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SUPPLEMENTARY MATERIAL

Synoptic results on the potential impacts of the Lake Maggiore water management strategy on freshwater littoral ecosystems and invertebrate biocoenosis (NW, Italy)

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Tab. S1. Results of the chemical analyses performed on the 36 samples collected at the different sites within 2019-2021.

Station	Data	pH	Cond.	Alk.	Cl	SO_4	N-NO_3	N-NH_4	RP	TP	RSi	TN
Fondo Toce - d	Aug/2019	7.75	135.5	0.823	2.64	25.6	418	28	2	10	0.29	0.88
Fondo Toce - w	Aug/2019	7.91	132.7	0.744	2.54	26.1	437	29	3	11	0.33	0.64
Sesto Calende - d	Aug/2019	8.04	134.3	0.773	2.82	24.5	429	49	3	14	0.15	0.91
Sesto Calende - w	Aug/2019	8.24	134.9	0.785	2.97	25.3	401	19	2	5	0.22	0.56
Magadino - d	Aug/2019	7.35	151.4	0.917	2.90	28.2	393	37	6	36	0.62	0.84
Magadino - w	Aug/2019	7.32	158.3	0.999	2.94	28.1	410	42	8	8	1.22	0.81
Fondo Toce - d	Sept/2019	8.20	139.7	0.834	2.77	26.7	353	29	3	8	0.60	0.57
Fondo Toce - w	Sept/2019	8.34	142.7	0.808	2.55	28.9	378	19	2	9	0.80	0.56
Sesto Calende - d	Sept/2019	8.32	138.2	0.821	-	-	-	26	2	9	0.58	0.56
Sesto Calende - w	Sept/2019	8.92	135.9	0.794	-	-	-	18	2	6	0.49	0.52
Magadino - d	Sept/2019	8.36	194.5	1.413	5.96	25.8	330	85	6	37	1.74	0.70
Magadino - w	Sept/2019	7.37	182.3	1.343	3.35	26.4	292	100	11	21	1.95	0.64
Fondo Toce - d	July/2020	7.47	133.1	0.801	3.05	23.6	378	34	3	13	0.49	0.69
Fondo Toce - w	July/2020	8.63	132.5	0.785	2.82	24.6	453	13	4	11	0.67	0.72
Sesto Calende - d	July/2020	8.44	136.0	0.843	3.4	23.5	426	21	2	11	0.40	0.72
Sesto Calende - w	July/2020	8.46	137.9	0.864	3.4	23.6	416	27	2	9	0.43	0.79
Magadino - d	July/2020	7.33	151.6	0.943	2.9	26.9	439	50	12	25	1.55	0.63
Magadino - w	July/2020	8.50	162.2	1.035	4.2	26.7	452	50	6	18	1.56	0.58
Fondo Toce - d	Aug/2020	9.07	136.9	0.796	2.85	25.6	338	46	3	8	0.47	0.58
Fondo Toce - w	Aug/2020	9.15	135.9	0.79	2.88	25.8	345	41	1	7	0.45	0.55
Sesto Calende - d	Aug/2020	8.72	132.8	0.814	2.96	24	333	90	2	15	0.49	0.65
Sesto Calende - w	Aug/2020	9.21	133.5	0.814	2.96	24.1	348	28	1	8	0.35	0.56
Magadino - d	Aug/2020	8.08	203.4	1.532	5.6	27.3	368	46	8	39	1.84	0.76
Magadino - w	Aug/2020	7.71	225.2	1.954	4.24	23.0	252	489	14	85	3.25	1.02
Fondo Toce - d	Sept/2020	8.40	137.9	0.802	2.86	26.2	268	44	3	9	0.50	0.71
Fondo Toce - w	Sept/2020	8.14	165.9	0.829	2.22	39.2	342	28	3	8	0.49	1.54
Sesto Calende - d	Sept/2020	7.91	144.4	0.842	2.89	28.1	256	4	3	13	0.47	0.64
Sesto Calende - w	Sept/2020	8.34	140.9	0.782	2.80	28.0	375	10	4	10	0.58	0.95
Magadino - d	Sept/2020	8.97	138.9	0.823	2.97	26.1	230	27	4	9	0.48	0.63
Magadino - w	Sept/2020	8.97	138.1	0.822	2.95	26.0	232	21	5	10	0.48	0.63
Fondo Toce - d	July/2021	8.09	141.5	0.823	3.09	26.6	530	18	2	9	0.11	0.70
Fondo Toce - w	July/2021	8.18	142.2	0.823	3.04	26.5	498	15	2	8	0.17	0.66
Sesto Calende - d	July/2021	8.78	143.6	0.846	3.39	26.6	508	10	4	10	0.17	0.68
Sesto Calende - w	July/2021	8.36	145.6	0.871	3.41	26.5	508	9	3	11	0.16	0.70

Magadino - d	July/2021	7.45	144.6	0.848	2.86	27.2	447	25	11	33	0.73	0.69
Magadino - w	July/2021	7.66	147.2	0.864	3.3	27.6	437	23	7	24	0.54	0.67

Cond., conductivity at 20°C (in µS cm^{-1}); Alk., total alkalinity (in meq L^{-1}); RP, TP, TN, reactive and total phosphorus, total nitrogen (in µg L^{-1}). Cl, SO4, RSi, chloride, sulphate, reactive silica (in mg L^{-1}).

Tab. S2. Pseudo-Fs and p-values of the PERMANOVA performed on the overall abundance of littoral meiofaunal taxa and copepods of Lake Maggiore, and *t*-values and p-values of the permutational *post-hoc t*-tests. PERMANOVA was performed under factors: WL (water level), ST (sampling station) and H (habitat) and their interactions. The *t*-tests were performed under the levels H (high), L (low) and M (medium) of the factor WL.

Source	df	Pseudo-F	p-values	Source	df	Pseudo-F	p-values
PERMANOVA				*PERMANOVA*			
All taxa				*Copepods*			
WL	2	4.0839	**0.001**	WL	2	2.4435	**0.017**
ST	2	1.7142	0.084	ST	2	2.5757	**0.009**
H	1	0.99762	0.452	SI	1	0.5482	0.744
WL×ST	4	0.51514	0.971	WL×ST	4	0.8196	0.695
ST×H	2	0.46001	0.923	ST×H	2	0.7164	0.703
WL×H	2	1.9022	0.056	WL×H	2	2.3393	**0.031**
WL×ST×H	4	0.70617	0.822	WL×ST×H	4	0.7006	0.851
Residuals	18			Residuals	18		
Total	35			Total	35		
PAIRWISE t-tests	df	t	p-values	*PAIRWISE t-tests*	df	t	p-values
All taxa				*Copepods*			
M, L	12	0.88377	0.596	M, L	12	1.2004	0.229
M, H	12	2.1376	**0.007**	M, H	12	2.0140	**0.022**
L, H	12	2.4912	**0.003**	L, H	12	1.5049	0.073
				t-tests		t	p-values
				M, SC	12	1.5773	0.051
				M, FT	12	1.8694	**0.010**
				SC, FT	12	1.3136	0.167

df, degree of freedom; bold, significant p-values (<0.05).

Tab. S3. p-values of the main tests of PERMANOVAs and pairwise *post-hoc t*-tests performed on functional traits of littoral meiofaunal and copepod assemblages of Lake Maggiore. PERMANOVAs were performed under the fixed factors WL (water level), ST (sampling stations), H (habitat) and their interactions. The *t*-tests were performed under H (high), L (low) and M (medium) levels of the factor WL.

Trait	WL	ST	H	WL×ST	WL×H	ST×H	WL×ST×H
All taxa							
PERMANOVA							
Body size	**0.001**	0.553	NA	0.988	NI	NI	NI
Body shape	**0.012**	0.207	**0.019**	0.946	0.695	0.274	0.946
Substrate relation	0.111	0.837	NA	0.958	NI	NI	NI
Diet	0.167	0.119	**0.012**	0.679	0.981	**0.043**	0.949
Feeding habits	0.187	0.607	0.121	0.949	0.907	0.358	0.961
PAIRWISE t-tests	H, L	H, M	M, L				
Body size	**0.013**	**0.002**	0.708				
Body shape	**0.017**	**0.010**	0.762				
Copepods							
PERMANOVA	WL	ST	H	WL×ST	WL×H	ST×H	WL×ST×H
Biomass	**0.044**	0.567	0.351	0.984	0.277	0.347	0.810
Body size	0.113	0.516	NI	0.814	NI	NI	NI
Body shape	**0.025**	0.837	0.238	0.486	0.627	0.522	0.643
Substrate relation	**0.013**	0.753	0.540	0.423	0.559	0.504	0.195
Diet	**0.038**	**0.043**	0.395	0.513	0.683	**0.007**	0.492
Feeding habits	**0.026**	**0.039**	0.295	0.502	0.423	**0.015**	0.410
PAIRWISE t-tests	H, L	H, M	M, L		M, SC	SC, FT	FT, M
Biomass	**0.036**	0.104	0.859				
Substrate relation	0.545	**0.008**	0.062				
Diet	0.229	**0.033**	0.119		0.159	0.260	**0.039**
Feeding habits	0.219	**0.032**	0.123		0.134	0.345	**0.023**
Body shape	**0.020**	**0.020**	0.248				

NI, non-inclusion of a factor due to data heteroskedasticity; bold, significant p-values (<0.05).

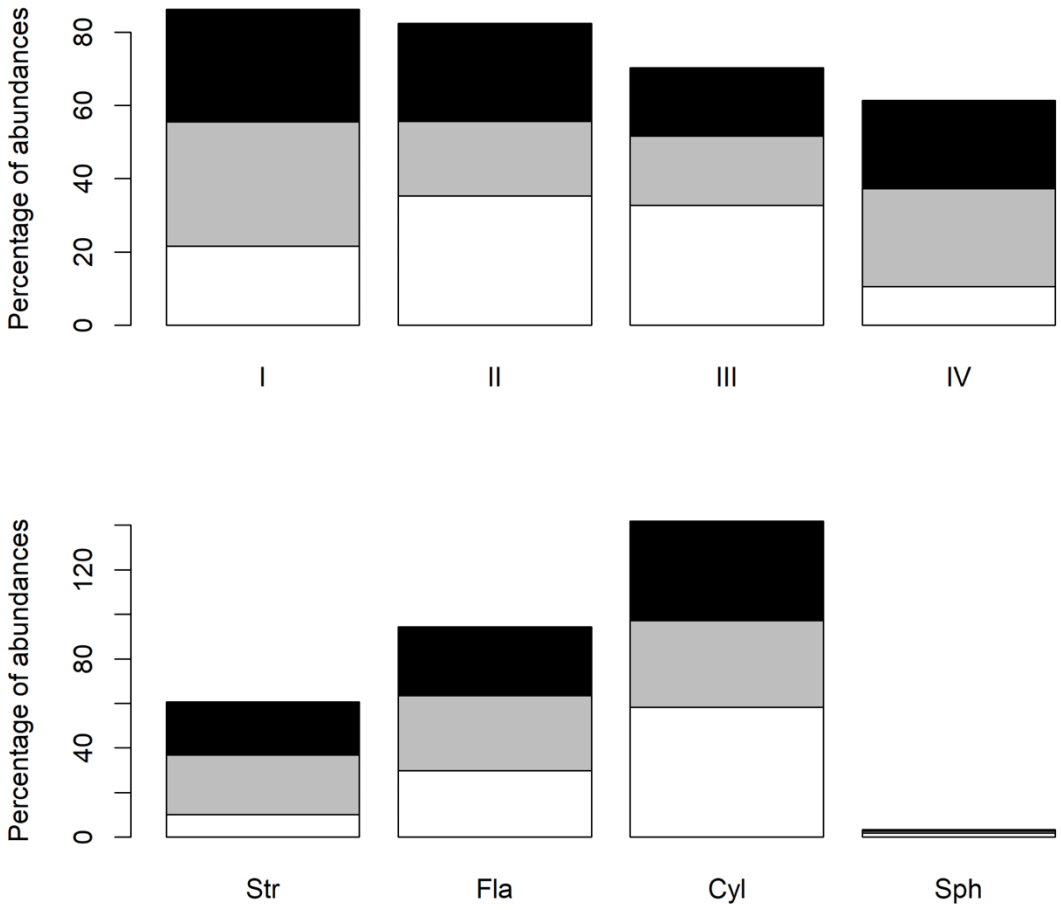

Fig. S1. Barplots of mean percentages of body size (a) and body shape (b) traits during high (white), medium (grey), and low (black) levels. I, ≤ 0.25 mm; II, 0.26 < x ≤ 0.50 mm; III, 0.51 < x ≤ 0.75 mm; IV, 0.76 < x ≤ 1 mm. Str, streamlined; Fla, flattened; Cyl, cylindrical; Sph: spherical.

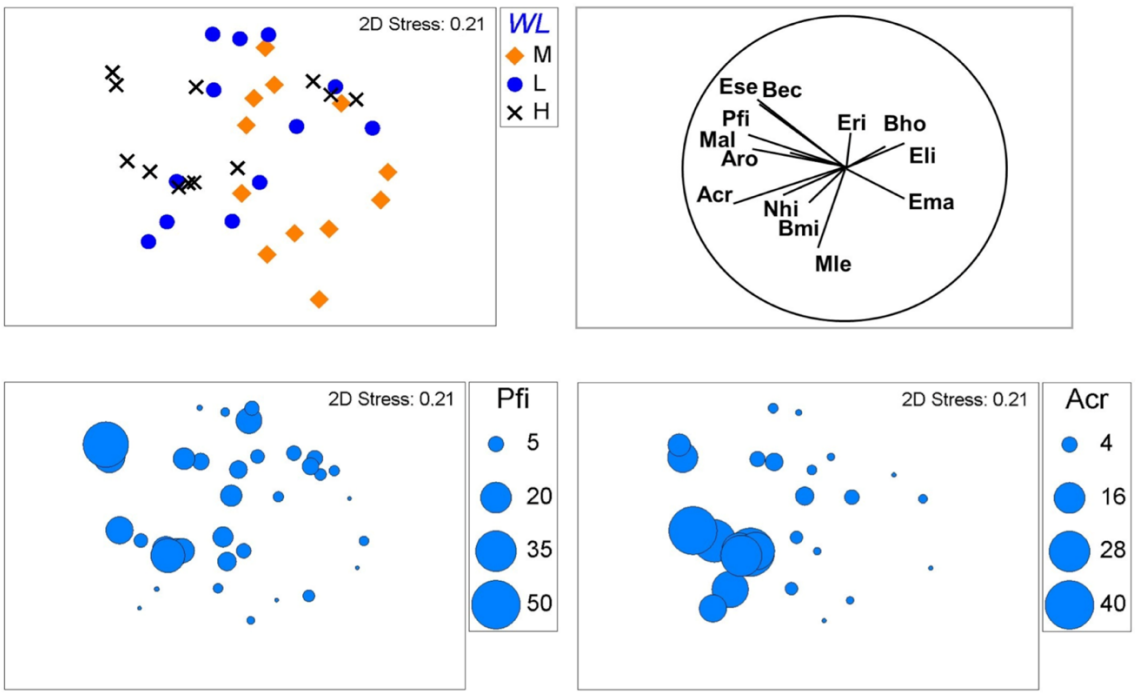

Fig S2. nMDS plot of mean abundance of littoral copepod species of Lake Maggiore during high (H), medium (M) and low (L) water levels (WL). Circle sizes are proportional to abundances: Acr, *Attheyella crassa*; Aro, *Acanthocyclops robustus*; Pfi, *Paracyclops fimbriatus*; Ema, *Eucyclops macrurus*; Ese, *Eucyclops serrulatus*; Mle, *Mesocyclops leuckarti*; Mal, *Macrocyclops albidus*; Eli, *Eucyclops lilljeborgi*; Bec, *Bryocamptus echinatus*; Acr, *Attheyella crassa*; Bmi, *Bryocamptus minutus*; Nhi, *Nitokra hibernica*; Bho, *Bryocamptus hoferi*; Eri, *Epactophanes richardi*.