Supplementary Material

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Table S1. Water quality parameters and Carlson Trophic State Index (TSI) recorded during the experimental period in Laguna Chica de San Pedro. Values are means ± SD calculated from vertically integrated water-column profiles for each experiment. Reported variables include Secchi disk depth (SD), water temperature, dissolved oxygen, pH, electrical conductivity, total nitrogen (TN), total phosphorus (TP), and chlorophyll-a concentration (Chl-a). TSI components are presented based on Secchi depth (TSI(SD)), total phosphorus (TSI(TP)), and chlorophyll-a (TSI(Chl-a)), together with the composite Carlson Trophic State Index (CTSI). Sample size (N) corresponds to the number of sampled depths per vertical profile and is indicated for each variable. Experiments (Exp) correspond to: Exp 1 = Winter 2023; Exp 2 = Spring 2023; Exp 3 = Summer 2023–2024; Exp 4 = Autumn 2023; Exp 5 = Winter 2024; Exp 6 = Spring 2024.

Exp	Secchi disc (m)	Temperature (°C) (N = 17)	Dissolved oxygen (mg · L^{-1}) (N = 17)	pH (N = 17)	Conductivity (µS · cm^{-1}) (N = 17)	Total-N (mg · L^{-1}) (N = 3)	Total-P (mg · L^{-1}) (N = 3)	Chlorophyll-a (µg · L^{-1}) (N = 17)	TSI (SD)	TSI (TP)	TSI (Chl-a)	CTSI
1	9.6	10.6 ± 0.0	11.2 ± 0.0	6.9 ± 0.0	89.0 ± 0.2	0.10 ± 0.02	0.024 ± 0.027	0.65 ± 0.36	27.4	50.2	26.4	34.7
2	8.8	15.5 ± 1.8	9.5 ± 0.4	7.3 ± 0.3	90.6 ± 4.2	0.19 ± 0.02	0.006 ± 0.000	1.22 ± 0.80	28.7	30.0	32.6	30.4
3	7.9	20.5 ± 3.0	7.7 ± 1.1	6.9 ± 0.5	103.3 ± 9.0	0.09 ± 0.02	0.009 ± 0.004	0.80 ± 0.60	30.2	36.4	28.4	31.7
4	5.2	15.5 ± 1.9	9.5 ± 0.6	7.5 ± 0.1	91.1 ± 4.3	0.16 ± 0.03	0.006 ± 0.000	1.15 ± 0.80	36.2	30.0	32.0	32.7
5	9.6	10.7 ± 0.0	11.4 ± 0.0	6.9 ± 0.0	89.1 ± 0.2	0.10 ± 0.02	0.024 ± 0.024	0.64 ± 0.33	27.4	50.0	26.3	34.6
6	8.3	15.6 ± 2.2	9.7 ± 0.5	7.7 ± 0.3	90.9 ± 4.4	0.16 ± 0.03	0.007 ± 0.001	1.08 ± 0.80	29.5	32.2	31.3	31.0

Table S2. Results of in situ experiments evaluating the effects of *Diplodon chilensis* on sediment biogeochemistry in Laguna Chica de San Pedro. Treatments included sand control (C1), sand with shells of dead mussels (C2), and sand with live mussels (Tr). Values are means ± SD (N = 4 blocks). Overall treatment effects were assessed using Quade tests (F(2,6)), with significant *p*-values ($p < 0.05$) shown in bold. Pairwise comparisons (Tr vs C1, Tr vs C2, C1 vs C2) were performed using Wilcoxon signed-rank tests; effect sizes are expressed as *r* (Rosenthal, 1991), with large effects highlighted in bold when significant. Percentage change (% Change) represents the relative difference of Tr with respect to the mean of both controls, calculated after 60-day experimental periods for each variable (OM, TN, TP). Experiments were conducted seasonally between Winter 2023 and Spring 2024.

Variable	Exp*	C1 (mean ± SD)	C2 (mean ± SD)	Tr (mean ± SD)	F	*p*-value	Wilcoxon effect size (*r*)			% Change (Tr vs controls)
							Tr vs C1	Tr vs C2	C1 vs C2	
OM	1	0.261 ± 0.080	0.256 ± 0.100	0.490 ± 0.080	6.71	**0.030**	**0.913**	**0.913**	0.183	89.6
(%)	2	0.635 ± 0.153	0.612 ± 0.085	0.775 ± 0.233	2.40	0.172	0.913	0.913	0.183	24.3
	3	0.737 ± 0.125	0.769 ± 0.108	0.959 ± 0.117	6.37	**0.033**	**0.913**	**0.913**	0.365	27.4
	4	0.643 ± 0.097	0.662 ± 0.099	0.827 ± 0.101	6.07	**0.036**	**0.913**	**0.913**	0.548	26.7
	5	0.251 ± 0.042	0.254 ± 0.069	0.441 ± 0.065	6.17	**0.035**	**0.913**	**0.913**	0.183	74.7
	6	0.645 ± 0.037	0.650 ± 0.081	0.818 ± 0.136	4.21	0.072	0.913	0.913	0.000	26.3
TN	1	0.349 ± 0.107	0.343 ± 0.096	0.663 ± 0.153	6.04	**0.037**	**0.913**	**0.913**	0.365	91.6
($mg \cdot g^{-1}$)	2	0.635 ± 0.221	0.695 ± 0.163	1.052 ± 0.355	5.72	**0.041**	**0.913**	**0.913**	0.365	58.2
	3	0.787 ± 0.113	0.792 ± 0.110	1.135 ± 0.167	5.67	**0.041**	**0.913**	**0.913**	0.274	43.8
	4	0.731 ± 0.048	0.696 ± 0.106	0.962 ± 0.099	5.10	0.051	0.913	0.913	0.274	34.8
	5	0.339 ± 0.052	0.336 ± 0.048	0.633 ± 0.105	24.91	**0.001**	**0.913**	**0.913**	0.274	87.5
	6	0.658 ± 0.124	0.702 ± 0.139	0.901 ± 0.279	12.18	**0.008**	**0.913**	**0.913**	0.365	32.5
TP	1	0.258 ± 0.041	0.277 ± 0.035	0.304 ± 0.071	4.28	0.067	0.730	0.182	0.091	13.6
($mg \cdot g^{-1}$)	2	0.397 ± 0.033	0.386 ± 0.017	0.389 ± 0.036	0.25	0.788	0.182	0.091	0.182	–0.6
	3	0.422 ± 0.049	0.428 ± 0.052	0.461 ± 0.035	1.11	0.393	0.091	0.091	0.000	8.4
	4	0.385 ± 0.022	0.368 ± 0.036	0.414 ± 0.049	1.81	0.238	0.091	0.091	0.000	10.2
	5	0.234 ± 0.061	0.254 ± 0.043	0.295 ± 0.045	6.37	**0.032**	**0.500**	**0.500**	0.250	20.9
	6	0.410 ± 0.042	0.407 ± 0.044	0.354 ± 0.084	3.86	0.082	0.500	0.500	0.000	–13.6

*Exp = Experiment number; Exp 1 = Winter 2023; Exp 2 = Spring 2023; Exp 3 = Summer 2023–24; Exp 4 = Autumn 2023; Exp 5 = Winter 2024; Exp 6 = Spring 2024.

Table S3. Results of in situ experiments evaluating the effects of *Diplodon chilensis* on benthic communities in Laguna Chica de San Pedro. Treatments included sand control (C1), sand with shells of dead mussels (C2), and sand with live mussels (Tr). Values are means ± SD (N = 4 blocks). Overall treatment effects were assessed using Quade tests (F(2,6)), with significant *p*-values ($p < 0.05$) shown in bold. Pairwise comparisons (Tr vs C1, Tr vs C2, C1 vs C2) were performed using Wilcoxon signed-rank tests; effect sizes are expressed as *r* (Rosenthal, 1991), with large effects highlighted in bold when significant. Percentage change (% Change) represents the relative difference of Tr with respect to the mean of both controls, calculated after 60-day experimental periods for macrofaunal taxon richness, macrofaunal abundance, and meiofaunal abundance. Experiments were conducted seasonally between Winter 2023 and Spring 2024.

Variable	Exp*	C1 (mean ± SD)	C2 (mean ± SD)	Tr (mean ± SD)	F	*p*-value	Wilcoxon effect size (*r*)			% Change (Tr vs controls)
							Tr vs C1	Tr vs C2	C1 vs C2	
Macrofaunal	1	2.92 ± 0.67	3.58 ± 1.00	5.92 ± 1.68	10.69	**0.011**	**0.500**	**0.500**	0.167	82.2
richness	2	1.92 ± 0.67	2.50 ± 0.67	4.92 ± 1.38	9.91	**0.013**	**0.500**	**0.500**	0.167	122.6
(N taxa)	3	1.92 ± 0.90	2.08 ± 0.90	2.67 ± 0.89	0.87	0.464	0.250	0.167	0.167	33.5
	4	2.58 ± 0.79	3.50 ± 0.80	5.50 ± 1.31	6.40	**0.031**	**0.500**	**0.500**	0.250	80.9
	5	2.58 ± 1.16	3.42 ± 1.56	5.00 ± 1.54	10.81	**0.011**	**0.500**	**0.500**	0.125	66.7
	6	5.25 ± 1.60	5.58 ± 1.51	4.92 ± 1.62	4.25	0.067	0.250	0.500	0.250	–9.1
Macrofaunal	1	14.33 ± 5.50	16.75 ± 6.86	46.33 ± 9.88	32.83	**<0.001**	**0.750**	**0.750**	0.250	198.1
abundance	2	9.25 ± 5.22	9.58 ± 3.92	22.42 ± 7.32	30.02	**<0.001**	**0.750**	**0.750**	0.000	138.1
(N·20 cm^{-2})	3	4.33 ± 2.15	5.50 ± 4.27	18.58 ± 15.98	10.67	**0.011**	**0.750**	**0.750**	0.000	278.0
	4	30.08 ± 17.48	38.42 ± 16.42	73.33 ± 26.53	8.22	**0.020**	**0.750**	**0.750**	0.000	114.1
	5	14.42 ± 11.80	23.17 ± 17.86	62.42 ± 21.46	9.31	**0.014**	**0.750**	**0.750**	0.250	232.1
	6	27.17 ± 11.39	27.08 ± 11.45	31.33 ± 16.70	1.06	0.396	0.250	0.500	0.250	15.5
Meiofaunal	1	346.75 ± 113.66	363.50 ± 94.39	208.67 ± 72.74	5.78	**0.040**	**0.913**	**0.913**	0.365	–41.2
abundance	2	106.33 ± 23.41	112.08 ± 26.73	117.83 ± 34.88	0.33	0.729	0.370	0.370	0.180	7.9
(N·20 cm^{-2})	3	93.92 ± 22.52	96.83 ± 27.73	45.25 ± 24.91	5.55	**0.043**	**0.913**	**0.913**	0.000	–52.6
	4	118.33 ± 53.73	137.50 ± 34.84	99.67 ± 26.67	2.29	0.182	0.550	0.913	0.182	–22.1
	5	356.08 ± 76.05	354.50 ± 61.46	134.08 ± 24.36	5.00	0.053	0.913	0.913	0.000	–62.3
	6	228.00 ± 147.92	126.33 ± 140.75	147.83 ± 80.96	2.07	0.207	0.913	0.000	0.550	–16.6

*Exp = Experiment number; Exp 1 = Winter 2023; Exp 2 = Spring 2023; Exp 3 = Summer 2023–24; Exp 4 = Autumn 2023; Exp 5 = Winter 2024; Exp 6 = Spring 2024.

Table S4. Taxonomic composition and relative abundance of zoobenthic assemblages recorded during the six seasonal in situ experiments conducted in Laguna Chica de San Pedro. (a) Macrofaunal taxa and (b) meiofaunal taxa are shown separately. For each taxon, relative abundance (%) is reported for each seasonal experiment (EXP1–EXP6), calculated by pooling individuals from all experimental treatments (live mussels, Tr; sand control, C1; and shell control, C2). The column "EXP1–EXP6" represents the mean relative abundance across the six experiments.

(a) Macrofaunal relative abundance (%)

Phylum	Class	Order	Family	Taxa	EXP1	EXP2	EXP3	EXP4	EXP5	EXP6	EXP1-EXP6
Porifera	Demospongi	Spongillida	Spongillidae	*Eunapiys*	0,11	0,20	0,29	0,00	0,00	0,00	**0,05**
Platyhelmint	Rhabditopho	Tricladida	Dugesiidae	*Dugesia*	0,32	0,61	0,00	0,24	0,25	0,19	**0,21**
Platyhelmint	Rhabditopho	Temnocephal	Temnocephal	*Temnocephala*	0,32	0,20	0,00	0,12	0,08	1,46	**0,42**
Annelida	Clitellata	Haplotaxida	Naididae	*Tubifex*	22,71	21,62	17,60	16,33	49,58	37,39	**18,28**
Annelida	Clitellata	Haplotaxida	Naididae	*Nais sp.*	14,85	2,63	2,35	15,33	24,58	10,32	**19,69**
Annelida	Clitellata	Arhynchobd	-	Hirudinea	0,11	0,00	0,00	0,06	0,08	0,00	**5,22**
Mollusca	Gastropoda	Hygrophila	Chilinidae	*Chilina*	1,18	0,61	2,35	0,29	0,58	0,49	**0,58**
Mollusca	Gastropoda	Hygrophila	Physidae	*Physa*	0,43	1,01	0,88	0,06	0,08	1,07	**0,54**
Mollusca	Gastropoda	Hygrophila	Lymnaeidae	*Lymnaea*	0,22	0,40	0,59	0,06	0,08	0,00	**0,14**
Mollusca	Gastropoda	Hygrophila	Planorbidae	*Biomplalaria*	0,54	0,20	0,00	0,00	0,17	0,00	**0,12**
Mollusca	Gastropoda	Hygrophila	Planorbidae	*Uncancylus*	0,00	0,61	0,59	0,06	0,08	0,19	**0,18**
Mollusca	Gastropoda	Littorinimor	Cochliopidae	*Heleobia sp.*	0,11	0,00	0,59	0,12	0,08	0,00	**0,11**
Mollusca	Bivalvia	Veneroida	Sphaeriidae	*Pisidium*	1,08	0,40	0,00	0,06	0,08	1,56	**0,53**
Mollusca	Bivalvia	Veneroida	Sphaeriidae	*Musculium*	0,11	0,40	0,29	0,00	0,50	0,00	**0,09**
Mollusca	Bivalvia	Unionida	Hyriidae	*Diplodon*	0,11	0,20	0,00	0,12	0,08	0,10	**0,19**
Arthropoda	Malacostraca	Amphipoda	Hyalellidae	*Hyalella*	0,32	0,40	0,59	0,06	0,33	0,29	**0,21**
Arthropoda	Malacostraca	Anomura	Aeglidae	*Aegla laevis*	0,32	0,81	0,29	0,06	0,00	0,00	**0,23**
Arthropoda	Malacostraca	Decapoda	Parastacidae	*Santastacus*	0,43	0,40	0,00	0,18	0,17	0,00	**0,16**
Arthropoda	Insecta	Ephemeropte	Leptophlebii	*Meridialaris*	0,22	0,20	0,00	0,18	0,17	0,00	**0,14**
Arthropoda	Insecta	Ephemeropte	Baetidae	*Andesiops*	0,11	0,20	0,00	0,12	0,17	0,00	**0,11**
Arthropoda	Insecta	Ephemeropte	Caenidae	*Caenis axillata*	0,11	0,20	0,00	0,12	0,00	3,41	**0,72**
Arthropoda	Insecta	Diptera	Ceratopogon	Ceratopogon	0,22	0,20	0,00	0,12	0,33	0,00	**0,09**
Arthropoda	Insecta	Diptera	Chironomida	*Alotanypus*	0,00	0,00	0,00	0,24	0,00	18,79	**3,53**
Arthropoda	Insecta	Diptera	Chironomida	Tanypodinae	0,00	0,00	41,06	0,06	0,00	0,68	**2,60**
Arthropoda	Insecta	Diptera	Chironomida	Orthocladiin	0,00	0,61	0,00	0,18	0,00	0,58	**0,21**
Arthropoda	Insecta	Diptera	Chironomida	Chironomida	55,87	67,68	32,55	65,75	22,33	23,17	**40,78**
Arthropoda	Insecta	Diptera	Chironomida	Chironomida	0,00	0,00	0,00	0,00	0,00	0,19	**4,74**
Arthropoda	Insecta	Trichoptera	Leptoceridae	*Hudsonema*	0,11	0,20	0,00	0,12	0,17	0,10	**0,09**
Bryozoa	Phylactolaem	Plumatellida	Plumatellida	*Plumatella*	0,11	0,00	0,00	0,00	0,00	0,00	**0,05**

Table S4. (continued).

(b) Meiofaunal relative abundance (%)

Phylum	Class	Order	Family	Taxa	EXP1	EXP2	EXP3	EXP4	EXP5	EXP6	EXP1-EXP6
Nematoda	-	-	-	Nematoda	19,52	34,32	6,67	21,31	0,00	18,42	**19,44**
Arthropoda	Arachnida	Trombidifor	Arrenuridae	Arrenuridae	0,16	0,25	0,14	0,21	99,56	0,65	**4,87**
Arthropoda	Arachnida	Oribatida	Nothridae	Nothridae	0,02	0,10	0,07	0,07	0,29	0,00	**0,05**
Arthropoda	Hexanauplia	Harpacticoid	Canthocampt	*Cletocampus*	80,27	65,30	93,04	78,36	0,07	80,91	**75,60**
Arthropoda	Ostracoda	Podocopida	Darwinulida	*Penthesilenula*	0,03	0,02	0,07	0,05	0,07	0,02	**0,03**

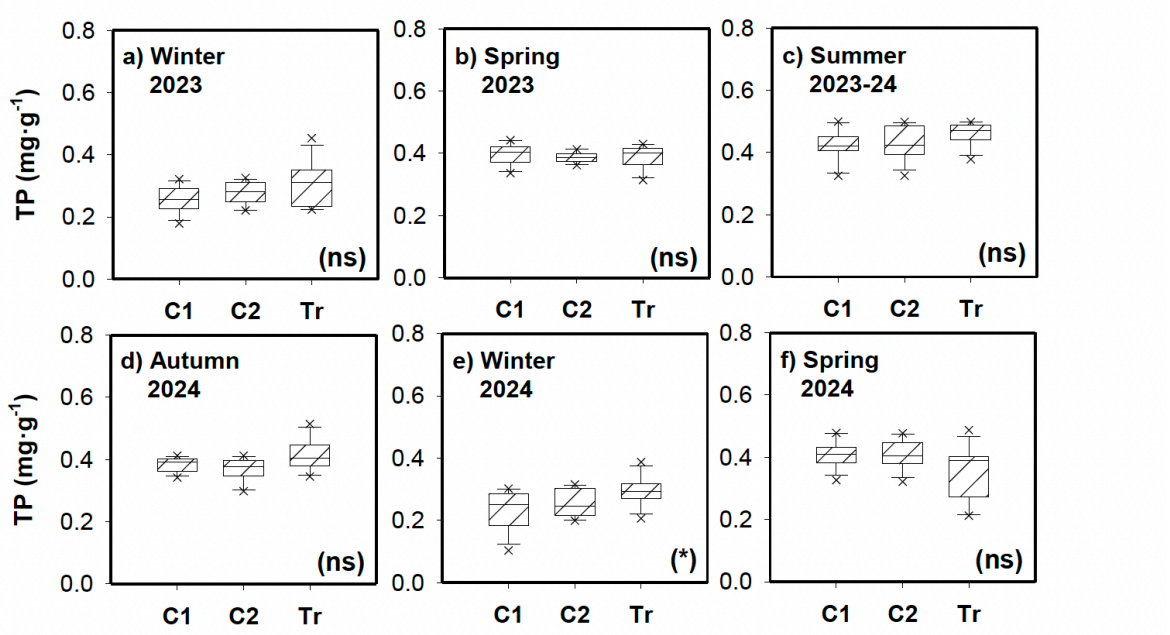


Figure S1. Seasonal boxplots of sediment total phosphorus (TP, mg·g^{-1}). Treatments: C1 = sand control; C2 = sand plus shells of dead mussels; Tr = sand plus live mussels. Panels (a–f) correspond to seasonal experiments conducted between Winter 2023 and Spring 2024, each lasting two months. Boxes show interquartile ranges with medians; whiskers indicate the minimum and maximum values excluding outliers; crosses (×) denote outliers. Each boxplot is based on N = 12 observations per treatment. Statistical results are presented in Table S2. ns = not significant; $p < 0.05$.

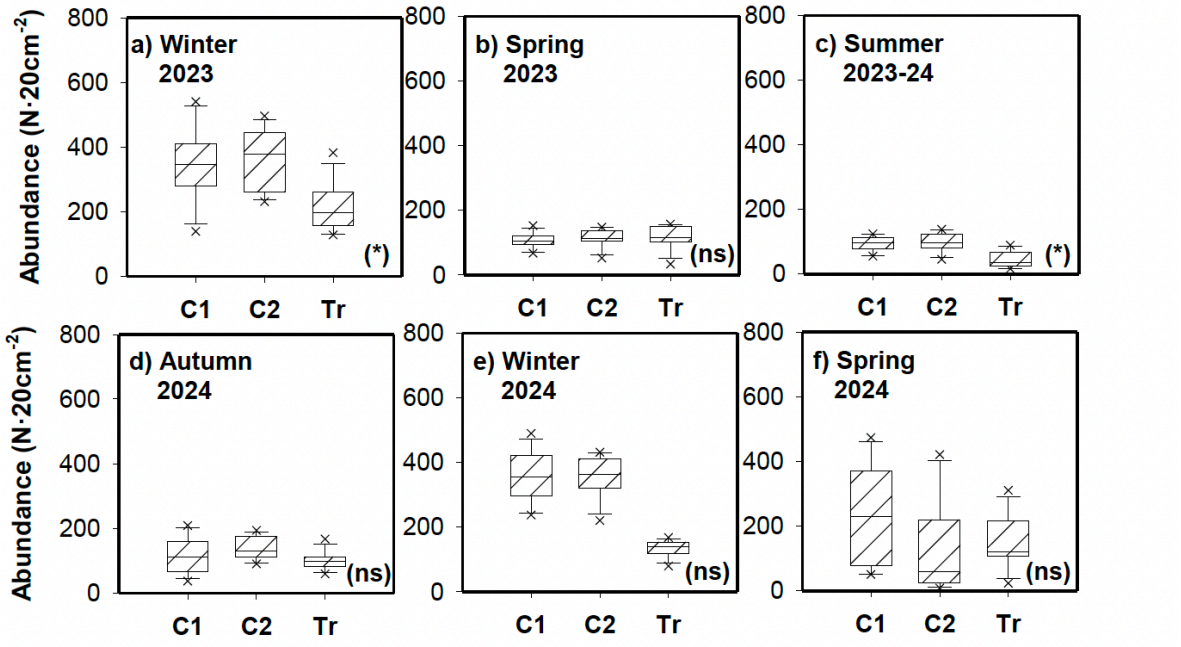


Figure S2. Seasonal boxplots of meiofaunal abundance (63–500 µm; N·20 cm^{-2}). Treatments: C1 = sand control; C2 = sand plus shells of dead mussels; Tr = sand plus live mussels. Panels (a–f) correspond to seasonal experiments conducted between Winter 2023 and Spring 2024, each lasting two months. Boxes show interquartile ranges with medians; whiskers indicate data range; and crosses (×) denote outliers. Each boxplot is based on N = 12 observations per treatment. Statistical results are presented in Table S3. ns = not significant; $p < 0.05$.