SUPPLEMENT to the article: **Ecological foundation of Gumara River and connected wetlands as a basis for a holistic environmental flow assessment in the Lake Tana Basin, Ethiopia**

Wubneh B. Abebe[1,2,*], Seifu A. Tilahun [2], Michael M. Moges [2], Ayalew Wondie [3], Minychl G. Derseh [2], Workiye W. Assefa[4], Demesew A. Mhiret[2], Anwar A. Adem[5], Fasikaw A. Zimale[2], Wuletawu Abera[6], Tammo A. Steenhuis[7], Michael E. McClain[8]

1. Macroinvertebrate data collection and processing

Macroinvertebrate samples were taken following multi-habitat-sampling approach from all 30 sampling sites. They were taken using a D-frame net with mesh size of 500 μm. During sampling, 100-meter representative river stretch of the sampling site was selected and its microhabitat composition was estimated (flow condition as proportion of hydro-morphology of pool, riffle, lotic and lentic and then, cover of mineral substrates, macrophytes, snags, and cover of biotic microhabitats). Then, 20 sample units (jags) were distributed according to the estimated share of habitats, each replicate covering an area of approximately 25 × 25 cm [23]. Stony microhabitats were sampled to a depth of approximately 10 cm, sandy and organic micro-habitats to a depth of approximately 3 cm (Table S1). Macro-invertebrate samples were kept in small plastic container immersed in a 4% formaldehyde. Pooled macro-invertebrate samples were preserved in 4% formaldehyde and transported to the Bahir Dar Fishery Research Centre to identify them into the lowest possible taxa (family in this case) using identification keys with the help of a dissecting microscope [24]. Ecological status of the Gumara river was evaluated using macroinvertebrates biotic scoring. For this purpose macroinvertebrate-based ETHBios scoring methodology developed by Aschalew and Moog [15] was used and supplemented using South African Sensitivity Score (SASS) and Average BMWP Score Per Taxon (ASPT) methods [5]. Moreover, abundance, Shannon Weiner diversity index, richness, evenness calculated for species diversity description of macroinvertebrates. The formula for Shannon diversity index:

$$\textbf{Shannon Index (H)} = -\sum_{i=1}^{s} \boldsymbol{Pi\ lnPi;} \quad (1)$$

where, P_i-the proportion of individuals in the i^{th} species and s-number of individuals in the site.

2. Land use and land cover classification and analysis

Land use/cover of Gumara watershed was mapped from 1985 to 2020 to investigate changes that could impact ecosystem services. Random forest algorithm classification provided good results with an overall accuracy of 0.90, kappa coefficient of 0.87 and validation overall accuracy of 1. Cultivated land exceeded by far other cover types since 1985 and farmland covered 114,779 ha (67%) in 1985 and 108,422 ha (63%) in 2020. Cultivated land is the dominant cover during the study period, but its size decreased overtime. This is because of small landholding size; farmers tend to change their farmland to eucalyptus plantation. Study confirms that eucalyptus fuelwood is much more profitable than field crops [43-45]. Thus, the vegetation cover increased from 6809 ha in 1985 to 19824.1 ha in 2020 in the study watershed (figure S7).

3. Tables and figures

Table S1. Sampling Sites in the Gumara river and Shesher wetland. LR – lower reach, MR – middle reach, UR- upper reach. * fish sampling sites.

S.N.	SITE (ID)	SITE_NAME	S.N.	SITE	SITE_NAME	S.N.	SITE	SITE_NAME
1	LR00 (0)	Guanta lower	**11**	LR10* (10)	Wanzaye	**21**	MR08* (8)	Aba Gunda
2	LR01 (1)	Kizin lower	**12**	LR12* (12)	Gava	**22**	UR00 (0)	GenaMechawecha
3	LR02 (2)	Wonzema lower	**13**	MR00* (0)	Fuafuat	**23**	UR01 (1)	Sendie meder

4	LR03 (3)	Kizin upper	**14**	MR01 (1)	Walbo	**24**	UR02 (2)	Tosign Ber
5	LR04 (4)	Guanta upper	**15**	MR02* (2)	Menekuzer	**25**	UR03 (3)	Lewaye
6	LR05* (5)	Gumara bridge	**16**	MR03 (3)	Nifara	**26**	UR04 (4)	Debretabor town
7	LR06* (6)	Shesher 01	**17**	MR04 (4)	Fogeda river	**27**	UR05 (5)	Bilando
8	LR07* (7)	Shesher 02	**18**	MR05* (5)	Ras amba	**28**	UR06 (6)	Sensawuha
9	LR08 (8)	Woreta town	**19**	MR06 (6)	Gebetit	**29**	UR07 (7)	Kosterwuha
10	LR09* (9)	Gumara mouth	**20**	MR07* (7)	Chan river	**30**	UR08 (8)	Shimagle Giorgis

Table S2. Hydromorphological condition of sampling sites in Gumara river and Shesher wetland. For the location of the sites see Figure 1, main text.

S.N.	SITE	HYDROMORPHOLOGY	HABITAT TYPE; (HYDRMORPHOLOGYPERCENT, ABIOTIC_VS_BIOTIC)
1	LR00	100% pool, dammed	pool100, Psammo-pelal_Vs_LPTP100
2	LR01	40% pool, 60% riffle	Pool40, Mesolithal_Vs_MA10&SMA15&EMP15; Riffle60, macrolithal_Vs_EMP60
3	LR02	40% pool, 60% riffle	Pool40, microlithal_Vs_CPOM40; Riffle60, macrolithal_Vs_MA50&EMP10
4	LR03	60% pool, 40% riffle	Pool60, mesolithal_Vs_MA30&SMP30; riffle40, macrolithal_Vs_EMP40
5	LR04	90% pool, 10% Riffle	Pool90, Argyllal_Vs_MA30&SMP30&EMP30; Riffle10, microlithal_Vs_EMP10
6	LR05	100% pool	Pool100, Pelal_Vs_BM100
7	LR06	100% pool	Pool100, Pelal_Vs_MIA100
8	LR07	100% pool	Pool100, Pelal_Vs_MIA100
9	LR08	95% pool, 5% lotic	Pool95, Pelal_Vs_MA95; Lotic5, Psammo-pelal_Vs_BM5
10	LR09	100% pool	Pool100, psammo-pelal_Vs_BM20&EMP80
11	LR10	80% pool, 10% riffle, 10% lotic	Pool80, pelal_Vs_BM80; Riffle10, macrolithal_Vs_BM10; lotic10, macrolithal_Vs_MIA10
12	LR12	100% pool	Pool100, pelal_Vs_BM90&xylal10
13	MR00	90% pool, 10% riffle	Pool90, pelal_Vs_BM45%EMP45; riffle10, akal_Vs_BM10
14	MR01	80% pool, 20% riffle	Pool80, megalithal_Vs_LPTP80; Riffle20, megalithal_Vs_EMP20
15	MR02	100% pool	Pool100, pelal_Vs_BM100
16	MR03	100% pool	Pool100, megalithal_Vs_LPTP80&psammal_Vs_LPTP20
17	MR04	60% pool, 30% riffle, 10% lotic	Pool60, megalithal_Vs_BM20&psammal_Vs_BM20&psammal_Vs_EMP20; Riffle30, mesolithal_Vs_MA30; Lotic10, microlithal_Vs_BM10
18	MR05	80% pool, 20% riffle	Pool80, megalithal_Vs_BM70&EMP10; Riffle20, psammal-pelal_Vs_BM20
19	MR06	80% pool, 20% lotic	Pool80, pelal_Vs_BM80; lotic20, megalithal_Vs_BM20
20	MR07	40% pool, 60% lotic	Pool40, microlithal_Vs_BM40; lotic60, mesolithal_Vs_BM60
21	MR08	100% pool	Pool100, pela_Vs_BM100
22	UR00	50% pool, 50% riffle	Pool50, megalithal_Vs_BM25&pelal_Vs_BM25; Riffle50, macrolithal_Vs_BM50
23	UR01	40% pool, 60% riffle	Pool40, microlithal_Vs_BM40; Riffle60, macrolithal_Vs_BM60
24	UR02	40% pool, 60% riffle	Pool40, megalithal_Vs_MIA40; Riffle60, megalithal_Vs_CPOM60
25	UR03	100% pool	Pool100, macrolithal_Vs_BM10&mesolithal_Vs_BM20& microlithal_Vs_BM20&akal_Vs_BM20&

			psammal_Vs_BM10&psammal-pelal_Vs_BM20
26	UR04	20% pool, 80% riffle	Pool20, mesolithal_Vs_MA20; Riffle80, macrolithal_Vs_MA80
27	UR05	50% pool, 50% lotic	Pool50, mesolithal_Vs_MA20&SMP10&EMP20; lotic50, psammal_vs_BM50
28	UR07	80% pool, 20% riffle	Pool80, microlithal_Vs_BM80; Riffle20, mesolithal_Vs_BM20
29	UR06	80% pool, 20% riffle	Pool80, mesolithal_Vs_BM80; Riffle20, macrolithal_Vs_BM20
30	UR08	100% pool	Pool100, pelal_Vs_EMP20&Argylal_Vs_MA20&EMP60

*LPTP- living parts of terrestrial plant, MA-macro algae; MI-micro algae, SMA-submerged macrophyte, EMP-Emergent macrophyte, CPOM-course particulate organic matter, FPOM-Fine particulate organic matter, Xylal-dead wood, BM-Bare mineral.

Table S3. Average Daily Flow (m^3s^{-1}) of the 30 sampling sites in March 2016 and 2020 with their category in flow exceedance from the highest historical minimum value, Q80. Q80- the 80th percentile flow; FDC - flow duration curve, LR- lower reach, MR – middle reach, UR – upper reach, Rch – reach, Lo – lower, Up – upper, Lf – low flow; Mhf – Moderate/high flow.

Site	Highest Threshold Minimum Flow On FDC, Q_{80}	Average Flow, March 2016	Category, 2016	Average Flow, March 2020	Category, 2020
LR00	0.019	0.016	Lf	0.033	Mhf
LR01	0.005	0.004	Lf	0.007	Mhf
LR10	1.81	1.657	Lf	3.111	Mhf
LR12	6.090	3.994	Lf	5.509	Mhf
LR02	0.002	0.002	Lf	0.003	Mhf
LR03	0.002	0.002	Lf	0.004	Mhf
LR04	0.000	0.000	Lf	0.001	Mhf
LR05	6.084	2.392	Lf	4.270	Mhf
LR06	0	0.002	Mhf	0.006	Mhf
LR07	0.006	0.004	Lf	0.008	Mhf
LR08	0	0.001	Mhf	0.003	Mhf
LR09	6.184	4.318	Lf	6.819	Mhf
MR00	0.283	0.183	Lf	0.354	Mhf
MR01	1.51	1.106	Lf	2.172	Mhf
MR02	1.24	0.747	Lf	1.496	Mhf
MR03	0.001	0.001	Lf	0.002	Mhf
MR04	0.023	0.014	Lf	0.027	Mhf
MR05	0.137	0.089	Lf	0.171	Mhf
MR06	0.002	0.002	Lf	0.003	Mhf
MR07	0.036	0.023	Lf	0.045	Mhf
MR08	0.467	0.270	Lf	0.551	Mhf
UR00	0.070	0.041	Lf	0.081	Mhf
UR01	0.003	0.002	Lf	0.005	Mhf
UR02	0.001	0.001	Lf	0.001	Mhf
UR03	0.005	0.004	Lf	0.007	Mhf
UR04	0.001	0.001	Lf	0.002	Mhf
UR05	0.006	0.005	Lf	0.009	Mhf

Site	Highest Threshold Minimum Flow On FDC, Q_{80}	Average Flow, March 2016	Category, 2016	Average Flow, March 2020	Category, 2020
UR06	0.208	0.121	Lf	0.246	Mhf
UR07	0.001	0.001	Lf	0.002	Mhf
UR08	0.001	0.001	Lf	0.001	Mhf

Table S4. Water quality data for 30 locations in 3 major reaches of the Gumara river in March 2020

S.N.	Site_Name	Site	Reach	TN	TP	NH3-N	NH4+	NH4+-N	NH3	PO4-	PO4--P	DO (Sat%)
1	Guanta lower	LR00	LR	7.84	0.11	0.24	0.30	0.24	0.28	0.16	0.05	126.71
2	Kizin lower	LR01	LR	1.16	0.05	0.31	0.40	0.31	0.38	0.07	0.02	127.96
3	Wonzema lower	LR02	LR	1.35	0.90	0.18	0.23	0.18	0.22	1.30	0.43	52.33
4	Kizin upper	LR03	LR	1.31	1.66	0.14	0.19	0.15	0.17	2.41	0.80	170.01
5	Guanta upper	LR04	LR	1.73	0.68	0.17	0.23	0.18	0.24	0.99	0.33	162.12
6	Gumara bridge	LR05	LR	1.50	0.96	0.13	0.17	0.13	0.16	0.27	0.09	157.43
7	Shesher 01	LR06	LR	4.98	0.93	0.35	0.45	0.35	0.42	1.34	0.44	190.58
8	Shesher 02	LR07	LR	1.78	2.78	0.17	0.23	0.18	0.21	4.15	1.37	153.8
9	Woreta town	LR08	LR	1.51	1.03	1.92	2.50	1.94	2.37	1.24	0.41	121.69
10	Gumara mouth	LR09	LR	1.22	1.13	0.14	0.18	0.14	0.17	1.00	0.33	211.79
11	Wanzaye	LR10	LR	1.47	0.40	0.28	0.36	0.28	0.34	0.58	0.19	142.01
12	Gava	LR12	LR	1.46	0.11	0.08	0.10	0.08	0.10	0.15	0.05	151.1
13	Fuafuat	MR00	MR	1.55	0.76	0.15	0.19	0.15	0.18	1.12	0.37	157.73
14	Walbo	MR01	MR	1.57	0.08	0.21	0.27	0.21	0.25	0.10	0.03	140.34
15	Menekuzer	MR02	MR	1.19	0.17	0.64	0.82	0.63	0.78	0.24	0.08	141.15
16	Nifara	MR03	MR	6.50	0.08	0.19	0.24	0.19	10.79	0.11	0.04	186.09
17	Fogeda river	MR04	MR	1.65	0.28	0.27	0.35	0.27	0.33	0.41	0.13	120.4
18	Ras amba	MR05	MR	1.38	0.09	0.12	0.15	0.12	0.14	0.13	0.04	159.85
19	Gebetit	MR06	MR	3.40	0.48	0.10	0.13	0.10	0.13	0.68	0.22	136.95
20	Chan river	MR07	MR	1.57	0.42	0.05	0.07	0.05	0.06	0.61	0.20	174.73
21	Aba Gunda	MR08	MR	2.88	0.12	0.24	0.31	0.24	0.29	0.17	0.06	136.74
22	GenaMechawecha	UR00	UR	2.07	1.12	0.15	0.19	0.15	0.18	10.20	3.36	131.59
23	Sendie meder	UR01	UR	1.61	0.21	0.31	0.40	0.31	0.37	0.31	0.10	222.38
24	Tosign Ber	UR02	UR	0.88	0.97	0.40	0.51	0.40	0.49	1.51	0.50	280.02
25	Lewaye	UR03	UR	1.71	1.33	0.17	0.22	0.17	0.20	1.92	0.63	192.16
26	Debretabor town	UR04	UR	14.67	0.79	0.17	0.22	0.17	0.20	1.15	0.38	190.26
27	Bilando	UR05	UR	1.55	0.63	0.14	0.18	0.14	0.17	0.91	0.30	160.92
28	Sensawuha	UR06	UR	1.63	0.76	0.18	0.24	0.19	0.22	1.10	0.36	256.42
29	Kosterwuha	UR07	UR	2.00	0.39	0.30	0.38	0.30	0.36	0.57	0.19	321.05
30	Shimagle Giorgis	UR08	UR	3.60	0.09	0.34	0.43	0.33	0.41	0.12	0.04	153.15

Table S5. Water quality status at each sampling site. Location of the sites are given in **Error! Reference source not found.**of the main text. Score values are taken from the research output of Chapman (1996) and Stevenick et al. (2006).

S.N.	SITE	SITE_NAME	N_SCORE	P_SCORE	DO_SCORE	SUM	QUALITY_PHYCHEM
1	LR00	Guanta lower	1	2	3	6	Good, slightly polluted
2	LR01	Kizin lower	1	1	3	5	Good, slightly polluted
3	LR02	Wonzema lower	1	3	3	7	Good, slightly polluted
4	LR03	Kizin upper	1	3	5	9	Moderate, doubtful
5	LR04	Guanta upper	1	3	5	9	Moderate, doubtful
6	LR05	Gumara bridge	1	2	5	8	Moderate, doubtful
7	LR06	Shesher 01	1	3	5	9	Moderate, doubtful
8	LR07	Shesher 02	1	4	5	10	Moderate, doubtful
9	LR08	Woreta town	3	3	3	9	Moderate, doubtful
10	LR09	Gumara mouth	1	3	5	9	Moderate, doubtful
11	LR10	Wanzaye	1	2	4	7	Good, slightly polluted
12	LR12	Gava	1	2	5	8	Moderate, doubtful
13	MR00	Fuafuat	1	3	5	9	Moderate, doubtful
14	MR01	Walbo	1	1	4	6	Good, slightly polluted
15	MR02	Menekuzer	2	2	4	8	Moderate, doubtful
16	MR03	Nifara	1	1	5	7	Good, slightly polluted
17	MR04	Fogeda river	1	2	2	5	Good, slightly polluted
18	MR05	Ras amba	1	1	5	7	Good, slightly polluted
19	MR06	Gebetit	1	2	4	7	Good, slightly polluted
20	MR07	Chan river	1	2	5	8	Moderate, doubtful
21	MR08	Aba Gunda	1	2	4	7	Good, slightly polluted
22	UR00	GenaMechawecha	1	5	4	10	Moderate, doubtful
23	UR01	Sendie Meder	1	2	5	8	Moderate, doubtful
24	UR02	Tosign Ber	1	3	5	9	Moderate, doubtful
25	UR03	Lewaye	1	3	5	9	Moderate, doubtful
26	UR04	Debretabor town	1	3	5	9	Moderate, doubtful
27	UR05	Bilando	1	3	5	9	Moderate, doubtful

28	UR06	Sensawuha	1	3	5	9	Moderate, doubtful
29	UR07	Kosterwuha	1	2	5	8	Moderate, doubtful
30	UR08	Shimagle Giorgis	1	1	5	7	Good, slightly polluted

Table S6. Abundance and community composition of macroinvertebrates sampled in Gumara river in March 2020

ID	**Family**	**sites**	**Number**	**ID**	**Family**	**sites**	**Number**	**ID**	**Family**	**sites**	**Number**
1	Aeshnidae	12	92	**15**	Ephemerellidae	21	621	**29**	Notonectidae	14	131
2	Agriidae	1	1	**16**	Erpobdellidae	1	1	**30**	Oligochaeta	5	43
3	Athericidae	3	12	**17**	Gerridae	1	1	**31**	Periodidae	16	104
4	Chaoboridae	1	1	**18**	Haemopidae	1	1	**32**	Philopotamidae	7	80
5	Chironomidae	20	272	**19**	Hydaenidae	1	5	**33**	Phryganeidae	1	1
6	Coenagriidae	12	155	**20**	Hydrobiidae	3	8	**34**	Physidae	3	10
7	Cordulidae	1	1	**21**	Hydrometridae	5	9	**35**	Piscicolidae	1	1
8	Corixidae	25	390	**22**	Hydrophilidae	1	5	**36**	Planariidae	2	2
9	Culicidae	1	1	**23**	Hydropsychidae	9	100	**37**	Planorbidae	10	79
10	Curculionidae	1	1	**24**	Hygrobiidae	14	137	**38**	Pleidae	1	1
11	Dendrocoelidae	4	27	**25**	Lepidostomatidae	1	3	**39**	Sialidae	2	3
12	Dyropidae	1	2	**26**	Libellulidae	20	196	**40**	Syriphidae	2	2
13	Dytiscidae	3	17	**27**	Naucoridae	4	70	**41**	Tabanidae	3	3
14	Ecnomidae	1	3	**28**	Nepidae	10	19	**42**	Tipulidae	1	1
								43	Unionidae	6	31

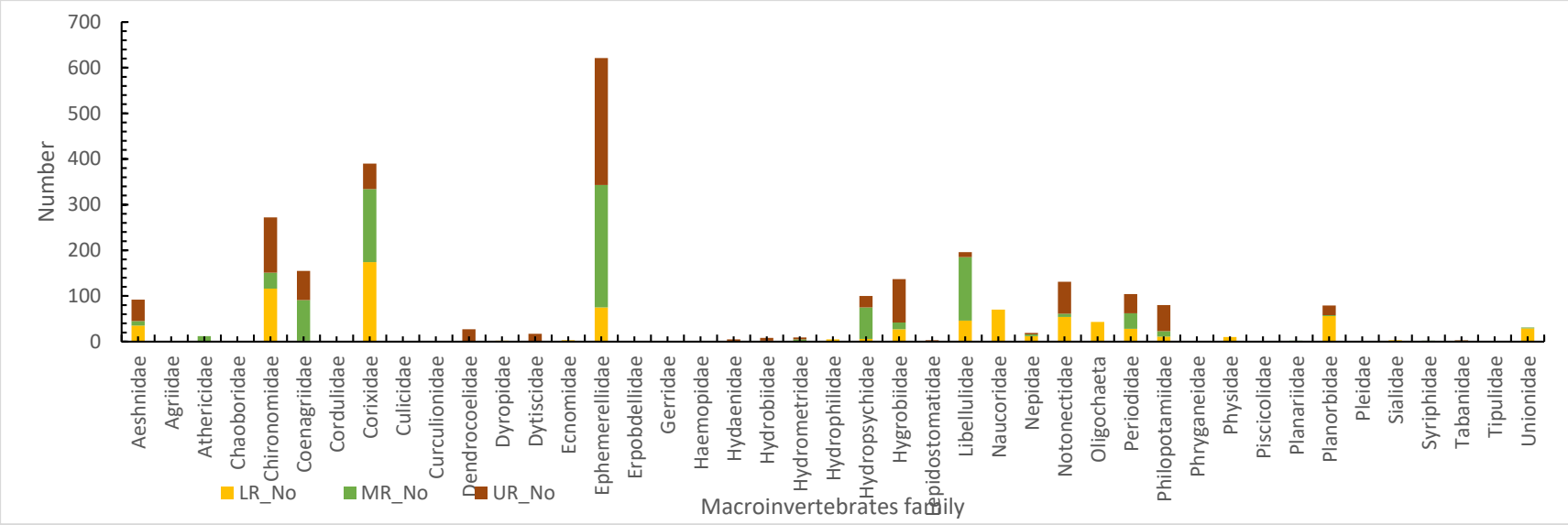

Figure S1. Abundance/number of macroinvertebrate families in the lower, middle and upper reaches of Gumara river

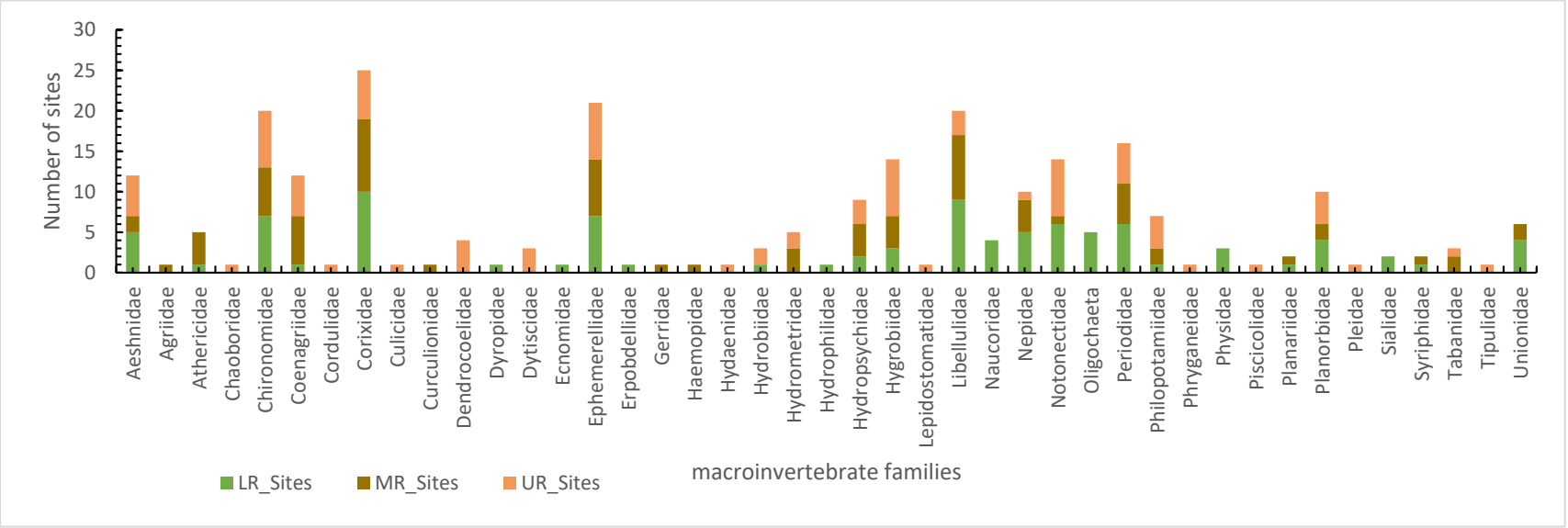

Figure S2. Distribution of macroinvertebrate families sampled in the lower, middle and upper reaches of Gumara river

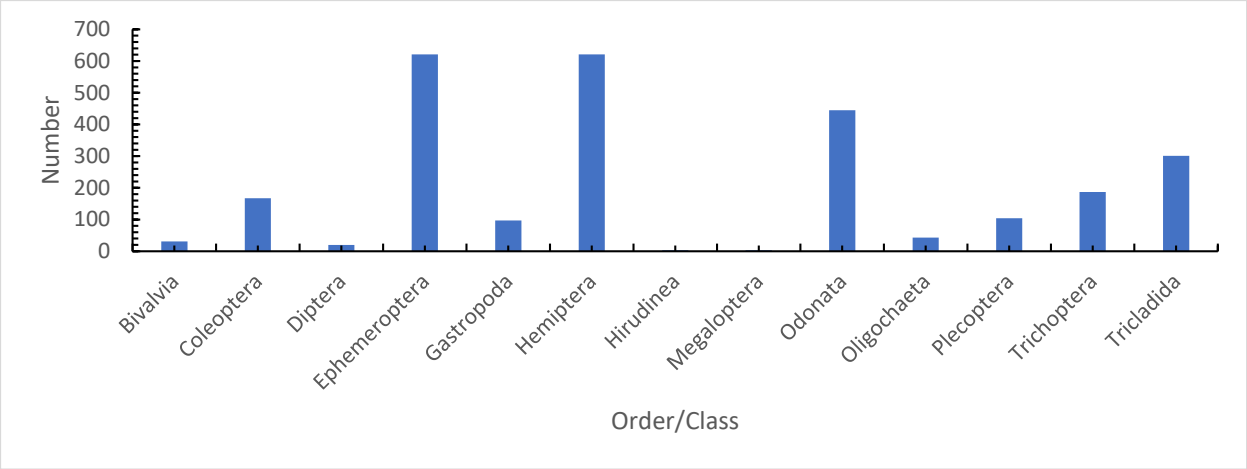

Figure S3. Number of macroinvertebrate orders identified in the Gumara river in March 2020

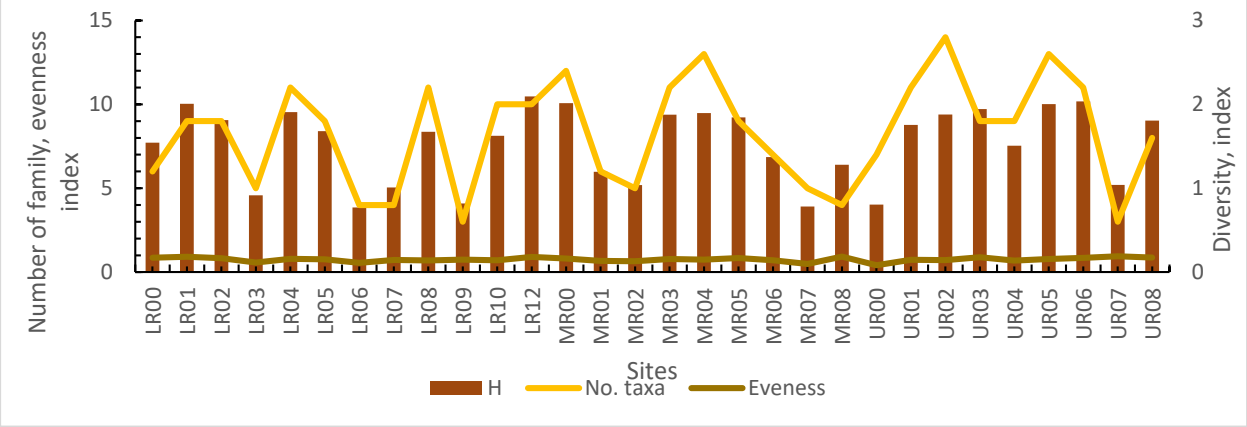

Figure S4. Number Macroinvertebrates of family, diversity (H) and evenness in the Gumara river, March 2020

Table S7. Analysis of Ecological health based on ETHBios macroinvertebrate scoring at each sampling station in Gumara river

S. N.	SITE CODE	SITE NAME	TOTAL SCORE	NO. TAXA	AVERAGE ETHBIOS	DESCRIPTION
1	LR00	Guanta lower	22	6	3.7	Poor water quality; major degradation
2	LR01	Kizin lower	33	9	3.7	Poor water quality; major degradation
3	LR02	Wonzema lower	45	9	5.0	Moderate water quality; significant ecological disturbance
4	LR03	Kizin upper	21	5	4.2	Moderate water quality; significant ecological disturbance
5	LR04	Guanta upper	48	11	4.4	Moderate water quality; significant ecological disturbance
6	LR05	Gumara bridge	47	9	5.2	Good water quality, slight ecological degradation
7	LR06	Shesher 01	18	4	4.5	Moderate water quality; significant ecological disturbance

8	LR07	Shesher 02	12	4	3.0	Poor water quality; major degradation
9	LR08	Woreta town	53	11	4.8	Moderate water quality; significant ecological disturbance
10	LR09	Gumara mouth	23	3	7.7	High water quality; low level of degradation
11	LR10	Wanzaye	68	10	6.8	High water quality; low level of degradation
12	LR12	Gava	60	10	6.0	Good water quality, slight ecological degradation
13	MR00	Fuafuat	74	12	6.2	Good water quality, slight ecological degradation
14	MR01	Walbo	44	6	7.3	High water quality; low level of degradation
15	MR02	Menekuzer	26	5	5.2	Good water quality, slight ecological degradation
16	MR03	Nifara	61	11	5.5	Good water quality, slight ecological degradation
17	MR04	Fogeda river	76	13	5.8	Good water quality, slight ecological degradation
18	MR05	Ras amba	41	9	4.6	Moderate water quality; significant ecological disturbance
19	MR06	Gebetit	33	7	4.7	Moderate water quality; significant ecological disturbance
20	MR07	Chan river	34	5	6.8	High water quality; low level of degradation
21	MR08	Aba Gunda	20	4	5.0	Moderate water quality; significant ecological disturbance
22	UR00	Gena Mechawecha	31	7	4.4	Moderate water quality; significant ecological disturbance
23	UR01	Sendie meder	72	11	6.5	High water quality; low level of degradation
24	UR02	Tosign Ber	83	14	5.9	Good water quality, slight ecological degradation
25	UR03	Lewaye	47	9	5.2	Good water quality, slight ecological degradation
26	UR04	Debretabor town	52	9	5.8	Good water quality, slight ecological degradation
27	UR05	Bilando	67	13	5.2	Good water quality, slight ecological degradation
28	UR06	Sensawuha	68	11	6.2	Good water quality, slight ecological degradation
29	UR07	Kosterwuha	21	3	7.0	High water quality; low level of degradation
30	UR08	Shimagle Giorgis	33	8	4.1	Moderate water quality; significant ecological disturbance

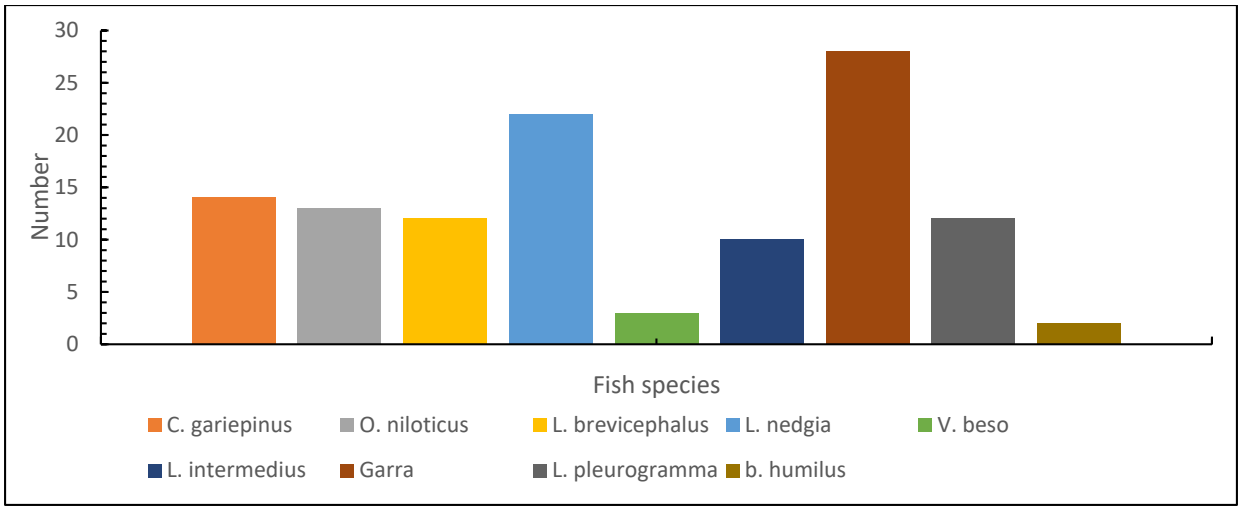

Figure S5. Fish species in the Gumara river and Flood plain wetland in March 2020.

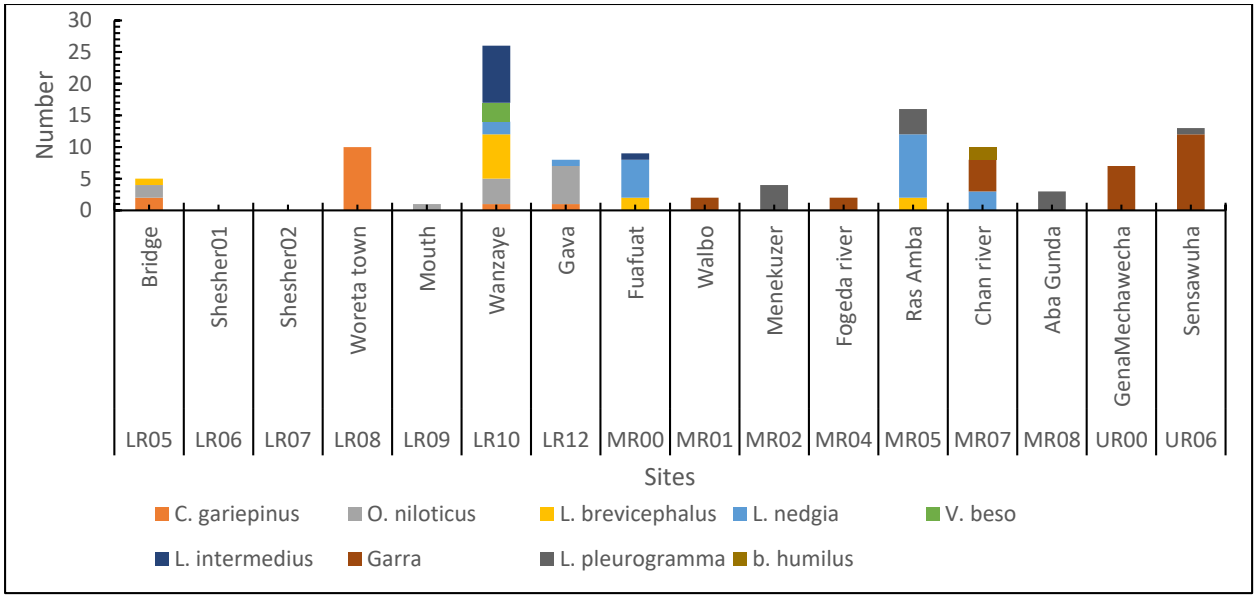

Figure S6. Fish species composition in different reaches of Gumara river and the Flood plain wetland in March 2020

Table S8. Fish species diversity status in Gumara river and wetlands; taking Wanzaye (LR10) as reference site

S.N.	Site	No. catch	No. spp.	H	Description	S.N.	Site	No. catch	No. spp.	H	Description
1	LR05	5	3	1.05	Moderate	9	MR01	2	1	0	Poor
2	LR06	0	0	0	Poor	10	MR02	4	1	0	Poor
3	LR07	0	0	0	Poor	11	MR04	2	1	0	Poor
4	LR08	10	1	0	Poor	12	MR05	16	3	0.90	Moderate
5	LR09	1	1	0	Poor	13	MR07	10	3	1.03	Moderate
6	LR10	26	6	1.58	Good	14	MR08	3	1	0	Poor
7	LR12	8	3	0.74	Moderate	15	UR00	7	1	0	Poor
8	MR00	9	3	0.85	Moderate	16	UR06	13	2	0.27	Poor

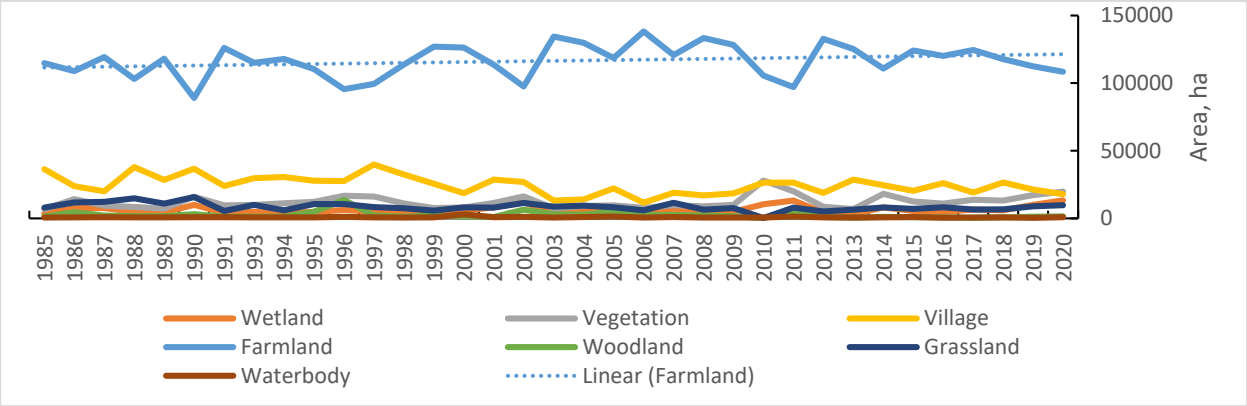

Figure S7. Time series of land use and land cover of Gumara river watershed between 1985-2020

Table S9. Riparian tree species in the Gumara river

S. N.	LOCAL NAME	SCIENTIFIC NAMES	INDICATION/BENEFIT (AMHARIC/ENGLISH)
1	Shola	*Ficus sycomorus*	fruit edible, ecological importance - shade for birds
2	Kulkual	*Euphorbia abyssinica*	edible, fruit for human and leaves for livestock
3	Saba	Unidentified	Ecological importance being ever green
4	Agam	*Carissa spinarum*	food and medicinal plant
5	Lankuso	*Dracaena steudneri*	construction, rope making
6	Sensel/ Simiza	*Justicia schimperiana*	fuelwood, fencing
7	Kega	*Rosa abyssinica*	edible fruit, fencing
8	Abalo	*Terminalia brownii*	food smoking, charcoal
9	Bisana	*Croton macrostachyus*	farm shed, medicinal for treating fungus, farm tools
10	Enqoqo	*Embelia schimperi*	medicine for tape worm, leaves for pesticide
11	Endawula	*Kalanchoe laciniata*	medicine for inflammation
12	Donga	*Apodytes dimidiata*	lumber
13	Decurrens	*Acacia decurrens*	exotic, charcoal, fuelwood, soil fertility
14	Bahir zaf	*Eucalyptus camaldulensis, and E. globulus*	exotic, construction, fuelwood, medicine-for cough
15	Gumero	*Acacia bussei*	fuelwood, fencing
16	Shembeko	*Arundo donax*	thatching and fencing, musical instrument-'washint'
17	Banba	*Ficus sur*	ecological importance, livestock-shed, birds-shed
18	Enzert	Unidentified	Fuelwood, ecologically important
19	Sehel	Unidentified	Fuelwood, fence, construction
20	Kechem/ qacama	*Myrsine africana*	Serve as medicinal purpose for treating intestinal problem
21	Zigba	*Podocarpus falcatus*	lumber, fuelwood
22	Wulkifa	*Dombeya torrida*	Fuelwood, charcoal
23	Dingayseber	*Pavetta abyssinica*	Root used for poison for crop pests
24	Lol	*Ekebergia capensis*	Furniture

S. N.	LOCAL **NAME**	**SCIENTIFIC NAMES**	**INDICATION/BENEFIT (AMHARIC/ENGLISH)**
25	Koma	*Prunus Africana*	medicine for fungal and bacterial infection
26	Mech	*Guizotia scabra*	Medicine for epilepsy
27	Kosheshila	*Acanthus sennii*	medicine for tape worm
28	Atat	*Maytenus arbutifolia*	Planted as a fence
29	Jejeba	*Berchemia discolor*	food and feed, dye for basket
30	Yewusha milas	*Rumex nepalensis*	Medicine for treating febrile illness
31	Girawa	*Vernonia amygdalina*	Medicine for treating bladder distention
32	Woiyra	*Olea africana*	Fuelwood, pole, teeth cleaner/brushing
33	Atquar/ Tikur anfar	*Buddleja davidii*	For creating fire by rubbing
34	Zik	Unidentified	Fuelwood, ecologically important
35	Azo hareg	*Clematis longicauda, and C. simensis*	Fresh leaves are squeezed on wound; and Hemorrhoids, skin cancer, Eczema
36	Tid	*Juniperus procera L.*	lumber, fuelwood
37	Wanza	*Cordia africana*	lumber, fuelwood, animal shade
38	Sesa	*Albizia gummifera*	Coffee-shed, leaves for banana ripening, holes on wood for bees' habitat

Table S10. Medicinal plants identified in the Gumara and associated rivers of lake tana Sub-basin

S. N.	**LOCAL NAME**	**SCIENTIFIC NAME**	**INDICATION/BENEFIT (AMHARIC/ENGLISH)**
1	Agam	*Carissa spinarum*	Used for protecting against 'Buda'/evil eye
2	Ameraro	*Discopodium penninervum*	large leaves for baking bread
3	Aregresa,	*Zehneria scabra*	headache, cough/flu
4	Astenager	*Datura stramonium*	Fufu or quaqucha/skin fungus, anti-malaria
5	Yeayit areg,	*Stephania abyssinica*	Lekumegna/ Evil eye – livestock blooding skin
6	Chegegit/ Shimgigit	*Cynoglossum coeruleum*	gereft/pneumonia
7	Chifreg	*Sida tenuicarpa*	cleaning teeth
8	Chikugn,	*Artemisia abyssinica*	Buda/evil eye, stomach ache/intestinal problem
9	Damakessie	*Ocimum grattissimum*	pneumonia, cough/flu
10	Enquay	*Ximenia americana*	Edible fruit
11	Gid-zemede	Unidentified	Shihola/ livestock intestinal ache
12	Guticha Abeba	*Acmella caulirhiza Del.*	sore throat, boils, tooth ache
13	Yejib-shinkurt	*Crinum abyssinicum*	Buda/evil eye, pneumonia
14	Qotetina	*Verbascum sinaiticum*	kumegna/bloody stool, anti-pain, for cleaning crop threshing ground
15	Kulkual	*Euphorbia abyssinica*	Sore; edible, fruit for human and leaves for livestock

16	Misana	*Croton macrostachyus*	Cattle nifat/bloating, lenekersa/cancer
17	Simiza,	*Justicia schimperiana*	Sanitazation, utensil cleaning
18	Tenadam	*Ruta chalepensis L.*	buda/ evil eye, abdominal pain
19	Tobia	*Englerina woodfordi oides*	Sore treatment, Cutaneous leshmaniasis
20	Tunjit,	*Otostegia integrifolia*	Flies and mosquitoes, expels evil spirits
21	Yaheya shoh	*Argemone mexicana L.*	Feed, poultice for inflamed skin
22	yemeder embuaye	*Solanum incanum L.*	Kebet wogi/ Attention deficient disorder
23	yemerz-zaf	Unidentified	Anti-poison, fuelwood
24	Yeset kest	*Asparagus africanus*	cattle lekumegna/bloody stool and skin problem
25	Nech Bahir zaf	*Eucalyptus globulus*	Cough/flu

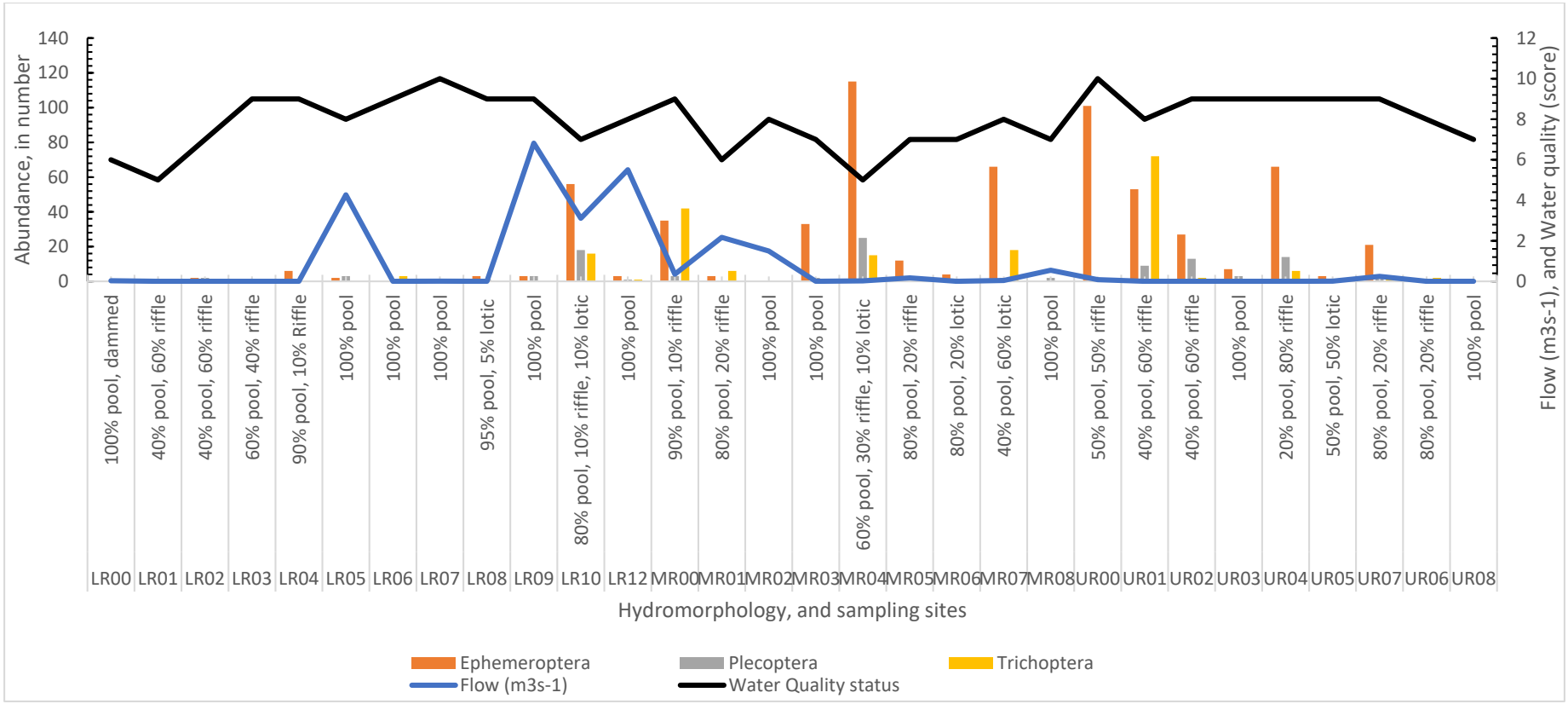

Figure S8. EPT abundance and water quality status (score) in different Hydromorphic proportion of sampling site