Table S1 Clean data statistics

Samples	Sequences	Bases(bp)	AverageLength(bp)
RMT1	132984	17713517	133.2
RMT2	124862	16629275	133.18
RMT3	122796	16371884	133.33
RMT4	131772	17561634	133.27
RMT5	129690	17278323	133.23
RMT6	129631	17270017	133.22
RMT7	115752	15427757	133.28
RMT8	138772	18490218	133.24
RMT9	114050	15191764	133.2
RMT10	117819	15688259	133.16
RFT1	122343	15955521	130.42
RFT2	116407	15372781	132.06
RFT3	120512	15964157	132.47
RFT4	133802	17701086	132.29
RFT5	132268	17529821	132.53
RFT6	118775	15625885	131.56
RFT7	122058	16100339	131.91
RFT8	118879	15791198	132.83
RFT9	122507	16068123	131.16
RFT10	120120	15783160	131.39
RMJ1	134928	17635295	130.7
RMJ2	130803	17098012	130.72
RMJ3	123527	16143573	130.69
RMJ4	114887	15020827	130.74
RMJ5	138842	18142485	130.67
RMJ6	117210	15317669	130.69
RMJ7	110501	14433356	130.62
RMJ8	111893	14618133	130.64
RMJ9	111003	14492208	130.56
RMJ10	134831	17620494	130.69
RFJ1	138989	18593489	133.78
RFJ2	119420	15906745	133.2
RFJ3	128191	16993316	132.56
RFJ4	112146	14999117	133.75
RFJ5	131969	17530162	132.84
RFJ6	140052	18383206	131.26
RFJ7	127553	16788967	131.62
RFJ8	136666	18002443	131.73
RFJ9	138214	18263680	132.14
RFJ10	114192	15079733	132.06
RMF1	132880	17411415	131.03
RMF2	130806	17170590	131.27

RMF3	131068	17199266	131.22
RMF4	117480	15416257	131.22
RMF5	132351	17348468	131.08
RMF6	130141	17073382	131.19
RMF7	110687	14510957	131.1
RMF8	122061	16002891	131.11
RMF9	120752	15831701	131.11
RMF10	125232	16427621	131.18
RFF1	118763	15647113	131.75
RFF2	127959	16798673	131.28
RFF3	128615	16981304	132.03
RFF4	125466	16419295	130.87
RFF5	122593	16137921	131.64
RFF6	128507	16834264	131
RFF7	125909	16446492	130.62
RFF8	137702	18046778	131.06
RFF9	112673	14743429	130.85
RFF10	126760	16667754	131.49
RMG1	131655	17039115	129.42
RMG2	132963	17263615	129.84
RMG3	137435	17789272	129.44
RMG4	132871	17191751	129.39
RMG5	137215	17749320	129.35
RMG6	133767	17318065	129.46
RMG7	119049	15401549	129.37
RMG8	116845	15115603	129.36
RMG9	110441	14341737	129.86
RMG10	124249	16091655	129.51
RFG1	136529	17760224	130.08
RFG2	120251	15468958	128.64
RFG3	118645	15517495	130.79
RFG4	130390	17050691	130.77
RFG5	122805	16020156	130.45
RFG6	130528	17144743	131.35
RFG7	115409	15197292	131.68
RFG8	121108	15978750	131.94
RFG9	139724	18324738	131.15
RFG10	138682	18268381	131.73

Table S2. Statistics of taxonomy annotation of phytoplankton in rice-carp co-culture and rice monoculture

Taxonomy	Phylum	Family	Genus	Species
RMT1	9	61	150	79
RMT2	9	61	149	74
RMT3	9	60	143	76
RMT4	9	63	150	87
RMT5	9	64	157	84
RMT6	9	61	158	88
RMT7	9	60	154	73
RMT8	9	63	146	78
RMT9	9	60	148	82
RMT10	9	62	151	76
RFT1	9	62	157	92
RFT2	9	63	154	83
RFT3	9	65	152	70
RFT4	9	62	151	75
RFT5	9	61	148	82
RFT6	9	59	154	91
RFT7	9	64	153	79
RFT8	9	60	148	74
RFT9	9	64	155	87
RFT10	9	60	144	84
RMJ1	8	60	154	79
RMJ2	9	61	153	72
RMJ3	9	59	152	76
RMJ4	9	57	149	79
RMJ5	9	63	163	79
RMJ6	9	58	151	83
RMJ7	9	62	154	74
RMJ8	8	57	145	75
RMJ9	9	57	153	71
RMJ10	9	59	153	71
RFJ1	9	60	146	79
RFJ2	9	63	150	74
RFJ3	9	60	149	93
RFJ4	9	58	145	80
RFJ5	9	60	151	81
RFJ6	9	61	143	94
RFJ7	8	63	157	97
RFJ8	9	64	152	94
RFJ9	9	60	142	82
RFJ10	9	61	144	76

RMF1	9	65	156	87
RMF2	8	64	156	92
RMF3	9	69	161	97
RMF4	8	67	162	94
RMF5	9	66	162	88
RMF6	9	67	165	94
RMF7	9	65	156	87
RMF8	9	63	157	96
RMF9	9	65	160	89
RMF10	9	68	159	87
RFF1	8	63	153	87
RFF2	9	68	168	93
RFF3	9	71	157	94
RFF4	9	65	157	81
RFF5	8	68	153	94
RFF6	9	63	142	82
RFF7	9	60	142	78
RFF8	9	71	159	91
RFF9	9	63	144	85
RFF10	8	54	131	73
RMG1	9	54	114	54
RMG2	9	54	119	65
RMG3	9	49	118	55
RMG4	8	49	114	52
RMG5	9	57	119	57
RMG6	9	52	116	50
RMG7	9	49	112	46
RMG8	9	54	113	43
RMG9	8	50	103	40
RMG10	9	51	114	50
RFG1	8	68	150	76
RFG2	8	63	135	55
RFG3	9	69	161	77
RFG4	9	67	160	69
RFG5	9	66	151	78
RFG6	9	62	146	63
RFG7	9	59	141	57
RFG8	9	62	144	69
RFG9	9	62	145	68
RFG10	9	62	144	69
Total	9	89	275	249

Table S3. Statistics of taxonomy annotation of microzooplankton in rice-carp co-culture and rice monoculture

Taxonomy	Phylum (or subphylum and class)	Family	Genus	Species
RMT1	14	58	101	47
RMT2	14	57	94	49
RMT3	15	55	95	51
RMT4	14	53	89	53
RMT5	15	58	101	51
RMT6	13	53	101	55
RMT7	13	52	88	41
RMT8	13	56	104	53
RMT9	14	54	95	49
RMT10	14	53	94	55
RFT1	12	54	101	56
RFT2	12	56	103	55
RFT3	14	56	94	42
RFT4	14	58	99	47
RFT5	12	54	104	49
RFT6	14	57	111	55
RFT7	12	51	104	56
RFT8	12	52	98	50
RFT9	14	55	103	59
RFT10	14	55	109	54
RMJ1	11	51	90	50
RMJ2	13	55	99	49
RMJ3	11	51	89	49
RMJ4	10	49	89	53
RMJ5	13	54	99	57
RMJ6	12	55	89	50
RMJ7	10	50	95	43
RMJ8	13	53	96	51
RMJ9	12	52	92	50
RMJ10	12	54	101	56
RFJ1	12	57	92	46
RFJ2	14	57	101	46
RFJ3	12	58	99	63
RFJ4	11	52	89	47
RFJ5	12	52	103	52
RFJ6	14	56	99	74
RFJ7	14	58	112	67
RFJ8	11	51	89	57
RFJ9	12	53	88	53

RFJ10	15	56	100	53
RMF1	14	55	95	61
RMF2	13	56	105	67
RMF3	12	55	98	61
RMF4	12	55	95	62
RMF5	13	52	95	58
RMF6	13	53	96	66
RMF7	11	52	99	62
RMF8	12	54	99	70
RMF9	13	57	99	65
RMF10	11	55	107	73
RFF1	14	58	112	61
RFF2	15	62	127	66
RFF3	16	70	136	78
RFF4	13	54	106	61
RFF5	13	58	112	66
RFF6	13	49	89	65
RFF7	13	52	102	54
RFF8	12	56	105	61
RFF9	12	53	98	61
RFF10	14	54	95	60
RMG1	12	45	65	35
RMG2	9	43	66	39
RMG3	10	42	67	38
RMG4	11	43	64	30
RMG5	12	47	83	39
RMG6	12	48	62	34
RMG7	10	42	60	29
RMG8	11	46	71	30
RMG9	11	47	71	33
RMG10	11	47	73	35
RFG1	13	59	109	52
RFG2	13	52	92	36
RFG3	14	58	118	52
RFG4	12	54	111	51
RFG5	15	58	108	54
RFG6	13	51	103	47
RFG7	11	47	87	42
RFG8	11	46	92	43
RFG9	10	51	101	44
RFG10	12	52	102	46
Total	20	85	222	179

Table S4. Significance tests of environmental factors in Redundancy analysis (RDA) of phytoplankton

Environmental factors	RDA1	RDA2	r2	Pr(>r)
NO_2-N	0.961	0.2765	0.2439	0.001
NH_4-N	-0.9561	0.2931	0.515	0.001
NO_3-N	0.4196	-0.9077	0.1403	0.005
TN	0.9874	0.1585	0.5404	0.001
TP	0.357	-0.9341	0.0178	0.503

Table S5. Significance tests of environmental factors in Redundancy analysis (RDA) of microzooplankton

Environmental factors	RDA1	RDA2	r2	Pr(>r)
NO2-N	0.8966	0.4429	0.1241	0.007
NH4-N	-0.9961	-0.0881	0.3269	0.001
NO3-N	0.8363	-0.5482	0.0243	0.376
TN	0.9094	0.4159	0.3264	0.001
TP	0.6949	0.7191	0.1433	0.005

Table S6. The composition of microzooplankton at phylum level (or subphylum and class)

Phylum (or subphylum and class)	RFF	RFG	RFJ	RFT	RMF	RMG	RMJ	RMT
Incertae Sedis	0	0.000348	0	0	0.000525	0	0	0
Foraminifera	0	0	0	0	0	0	0	0.00404
Apicomplexa	0.000778	0	0.000826	0.002887	0	0	0	0
Ascetosporea (Class)	0	0	0.000426	0	0.001002	0	0.001634	0.001756
Parabasalia	0.004718	0.002706	0.001635	0	0.008805	0.000479	0.001779	0.001172
Rhizaria	0.004098	0.002045	0.001053	0.00832	0.002547	0	0.004468	0.004204
Retaria	0.004404	0.000348	0.0008	0.003933	0.004558	0	0.000299	0.012534
Euglenozoa	0.005539	0.019191	0.001577	0	0.001006	0.005281	0	0
Aconoidasida (Class)	0.033236	0.012895	0.047487	0.028083	0.529763	0.010896	0.004667	0.028957
Postciliodesmatophora (Subphylum)	0.262763	0.068042	0.02175	0.18394	0.068823	0.011335	0.026436	0.170351
Ciliophora	0.16277	0.004431	1.295999	0.053168	0	0	0	0.027457
Imbricatea (Class)	0.1332	0.105193	0.395538	0.614203	0.184868	0.012322	0.162582	0.603641
Heterolobosea	0.165149	0.063616	0.087907	0.287235	0.117514	0.013638	0.216982	1.68838
Thecofilosea (Class)	0.626658	0.963756	0.43205	0.353212	0.812267	0.20481	0.906325	0.150249
Polycystinea (Class)	0.010071	0.008861	1.108306	3.327458	0.004197	0.00375	0.0007	0.018238
Kinetoplastea (Class)	2.556213	1.235987	2.351783	2.18424	1.919466	0.339012	0.499576	7.370596
Stramenopiles	4.547177	4.204409	7.371046	7.346864	6.863117	2.161148	4.297111	11.63715
Cercozoa	6.224971	3.221243	7.355532	13.43836	7.949283	2.336847	4.167469	23.10185
Conoidasida (Class)	7.744372	32.74891	2.681379	2.689837	23.34839	55.70701	33.8711	1.453897
Intramacronucleata (Subphylum)	39.20447	45.67978	49.34648	45.97517	30.85672	33.44353	43.01764	33.47088

Note: Here, species in the classes Imbricata (class) and Thecofilosea (class) were classified separately from those in the Cercozoa phylum, with the data for Imbricata and Thecofilosea being distinct from that of Cercozoa; species in the Intramacronucleata (subphylum) and Postciliodesmatoph-ora (subphylum) were independently analyzed from those in the Ciliophora phylum, with the data for Intramacronucleata and Postciliodesmatophora being distinct from that of Ciliophora; species in the Kinetoplastea were analyzed independently from the Euglenozoa phylum, within the Euglenozoa phylum, species from both Kinetoplastea and Euglenida were excluded; species in Conoidasida (class) and Aconoidasida were independently analyzed from those in the Apicomplexa phylum, with the data for Conoidasida and Aconoidasida being distinct from that of Apicomplexa; the data pertaining to the phyla Retaria and Rhizaria do not overlap with the data for other phyla.

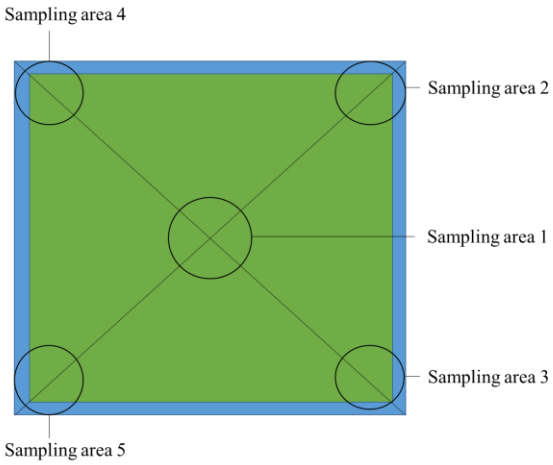


Figure S1. Schematic diagram of the 5-point sampling method in the study

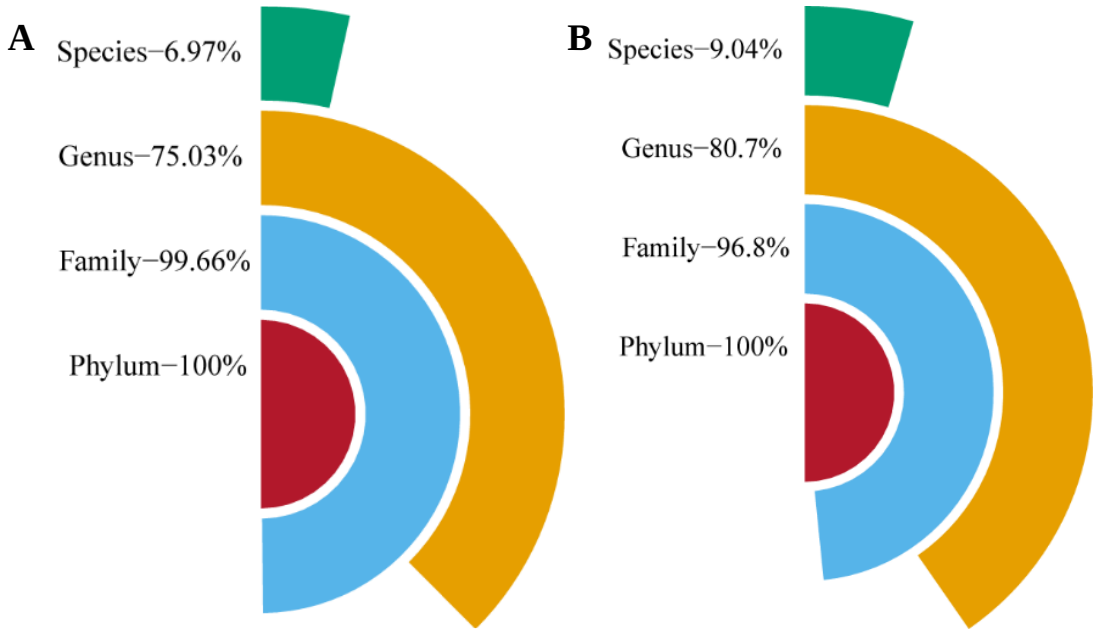


Figure S2. Ratios of successfully annotated ASVs at different taxonomic levels in phytoplankton and zooplankton