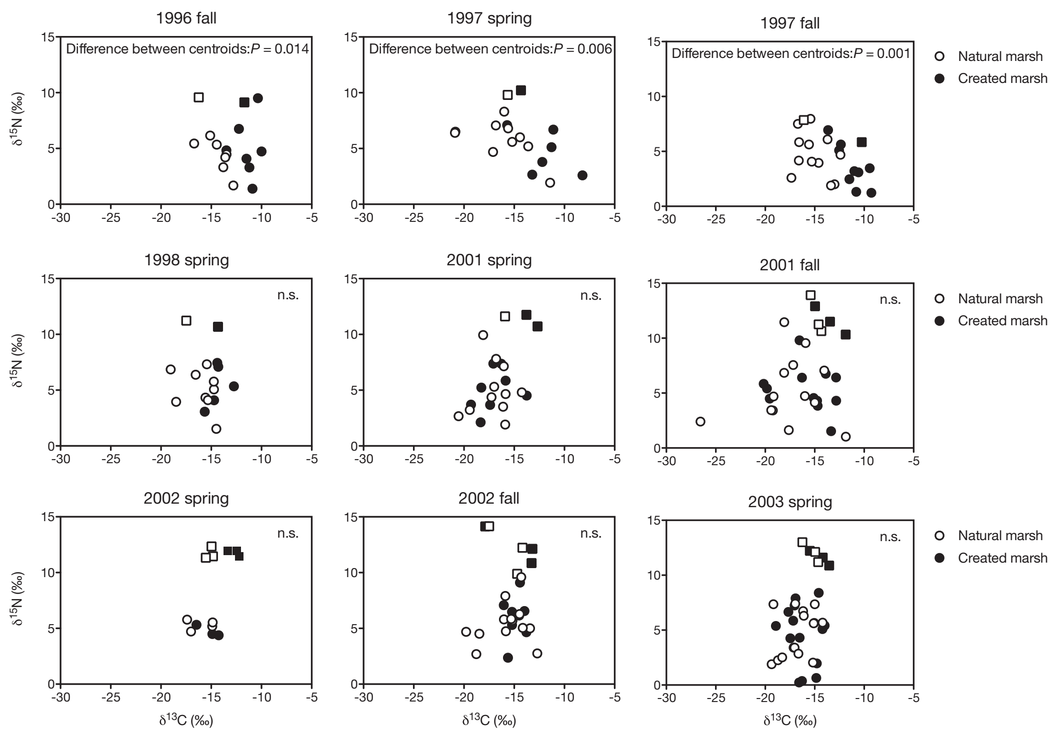

Fig. S2. $\delta^{13}C$ and $\delta^{15}N$ values (n = 6–18) of consumers in natural and created *Spartina foliosa* marshes. Circles indicate macroinvertebrates and squares indicate fishes. Each point represents the mean value for a particular taxon. The consumer assemblage positions in isotope space differed (residual permutation procedure) during the first 2 yr of the developing marsh (top 3 panels)

Table S2. Comparison of isotopic niche properties (centroid location, mean distance to centroid, mean distance to nearest neighbor, and difference between standard ellipse area [SEA]) (A) within the mature marsh, (B) within the young marsh and (C) between marsh types. Absolute distances and differences significantly different from zero shown in bold. S: spring; F: fall

			Centroid location		Distance to centroid		Nearest neighbor		SEA
			Distance	p	Difference	p	Difference	p	p
(A) Natural marsh									
1996 F	vs.	1997 S	2.008	0.144	0.716	0.373	0.016	0.980	**0.034**
1997 S	vs.	1997 F	1.619	0.170	0.475	0.440	0.330	0.366	0.879
1997 F	vs.	1998 S	1.272	0.288	0.172	0.751	0.749	0.059	0.668
1998 S	vs.	2001 S	0.747	0.734	0.372	0.619	0.320	0.448	0.746
2001 S	vs.	2001 F	0.911	0.754	1.491	0.086	0.577	0.371	**0.008**
2001 F	vs.	2002 S	1.437	0.623	0.252	0.811	0.735	0.428	**0.032**
2002 S	vs.	2002 F	0.615	0.858	0.956	0.324	0.016	0.984	0.647
2002 F	vs.	2003 F	1.076	0.477	0.045	0.950	0.504	0.103	0.768
(B) Created marsh									
1996 F	vs.	1997 S	0.864	0.758	0.445	0.567	0.874	0.195	0.832
1997 S	vs.	1997 F	1.991	0.146	0.978	0.166	**1.342**	**0.008**	**0.037**
1997 F	vs.	1998 S	**4.048**	**<0.001**	0.250	0.695	0.416	0.506	0.632
1998 S	vs.	2001 S	2.511	0.240	1.427	0.261	0.452	0.603	0.945
2001 S	vs.	2001 F	1.789	0.332	0.062	0.938	0.507	0.418	0.813
2001 F	vs.	2002 S	1.252	0.692	1.123	0.250	0.430	0.671	0.740
2002 S	vs.	2002 F	1.390	0.590	1.761	0.149	0.202	0.855	0.719
2002 F	vs.	2003 F	2.199	0.122	0.443	0.563	0.697	0.188	0.695
(C) Natural versus created marsh									
1996 F			**3.129**	**0.01**	0.515	0.477	0.205	0.616	0.770
1997 S			**3.927**	**0.003**	0.243	0.770	1.095	0.116	0.502
1997 F			**4.147**	**<0.001**	0.259	0.546	0.082	0.806	0.824
1998 S			1.938	0.190	0.181	0.833	0.250	0.746	0.787
2001 S			0.280	0.965	0.873	0.348	0.521	0.419	0.656
2001 F			1.689	0.359	0.679	0.388	0.563	0.289	0.873
2002 S			1.636	0.567	0.695	0.601	0.602	0.437	0.578
2002 F			1.328	0.422	0.109	0.907	0.384	0.406	0.806
2003 f			0.566	0.777	0.288	0.645	0.191	0.376	0.640

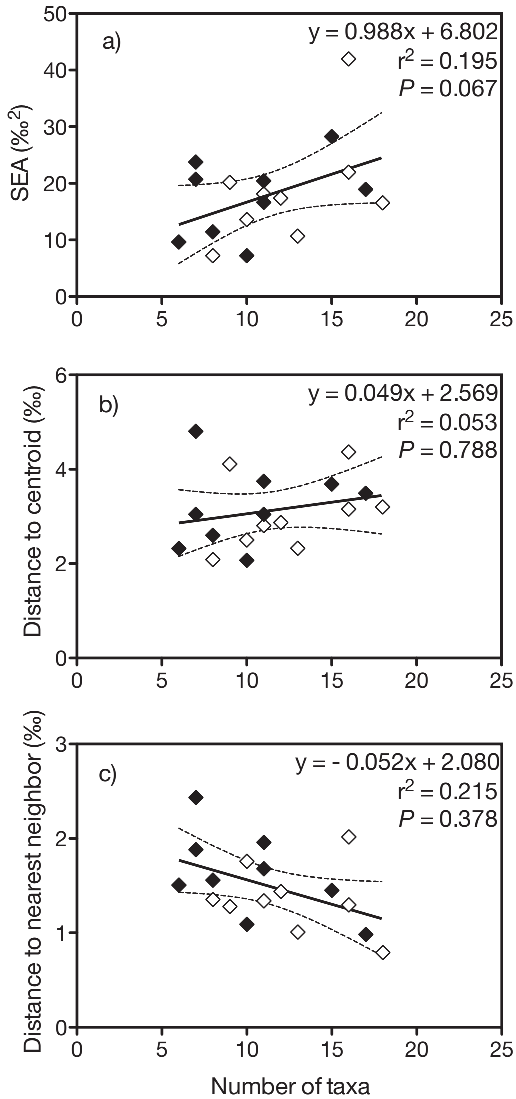

Fig. S3. The relationship between number of taxa included in the analyses and (a) standard ellipse area (SEA), (b) distance to centroid and (c) distance to nearest neighbor for each sampling date as a function of marsh type. Lines show slope with 95% confidence intervals from linear regression. Open symbols represent the natural marsh and closed symbols represent the created marsh