

Llanquín-Rosas, 2024. Benthic macroinvertebrates community structure and physical-chemical characteristics at Lauca River Basin high altitude wetlands, Altiplano, Chile. *Limnetica* 43 (1), 2024

SUPPLEMENTARY MATERIAL

Table S1. Type of ecosystems and geographic coordinates of the sampling sites. *Tipo de ecosistemas y coordenadas geográficas de los sitios de muestreo.*

Locality	Type of Ecosystem	Coordinates
Ancuta (ANC)	Lentic	18°26'47.31"S 69°11'45.19"W
Ancayuconi (ANY)	Lentic	18°34'21.53"S 69° 4'14.15"W
Misitune (MST)	Lotic	18°22'48.11"S 69°20'56.07"W
Pisarata (PIS)	Lotic	18°31'41.98"S 69°10'7.14"W
Paquisa (PAQ)	Lentic	18°41'6.49"S 69° 6'20.64"W

Table S2. Physicochemical variables of the water column corresponding to the five sampling stations distributed along the Lauca River Basin according to site, season, and type of system factors. *Variables fisicoquímicas de la columna de agua correspondiente a las cinco estaciones de muestreo distribuidas a lo largo de la cuenca del río Lauca, de acuerdo con los factores sitio, estación y tipo de sistema.*

Variable	Site					Season		Ecosystem	
	PAQ	ANY	PIS	MST	ANC	Pre-rainfall	Post-rainfall	Lentic	Lotic
pH	9.4±0.74	8.7±1.29	8.7±0.74	7.8±0.35	8.3±0.48	8.9±1	8.3±0.63	8.8±0.89	8.3±0.74
DO (mg/L)	8.6±0.06	6.9±1.02	7.4±0.06	6.8±0.64	6.7±0.75	7.1±1.11	7.4±0.71	7.3±1.12	7.1±0.53
Conductivity(µS/cm)	624.8±1.8	244.5±92.12	652.0±1.83	330.5±152.81	141.8±2.25	371.2±226.85	426.3±223.97	322.0±221.3	491.3±198.8
Temperature (°C)	6.6±2.96	12.3±9.19	10.2±0.67	14.9±2.91	17.8±0.27	14.7±4.77	10.0±5.64	12.7±6.95	12.6±3.18
Hardness (mg/L)	200.2±23	58.8±11.83	237.7±18.50	127.6±85.08	62.6±43.34	133.1±79.07	141.6±92.67	103.7±73.60	182.7±81.93
Alkalinity (mg/L)	125.1±57.8	173.9±97.33	312.8±65.70	141.4±32.17	105.1±23.47	212.7±95.28	130.6±75.51	132.4±67.50	227.1±103.9
Chloride (mg/L)	8.9±2.05	16.0±6.14	41.7±3.39	16.8±4.46	8.9±2.05	17.7±11.58	19.1±14.68	11.0±4.98	29.2±13.76
Nitrite (µg/L)	1.0±0.07	1.5±0.12	1.1±0.11	1.2±0.58	1.6±0.35	1.1±0.22	1.4±0.42	1.4±0.33	1.2±0.40
Nitrate (µg/L)	0.1±0.00	0.1±0.04	0.1±0.03	0.0±0.03	0.0±0.04	0.0±0.03	0.1±0.03	0.1±0.03	0.0±0.04
Ammonium (µg/L)	11.0±4.56	20.7±6.67	13.5±3.08	12.9±5.31	6.9±3.52	14.3±6.72	11.8±5.35	12.4±7.35	13.2±4.08
Phosphate (µg/L)	27.4±5.52	30.3±30.5	164.4±10.45	113.4±54.42	122.4±10.77	78.1±60.27	105.0±62.62	64.8±49.06	138.9±45.45
Sulfate (mg/L)	49.2±30.9	7.3±2.24	36.3±17.33	5.7±3.17	4.0±0.59	12.1±8.34	28.8±31.07	18.9±26.87	21.0±19.79
Silica (mg/L)	48.3±6.30	12.5±1.65	44.6±5.92	34.7±7.89	40.0±5-26	32.0±12.11	40.0±15.14	34.1±16.70	39.7±8.22
N-Kjeldahl (µg/L)	38.8±26.3	569.4±72.67	130.4±25.53	170.4±37.18	109.4±54.29	186.7±193.56	220.7±196.50	229.2±243.0	150.4±34.40
P-Kjeldahl (µg/L)	156.9±28.	635.4±155.3	209.2±28.60	136.9±46.93	92.3±26.23	226.2±220.19	266.2±220.19	279.3±267.6	173.1±51.32

PAQ= Paquisa; ANY= Ancoyoacani; PIS= Pissarata; MST= Misitune; ANC= Ancuta;

DO= Dissolved Oxygen

Table S3. Macroinvertebrates taxa frequency according to presence/absence in each type of ecosystems and season. S=Richness; %=Frequency; Pre=Pre-rainfall; Post=Post-rainfall. *Frecuencia de taxa de macroinvertebrados de acuerdo con la presencia/ ausencia en cada tipo de ecosistema y estación. S= riqueza; %= frecuencia; Pre=Pre-lluvia; Post = Post-lluvia.*

Type of Ecosystem	Lentic				Lotic				Frequency		
	PAQ		ANY		ANC		PIS			MST	
Season	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	
Taxa											%
Nematoda											
<i>Plectidae sp</i>			✓	✓							20
Mollusca											
<i>Biomphalaria sp</i>	✓	✓				✓					30
<i>Sphaerium sp</i>		✓									10
Annelida											
<i>Haementeria sp.</i>	✓	✓	✓	✓	✓	✓	✓		✓	✓	90
Naididae			✓	✓		✓	✓	✓	✓		60
Arachnida											
Hydrachnidia sp								✓		✓	20
Hydrachnidae						✓					10
Hygrobatidae			✓		✓	✓	✓		✓	✓	60
<i>Hydrozetes sp.</i>			✓		✓	✓					30
Malacostraca											
<i>Hyalella cf kochi</i>	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	100
Ostracoda											
Ostracoda	✓	✓	✓			✓			✓		50
Entognatha											
Isotomidae			✓			✓					20
Coleoptera											
<i>Austrelmis sp.</i>	✓	✓	✓	✓		✓	✓	✓	✓	✓	90
<i>Lancetes sp.</i>			✓	✓							20
Diptera											
Ceratopogonidae			✓	✓							20
Chironominae	✓	✓	✓	✓	✓						50
Diamesinae								✓			10
Podonominae		✓	✓	✓	✓		✓	✓		✓	70
Orthoclaadiinae	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	100
Tanypodinae	✓		✓	✓	✓	✓					50
Culicidae		✓	✓								20
Empididae					✓				✓	✓	30
Limonidae					✓	✓		✓			30
Muscidae			✓	✓		✓	✓				40
Simuliidae					✓		✓	✓		✓	40
Ephemeroptera											

<i>Andesiops sp</i>			✓			✓	✓	✓		✓	50
<i>Meridialaris sp</i>					✓						10
Hemiptera											
<i>Ectemnostega sp</i>	✓	✓		✓		✓					40
Plecoptera											
<i>Claudioperla sp</i>							✓	✓		✓	30
Odonata											
<i>Protallagma sp</i>					✓						10
Trichoptera											
Helicopsychidae					✓	✓			✓	✓	40
<i>Cailloma sp</i>								✓			10
<i>Metrichia sp</i>	✓		✓		✓	✓	✓	✓	✓	✓	80
Leptoceridae					✓		✓		✓	✓	40
Sericostomatidae						✓	✓	✓			30
S	10	11	20	13	15	19	14	14	11	14	

Table S4. Values (mean \pm standard deviation) of the diversity indices calculated from the biological data matrix: S= richness, N= abundance, J' = Pielou's Evenness, H' = Shannon Diversity. *Valores (media \pm desviación estandar) de los índices de diversidad calculados a partir de la matriz de datos biológicos: S= Riqueza, N= abundancia, J' = Índice de Pielou, H' = Diversidad de Shannon.*

Factor		S		N		J'		H'	
Site	PAQ	9.25	\pm 1.26	226.00	\pm 79.55	0.63	\pm 0.06	1.39	\pm 0.20
	ANY	12.25	\pm 3.77	480.00	\pm 438.55	0.58	\pm 0.03	1.42	\pm 0.17
	PIS	9.75	\pm 3.59	96.00	\pm 61.53	0.77	\pm 0.13	1.73	\pm 0.57
	MST	8.75	\pm 3.59	65.75	\pm 66.72	0.82	\pm 0.11	1.71	\pm 0.08
	ANC	11.75	\pm 1.26	292.00	\pm 185.14	0.68	\pm 0.05	1.68	\pm 0.13
Season	Pre-rainfall	10.60	\pm 2.22	174.30	\pm 104.91	0.71	\pm 0.10	1.65	\pm 0.26
	Post-rainfall	10.10	\pm 3.70	289.60	\pm 333.85	0.68	\pm 0.14	1.52	\pm 0.33
Ecosystem	Lentic	11.08	\pm 2.57	332.67	\pm 275.97	0.63	\pm 0.06	1.50	\pm 0.20
	Lotic	9.25	\pm 3.37	80.88	\pm 61.58	0.79	\pm 0.11	1.72	\pm 0.37

Table S5. Pairwise text between the different sites and significance level for biological and environmental data. *Análisis pareado entre los diferentes sitios y el nivel de significancia para los datos biológicos y ambientales.*

Pairwise Tests	Biological Data				
Groups	R Statistic	Significance Level %	Possible Permutations	Actual Permutations	Number >= Observed
PAQ – ANY	0.719	2.9	35	35	1
PAQ – PIS	0.854	2.9	35	35	1
PAQ – MST	0.802	2.9	35	35	1
PAQ – ANC	0.667	2.9	35	35	1
ANY – PIS	0.865	2.9	35	35	1
ANY – MST	0.719	2.9	35	35	1
ANY – ANC	0.896	2.9	35	35	1
PIS – MST	0.271	5.7	35	35	2
PIS – ANC	0.479	2.9	35	35	1
MST – ANC	0.573	2.9	35	35	1

Pairwise Tests	Environmental Data				
Groups	R Statistic	Significance Level %	Possible Permutations	Actual Permutations	Number >= Observed
PAQ – ANY	0.998	0.02	6435	6435	1
PAQ – PIS	0.996	0.02	6435	6435	1
PAQ – MST	0.772	0.02	6435	6435	1
PAQ – ANC	1	0.02	6435	6435	1
ANY – PIS	0.996	0.02	6435	6435	1
ANY – MST	0.613	0.02	6435	6435	1
ANY – ANC	0.866	0.02	6435	6435	1
PIS – MST	0.7	0.03	6435	6435	2
PIS – ANC	1	0.02	6435	6435	1
MST – ANC	0.309	0.6	6435	6435	39