Supplementary Information:

Title:
Meta-analysis of oyster impacts on coastal biogeochemistry

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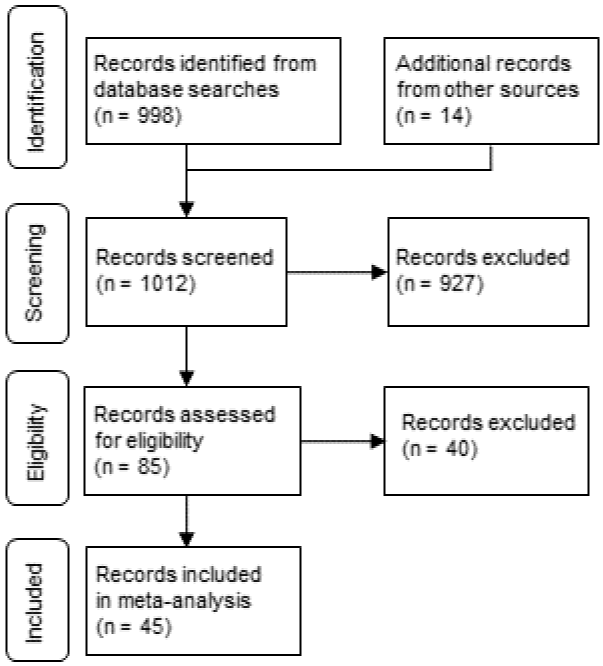
Supplementary Figure 1: Literature selection flowchart for this study, based on the flowchart from Maki et al. 2019[1].



Studies included in the meta-analysis:

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Supplementary Table 1: Results of tests to identify possible publication bias. When significant bias was identified using Egger's Test ($p \leq 0.05$), we removed the outlier studies and used the updated, outlier free model. There were not enough studies to perform outlier tests or publication bias tests for NO_2^- or DSi fluxes.

Effect Size Metric	**Random Effects Model (Before)**			**Publication Bias Test**		**Outliers**	**Random Effects Model (After)**			
	n	*g*	±95% CI	t-value	p-value	n	n	*g*	±95% CI	Change?
N_2 Flux (N_2/Ar)	20	0.617	0.284	3.124	0.006	1	19	0.682	0.276	Yes
N_2 Flux (IPT)	7	0.239	0.745	0.045	0.966	0	7	0.239	0.745	No
NH_4^+ Flux	25	0.750	0.377	1.757	0.092	4	21	0.692	0.372	No
NO_x Flux	12	0.406	1.577	0.432	0.675	2	10	0.354	0.594	No
NO_3^- Flux	9	0.012	0.478	-1.200	0.269	0	9	0.012	0.478	No
NO_2^- Flux	2	0.784	0.927	--	--	--	--	--	--	--
PO_4^{3-} Flux	12	0.561	0.319	-0.917	0.381	0	12	0.561	0.319	No
DSi Flux	2	0.375	0.974	--	--	--	--	--	--	--
CO_2 Flux	3	0.620	1.194	0.205	0.871	0	3	0.620	1.194	No
N_2O Flux	4	-0.771	2.969	-2.696	0.114	0	4	-0.771	2.969	No
CH_4 Flux	3	0.432	1.592	-0.063	0.960	0	3	0.432	1.592	No

Supplementary Table 2: Calculated Hedges *g*-values, 95% confidence interval range, and weight (determined using a random effects meta-analysis model) for each study included in sediment denitrification (net N_2 flux) meta-analysis. For context, small effect: $g = 0 - 0.2$, medium effect: $g = 0.2 - 0.5$, and a strong effect: $g > 0.5$[2].

Study	*g*	95% CI	% Weight
Porter et al. 2004	0.2185	-0.9181 – 1.3551	4.1
Piehler & Smyth 2011	0.7128	-0.1172 – 1.5427	5.7
Smyth et al. 2013a	0.5643	-0.2546 – 1.3833	5.7
Kellogg et al. 2013	1.7035	0.8656 – 2.5415	5.6
Higgins et al. 2013	0.5572	-0.3894 – 1.5038	5.0
Hoellein et al. 2015	0.5797	-0.5901 – 1.7419	4.0
Smyth et al. 2015 – low	1.2981	0.2570 – 2.3392	4.5
Smyth et al. 2015 – high	1.9519	0.7797 – 3.1241	3.9
Mortazavi et al. 2015	0.6502	-0.3588 – 1.6592	4.7
Testa et al. 2015	-0.0415	-0.8418 – 0.7587	5.8
Smyth et al. 2016	1.4092	0.2793 – 2.5391	4.1
Humphries et al. 2016 - Aquaculture	0.5520	-0.0379 – 1.1419	7.2
Humphries et al. 2016 - Reef	0.9822	0.3673 – 1.5971	7.1
Onorevole et al. 2018	0.1902	-0.1570 – 0.5374	8.9
Westbrook et al. 2019	-0.0114	-0.7044 – 0.6815	6.5
Smyth et al. 2013b	2.3369	-0.4295 – 5.1032	1.0
Ray et al. 2020	0.6437	-0.0323 – 1.3196	6.6
Hasset 2015	-0.0107	-1.1423 – 1.1209	4.1
Jackson 2019 – Ch. 4	0.7523	-0.1395 – 1.6442	5.3
Grand Mean	**0.6817**	**0.4053 – 0.9581**	**100**

Supplementary Table 3: Calculated Hedges *g*-values, 95% confidence interval range, and weight (determined using a random effects meta-analysis model) for each study included in sediment denitrification (Isotope Pairing Technique; IPT) meta-analysis. For context, small effect: $g = 0 - 0.2$, medium effect: $g = 0.2 - 0.5$, and a strong effect: $g > 0.5$[2].

Study	*g*	95% CI	% Weight
Higgins et al. 2013	-1.1986	-1.9848 – -0.4124	16.0
Hoellein et al. 2015	1.1916	-0.0808 – 2.4639	11.2
Smyth et al. 2018	0.7110	-0.2496 – 1.6716	14.1
Lunstrum et al. 2018	0.8785	0.2423 – 1.5147	17.5
Erler et al. 2017	-0.1995	-1.4442 – 1.0452	11.4
Hassett 2015	0.2618	-0.8770 – 1.4006	12.4
Vieilliard 2017	0.1863	-0.4686 – 0.8412	17.3
Grand Mean	**0.2387**	**-0.5069 – 0.9843**	**100**

Supplementary Table 4: Calculated Hedges *g*-values, 95% confidence interval range, and weight (determined using a random effects meta-analysis model)for each study included in sediment ammonium (NH_4^+) meta-analysis. For context, small effect: *g* = 0 - 0.2, medium effect: *g* = 0.2 - 0.5, and a strong effect: *g* > 0.5[2].

Study	*g*	95% CI	% Weight
Boucher-Rodoni & Boucher 1990	1.3735	0.1827 – 2.5643	3.8
Mazouni et al. 1996	0.7384	0.3828 – 1.0941	4.7
Porter et al. 2004	1.2113	0.1846 – 2.2380	4.0
Green et al. 2012	0.4180	-0.4455 – 1.2815	4.2
Smyth et al. 2013a	0.6310	-0.1927 – 1.4546	4.3
Kellogg et al. 2013	1.9174	1.0427 – 2.7875	4.2
Higgins et al. 2013	0.9867	-0.0066 – 1.9800	4.0
Green et al. 2013	0.4490	-0.6967 – 1.5947	3.8
Hoellein & Zarnoch 2014	0.1291	-0.0776 – 0.3359	4.8
Andrieux-Loyer et al. 2014	1.1161	0.6548 – 1.5774	4.6
Hoellein et al. 2015	0.4778	-0.6776 – 1.6332	3.8
Smyth et al. 2015 – low	0.2252	-0.7025 – 1.1529	4.1
Smyth et al. 2015 – high	0.6841	-0.2738 – 1.6420	4.1
Mortazavi et al. 2015	0.5069	-0.4909 – 1.5046	4.0
Testa et al. 2015	2.9066	1.7028 – 4.1104	3.8
Smyth et al. 2016	0.7649	-0.2615 – 1.7914	4.0
Smyth et al. 2018	-0.2895	-1.2196 – 0.6406	4.1
Lunstrum et al. 2018	1.5090	0.8156 – 2.2023	4.4
Smyth et al. 2013b	12.9279	0.3425 – 25.5133	0.2
Erler et al. 2017	0.7650	-0.5509 – 2.0720	3.6
Ray et al. 2020	0.3954	-0.2786 – 1.0694	4.4
Ayvazian et al. In Prep	1.6592	1.1860 – 2.1324	4.6
Hasset 2015	-0.6898	-1.8704 – 0.4908	3.8
Vieilliard 2017	-0.2888	-0.9460 – 0.3683	4.4
Jackson 2019 – Ch. 4	0.0447	-0.8108 – 0.9003	4.2
Grand Mean	**0.7495**	**0.3730 – 1.1260**	**100**

Supplementary Table 5: Calculated Hedges *g*-values, 95% confidence interval range, and weight (determined using a random effects meta-analysis model)for each study included in sediment phosphate (PO_4^{3-}) flux meta-analysis. For context, small effect: *g* = 0 - 0.2, medium effect: *g* = 0.2 - 0.5, and a strong effect: *g* > 0.5[2].

Study	*g*	95% CI	% Weight
Mazouni et al. 1996	0.8045	0.4466 – 1.1623	13.6
Gaertner-Mazouni et al. 2012	0.5297	-0.4729 – 1.5322	6.1
Kellogg et al. 2013	1.5124	0.7009 – 2.3240	7.8
Hyun et al. 2013	0.5271	-1.0270 – 2.0812	3.3
Andrieux-Loyer et al. 2014	0.9410	0.4891 – 1.3928	12.3
Hoellein et al. 2015	0.6686	-0.5091 – 1.8463	5.0
Lacoste & Gaertner-Mazouni 2016	0.3431	-0.5122 – 1.1984	7.4
Lunstrum et al. 2018	0.9586	0.3166 – 1.6007	9.8
Ray et al. 2020	-0.0923	-0.7617 – 0.5771	9.4
Ayvazian et al. In prep	0.3606	-0.0704 – 0.7915	12.6
Hasset 2015	-0.1763	-1.3112 – 0.9585	5.2
Jackson 2019 – Ch. 4	-0.1782	-1.0357 – 0.6793	7.4
Grand Mean	**0.5607**	**0.2421 – 0.8794**	**100**

Supplementary Table 6: Calculated Hedges *g*-values, 95% confidence interval range, and weight (determined using a random effects meta-analysis model)for each study included in sediment nitrate+nitrite (NO_x) meta-analysis. For context, small effect: *g* = 0 - 0.2, medium effect: *g* = 0.2 - 0.5, and a strong effect: *g* > 0.5[2].

Study	*g*	95% CI	% Weight
Mazouni et al. 1996	0.2037	-0.1411 – 0.5484	8.9
Porter et al. 2004	-0.0641	-0.9884 – 0.8601	8.6
Smyth et al. 2013a	-0.0914	-0.8921 – 0.7092	8.7
Kellogg et al. 2013	2.3291	1.3904 – 3.2678	8.6
Higgins et al. 2013	0.9594	-0.0303 – 1.9490	8.6
Smyth et al. 2015 – low	0.7907	-0.1784 – 1.7597	8.6
Smyth et al. 2016	-5.4333	-7.8127 – -3.0538	7.2
Smyth et al. 2018	6.6431	4.0197 – 9.2665	6.9
Smyth et al 2013b	0.7343	-1.0161 – 2.4846	7.9
Ray et al. 2020	-0.2342	-0.9051 – 0.4366	8.8
Hasset 2015	-0.0914	-0.8921 – 0.7092	8.7
Jackson 2019 – Ch.4	-0.5275	-1.4010 – 0.3460	8.7
Grand Mean	**0.4059**	**-1.1713 – 1.9830**	**100**

Supplementary Table 7: Calculated Hedges *g*-values, 95% confidence interval range, and weight (determined using a random effects meta-analysis model) for each study included in sediment nitrate (NO_3^-) flux meta-analysis. For context, small effect: *g* = 0 - 0.2, medium effect: *g* = 0.2 - 0.5, and a strong effect: *g* > 0.5[2].

Study	*g*	95% CI	% Weight
Boucher-Rodoni & Boucher 1990	0.6518	-0.4369 – 1.7404	8.8
Hoellein et al. 2015	0.1587	-0.9756 – 1.2929	8.5
Mortazvi et al. 2015	-0.3001	-1.2863 – 0.6862	9.8
Testa et al. 2015	-0.9831	-1.8391 – -0.1271	11.0
Lunstrum et al. 2018	0.3991	-0.2123 – 1.0106	13.8
Westbrook et al. 2019	0.5716	-0.1353 – 1.2786	12.7
Erler et al. 2017	-1.3891	-2.8548 – 0.0766	6.2
Ayvazian In Prep	0.1722	-0.2455 – 0.5898	16.0
Vieilliard 2017	0.0750	-0.5786 – 0.7286	13.3
Grand Mean	**0.0119**	**-0.4660 – 0.4898**	**100**

Supplementary Table 8: Calculated Hedges *g*-values, 95% confidence interval range, and weight (determined using a random effects meta-analysis model) for each study included in sediment silica flux meta-analysis. For context, small effect: $g = 0 - 0.2$, medium effect: $g = 0.2 - 0.5$, and a strong effect: $g > 0.5$[2].

Study	*g*	95% CI	% Weight
Gaertner-Mazouni et al. 2012	0.4416	-0.5541 – 1.4373	56.6
Green et al. 2013	0.2870	-0.8504 – 1.4243	43.4
Grand Mean	**0.3745**	**-0.5991 – 1.3481**	**100**

Supplementary Table 9: Calculated Hedges *g*-values, 95% confidence interval range, and weight (determined using a random effects meta-analysis model) for each study included in sediment nitrite (NO_2^-) flux meta-analysis. For context, small effect: *g* = 0 - 0.2, medium effect: *g* = 0.2 - 0.5, and a strong effect: *g* > 0.5[2].

Study	*g*	95% CI	% Weight
Ayvazian et al. In prep	0.8313	0.3959 – 1.2668	70.3
Jackson 2019 – Ch. 4	0.6717	-0.0020 – 1.3454	29.7
Grand Mean	**0.7839**	**-0.1426 – 1.7104**	**100**

Supplementary Table 10: Calculated Hedges *g*-values, 95% confidence interval range, and weight (determined using a random effects meta-analysis model) for each study included in sediment carbon dioxide (CO_2) meta-analysis. For context, small effect: *g* = 0 - 0.2, medium effect: *g* = 0.2 - 0.5, and a strong effect: *g* > 0.5[2].

Study	*g*	95% CI	% Weight
Green et al. 2012	1.1991	0.2791 – 2.1192	31.1
Green et al. 2013	0.2675	-0.8692 – 1.4041	22.9
Ray et al. 2019	0.4054	-0.2569 – 1.0677	46.0
Grand Mean	**0.6204**	**-0.5732 – 1.8139**	**100**

Supplementary Table 11: Calculated Hedges *g*-values, 95% confidence interval range, and weight (determined using a random effects meta-analysis model) for each study included in sediment methane (CH_4) flux meta-analysis. For context, small effect: *g* = 0 - 0.2, medium effect: *g* = 0.2 - 0.5, and a strong effect: *g* > 0.5[2].

Study	*g*	95% CI	% Weight
Green et al. 2012	1.1327	0.2194 – 2.0460	32.5
Green et al. 2013	-0.2043	-1.3389 – 0.9302	25.9
Ray et al. 2019	0.2809	-0.3821 – 0.9438	41.6
Grand Mean	**0.4317**	**-1.1601 – 2.0234**	**100**

Supplementary Table 12: Calculated Hedges *g*-values, 95% confidence interval range, and weight (determined using a random effects meta-analysis model) for each study included in sediment nitrous oxide (N_2O) flux meta-analysis. For context, small effect: *g* = 0 - 0.2, medium effect: *g* = 0.2 - 0.5, and a strong effect: *g* > 0.5[2].

Study	*g*	95% CI	% Weight
Green et al. 2013	-0.4377	-1.5826 – 0.7073	25.9
Onorevole et al. 2018	0.1859	-0.1613 – 0.5330	28.4
Erler et al. 2017	-4.1774	-6.8359 – -1.5189	18.0
Ray et al. 2019	0.1478	-0.5135 – 0.8091	27.7
Grand Mean	**-0.7711**	**-3.7401 – 2.1979**	**100**

References cited in the Supplement

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