

Monitoring sites: main sources (Bijela Rijeka source, Crna Rijeka source, Plitvica source), rivers (Bijela Rijeka, Crna Rijeka, Matica, Plitvica , Sartuk, Rječica, Korana), lake outlets (lotic biotops on tufa barriers: Proščansko jezero lake, Batinovac, Gradinsko, Kozjak lake, Novakovića Brod) and lakes (Veliko jezero).

Physico-chemical indicators

Site	Date	Temperature /°C	pH	Conductivity / $\mu\text{S cm}^{-1}$	Oxygen / $\text{mg O}_2 \text{L}^{-1}$	COD_KMnO <sub>4</sub> / $\text{mg O}_2 \text{L}^{-1}$	Total hardness / $\text{mg CaCO}_3 \text{L}^{-1}$	Orthophosphates / $\text{mg P L}^{-1}$	Ammonia / $\text{mg N L}^{-1}$	Nitrates / $\text{mg N L}^{-1}$	Total phosphorus / $\text{mg P L}^{-1}$	Total nitrogen / $\text{mg N L}^{-1}$
Bijela Rijeka source	01.03.21.	7.4	7.79	501	10.05	0.98	286.15	0.008	0.000	0.99	0.000	1.18
	12.04.21.	7.7	7.85	492	10.57	0.64	292.01	0.007	0.000	1.00	-	1.37
	04.05.21.	8.6	7.76	496	11.09	0.90	330.40	0.007	0.005	1.07	-	1.34
	08.06.21.	8.5	7.84	498	10.22	0.39	293.23	0.006	0.005	1.00	-	1.41
	06.07.21.	8.6	7.69	492	10.40	1.48	305.89	0.005	0.000	1.08	-	1.32
	11.08.21.	8.6	7.75	495	10.87	1.70	296.70	0.006	0.000	1.10	-	1.44
	06.09.21.	8.0	7.78	497	10.63	0.56	287.72	0.008	0.006	1.12	-	1.32
	04.10.21.	7.6	7.99	501	9.69	0.90	290.99	0.009	0.004	1.05	0.016	1.40
Crna Rijeka source	01.03.21.	7.9	7.65	431	9.96	0.73	256.49	0.011	0.000	0.69	0.002	1.12
	12.04.21.	7.9	7.68	423	10.25	0.62	253.46	0.010	0.000	0.58	-	0.97
	04.05.21.	8.0	7.43	425	9.93	0.79	272.20	0.011	0.001	0.67	-	0.87
	08.06.21.	8.2	7.45	434	9.61	0.55	249.53	0.009	0.001	0.59	-	1.00
	06.07.21.	8.1	7.32	435	9.94	1.42	300.38	0.009	0.004	0.68	-	1.00
	11.08.21.	8.0	7.21	439	9.67	0.60	283.63	0.013	0.000	0.73	-	1.07
	06.09.21.	8.0	7.32	441	8.35	0.36	257.91	0.014	0.000	0.75	-	0.94
	04.10.21.	8.0	7.43	442	8.01	0.63	255.45	0.007	0.000	0.76	0.020	1.04
Plitvica source	01.03.21.	7.3	7.63	468	10.08	1.14	283.73	0.014	0.006	1.27	0.000	1.45
	12.04.21.	7.4	7.89	420	10.19	0.67	257.90	0.003	0.000	1.09	-	1.58
	04.05.21.	7.5	7.58	444	10.46	1.11	310.18	0.016	0.005	1.27	-	1.70
	08.06.21.	7.7	7.60	467	9.79	0.65	270.16	0.011	0.000	1.19	-	2.13
	06.07.21.	7.6	7.41	472	10.21	1.27	314.88	0.011	0.001	1.23	-	1.76
	11.08.21.	7.6	7.33	460	9.70	0.82	284.86	0.016	0.000	1.34	-	1.68
	06.09.21.	7.5	7.56	471	9.63	0.58	270.97	0.010	0.000	1.29	-	1.54
	04.10.21.	7.5	7.68	472	9.17	0.97	271.38	0.008	0.000	1.10	0.014	1.41
Bijela Rijeka river	01.03.21.	6.7	8.25	485	10.95	1.42	295.03	0.011	0.008	0.93	0.000	1.27
	12.04.21.	7.8	8.23	476	10.80	0.93	292.01	0.011	0.003	0.82	-	1.52
	04.05.21.	9.8	8.26	475	10.19	1.46	324.27	0.011	0.006	0.91	-	1.20
	08.06.21.	10.3	8.24	481	9.89	0.92	282.41	0.010	0.008	0.79	-	1.29
	06.07.21.	11.3	8.19	481	9.81	1.94	306.71	0.008	0.004	0.90	-	1.12
	11.08.21.	11.0	8.00	560	9.47	1.12	339.79	0.013	0.000	0.90	-	1.20
	06.09.21.	9.3	8.03	463	9.72	1.08	279.35	0.009	0.005	0.93	-	1.19
	04.10.21.	8.9	8.07	491	9.23	1.34	283.63	0.006	0.000	0.85	0.005	1.10
Crna Rijeka river	01.03.21.	7.8	8.10	436	10.26	1.01	258.51	0.015	0.003	0.70	0.018	0.85
	12.04.21.	8.2	8.06	427	10.89	0.70	254.67	0.013	0.000	0.58	-	0.98
	04.05.21.	9.5	8.04	427	10.49	1.04	289.76	0.009	0.001	0.64	-	0.90
	08.06.21.	9.2	8.15	435	10.61	0.68	258.31	0.008	0.005	0.57	-	1.15
	06.07.21.	10.7	7.90	436	10.89	1.43	285.27	0.009	0.004	0.68	-	1.35
	11.08.21.	9.9	7.98	440	10.41	0.94	312.02	0.014	0.000	0.73	-	1.07
	06.09.21.	8.3	7.98	438	10.34	0.67	257.50	0.011	0.000	1.12	-	0.98
	04.10.21.	8.3	8.11	443	9.61	0.97	264.85	0.006	0.000	0.76	0.014	0.99
Matica river	01.03.21.	7.6	8.17	457	10.67	1.27	271.02	0.016	0.009	0.77	0.007	1.06
	12.04.21.	7.9	8.09	452	10.37	0.86	273.24	0.011	0.008	0.63	-	1.23
	04.05.21.	8.7	8.16	441	10.37	1.09	335.30	0.014	0.000	0.71	-	1.04
	08.06.21.	9.2	8.14	451	9.95	0.65	268.12	0.013	0.006	0.47	-	1.15
	06.07.21.	9.4	8.01	453	10.31	1.78	305.48	0.014	0.000	0.76	-	1.10
	11.08.21.	9.7	7.86	460	10.24	1.27	303.65	0.014	0.000	0.76	-	1.34
	06.09.21.	9.1	8.00	460	9.40	0.98	267.50	0.009	0.005	0.75	-	1.01
	04.10.21.	8.7	7.97	461	8.89	1.05	274.24	0.013	0.000	0.55	0.014	0.95
Rječica river	08.03.21.	4.6	8.35	515	11.55	1.42	326.51	0.007	0.025	0.91	0.000	1.32
	21.04.21.	6.3	8.25	509	10.90	1.38	342.85	0.010	0.005	1.03	-	1.22
	10.05.21.	8.2	8.21	512	10.31	1.28	303.03	0.007	0.015	0.84	-	1.47
	14.06.21.	10.1	8.12	515	10.01	1.35	314.26	0.008	0.010	0.68	-	1.08
	12.07.21.	12.1	7.95	517	9.43	1.39	206.65	0.010	0.006	0.73	-	1.24
	16.08.21.	11.8	7.88	519	9.16	1.83	336.11	0.008	0.000	0.78	-	1.08
	14.09.21.	10.5	8.01	505	9.84	1.40	326.11	0.011	0.001	0.73	-	1.03
	12.10.21.	8.1	8.12	462	9.93	2.92	273.63	0.005	0.000	0.82	0.020	1.19

Sartuk river	01.03.21.	2.6	8.39	477	12.48	2.84	292.41	0.011	0.001	0.96	0.000	1.17
	12.04.21.	6.3	8.36	460	10.99	2.06	278.48	0.000	0.000	0.75	-	1.21
	04.05.21.	6.0	8.46	470	11.71	2.32	337.75	0.013	0.000	0.79	-	1.08
	08.06.21.	11.1	8.45	469	9.94	2.46	284.66	0.009	0.008	0.55	-	1.13
	06.07.21.	13.4	8.26	455	9.57	3.61	321.21	0.010	0.001	0.64	-	0.90
	11.08.21.	15.8	8.35	447	8.65	4.01	291.39	0.015	0.000	0.65	-	1.00
	06.09.21.	10.8	8.45	442	9.79	2.37	263.21	0.011	0.000	0.73	-	1.07
04.10.21.	10.7	8.37	459	8.76	3.16	279.75	0.007	0.000	0.41	0.023	0.92	
Plitvica river	01.03.21.	5.4	8.31	451	11.17	1.41	272.83	0.010	0.015	1.18	0.000	1.34
	12.04.21.	7.7	8.28	436	10.79	1.00	258.51	0.010	0.001	1.01	-	1.41
	04.05.21.	8.9	8.36	426	11.20	1.24	316.31	0.010	0.004	1.36	-	1.81
	08.06.21.	11.4	8.38	440	9.87	1.09	267.91	0.011	0.010	0.96	-	1.50
	06.07.21.	13.1	8.22	438	9.78	1.93	285.06	0.014	0.005	1.03	-	1.57
	11.08.21.	15.7	8.23	429	9.11	1.52	282.82	0.013	0.000	1.11	-	1.41
	06.09.21.	11.8	8.29	439	8.13	1.04	256.68	0.008	0.000	1.10	-	1.47
04.10.21.	10.8	8.23	443	9.14	1.53	275.06	0.006	0.000	0.89	0.021	1.31	
Korana river	01.03.21.	4.1	8.43	397	11.91	1.38	233.08	0.014	0.006	0.74	0.000	0.97
	12.04.21.	7.7	8.32	393	11.34	0.89	252.05	0.001	0.000	0.60	-	1.44
	04.05.21.	9.4	8.46	387	10.89	1.11	288.13	0.011	0.000	0.69	-	0.90
	08.06.21.	16.3	8.43	366	9.41	0.69	226.47	0.009	0.006	0.49	-	1.02
	06.07.21.	19.2	8.40	352	8.81	1.50	290.99	0.010	0.000	0.51	-	1.28
	11.08.21.	22.2	8.33	341	7.96	1.36	245.65	0.013	0.000	0.47	-	0.83
	06.09.21.	17.3	8.42	203*	8.81	0.93	207.88	0.010	0.003	0.41	-	1.16
04.10.21.	15.5	8.18	343	8.22	1.20	211.55	0.008	0.003	0.20	0.021	0.63	
Prošćansko jezero lake outlet	08.03.21.	5.9	8.37	440	10.77	1.25	282.32	0.008	0.004	0.67	0.000	1.08
	21.04.21.	7.2	8.30	438	11.24	1.08	328.56	0.013	0.003	0.59	-	1.04
	10.05.21.	10.9	8.34	431	10.17	1.09	272.81	0.007	0.014	0.62	-	1.11
	14.06.21.	15.1	8.33	427	9.95	1.24	253.00	0.006	0.016	0.46	-	0.84
	12.07.21.	20.5	8.26	406	8.69	1.28	235.44	0.011	0.018	0.47	-	1.06
	16.08.21.	21.9	8.24	385	8.00	1.27	291.60	0.009	0.013	0.42	-	0.94
	14.09.21.	17.1	8.26	390	12.24	1.26	261.99	0.010	0.024	0.37	-	0.75
12.10.21.	11.0	8.21	414	9.05	1.77	245.65	0.005	0.058	0.43	0.025	0.88	
Gradinsko jezero lake outlet	08.03.21.	5.2	8.42	406	11.27	0.93	268.60	0.007	0.000	0.65	0.000	1.25
	21.04.21.	7.1	8.31	406	10.72	0.94	280.16	0.008	0.006	0.54	-	0.98
	10.05.21.	11.5	8.35	399	10.34	0.83	233.61	0.006	0.009	0.55	-	1.06
	14.06.21.	17.0	8.27	386	9.26	0.92	225.44	0.006	0.003	0.42	-	0.76
	12.07.21.	21.0	8.19	376	8.77	1.24	225.44	0.007	0.015	0.42	-	0.87
	16.08.21.	22.3	8.15	365	8.63	1.12	242.59	0.005	0.003	0.40	-	0.72
	14.09.21.	18.3	8.17	358	9.44	0.67	268.73	0.007	0.008	0.31	-	0.80
12.10.21.	12.3	8.35	372	8.80	1.63	217.07	0.002	0.009	0.35	0.012	0.77	
Kozjak lake outlet	08.03.21.	5.0	8.44	412	11.86	1.13	313.80	0.005	0.001	0.66	0.000	1.29
	21.04.21.	7.0	8.32	409	11.03	1.27	298.75	0.007	0.010	0.58	-	0.97
	10.05.21.	12.2	8.41	405	10.17	0.99	242.18	0.005	0.010	0.60	-	1.00
	14.06.21.	17.8	8.22	399	9.34	1.17	243.61	0.003	0.008	0.45	-	0.78
	12.07.21.	22.5	8.26	399	8.64	1.41	226.05	0.006	0.013	0.73	-	1.04
	16.08.21.	24.0	8.16	378	7.96	0.85	253.21	0.003	0.026	0.45	-	0.77
	14.09.21.	19.3	8.16	371	9.16	1.00	315.29	0.007	0.016	0.35	-	0.74
12.10.21.	14.5	8.25	374	9.40	1.66	214.21	0.006	0.010	0.36	0.012	0.71	
Novakovića Brod lake outlet	08.03.21.	4.8	8.25	406	11.96	1.20	283.73	0.005	0.005	0.65	0.000	0.95
	21.04.21.	7.1	8.22	401	10.54	1.13	292.41	0.005	0.008	0.57	-	0.95
	10.05.21.	11.6	8.46	397	10.34	0.64	236.06	0.003	0.011	0.56	-	1.40
	14.06.21.	18.1	8.30	375	8.98	0.90	215.64	0.007	0.013	0.44	-	0.84
	12.07.21.	22.7	8.31	375	8.40	1.43	221.35	0.006	0.201	0.45	-	0.92
	16.08.21.	23.3	8.29	355	8.34	1.27	227.07	0.002	0.011	0.41	-	0.77
	14.09.21.	18.6	8.25	348	9.06	1.07	268.52	0.005	0.003	0.35	-	0.76
12.10.21.	14.5	8.40	362	8.59	1.54	211.14	0.001	0.009	0.36	0.007	0.71	

Site	Assessment of water body status by physico-chemical quality elements
Bijela Rijeka river	GOOD
Crna Rijeka river	GOOD
Matica river	GOOD
Rječica river	GOOD
Sartuk river	GOOD
Plitvica river	GOOD
Korana river	GOOD
Prošćansko jezero lake outlet	HIGH
Gradinsko jezero lake outlet	HIGH
Kozjak lake outlet	HIGH
Novakovića Brod lake outlet	HIGH

The data collected on the monitoring sites during the period from March 2021 until October 2021 for the sites of the rivers and lake outlets (lotic biotops on tufa barriers) and regarding the Regulation on water quality standards (OG 73/13, 151/14, 78/15, 61/16) by physico-chemical indicators, showed that monitored sites are in the good to high status (green to blue).

The data collected on monitored sites for sources of main rivers (Bijela Rijeka, Crna Rijeka, Plitvica) showed minor seasonal changes which was definitely expected because these sources are considered as typical karst representatives. However, some higher concentrations of nitrates were noticed but these are of natural origin due to the geological foundation.

The indicators that are important regarding the tufa deposition processes (pH, hardness, alkalinity etc.) monitored on all sites showed that these values changes seasonally as expected and differ between sites. This difference especially in the lakes system (between upper and lower lakes) is due to the natural process of tufa deposition.

Nutrients, as limiting factors for primary production, were calculated by the Regulation for above stated monitored sites and are in the range of good to high status.

### Microbiological indicators

Croatian legislation on water quality and microbiological indicators has been changing over the years. Until the year 2010, the microbiological indicators such as Total coliforms (TC), Fecal coliforms (FC), Fecal streptococci (FS) and Heterotrophic bacteria (HB) were listed in the Regulation of water quality (OG 77/98) and were, along with other indicators, contributing indicators for determination of water quality for natural waters. Microbiological indicators are excluded from the new Regulation on water quality standards (OG 73/13, 78/15, 61/16, 151/14) and therefore their acceptable values in natural waters it cannot be interpreted. We can only confirm or not their presence in natural waters, but we cannot comment on the range of acceptable values according to the current legislative.

Microbiological indicators in the monitored period showed seasonal changes with certain higher values of bacteria during the summer months for some monitored sites. This can imply to potential fecal (animals and humans) contamination in the area. However, hydrological conditions for the monitored period (for each month, low-high water level, discharge, precipitation, water temperature etc.) should be considered.

Site	Date	UK /CFU 100mL <sup>-1</sup>	FK /CFU 100mL <sup>-1</sup>	FS /CFU 100mL <sup>-1</sup>	BK /CFU ml <sup>-1</sup>
Bijela Rijeka source	01.03.21.	49	1	0	150
	12.04.21.	20	0	1	170
	04.05.21.	48	1	0	255
	08.06.21.	44	2	0	555
	06.07.21.	50	1	82	550
	11.08.21.	66	2	26	710
	06.09.21.	73	5	11	425
	04.10.21.	47	1	1	450
Crna Rijeka source	01.03.21.	2	0	0	5
	12.04.21.	0	0	0	0
	04.05.21.	5	0	0	25
	08.06.21.	1	0	0	15
	06.07.21.	1	0	13	255
	11.08.21.	20	0	12	35
	06.09.21.	3	0	3	65
	04.10.21.	0	1	1	0
Plitvica source	01.03.21.	15	0	0	65
	12.04.21.	12	0	0	20
	04.05.21.	9	0	0	55
	08.06.21.	8	1	1	460
	06.07.21.	7	0	2	20
	11.08.21.	119	0	7	70
	06.09.21.	32	0	1	75
	04.10.21.	10	2	6	495
Bijela Rijeka river	01.03.21.	100	11	1	540
	12.04.21.	56	13	6	415
	04.05.21.	253	3	62	610
	08.06.21.	152	27	75	890
	06.07.21.	334	18	398	1020
	11.08.21.	320	30	74	880
	06.09.21.	112	30	80	325
	04.10.21.	136	73	64	700
Crna Rijeka river	01.03.21.	121	2	1	215
	12.04.21.	10	0	5	895
	04.05.21.	92	0	1	115
	08.06.21.	110	1	3	210
	06.07.21.	37	1	89	585
	11.08.21.	90	11	20	230
	06.09.21.	41	3	11	135
	04.10.21.	64	2	14	410
Sartuk river	01.03.21.	78	0	1	365
	12.04.21.	24	7	10	550
	04.05.21.	41	1	11	455
	08.06.21.	106	25	35	620
	06.07.21.	586	44	106	595
	11.08.21.	612	55	121	450
	06.09.21.	170	88	46	720
	04.10.21.	260	88	58	620
Plitvica river	01.03.21.	83	3	0	705
	12.04.21.	47	10	1	240
	04.05.21.	41	2	2	515
	08.06.21.	166	13	16	625
	06.07.21.	154	16	60	1350
	11.08.21.	136	14	39	1110
	06.09.21.	94	13	24	400
	04.10.21.	140	30	20	495
Korana river	01.03.21.	57	1	0	175
	12.04.21.	22	3	0	560
	04.05.21.	38	0	3	235
	08.06.21.	120	7	40	380
	06.07.21.	87	5	69	935
	11.08.21.	198	6	53	690
	06.09.21.	108	37	26	780
	04.10.21.	>500	338	>500	1215
Prošćansko jezero lake outlet	08.03.21.	21	0	0	190
	21.04.21.	32	0	0	160
	10.05.21.	17	0	0	190
	14.06.21.	31	2	16	305
	12.07.21.	27	4	20	545
	16.08.21.	111	14	38	450
	14.09.21.	31	5	10	405
	12.10.21.	62	6	17	340
Gradinsko jezero lake outlet	08.03.21.	8	0	0	170
	21.04.21.	20	0	0	210
	10.05.21.	8	0	0	175
	14.06.21.	3	0	1	235
	12.07.21.	6	7	11	325
	16.08.21.	7	0	5	455
	14.09.21.	8	1	1	480
	12.10.21.	112	4	40	760

Matica river	01.03.21.	54	0	3	475	Kozjak lake outlet	08.03.21.	6	0	0	155
	12.04.21.	25	1	2	195		21.04.21.	8	0	0	50
	04.05.21.	71	1	18	215		10.05.21.	11	0	0	50
	08.06.21.	71	10	12	440		14.06.21.	16	1	7	155
	06.07.21.	86	5	47	405		12.07.21.	22	6	15	155
	11.08.21.	197	110	38	855		16.08.21.	23	6	21	325
	06.09.21.	70	6	30	575		14.09.21.	9	2	9	725
	04.10.21.	75	16	23	215		12.10.21.	52	3	50	985
Rječica river	08.03.21.	13	0	1	345	Novakovića Brod lake outlet	08.03.21.	27	0	1	160
	21.04.21.	38	0	1	260		21.04.21.	27	0	0	165
	10.05.21.	28	0	2	285		10.05.21.	10	0	0	130
	14.06.21.	21	13	16	275		14.06.21.	19	2	10	270
	12.07.21.	27	6	50	655		12.07.21.	12	3	33	370
	16.08.21.	80	24	56	470		16.08.21.	44	4	27	525
	14.09.21.	37	8	34	565		14.09.21.	29	0	8	680
	12.10.21.	70	3	11	570		12.10.21.	69	4	28	470