Oikos

OIK-04578

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Appendix 1

Environmental invertebrate abundance

Semi -quantitative kick samples of benthic invertebrate prey communities were taken at five locations within each site to estimate composition and density. This was done by 10 kicks at each location using a fine meshed (250 μm) kick net. Samples were pooled and stored in ethanol before counting and identification to various taxonomic levels in the laboratory.

Benthic invertebrate community composition differed significantly between stream types ($F_{1,8} = 9.68$, $p < 0.01$) (Table A2). The largest differences were seen in the number of ephemeroptera and tricoptera, which dominate the invertebrate community in surface water fed streams, and gammarids, which are far more abundant in groundwater fed streams. Differences in invertebrate densities were large, (groundwater 651 ± 522 individuals, surface water 319 ± 268 individuals per sample), but not significant between stream types (t-test, $t_8 = 1.13$, $p = 0.29$).

Table A1. Streams in which habitat mapping and quantitative fishings were conducted. Main study streams are in bold face text

Stream	Stream type	Coordinates	Altitude m a.s.l.	Mean width (m)	Length of transect (m)	Trout density (ind m^{-2})
Giessen	GW	46.898, 8.619	451	4.0	26	0.13
Klosterbach SZ	GW	46.997, 8.613	437	2.6	21.9	0.21
Klosterbach UR	GW	46.886, 8.610	434	4.2	23	0.87
N2 Entw.kanal	GW	46.967, 8.349	443	2.7	57	1.54
Schibenriedbach	GW	46.837, 8.175	493	3.5	26	0.75
Schützenbrunnen	GW	46.809, 8.662	474	3.2	25	0.31
Walenbrunnen	GW	46.852, 8.645	455	3.7	32.5	0.31
Altibach	SW	46.830, 8.159	540	3.6	23	0.19
Chli Schliere	SW	46.951, 8.282	438	8.7	58.6	0.06
Dorfbach	SW	46.898, 8.623	395	4.5	32	0.05
Gangbach	SW	46.858, 8.648	460	3.2	22	0.38
Meisibach	SW	46.943, 8.258	510	2.9	60	0.09
Scheidbächli	SW	47.065, 8.432	443	1.5	25.3	0.82
Steinibach	SW	46.928, 8.396	500	5.2	40.5	0.05
Würzenbach	SW	47.082, 8.400	495	3.7	28	0.65

Table A2. Abundance (counts) of invertebrates per pooled kick sample by taxonomic group for all main study streams. SW = surface water, GW = groundwater, Col = coleoptera, Dip= diptera, Tri = trichoptera, Eph = Ephemeroptera, Ple = Plecoptera, Gam = Gammarus, Gas = Gastropoda, Others = Unidentifiable taxa

Stream	Type	Col	Dip	Tri	Eph	Ple	Gam	Gas	Others	Total
N2	GW	605	0	0	29	0	835	144	0	1613
SB	GW	50	276	6	66	13	283	53	1	749
SG	GW	30	26	5	31	0	316	67	0	475
SR	GW	76	12	5	6	6	58	19	0	182
WB	GW	42	4	6	31	1	48	101	1	234
CS	SW	0	6	10	127	4	0	0	1	148
EA	SW	2	146	68	350	50	0	0	0	616
GB	SW	20	48	76	476	24	28	2	0	674
GM	SW	6	8	5	80	0	4	0	1	104
KB	SW	0	9	5	37	3	0	0	0	54

Table A3. Loadings for first two principal components from a PCA carried out on site substrate and hydromorphology habitat stability indicators. Values represent correlations between the original variables and the calculated PC axes: 0 = no correlation; 1 = perfect positive correlation; -1 = perfect negative correlation.

	Habitat variables	PC1 loading (Variance explained: 31%)	PC2 loading (Variance explained: 19%)
Substrate			
	emergent vegetation	-0.40	-0.17
	submerged vegetation	-0.36	0.31
	mud	-0.23	-0.37
	sand	-0.06	0.05
	gravel	0.15	-0.09
	pebbles	0.37	0.01
	cobbles	0.34	0.03
	large stones	0.01	-0.34
Hydromorphology			
	riffles	0.39	-0.08
	run	-0.30	0.30
	fast run	-0.10	0.24
	waterfalls	-0.25	-0.33
	pools	-0.14	-0.54
	Shallow water	0.19	-0.24

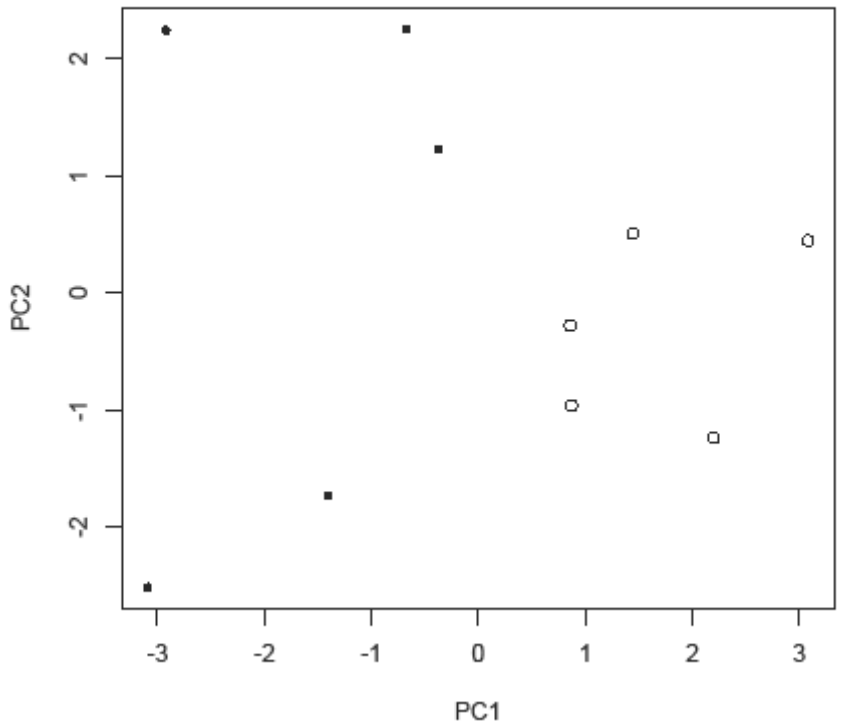

Figure A1. Biplot of the first two axes of a PCA analysis on substrate and hydromorphological habitat stability variables. Open circles = surface water fed streams; closed circles = groundwater fed streams. Loadings for PC axes are provided in Table A3.

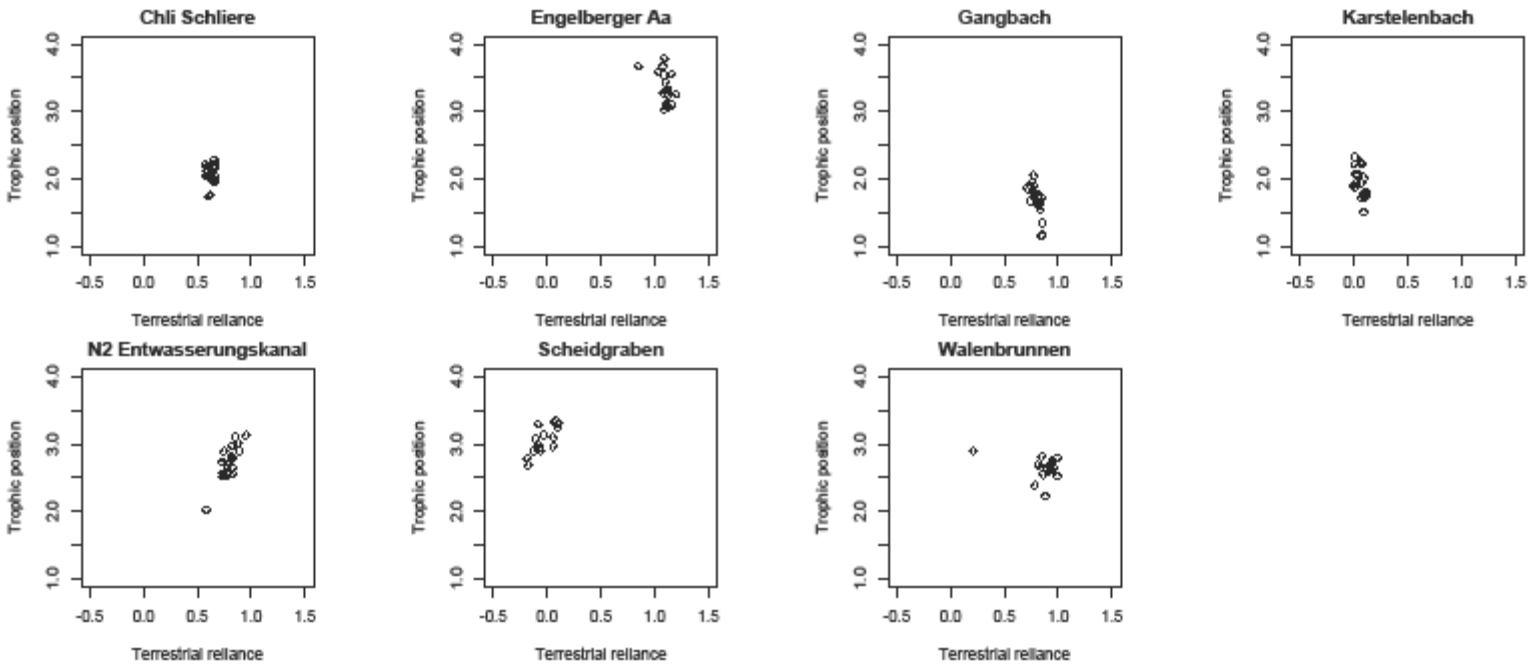

Figure A2. Biplot of terrestrial reliance and trophic position of trout populations across seven streams where isotopic analysis were possible. Top row = surface water fed; bottom row = groundwater fed. Data converted from raw $\delta^{13}C$ and $\delta^{15}N$ values using linear mixing equations.

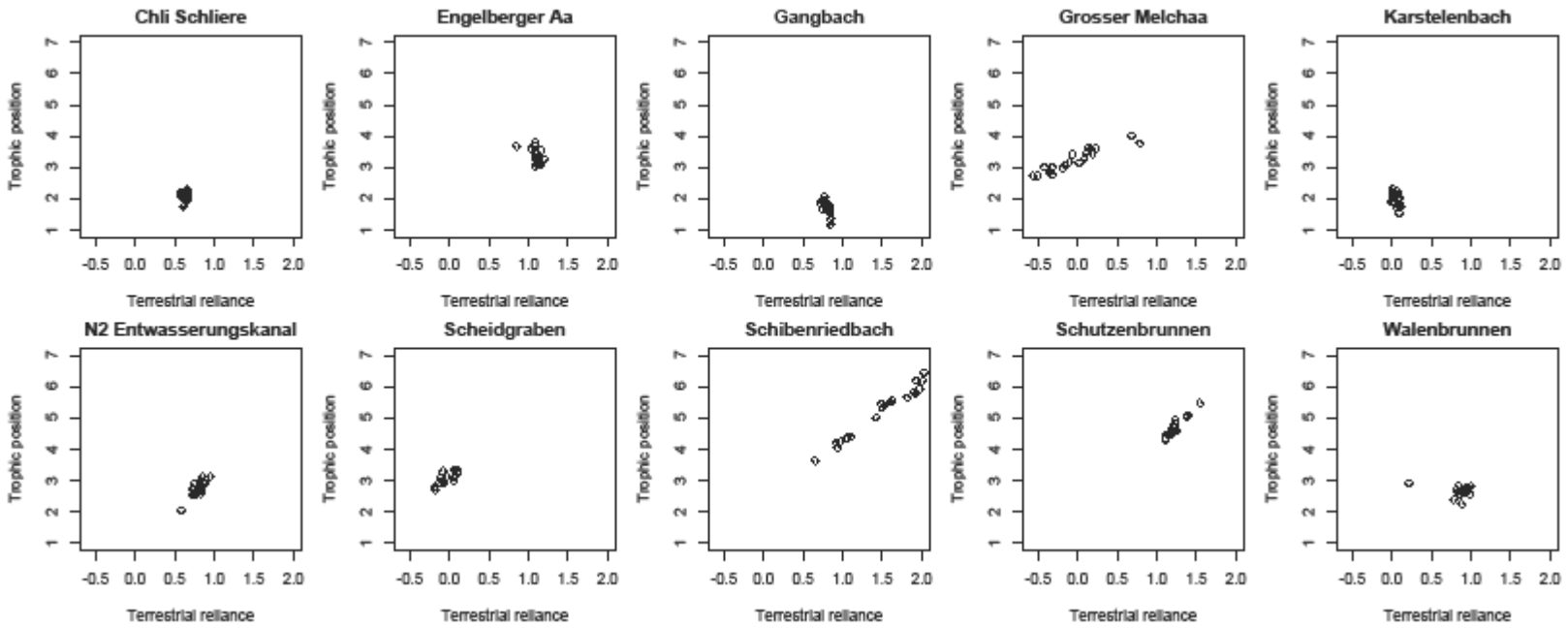

Figure A3. Biplot including all ten streams. Plots show that points are outside the interpretable range (terrestrial reliance above 100 or below 0%) in excluded streams, as well as very low difference in C (below three percentage points), which lead to the exclusion of these plots.

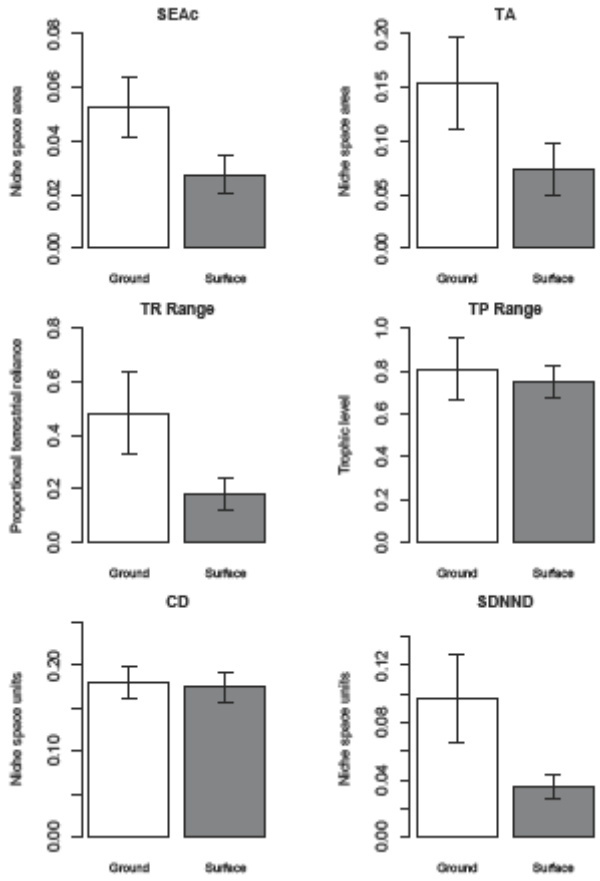

Figure A4. Bar plots of six additional isotopic niche metrics calculated for trout populations across the two stream types (ground = groundwater fed; surface = surface water fed). n = 7 as three streams (two groundwater, one surface water) were dropped due to non-interpretable baseline values (see methods). Bars represent mean ± 95% confidence interval values. Niche metric abbreviations: SEAc = sample-size-corrected standard ellipse area; TA = total hull area; TR range = total range of terrestrial reliance values; TP range = total range of trophic position values; CD = mean distance to centroid; SDNND = standard deviation of nearest neighbour distance.