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SUPPLEMENTARY MATERIAL

Odonata response to degraded environment

Odonata assemblages in anthropogenically impacted lotic habitats

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Supplementary Tab. 1. List of the 46 degraded lowland rivers and streams in Croatia, with their physical and chemical characteristics. Codes of the study sites are as in Fig. 1.

Study site	River size	RFI Group	Coordinates (N/E)		Tw	Oxy	Con	pH	NH_4^+	NO^{3-}	TN	PO_4^{3-}	TOC	BOD_5	COD	Substrate
1	S	1	46.24	16.17	14	10.09	503	7.96	0.373	1.090	1.940	0.062	4.037	2.308	3.942	Lithal, fine sediment, phytal
2	S	1	46.17	17.15	19	3.64	718	7.54	0.014	0.100	0.466	0.016	5.235	2.531	4.463	Fine sediment, phytal
3	S	1	46.04	15.99	13	9.96	556	8.15	0.224	1.033	1.788	0.094	3.429	2.192	3.567	Fine sediment, phytal
4	M	3	45.83	15.82	16	9.02	605	8.16	0.178	1.284	1.928	0.050	3.671	1.767	3.733	Fine sediment, phytal
5	M	3	45.93	15.82	16	8.05	628	8.13	0.316	1.227	2.073	0.065	3.671	2.150	3.933	Lithal, fine sediment, phytal
6	M	3	46.03	15.91	19	8.77	710	8.05	0.437	1.392	2.443	0.025	4.292	4.969	6.636	Lithal, fine sediment
7	S	1	46.15	15.88	13	8.97	574	8.17	0.920	1.179	2.950	0.025	4.917	6.663	8.878	Lithal, fine sediment, phytal
8	S	2	45.86	16.33	16	8.20	796	8.50	0.460	0.948	1.772	0.333	6.297	3.153	8.469	Fine sediment, phytal
9	S	2	45.86	16.40	15	3.92	702	7.64	3.240	1.110	6.379	1.952	9.971	3.028	10.308	Fine sediment, phytal
10	S	2	45.98	15.94	17	10.20	484	8.15	0.061	1.038	1.517	0.025	3.292	4.039	5.772	Fine sediment
11	S	3	45.67	16.42	11	6.02	564	7.85	0.333	1.701	2.527	0.215	7.608	3.019	7.992	Fine sediment, phytal
12	S	1	46.05	16.07	13	10.25	545	8.47	0.256	1.365	2.032	0.025	2.233	3.395	4.822	Lithal, fine sediment
13	S	2	46.50	16.47	16	9.81	446	7.82	0.279	2.600	3.775	0.046	1.874	1.525	1.898	Fine sediment, phytal
14	S	1	46.40	16.45	14	7.81	316	7.60	1.599	2.304	5.025	0.340	5.582	2.683	4.694	Lithal, phytal
15	S	1	46.27	16.86	21	6.90	982	7.52	0.158	0.540	1.080	0.058	4.561	1.880	5.070	Fine sediment, phytal
16	S	1	46.12	17.03	25	9.20	885	9.20	0.513	1.416	2.880	0.141	5.922	1.650	5.147	Fine sediment, phytal
17	S	1	45.69	16.39	11	8.12	625	8.12	0.306	1.852	2.370	0.310	7.352	3.240	8.449	Fine sediment, phytal

Study site	River size	RFI Group	Coordinates (N/E)		Tw	Oxy	Con	pH	NH_4^+	NO^{3-}	TN	PO_4^{3-}	TOC	BOD_5	COD	Substrate
18	S	1	46.48	16.51	14	9.55	332	7.58	0.018	3.918	5.250	0.010	2.095	1.033	2.085	Fine sediment, phytal
19	S	2	46.43	16.60	16	7.50	391	7.48	0.064	1.317	1.694	0.020	1.333	1.317	1.338	Fine sediment, phytal
20	S	2	46.37	16.69	16	9.89	735	8.19	0.276	6.541	8.192	0.080	1.000	1.146	0.936	Fine sediment, phytal
21	S	1	46.34	16.81	17	8.80	608	8.18	0.053	3.478	4.683	0.018	1.237	1.183	1.097	Fine sediment, phytal
22	M	3	45.82	16.28	14	8.41	592	8.22	0.157	1.873	2.260	0.136	3.633	2.303	4.584	Lithal
23	M	3	45.81	16.41	12	10.70	616	8.48	0.373	1.700	2.370	0.343	5.388	2.998	6.672	Fine sediment, phytal
24	M	3	45.78	16.49	11	6.60	610	7.98	0.574	1.938	3.702	0.333	5.489	5.600	10.933	Lithal, fine sediment
25	M	3	45.63	16.56	12	5.75	581	8.02	0.487	1.503	2.744	0.171	8.458	3.895	10.949	Fine sediment, phytal
26	M	3	45.72	17.04	21	3.58	429	7.52	0.067	0.796	1.170	0.105	6.230	4.178	11.689	Fine sediment, phytal
27	M	3	45.83	16.64	25	5.05	396	7.70	0.514	1.965	3.799	0.208	7.134	8.033	14.122	Lithal, phytal
28	M	3	45.84	16.82	23	6.75	401	7.78	0.096	1.285	2.168	0.103	6.046	4.967	12.633	Fine sediment, phytal
29	M	3	46.16	15.61	16	8.29	553	8.16	0.141	1.071	1.713	0.077	3.868	1.517	4.117	Fine sediment
30	M	2	46.00	17.25	17	9.17	551	7.77	0.115	0.654	1.375	0.040	3.096	1.242	2.320	Fine sediment, phytal
31	M	3	46.04	15.85	21	8.85	713	7.97	0.493	0.952	1.968	0.025	3.761	4.683	6.483	Fine sediment, phytal
32	M	3	46.00	15.86	19	8.78	732	8.02	0.198	1.031	1.733	0.025	4.672	3.949	5.772	Fine sediment, phytal
33	M	3	46.12	17.03	20	7.87	588	7.62	0.223	0.668	1.392	0.225	2.993	1.200	2.472	Fine sediment, phytal
34	M	3	45.58	17.04	24	8.30	461	8.04	0.413	2.179	3.227	0.224	3.316	4.089	6.678	Fine sediment
35	S	1	45.59	17.19	22	6.52	539	7.65	0.818	1.283	3.067	0.224	3.518	7.133	8.722	Fine sediment, phytal
36	S	1	45.61	17.24	18	8.95	465	8.23	0.015	1.070	1.000	0.035	2.184	4.963	4.850	Lithal, fine sediment
37	S	1	45.88	16.39	22	8.93	207	8.15	0.211	3.127	3.615	6.545	7.596	2.734	8.558	Fine sediment

Study site	River size	RFI Group	Coordinates (N/E)		Tw	Oxy	Con	pH	NH_4^+	NO^{3-}	TN	PO_4^{3-}	TOC	BOD_5	COD	Substrate
38	S	1	46.32	16.62	12	5.22	524	7.52	1.919	0.967	3.758	0.131	2.023	3.058	1.443	Fine sediment
39	S	1	46.52	16.43	16	8.29	629	7.77	0.537	1.251	2.567	0.092	3.866	2.208	3.451	Lithal, fine sediment, phytal
40	S	2	46.34	16.82	17	5.70	574	5.68	4.093	0.554	5.033	0.248	4.695	4.042	3.568	Phytal
41	S	2	46.01	16.45	25	1.53	619	7.85	5.007	1.484	9.567	1.569	27.671	6.225	9.408	Fine sediment, phytal
42	S	1	45.78	15.84	20	6.90	670	7.85	1.240	2.915	5.168	0.387	4.146	4.626	5.897	Fine sediment, phytal
43	S	2	45.60	16.99	20	4.52	601	7.75	3.495	3.880	14.023	1.488	8.142	22.856	18.933	Lithal, fine sediment
44	S	1	46.51	16.31	12	8.80	740	8.45	0.320	0.931	1.858	0.069	3.651	1.500	3.224	Lithal, fine sediment
45	S	2	46.45	16.59	14	3.50	541	7.36	0.103	5.545	7.258	0.025	2.120	0.729	1.807	Phytal
46	M	3	45.87	16.49	9	6.68	578	7.77	1.220	1.996	3.970	0.322	5.082	4.366	6.112	Fine sediment, phytal

S - small rivers (catchment area less than 100 km^2), M - medium-sized rivers (catchment area less than 1000 km^2). RFI - Group in SIMPER and Cluster analyses - according to RFI EQR (1 - good and high, 2 - moderate, 3- poor and bad EQR). Abiotic factors: Tw - Water temperature (^{0}C), Oxy - Dissolved oxygen content (mg/L), Con - Conductivity (µS/cm), pH – pH, NH_4^+ - Ammonium (mgN/L), NO_3- - Nitrates (mgN/L), TN - Total nitrogen (mgN/L), PO_4^{3-} - Orthophosphates (mgP/L), TOC - Total organic carbon (mg/L), BOD_5 - Biological Oxygen Demand (mgO_2/L), CODMn - Chemical oxygen demand (mgO_2/L), Substrate - Substrate composition (lithal - gravel, stones; fine sediment - silt, mud, sand; phytal - aquatic vegetation).

Supplementary Tab. 2. Vegetation characteristics at the 46 anthropogenically impacted sites in Croatia. Study site names are presented in Fig. 1.

Study site	Habitat width (m)	Habitat depth (m)	Light characteristics	Aquatic vegetation	Surrounding vegetation	Additional remarks
1	6.0	1.5	Partially shaded	Submerged vegetation present but scarce	Grassland, trees	
2	3.0	0.8	Sunny	Very dense emergent vegetation	Grassland	Emergent vegetation partially mowed
3	8.0	1.0	Sunny	Not present	Grassland, meadow	Muddy water; shoreline erosion
4	18.0	2.0	Partially shaded	Submerged and emergent vegetation	Grassland, trees	
5	16.0	30.0	Sunny	Submerged and emergent vegetation present but scarce	Grassland, bushes	
6	8.0	1.0	Partially shaded	Not present	Grassland, individual trees	Muddy water
7	6.0	0.4	Sunny	Submerged vegetation present but scarce	Bushes	
8	5.0	0.5	Sunny	Dense submerged and emergent vegetation, algae	Grassland, bushes	
9	3.0	0.3	Partially shaded	Dense submerged and emergent vegetation, algae	Bushes	
10	5.0	0.4	Sunny	Emergent vegetation around the habitat's edges present, no submerged vegetation	Grassland	
11	4.0	0.6	Partially shaded	Dense submerged and emergent vegetation	One side overgrown by trees, the other by grassland	Muddy water
12	3.0	0.4	Partially shaded	Not present	Grassland, trees	Muddy water
13	2.5	0.5	Sunny	Submerged and emergent vegetation	Grassland	Emergent vegetation at the habitat's edges and surrounding grassland mowed

Study site	Habitat width (m)	Habitat depth (m)	Light characteristics	Aquatic vegetation	Surrounding vegetation	Additional remarks
14	1.5	0.3	Sunny	Algae, dense emergent vegetation	Grassland	Emergent vegetation mowed at the habitat's edges
15	3.0	0.5	Shaded	Dense submerged and emergent vegetation	Trees	
16	1.5	0.3	Sunny	Submerged, floating and emergent vegetation	Grassland	
17	6.0	1.0	Sunny	Dense submerged vegetation	Grassland, bushes	Shoreline erosion
18	2.0	0.5	Sunny	Submerged and emergent vegetation	Grassland	Emergent vegetation and grassland mowed
19	5.0	0.8	Sunny	Algae, emergent vegetation	Grassland	Muddy water; emergent vegetation and grassland mowed
20	4.0	1.0	Sunny	Submerged and emergen vegetation	Grassland	Grassland mowed
21	7.0	1.0	Sunny	Dense submerged and emergent vegetation	Grassland	
22	4.0	0.8	Partially shaded	Not present	Grassland, trees	
23	10.0	0.8	Sunny	Submerged, floating and emergent vegetation	Grassland	
24	15.0	2.0	Sunny	Not present	Grassland	Muddy water, shoreline erosion
25	10.0	1.0	Sunny	Algae	Grassland, individual trees	Muddy water, shoreline erosion
26	6.0	1.0	Sunny	Submerged and emergent vegetation	Grassland	Muddy water
27	12.0	1.2	Partially shaded	Submerged and emergent vegetation	Grassland, trees	Muddy water
28	14.0	1.0	Sunny	Submerged and emergent vegetation	Grassland	Muddy water
29	9.0	0.6	Partially shaded	Not present	Bushes, trees	Muddy water

Study site	Habitat width (m)	Habitat depth (m)	Light characteristics	Aquatic vegetation	Surrounding vegetation	Additional remarks
30	6.0	1.5	Sunny	Emergent vegetation	Grassland, individual trees	
31	5.0	1.5	Sunny	Algae, emergent vegetation along the habitat's edges	Grassland	
32	2.5	0.4	Partially shaded	Emergent vegetation present but scarce	Grassland, trees	Grassland mowed
33	10.0	1.5	Sunny	Submerged, floating and emergent vegetation	Grassland	
34	4.0	0.5	Sunny	Not present	Grassland	Muddy water
35	5.0	0.5	Sunny	Submerged and emergent vegetation	Grassland	
36	4.5	0.3	Shaded	Not present	Trees	
37	1.5	0.2	Sunny	Dense algae	Meadow	Emergent vegetation present outside the water, at the shoreline
38	2.0	0.2	Shaded	Not present	Trees	
39	1.5	1.0	Sunny	Submerged and emergent vegetation present but scarce	Grassland	Grassland mowed
40	3.5	0.6	Sunny	Emergent vegetation	Grassland	Grassland mowed
41	2.0	0.4	Sunny	Dense algae	Grassland	Uspream is a cattle farm, dark muddy smelly water
42	2.5	0.3	Partially shaded	Very dense emergent vegetation	Grassland and trees	
43	2.5	0.3	Partially shaded	Not present	Grassland and trees	Muddy water
44	2.0	0.5	Partially shaded	Not present	Grassland and trees	
45	3.0	0.7	Sunny	Emergent vegetation	Grassland	Completely overgrown habitat
46	-	-	Sunny	Dense submerged and emergent vegetation, algae	Grassland	

Supplementary Tab. 3. Odonata taxa (individuals/m^2) recorded at the 46 anthropogenically impacted sites in Croatia. Abbreviations of the study site names are presented in Fig. 1.

Taxa/Study site	Taxa codes	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Zygoptera*	*Zyg*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16	0	0	0	0	0	0	0
Coenagrionidae*	*Coe*	0	0	0	16	0	0	0	96	224	24	0	0	0	0	0	0	0	0	0	0	0	0	48
Coenagrion puella (Linnaeus, 1758)	*C pu*	8	0	0	0	0	0	0	0	32	0	0	0	0	96	0	0	0	0	0	0	0	0	0
Erythromma lindenii (Selys, 1840)	*E li*	0	0	0	0	0	0	0	0	16	0	0	0	0	0	0	0	0	16	0	4	0	0	0
Erythromma viridulum Charpentier, 1840	*E vi*	0	0	0	0	0	0	0	0	0	16	0	0	0	0	0	0	0	0	0	0	0	0	0
Ischnura elegans (Vander Linden, 1820)	*I el*	0	8	0	20	0	0	0	352	80	40	16	0	0	0	0	0	16	0	0	0	0	0	104
Lestes viridis (Vander Linden, 1825)	*L vi*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0
*Calopteryx sp.**	*Cal*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Calopteryx splendens (Harris, 1780)	*C sp*	0	0	0	20	40	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0
Calopteryx virgo (Linnaeus, 1758)	*C vi*	32	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	4	18	96	0
Platycnemis pennipes (Pallas, 1771)	*P pe*	16	0	0	568	0	8	16	0	0	16	0	0	56	0	0	0	0	0	0	0	2	176	16
Anisoptera*	*Ani*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	64	0	0	0	0	0	0	0
*Aeshna sp.**	*Aes*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aeshna cyanea (Müller, 1764)	*A cy*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0
Anax imperator (Leach, 1815)	*A im*	0	0	0	0	0	0	0	0	0	16	0	0	0	0	0	0	0	0	0	0	0	0	0
Somatochlora meridionalis Nielsen, 1935	*S me*	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0	32	0	0	0	0	0	0	0
Gomphus vulgatissimus (Linnaeus, 1758)	*G vu*	24	0	0	0	0	0	0	0	0	0	0	32	0	0	0	0	8	0	0	0	8	16	0
Onychogomphus forcipatus (Linnaeus, 1758)	*O fo*	0	0	16	0	8	0	32	0	0	0	32	0	0	0	0	0	0	0	0	2	0	0	0
Ophiogomphus cecilia (Geoffroy in Fourcroy, 1785)	*O ce*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Libellulidae*	*Lib*	0	0	0	0	0	0	0	64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Libellula depressa Linnaeus, 1758	*L de*	0	0	0	0	0	0	0	64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Libellula quadrimaculata Linnaeus, 1758	*L qu*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Orthetrum albistylum (Selys, 1848)	*O al*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	8

Taxa/Study site	Taxa codes	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Orthetrum brunneum (Fonscolombe, 1837)	*O br*	0	0	0	0	0	0	0	0	0	0	0	0	0	80	0	0	0	0	0	0	0	0	0
Sympetrum sp.*	*Sym*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0
Zygoptera*	*Zyg*	0	0	0	0	84	0	0	136	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0
Coenagrionidae*	*Coe*	0	0	0	12	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coenagrion puella (Linnaeus, 1758)	*C pu*	0	80	0	0	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Erythromma lindenii (Selys, 1840)	*E li*	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Erythromma viridulum Charpentier, 1840	*E vi*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ischnura elegans (Vander Linden, 1820)	*I el*	24	64	4	0	11	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lestes viridis (Vander Linden, 1825)	*L vi*	0	0	1	0	0	0	0	0	64	0	0	0	0	0	0	0	0	0	0	0	0	0	0
*Calopteryx sp.**	*Cal*	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Calopteryx splendens (Harris, 1780)	*C sp*	0	0	0	0	6	0	0	0	32	0	14	0	0	0	0	0	0	0	0	0	0	0	0
Calopteryx virgo (Linnaeus, 1758)	*C vi*	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Platycnemis pennipes (Pallas, 1771)	*P pe*	0	0	0	0	0	0	4	14	32	0	10	0	0	0	0	0	0	0	0	0	0	0	0
Anisoptera*	*Ani*	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
*Aeshna sp.**	*Aes*	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aeshna cyanea (Müller, 1764)	*A cy*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Anax imperator (Leach, 1815)	*A im*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Somatochlora meridionalis Nielsen, 1935	*S me*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gomphus vulgatissimus (Linnaeus, 1758)	*G vu*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Onychogomphus forcipatus (Linnaeus, 1758)	*O fo*	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ophiogomphus cecilia (Geoffroy in Fourcroy, 1785)	*O ce*	0	0	0	0	0	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Libellulidae*	*Lib*	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Libellula depressa Linnaeus, 1758	*L de*	0	0	0	0	0	0	0	0	32	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Libellula quadrimaculata Linnaeus, 1758	*L qu*	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Orthetrum albistylum (Selys, 1848)	*O al*	0	32	0	0	1	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Taxa/Study site	Taxa codes	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Orthetrum brunneum (Fonscolombe, 1837)	*O br*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sympetrum sp.*	*Sym*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0