Figure S1. Overall number of studies that have investigated interactions between seagrasses and tellinid clams and the direction of the respective outcomes, separated by correlative studies (n = 12), manipulative studies on the effect of seagrasses on clams (n = 9), and manipulative studies on the effect of clams on seagrasses (n = 0). Dashed lines correspond to number of studies that involve the species *Zostera marina* and *Macoma balthica* (n = 9 in total). This graph is based on a global literature review on plant-bivalve interactions by Gagnon et al. (unpubl. data).

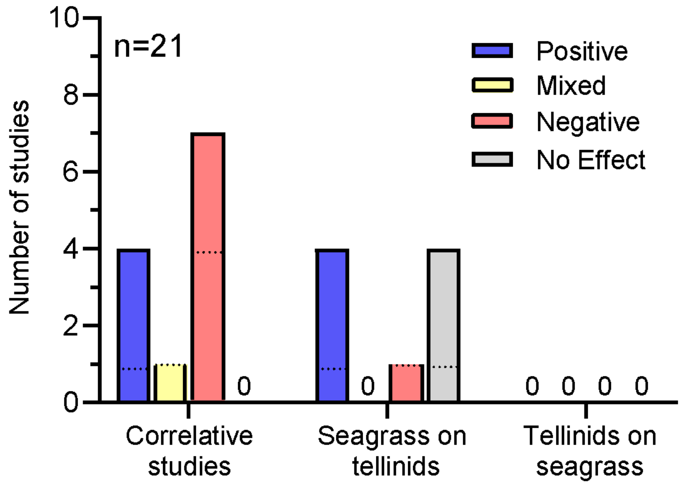

Figure S2. Histogram of size classes (1 mm intervals) of *Macoma* sampled from bare sediments and *Zostera* at sampling event T1 (September 2017) at the field site near the island of Fårö (59°55'20"N, 21°47'60"E).

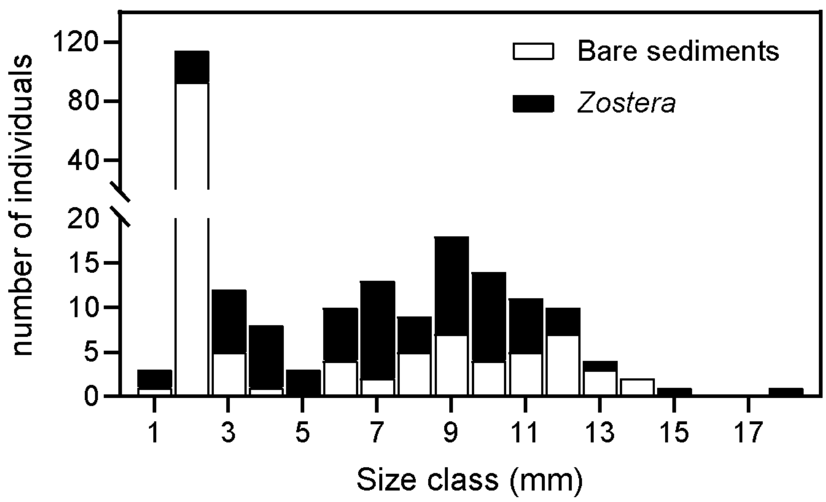

Figure S3. Hourly means in water temperature for the field site near the island of Fårö (59°55'20"N, 21°47'60"E) for the years 2017, 2018 and 2019. The heatwave in 2018 showed mean temperatures above 20 °C for 36 consecutive days.

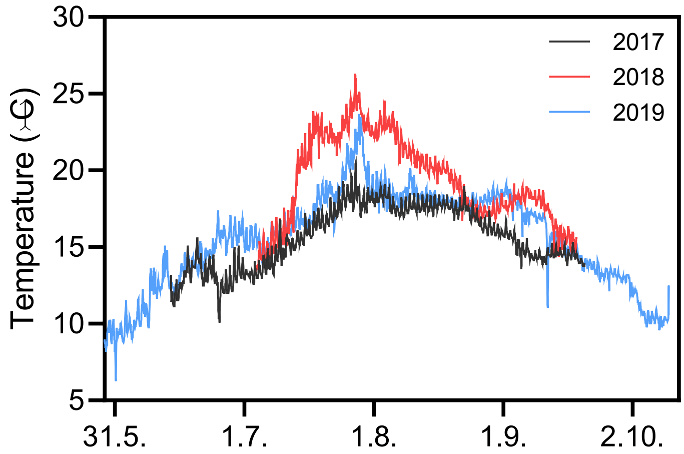

Table S1. Two-way ANOVA results of juvenile (a) and adult (b) *Macoma* abundance with Habitat (Zostera, Sand) and Sampling time (June, September) as factors. Raw data for adult *Macoma* was square root transformed before applying ANOVA to meet assumptions of homoscedasticity.

a) Macoma >5mm	**Sum Sq**	**DF**	**F**	**p-value**
Habitat (H)	4997431	1	35.06	<0.0001
Time (T)	52957	1	0.3715	0.5475
H×T	17292	1	0.1213	0.7304
Residual	3705924	26		
b) Macoma <5mm				
Habitat (H)	4.175	1	0.03151	0.8605
Time (T)	374.2	1	2.824	0.1048
H×T	1843	1	13.91	0.0009
Residual	3445	26		

Table S2. Two-way ANOVA results of condition index CI with Habitat (Zostera, bare sediment) and Time (2017, 2018) as factors.

CI	**Sum Sq**	**DF**	**F**	**p-value**
Habitat (H)	0.0875	1	40.23	<0.0001
Time (T)	0.0141	1	6.466	0.012
H×T	0.0292	1	13.42	<0.0001
Residual	0.8355	450		

Table S3. Linear models (LM) result from the field experiment, including PO_4^{3-} instead of NH_4^+ as a covariate mediating the effect of *Macoma* density manipulation on *Zostera* traits.

AB	**Df**	**Sum Sq**	**F**	**p-value**
Macoma	1	0.002	0.009	0.920
PO_4^-	1	0. 061	0.351	0.559
Macoma × PO_4^-	1	1.774	10.294	**0.004
Residuals	23	3.965		
Rhizomes				
Macoma	1	0.006	0.009	0.927
PO_4^-	1	0.936	2.049	0.166
Macoma × PO_4^-	1	2.039	4.461	*0.046
Residuals	23	10.511		
Roots				
Macoma	1	0.079	0.621	0.438
PO_4^-	1	0.624	4.905	*0.037
Macoma × PO_4^-	1	0.949	7.460	*0.012
Residuals	23	2.925		
Shoot count				
Macoma	1	0.188	0.476	0.497
PO_4^-	1	0.758	1.919	0.179
Macoma × PO_4^-	1	2.615	6.622	*0.017
Residuals	23	9.083		

Table S4. Summary table of generalised linear mixed models (GLMM) on effects of *Macoma* abundance (three levels: control, low, high) on plant traits and porewater nutrient concentrations from the aquarium experiment. Replicate block (n=6) was included as random factor.

AB	**Estimate**	**Std. error**	**t-value**	**p-value**
Intercept	1.794	0.081	22.192	**0**
Macoma low	0.065	0.114	0.568	0.574
Macoma high	-0.032	0.114	-0.277	0.784
Roots				
Intercept	0.527	0.033	15.744	**0**
Macoma low	0.036	0.047	0.757	0.455
Macoma high	0.051	0.047	1.075	0.292
Shoot count				
Intercept	13.68	0.8	17.104	**0**
Macoma low	1.554	1.025	1.516	0.141
Macoma high	-0.594	1.034	-0.575	0.57
Rhizomes				
Intercept	0.909	0.058	15.772	**0**
Macoma low	0.146	0.07	2.087	**0.046**
Macoma high	-0.018	0.071	-0.261	0.796
Ammonium				
Intercept	8.112	0.207	39.256	**0**
Macoma low	-1.264	0.292	-4.326	**0**
Macoma high	-1.318	0.292	-4.511	**0**
Phosphate				
Intercept	7.08	0.243	29.177	**0**
Macoma low	-1.593	0.335	-4.759	**0**
Macoma high	-1.69	0.336	-5.035	**0**

Text S1. **Literature review.**

Results of a global literature review, showing all 15 papers (including 21 studies) addressing seagrass-tellinid interactions (from Gagnon et al. unpubl. data). The outcome of interactions is summarized in Fig. S1.

Boström C and Bonsdorff E (2000) Zoobenthic community establishment and habitat complexity the importance of seagrass shoot-density, morphology and physical disturbance for faunal recruitment. Marine Ecology Progress Series 205:123–138

Boström C and Bonsdorff E (1997) Community structure and spatial variation of benthic invertebrates associated with *Zostera marina* (L.) beds in the northern Baltic Sea. Journal of Sea Research 37:153–166

Boström C, Törnroos A, Bonsdorff E (2010) Invertebrate dispersal and habitat heterogeneity: Expression of biological traits in a seagrass landscape. Journal of Experimental Marine Biology and Ecology 390:106–117

Dąbrowska AH, Janas U, Kendzierska H (2016) Assessment of biodiversity and environmental quality using macrozoobenthos communities in the seagrass meadow (Gulf of Gdańsk, Southern Baltic). Oceanological and Hydrobiological Studies 45:286–294

Edgar GJ, Shaw C, Watsona GF, Hammond LS (1994) Comparisons of species richness, size-structure and production of benthos in vegetated and unvegetated habitats in Western Port, Victoria. Journal of Experimental Marine Biology and Ecology 176:201–226

Glaspie CN and Seitz RD (2017) Role of habitat and predators in maintaining functional diversity of estuarine bivalves. Marine Ecology Progress Series 570:113–125

González-Ortiz V, Egea LG, Jiménez-Ramos R, Moreno-Marín F, Pérez-Lloréns JL, Bouma T, Brun F (2016) Submerged vegetation complexity modifies benthic infauna communities: The hidden role of the belowground system. Marine Ecology 37:543–552

Healey D and Hovel KA (2004) Seagrass bed patchiness: Effects on epifaunal communities in San Diego Bay, USA. Journal of Experimental Marine Biology and Ecology 313:155–174

Heck KL, Able KW, Roman CT, Fahay MP (1995) Composition, abundance, biomass, and production of macrofauna in a New England estuary: Comparisons among eelgrass meadows and other nursery habitats. Estuaries 18:379–389

Herkül K and Kotta J (2009) Effects of eelgrass (*Zostera marina*) canopy removal and sediment addition on sediment characteristics and benthic communities in the northern Baltic Sea. Marine Ecology 30:74–82

Lappalainen A, Hällfors G, Kangas P (1977) Littoral benthos of the northern Baltic Sea. IV. pattern and dynamics of macrobenthos in a sandy□bottom *Zostera marina* community in Tvärminne. Internationale Revue Der Gesamten Hydrobiologie Und Hydrographie 62: 465–503

Lohrer AM, Townsend M, Hailes SF, Rodil IF, Cartner K, Pratt DR, Hewitt JE (2016) Influence of New Zealand cockles (*Austrovenus stutchburyi*) on primary productivity in sandflat-seagrass (*Zostera muelleri*) ecotones. Estuarine, Coastal and Shelf Science 181: 238–248

Poore G and Rainer S (1974) Distribution and abundance of soft-bottom molluscs in Port Phillip Bay, Victoria, Australia. Marine and Freshwater Research 25:371–411

Rueda JL, Marina P, Urra J, Salas C (2009) Changes in the composition and structure of a molluscan assemblage due to eelgrass loss in southern Spain (Alboran Sea). Journal of the Marine Biological Association of the United Kingdom 89:1319–1330

Skilleter GA (1994) Refuges from predation and the persistence of estuarine clam populations. Marine Ecology Progress Series 109:29