The following supplement accompanies the article

Dominant macrobenthic populations experience sustained impacts from annual disposal of fine sediments on sandy beaches

Lisa M. Manning[1,3], Charles H. Peterson[1,*], Melanie J. Bishop[2]

[1]University of North Carolina at Chapel Hill, Institute of Marine Sciences, Morehead City, North Carolina 28557 USA
[2]Department of Biological Sciences, Macquarie University, New South Wales 2109 Australia

[3]*Present address:* National Oceanic and Atmospheric Administration, 1315 East-West Highway, SSMC3, Silver Spring, MD 20910 USA

*Corresponding author: cpeters@email.unc.edu

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Table S1. PERMANOVAs testing for sources of spatio-temporal variation in (a) median grain size and (b) sediment sorting, on control and disturbed beaches. Tr: Treatment (2 levels: control, disposal); Ye: Year (2 levels: 1, 2); Mo: Month (10 levels: Dec, Feb, Mar, Apr, May, Jun, Jul, Aug, Sep, Oct); Si: Site (2 levels nested within control beaches; 2 levels nested within disposal beaches); p-*F*: pseudo-*F*; n = 3 transects; p-values in **bold** are significant at $\alpha = 0.05$. See Table 1 in the main text for tidal zone definitions

(a)

Median Grain Size		Tidal zone 1			Tidal zone 2			Tidal zone 3			Tidal zone 4			Tidal zone 5		
Source	df	MS	p-*F*	p	MS	p-*F*	p	MS	p-*F*	p	MS	p-*F*	p	MS	p-*F*	p
Tr	1	13663	138.7	**0.001**	40343	30.4	**0.001**	120260	11.2	0.321	48561	3.8	0.343	76500	2.9	0.335
Ye	1	1512	1.9	0.297	217	0.1	0.752	14323	5.3	0.154	8051	5.5	0.148	8	<0.1	0.825
Mo	9	1385	2.9	0.062	4444	5.3	**0.005**	3845	1.1	0.419	5458	3.0	**0.048**	1456	1.2	0.349
Si(Tr)	2	83	0.3	0.761	1396	2.7	0.078	11569	12.5	**0.001**	13937	20.6	**0.001**	2826	3.3	**0.038**
Tr x Ye	1	4367	5.6	0.129	7678	0.4	0.588	14134	5.2	0.183	928	0.6	0.518	16	<0.1	0.761
Tr x Mo	9	3379	7.0	**0.002**	4832	5.7	**0.012**	4290	1.2	0.365	5597	3.0	**0.047**	981	0.8	0.602
Ye x Mo	3	2906	9.5	**0.001**	1709	3.3	**0.028**	3506	3.8	**0.015**	744	1.1	0.346	688	0.8	0.388
Si(Tr) x Ye	2	841	2.8	0.074	2223	4.3	**0.021**	2948	3.2	**0.047**	1564	2.3	0.103	63	0.1	0.884
Si(Tr) x Mo	15	489	1.6	0.111	855	1.7	0.063	3646	3.9	**0.001**	1881	2.8	**0.004**	1231	1.4	0.159
Tr x Ye x Mo	3	2894	9.5	**0.001**	3636	7.1	**0.002**	11671	12.6	**0.001**	2871	4.2	**0.007**	1777	2.1	0.130
Si(Tr) x Ye x Mo		No test			No test			No test			No test			No test		
Res	90	306			463480			9231			6765			8606		

(b)

Sorting		Tidal zone 1			Tidal zone 2			Tidal zone 3			Tidal zone 4			Tidal zone 5		
Source	df	MS	p-*F*	p	MS	p-*F*	p	MS	p-*F*	p	MS	p-*F*	p	MS	p-*F*	p
Tr	1	24496	58.3	**0.001**	110350	68.7	**0.001**	114290	49.3	0.347	48189	24.9	0.316	12799	11.6	0.353
Ye	1	16057	3.0	0.231	9445	0.9	0.444	6971	1.4	0.386	2349	2.5	0.255	254	0.2	0.666
Mo	9	39066	1.8	0.157	5192	1.7	0.182	3494	0.9	0.555	3825	0.9	0.508	1603	0.8	0.630
Si(Tr)	2	396	0.5	0.588	1663	1.8	0.196	2417	2.1	0.126	1980	1.4	0.268	1118	1.2	0.327
Tr x Ye	1	19928	3.8	0.201	8430	0.8	0.447	8157	1.7	0.337	691	0.7	0.496	166	0.1	0.715
Tr x Mo	9	8592	3.6	**0.010**	8617	2.9	**0.037**	9525	2.4	0.071	4177	1.0	0.482	1442	0.7	0.706
Ye x Mo	3	6023	8.0	**0.002**	1488	1.6	0.192	352	0.3	0.839	605	0.4	0.712	733	0.8	0.534
Si(Tr) x Ye	2	5847	7.7	**0.002**	11593	12.2	**0.001**	5359	4.6	**0.012**	897	0.6	0.535	1182	1.2	0.316
Si(Tr) x Mo	15	2433	3.2	**0.002**	3086	3.3	**0.001**	4107	3.5	**0.001**	4247	3.0	**0.001**	2106	2.2	**0.013**
Tr x Ye x Mo	3	5505	7.3	**0.001**	7044	7.4	**0.001**	14497	12.4	**0.001**	4659	3.3	**0.029**	3324	3.4	**0.021**
Si(Tr) x Ye x Mo		No test			No test			No test			No test			No test		
Res	90	757			948			1173			1413			970		

Table S2. PERMANOVA testing for sources of spatio-temporal variation in turbidity. Ti: Time (14 levels, see Fig. 3 in the main text); Tr: Treatment (2 levels: control, disposal); Si: Site (2 levels nested within control beaches; 2 levels nested within disposal beaches); p-*F*: pseudo-*F*; n = 6; p-values in **bold** are significant at $\alpha = 0.05$

Source	df	MS	p-*F*	p
Ti	13	8758	17.6	**0.010**
Tr	1	4967	5.8	**0.001**
Si(Tr)	2	1153	84.0	**0.001**
Ti x Tr	13	8147	16.4	**0.013**
Ti x Si (Tr)	8	545	39.7	**0.001**
Res	176	14		

Table S3. PERMANOVAs testing for sources of spatio-temporal variation in dominant macrofaunal taxa, on control and disturbed beaches. Tr: Treatment (2 levels: control, disposal); Ye: Year (2 levels: 1, 2); Mo: Month (10 levels: Dec, Feb, Mar, Apr, May, Jun, Jul, Aug, Sep, Oct); Si: Site (2 levels nested within control beaches; 2 levels nested within disposal beaches); p-*F*: pseudo-*F*; n = 3 transects; p-values in **bold** are significant at $\alpha = 0.05$

		Donax variabilis			*Emerita talpoida*			*Scolelepis squamata*		
		MS	p-*F*	p	MS	p-*F*	p	MS	p-*F*	p
Tr	1	27019	29.7	**0.001**	11530	7.5	**0.001**	17678	3.0	**0.001**
Ye	1	4454	9.2	0.124	6385	2.8	0.213	10988	70.6	0.017
Mo	8	13743	22.9	**0.001**	5629	11.2	**0.001**	10607	24.6	**0.001**
Si(Tr)	2	909	1.5	0.209	1536	7.0	**0.002**	5890	28.8	**0.001**
Tr x Ye	1	2137	4.4	0.224	126	<0.1	0.873	3793	24.4	**0.050**
Tr x Mo	8	3957	6.6	**0.002**	1181	2.4	0.060	3859	8.9	**0.001**
Ye x Mo	7	10030	42.1	**0.001**	2191	3.4	**0.020**	5355	6.9	**0.002**
Si(Tr) x Ye	2	486	0.8	0.477	2271	10.3	0.001	156	0.8	0.489
Si(Tr) x Mo	16	601	1.0	0.437	502	2.3	**0.009**	431	2.1	**0.015**
Tr x Ye x Mo	7	1674	7.0	**0.002**	1327	2.1	0.086	2653	3.4	**0.027**
Si(Tr) x Ye x Mo	14	238	0.4	0.970	646	2.9	**0.002**	774	3.8	**0.001**
Res	136	593			220			204		

		Haustorius sp.			*Parahaustorius longimerus*			*Amphiporeira virginiana*		
		MS	p-*F*	p	MS	p-*F*	p	MS	p-*F*	p
Tr	1	2126	1.5	**0.001**	71434	2.6	0.362	12972	11.4	**0.001**
Ye	1	1331	0.3	0.777	8485	1.3	0.375	1843	1.8	0.315
Mo	8	7663	3.2	**0.039**	14335	2.6	**0.046**	1449	2.1	0.099
Si(Tr)	2	1390	1.3	0.272	27520	8.3	**0.001**	1141	1.3	0.306
Tr x Ye	1	9157	2.1	0.238	7897	1.2	0.415	1522	1.5	0.379
Tr x Mo	8	4092	1.7	0.153	11835	2.2	0.081	1053	1.5	0.217
Ye x Se	7	14085	4.1	**0.010**	6825	0.6	0.835	1058	0.7	0.746
Si(Tr) x Ye	2	4439	4.2	**0.022**	6519	2.0	0.122	1045	1.2	0.343
Si(Tr) x Mo	16	2360	2.2	**0.009**	5416	1.6	0.061	687	0.8	0.808
Tr x Ye x Mo	7	2839	0.8	0.574	6725	0.5	0.831	886	0.6	0.831
Si(Tr) x Ye x Mo	14	3443	3.2	**0.002**	12372	3.7	**0.002**	1469	1.6	**0.036**
Res	136	1069			3329			892		

Table S4. PERMANOVAs testing for density-dependent effects of turbidity on the proportionate growth and weight gain of *Donax variabilis.* Tu: Turbidity (2 levels: control, enhanced); De: Density (2 levels: low, high); Ta: Tank (11 levels: nested within each Turbidity × Density treatment); p-*F*: pseudo-*F*; p-values in **bold** are significant at $\alpha = 0.05$

		Growth			*Weight gain*		
		MS	p-*F*	p	MS	p-*F*	p
Tu	1	0.17	17.1	**0.018**	3.24	17.5	**0.011**
De	1	0.16	15.6	**0.020**	1.67	9.0	**0.039**
Tu x De	1	0.17	17.2	**0.019**	2.69	14.5	**0.015**
Ta (Tu x De)	7	0.01	0.5	0.814	0.16	0.6	0.744
	2	909	1.5	0.209	1536	7.0	**0.002**
Res	204	0.03			0.26		