Table S4. Predicted functions of the GI tract-associated microbial communities between fish from the CR vs TR treatment across stages. Differentially abundant of these functional genes were tested by Welch-t test comparison at each sampling stage. All means was not significant based on adjusted p-value using False Discovery Rate method (FDR).

Stages	Level_2	CR Mean rel. abund. (%)	CR Std. dev	CR SEM	TR Mean rel. abund. (%)	TR Std. dev	TR SEM	Diff. betw. means	95% lower CI	95% upper CI	p-values	FDR
14dpf	Amino Acid Metabolism	12.391	0.000	0.000	12.434	0.044	0.031	-0.044	-0.597	0.510	0.500	0.501
14dpf	Biosynthesis of Other Secondary Metabolites	1.043	0.000	0.000	1.210	0.167	0.118	-0.167	-2.284	1.951	0.500	0.501
14dpf	Cancers	0.164	0.000	0.000	0.161	0.003	0.002	0.003	-0.038	0.045	0.500	0.501
14dpf	Carbohydrate Metabolism	11.737	0.000	0.000	12.119	0.382	0.270	-0.382	-5.238	4.474	0.500	0.501
14dpf	Cardiovascular Diseases	0.016	0.000	0.000	0.010	0.007	0.005	0.007	-0.080	0.094	0.500	0.501
14dpf	Cell Communication	0.001	0.000	0.000	0.000	0.000	0.000	0.000	-0.003	0.004	0.500	0.501
14dpf	Cell Growth and Death	0.653	0.000	0.000	0.609	0.044	0.031	0.044	-0.516	0.604	0.500	0.501
14dpf	Cell Motility	3.750	0.000	0.000	2.901	0.849	0.601	0.849	-9.943	11.642	0.500	0.501
14dpf	Circulatory System	0.046	0.000	0.000	0.029	0.017	0.012	0.017	-0.198	0.232	0.500	0.501
14dpf	Digestive System	0.035	0.000	0.000	0.047	0.012	0.009	-0.012	-0.167	0.143	0.500	0.501
14dpf	Endocrine System	0.590	0.000	0.000	0.525	0.065	0.046	0.065	-0.763	0.893	0.500	0.501
14dpf	Energy Metabolism	6.896	0.000	0.000	7.334	0.438	0.309	-0.438	-5.997	5.122	0.500	0.501
14dpf	Environmental Adaptation	0.163	0.000	0.000	0.163	0.000	0.000	0.000	-0.004	0.004	0.495	0.501
14dpf	Enzyme Families	2.083	0.000	0.000	2.219	0.136	0.096	-0.136	-1.861	1.589	0.500	0.501
14dpf	Excretory System	0.031	0.000	0.000	0.045	0.014	0.010	-0.014	-0.186	0.159	0.500	0.501

14dpf	Folding, Sorting and Degradation	2.762	0.000	0.000	2.894	0.132	0.093	-0.132	-1.810	1.546	0.500	0.501
14dpf	Glycan Biosynthesis and Metabolism	2.354	0.000	0.000	2.687	0.334	0.236	-0.334	-4.572	3.905	0.500	0.501
14dpf	Immune System	0.055	0.000	0.000	0.063	0.009	0.006	-0.009	-0.119	0.101	0.500	0.501
14dpf	Immune System Diseases	0.041	0.000	0.000	0.049	0.008	0.006	-0.008	-0.114	0.097	0.500	0.501
14dpf	Infectious Diseases	0.442	0.000	0.000	0.439	0.003	0.002	0.003	-0.035	0.041	0.500	0.501
14dpf	Lipid Metabolism	4.565	0.000	0.000	4.545	0.020	0.014	0.020	-0.236	0.277	0.500	0.501
14dpf	Membrane Transport	13.087	0.001	0.001	11.681	1.405	0.994	1.406	-16.452	19.263	0.500	0.501
14dpf	Metabolic Diseases	0.104	0.000	0.000	0.111	0.007	0.005	-0.007	-0.097	0.083	0.500	0.501
14dpf	Metabolism of Cofactors and Vitamins	4.758	0.000	0.000	5.116	0.357	0.253	-0.357	-4.895	4.180	0.500	0.501
14dpf	Metabolism of Other Amino Acids	2.075	0.000	0.000	2.056	0.019	0.014	0.019	-0.226	0.265	0.500	0.501
14dpf	Metabolism of Terpenoids and Polyketides	2.699	0.000	0.000	2.681	0.018	0.013	0.018	-0.210	0.245	0.501	0.501
14dpf	Nervous System	0.088	0.000	0.000	0.091	0.003	0.002	-0.003	-0.046	0.039	0.500	0.501
14dpf	Neurodegenerative Diseases	0.336	0.000	0.000	0.266	0.070	0.049	0.070	-0.819	0.958	0.500	0.501
14dpf	Nucleotide Metabolism	3.655	0.000	0.000	3.950	0.295	0.209	-0.295	-4.043	3.453	0.500	0.501
14dpf	Replication and Repair	8.416	0.000	0.000	8.669	0.253	0.179	-0.253	-3.467	2.961	0.500	0.501
14dpf	Sensory System	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.001	0.500	0.501

14dpf	Signal Transduction	2.495	0.000	0.000	2.332	0.164	0.116	0.164	-1.917	2.244	0.500	0.501
14dpf	Signaling Molecules and Interaction	0.147	0.000	0.000	0.195	0.049	0.034	-0.049	-0.665	0.568	0.500	0.501
14dpf	Transcription	2.434	0.000	0.000	2.642	0.208	0.147	-0.208	-2.853	2.437	0.500	0.501
14dpf	Translation	5.454	0.000	0.000	5.544	0.089	0.063	-0.090	-1.225	1.046	0.499	0.501
14dpf	Transport and Catabolism	0.422	0.000	0.000	0.451	0.028	0.020	-0.028	-0.387	0.330	0.500	0.501
14dpf	Xenobiotics Biodegradation and Metabolism	4.012	0.000	0.000	3.733	0.279	0.197	0.279	-3.262	3.819	0.500	0.501
21dpf	Amino Acid Metabolism	12.388	0.003	0.002	12.398	0.000	0.000	-0.009	-0.046	0.028	0.199	0.351
21dpf	Biosynthesis of Other Secondary Metabolites	1.043	0.001	0.000	1.046	0.000	0.000	-0.003	-0.010	0.004	0.131	0.348
21dpf	Cancers	0.164	0.000	0.000	0.164	0.000	0.000	0.000	-0.002	0.001	0.175	0.351
21dpf	Carbohydrate Metabolism	11.736	0.000	0.000	11.744	0.000	0.000	-0.008	-0.010	-0.006	0.006	0.057
21dpf	Cardiovascular Diseases	0.016	0.000	0.000	0.017	0.000	0.000	0.000	-0.001	0.001	0.304	0.433
21dpf	Cell Communication	0.001	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.218	0.351
21dpf	Cell Growth and Death	0.653	0.000	0.000	0.652	0.000	0.000	0.000	-0.002	0.003	0.331	0.433
21dpf	Cell Motility	3.748	0.000	0.000	3.734	0.000	0.000	0.014	0.011	0.018	0.008	0.059
21dpf	Circulatory System	0.046	0.000	0.000	0.046	0.000	0.000	0.000	-0.001	0.001	0.678	0.737
21dpf	Digestive System	0.035	0.000	0.000	0.034	0.000	0.000	0.000	0.000	0.000	0.131	0.348
21dpf	Endocrine System	0.589	0.000	0.000	0.588	0.000	0.000	0.001	-0.004	0.005	0.372	0.451
21dpf	Energy Metabolism	6.894	0.000	0.000	6.884	0.000	0.000	0.010	0.005	0.015	0.025	0.133

21dpf	Environmental Adaptation	0.163	0.000	0.000	0.163	0.000	0.000	0.000	0.000	0.001	0.132	0.348
21dpf	Enzyme Families	2.084	0.001	0.001	2.082	0.000	0.000	0.002	-0.012	0.016	0.323	0.433
21dpf	Excretory System	0.031	0.000	0.000	0.032	0.000	0.000	0.000	0.000	0.000	0.001	0.035
21dpf	Folding, Sorting and Degradation	2.762	0.000	0.000	2.758	0.000	0.000	0.004	-0.001	0.009	0.058	0.237
21dpf	Glycan Biosynthesis and Metabolism	2.353	0.000	0.000	2.347	0.000	0.000	0.006	0.004	0.008	0.015	0.093
21dpf	Immune System	0.055	0.000	0.000	0.055	0.000	0.000	0.000	-0.001	0.000	0.144	0.351
21dpf	Immune System Diseases	0.041	0.000	0.000	0.041	0.000	0.000	0.000	-0.001	0.001	0.948	0.960
21dpf	Infectious Diseases	0.443	0.000	0.000	0.442	0.000	0.000	0.000	-0.001	0.002	0.200	0.351
21dpf	Lipid Metabolism	4.563	0.002	0.001	4.561	0.000	0.000	0.002	-0.018	0.022	0.378	0.451
21dpf	Membrane Transport	13.097	0.001	0.000	13.143	0.001	0.001	-0.046	-0.054	-0.039	0.003	0.040
21dpf	Metabolic Diseases	0.104	0.000	0.000	0.104	0.000	0.000	0.000	0.000	0.000	0.079	0.293
21dpf	Metabolism of Cofactors and Vitamins	4.759	0.001	0.001	4.755	0.000	0.000	0.004	-0.008	0.016	0.154	0.351
21dpf	Metabolism of Other Amino Acids	2.075	0.001	0.000	2.076	0.000	0.000	-0.001	-0.008	0.005	0.291	0.433
21dpf	Metabolism of Terpenoids and Polyketides	2.697	0.001	0.001	2.696	0.000	0.000	0.001	-0.015	0.017	0.591	0.684
21dpf	Nervous System	0.088	0.000	0.000	0.088	0.000	0.000	-0.001	-0.001	0.000	0.002	0.040
21dpf	Neurodegenerative Diseases	0.336	0.000	0.000	0.336	0.000	0.000	0.000	-0.004	0.004	0.898	0.949

21dpf	Nucleotide Metabolism	3.657	0.002	0.001	3.653	0.000	0.000	0.003	-0.021	0.028	0.339	0.433
21dpf	Replication and Repair	8.418	0.004	0.003	8.406	0.000	0.000	0.012	-0.037	0.061	0.200	0.351
21dpf	Sensory System	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.218	0.351
21dpf	Signal Transduction	2.494	0.000	0.000	2.490	0.000	0.000	0.004	0.001	0.007	0.036	0.166
21dpf	Signaling Molecules and Interaction	0.147	0.000	0.000	0.147	0.000	0.000	0.000	-0.002	0.002	0.960	0.960
21dpf	Transcription	2.436	0.002	0.001	2.437	0.000	0.000	-0.001	-0.021	0.019	0.614	0.688
21dpf	Translation	5.454	0.002	0.001	5.443	0.000	0.000	0.012	-0.013	0.036	0.106	0.348
21dpf	Transport and Catabolism	0.422	0.000	0.000	0.421	0.000	0.000	0.001	-0.002	0.003	0.210	0.351
21dpf	Xenobiotics Biodegradation and Metabolism	4.009	0.004	0.003	4.016	0.000	0.000	-0.007	-0.055	0.042	0.336	0.433
36dpf	Amino Acid Metabolism	11.618	0.801	0.401	11.204	0.157	0.111	0.414	-1.006	1.834	0.449	0.824
36dpf	Biosynthesis of Other Secondary Metabolites	0.898	0.150	0.075	0.904	0.009	0.006	-0.006	-0.280	0.268	0.947	0.993
36dpf	Cancers	0.146	0.018	0.009	0.157	0.027	0.019	-0.011	-0.216	0.193	0.747	0.954
36dpf	Carbohydrate Metabolism	11.791	0.095	0.047	10.827	0.422	0.298	0.965	-4.038	5.967	0.258	0.824
36dpf	Cardiovascular Diseases	0.010	0.007	0.003	0.011	0.006	0.004	0.000	-0.028	0.028	0.993	0.993
36dpf	Cell Communication	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.182	0.824
36dpf	Cell Growth and Death	0.628	0.025	0.013	0.598	0.072	0.051	0.030	-0.756	0.817	0.748	0.954
36dpf	Cell Motility	3.092	0.674	0.337	4.910	0.414	0.293	-1.818	-3.694	0.058	0.054	0.465
36dpf	Circulatory System	0.026	0.020	0.010	0.087	0.023	0.016	-0.061	-0.206	0.083	0.171	0.824

36dpf	Digestive System	0.028	0.009	0.004	0.042	0.001	0.001	-0.014	-0.030	0.001	0.063	0.465
36dpf	Endocrine System	0.407	0.183	0.091	0.389	0.031	0.022	0.018	-0.307	0.343	0.879	0.956
36dpf	Energy Metabolism	6.461	0.434	0.217	6.804	0.469	0.331	-0.344	-3.251	2.564	0.598	0.851
36dpf	Environmental Adaptation	0.181	0.018	0.009	0.188	0.002	0.001	-0.008	-0.040	0.025	0.524	0.851
36dpf	Enzyme Families	2.456	0.379	0.190	2.221	0.073	0.051	0.235	-0.438	0.907	0.373	0.824
36dpf	Excretory System	0.041	0.010	0.005	0.019	0.003	0.002	0.022	0.004	0.040	0.027	0.465
36dpf	Folding, Sorting and Degradation	2.742	0.098	0.049	3.052	0.248	0.175	-0.310	-2.893	2.273	0.422	0.824
36dpf	Glycan Biosynthesis and Metabolism	2.098	0.264	0.132	2.859	0.030	0.021	-0.760	-1.236	-0.285	0.014	0.465
36dpf	Immune System	0.075	0.021	0.011	0.072	0.012	0.008	0.003	-0.050	0.056	0.864	0.956
36dpf	Immune System Diseases	0.067	0.027	0.013	0.050	0.012	0.008	0.017	-0.039	0.073	0.433	0.824
36dpf	Infectious Diseases	0.419	0.025	0.012	0.482	0.054	0.038	-0.063	-0.590	0.464	0.440	0.824
36dpf	Lipid Metabolism	4.078	0.506	0.253	3.821	0.056	0.040	0.257	-0.655	1.169	0.447	0.824
36dpf	Membrane Transport	14.550	1.455	0.727	13.024	1.973	1.395	1.525	-13.068	16.118	0.578	0.851
36dpf	Metabolic Diseases	0.103	0.002	0.001	0.095	0.005	0.003	0.008	-0.040	0.056	0.332	0.824
36dpf	Metabolism of Cofactors and Vitamins	4.909	0.160	0.080	4.993	0.183	0.129	-0.084	-1.267	1.100	0.733	0.954
36dpf	Metabolism of Other Amino Acids	1.942	0.143	0.071	1.926	0.024	0.017	0.017	-0.237	0.270	0.858	0.956
36dpf	Metabolism of Terpenoids and Polyketides	2.268	0.438	0.219	2.005	0.059	0.041	0.263	-0.522	1.048	0.379	0.824

36dpf	Nervous System	0.095	0.008	0.004	0.083	0.006	0.004	0.012	-0.017	0.041	0.237	0.824
36dpf	Neurodegenerative Diseases	0.258	0.079	0.039	0.475	0.091	0.064	-0.216	-0.807	0.374	0.204	0.824
36dpf	Nucleotide Metabolism	4.231	0.593	0.297	4.151	0.039	0.027	0.080	-1.002	1.162	0.831	0.956
36dpf	Replication and Repair	9.519	1.186	0.593	9.494	0.336	0.238	0.025	-2.106	2.157	0.975	0.993
36dpf	Sensory System	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.182	0.824
36dpf	Signal Transduction	2.135	0.365	0.182	2.863	0.114	0.081	-0.728	-1.394	-0.062	0.039	0.465
36dpf	Signaling Molecules and Interaction	0.216	0.069	0.035	0.172	0.014	0.010	0.044	-0.079	0.166	0.365	0.824
36dpf	Transcription	3.067	0.634	0.317	2.761	0.053	0.038	0.305	-0.846	1.457	0.468	0.824
36dpf	Translation	5.938	0.544	0.272	6.082	0.415	0.294	-0.144	-2.179	1.891	0.806	0.956
36dpf	Transport and Catabolism	0.322	0.101	0.050	0.358	0.023	0.016	-0.036	-0.215	0.143	0.598	0.851
36dpf	Xenobiotics Biodegradation and Metabolism	3.184	0.902	0.451	2.820	0.192	0.136	0.363	-1.234	1.960	0.551	0.851