

Temporal bacterial surveillance of salmon aquaculture sites indicates a long lasting benthic impact with minimal recovery

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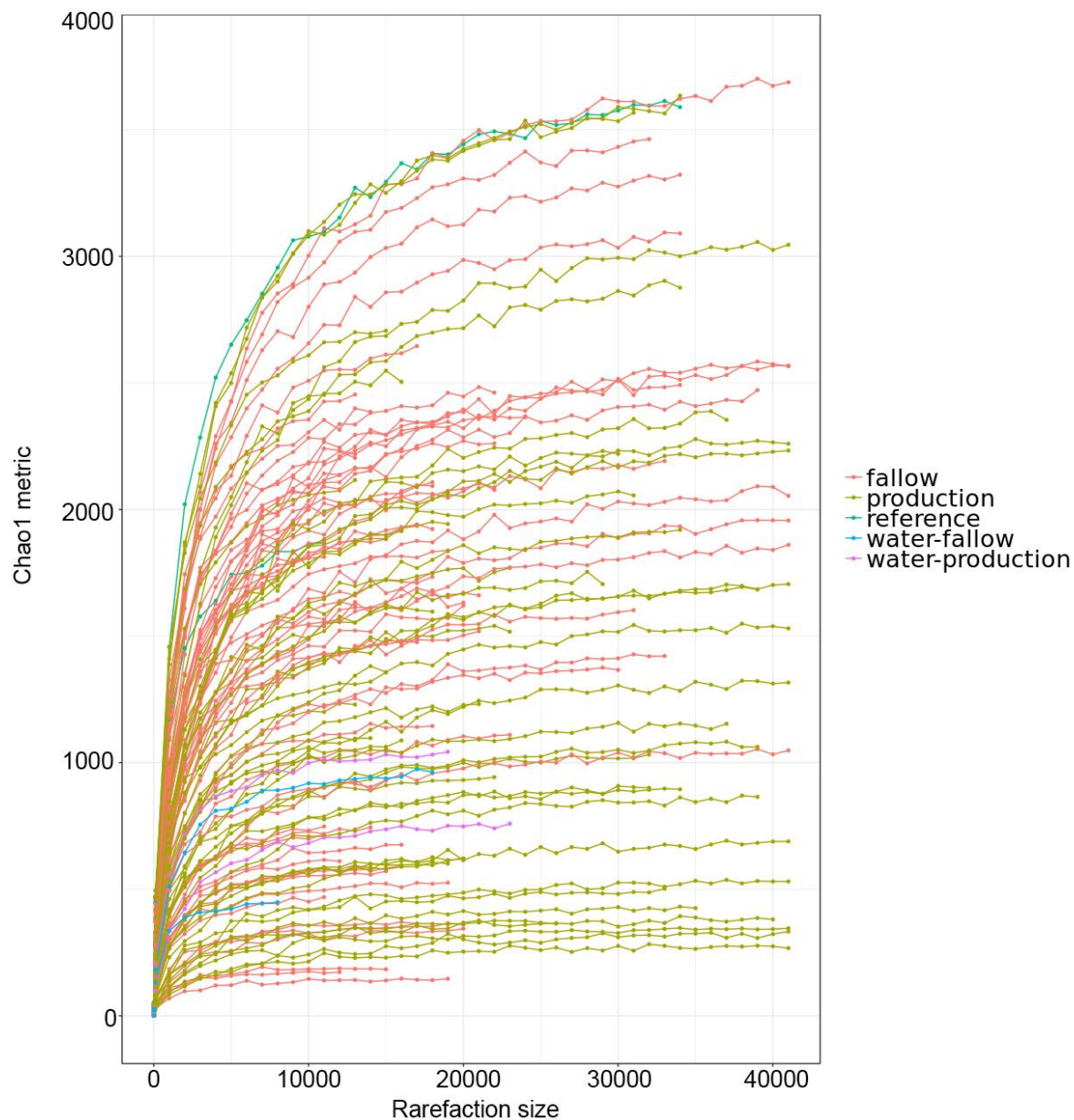
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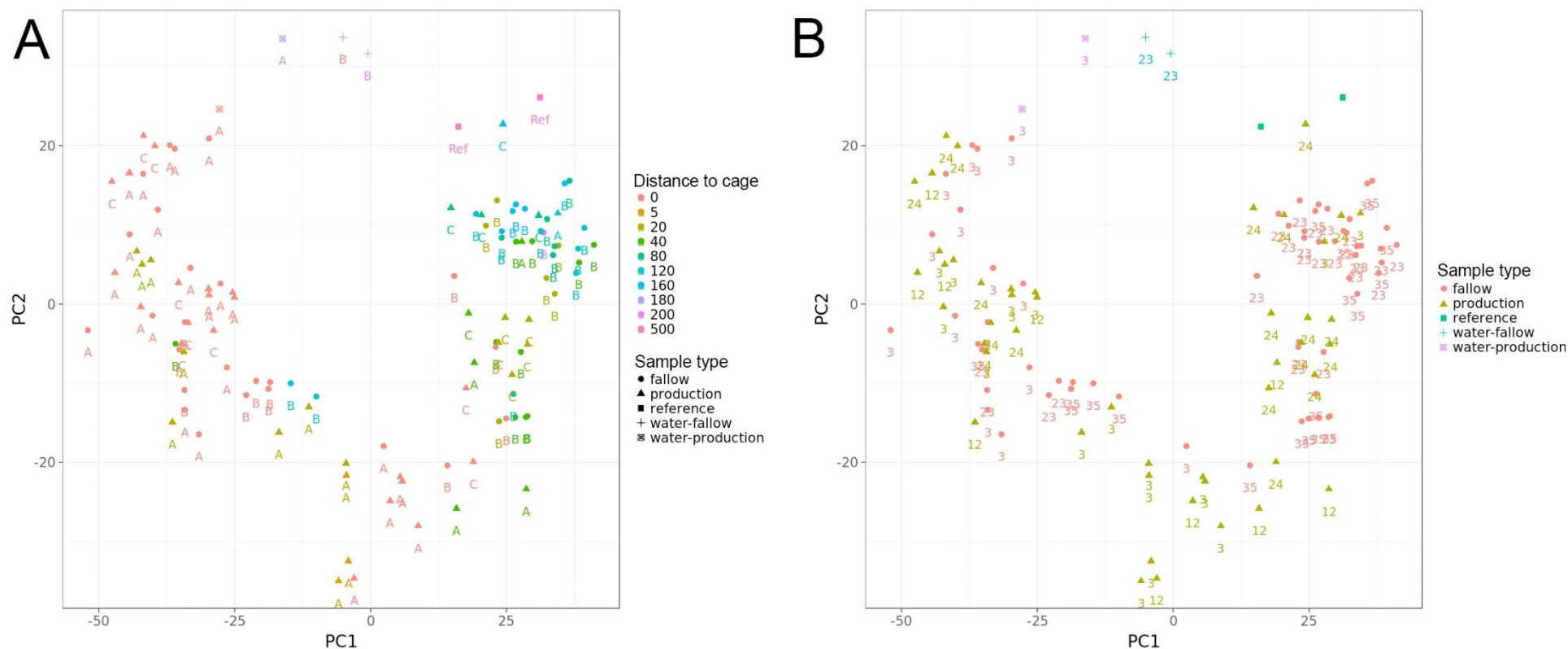
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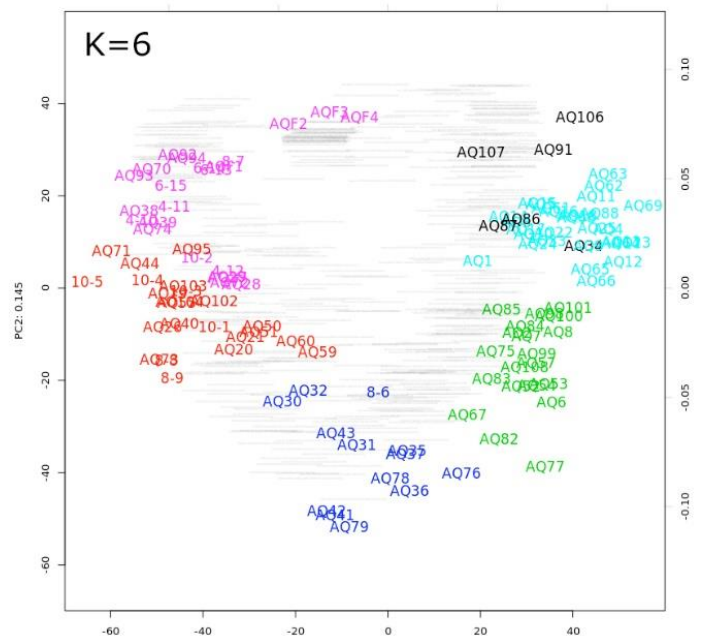
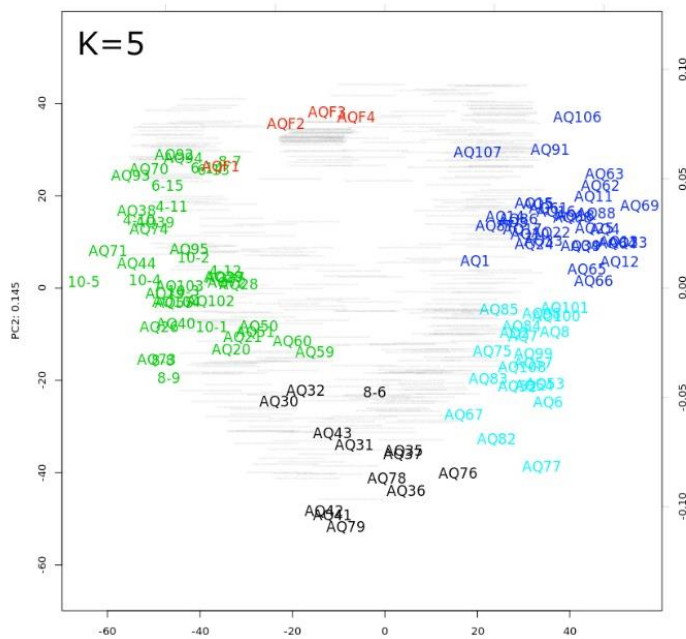
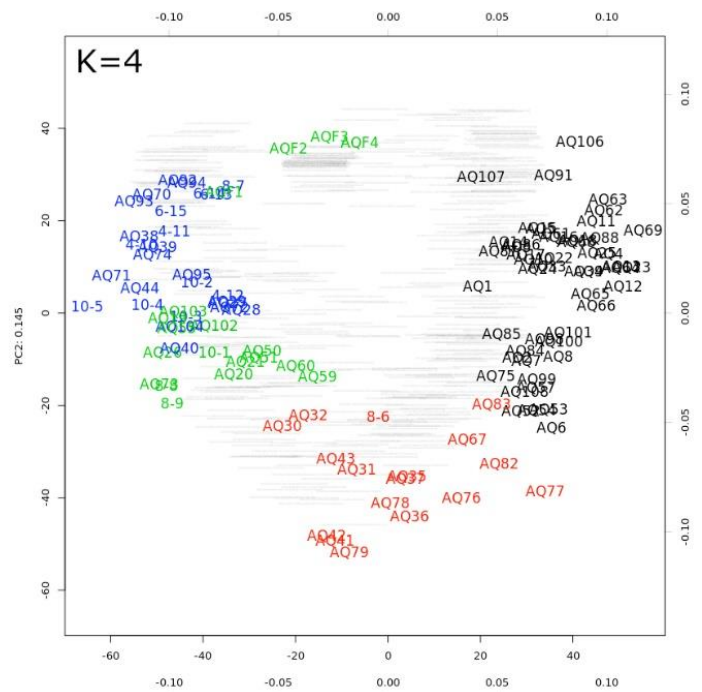
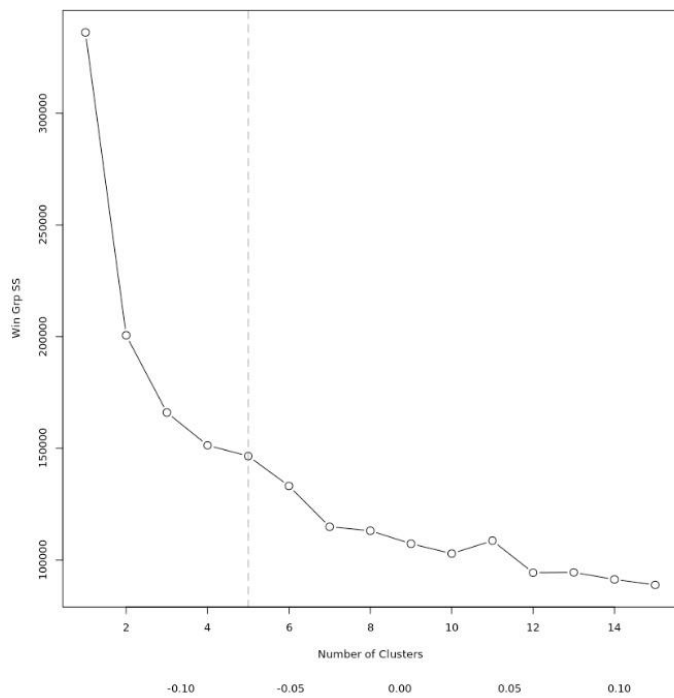


Supplementary figure S1: Rarefaction curve analysis of high-throughput sequencing data.

Data points indicate mean alpha diversity at specified rarefaction sizes for the Chao1 metric. Color indicates sample type, red: fallow, orange: production, green: far-field samples, blue: fallow water, pink: production water.



Supplementary figure S2: Compositional PCA plots of samples sequenced in this study. Symbols indicate samples and are separated by distances signifying multivariate differences. **(A)** Samples are color coded by distance to cage, with shape representing the sample type. Labels indicate the site from which a sample was collected. **(B)** Samples coded by type, with labels indicating either the fallow period in months (for fallow samples) or production period in months (for production samples).



Supplementary figure S3: Determination of the optimal number of clusters within the dataset. Upper left graph shows the result of within cluster sums of squares analysis, indicating an optimal cluster number of K=5 using the elbow method. Additional graphs show compositional PCA plots of flocculent matter and water samples, colour-coded to represent k-means clustering where K=4, 5 and 6.

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Supplementary Table S1: Samples sequenced in this study

Sample	Site	Transect - Station	Type	Collection (YYYY-MM)	Cage distance	Fallow Length	Impact cluster	Production Length	Sequences	OTUs	OTUs (0.5%)
10-1	A	CE-1 ^s	fallow	2015-08	0	3	I	NA	24756	737	217
10-2	A	CE-1 ^s	fallow	2015-08	0	3	I	NA	22821	477	166
10-3	A	CE-1 ^s	fallow	2015-08	0	3	I	NA	28346	602	197
10-4	A	CE-1 ^s	fallow	2015-08	0	3	I	NA	29083	587	184
10-5	A	CE-1 ^s	fallow	2015-08	0	3	I	NA	33366	541	160
4-10	A	CE-2 ^s	fallow	2015-08	0	3	I	NA	33071	370	146
4-11	A	CE-2 ^s	fallow	2015-08	0	3	I	NA	34165	379	133
4-12	A	CE-2 ^s	fallow	2015-08	0	3	I	NA	34330	606	195
6-13	A	CE-3 ^s	fallow	2015-08	0	3	I	NA	27243	195	66
6-14	A	CE-3 ^s	fallow	2015-08	0	3	I	NA	24407	178	63
6-15	A	CE-3 ^s	fallow	2015-08	0	3	I	NA	40626	346	124
8-6	A	CE-4 ^s	fallow	2015-08	0	3	II	NA	22682	768	224
8-7	A	CE-4 ^s	fallow	2015-08	0	3	I	NA	33468	147	54
8-8	A	CE-4 ^s	fallow	2015-08	0	3	I	NA	26785	765	194
8-9	A	CE-4 ^s	fallow	2015-08	0	3	I	NA	46809	1125	236
AQ1	B	3S-0m	fallow	2016-09	0	23	III	NA	18831	1695	200
AQ10	B	3S-80m	fallow	2016-09	80	23	III	NA	18366	1956	199
AQ100	C	T3-20m	production	2017-06	20	NA	IV	12	57554	2432	252
AQ101	C	T3-20m	production	2017-06	20	NA	IV	12	56732	3163	249
AQ102	C	T6-0m	production	2017-06	0	NA	I	12	75290	1374	263

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AQ103	C	T6-0m	production	2017-06	0	NA	I	12	60694	1182	222
AQ104	C	T6-0m	production	2017-06	0	NA	I	12	54171	1061	231
AQ105	R	REF3	reference	2017-06	NA	NA	I	12	125	46	NA
AQ106	R	REF3	reference	2017-06	NA	NA	III	12	48784	3710	146
AQ107	R	REF3	reference	2017-06	NA	NA	III	12	14870	1921	104
AQ108	B	4W	fallow	2017-06	0	35	IV	NA	62859	2038	249
AQ11	B	3S-80m	fallow	2016-09	80	23	III	NA	16154	2191	177
AQ12	B	3S-120m	fallow	2016-09	120	23	III	NA	18366	2286	213
AQ13	B	3S-120m	fallow	2016-09	120	23	III	NA	25902	2730	203
AQ14	B	3S-120m	fallow	2016-09	120	23	III	NA	18363	2480	185
AQ15	B	3S-160m	fallow	2016-09	160	23	III	NA	29788	2162	178
AQ16	B	3S-160m	fallow	2016-09	160	23	III	NA	26065	2166	189
AQ17	B	3S-160m	fallow	2016-09	160	23	III	NA	23234	1991	200
AQ18	B	3S-200m	fallow	2016-09	200	23	III	NA	29887	1910	178
AQ19	B	8W-0m	fallow	2016-09	0	23	I	NA	19699	638	175
AQ2	B	3S-0m	fallow	2016-09	0	23	IV	NA	25914	1790	238
AQ20	B	8W-0m	fallow	2016-09	0	23	I	NA	24008	948	238
AQ21	B	8W-0m	fallow	2016-09	0	23	I	NA	31464	1190	250
AQ22	B	8W-40m	fallow	2016-09	40	23	III	NA	28860	1688	189

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AQ23	B	8W-40m	fallow	2016-09	40	23	III	NA	28154	2558	224
AQ24	B	8W-40m	fallow	2016-09	40	23	III	NA	28670	2350	200
AQ25	B	8W-80m	fallow	2016-09	80	23	III	NA	22337	2156	225
AQ26	B	9N-0m	fallow	2016-09	0	23	I	NA	24769	689	174
AQ27	A	4S-0m	production	2016-10	0	NA	I	3	28398	621	184
AQ28	A	4S-0m	production	2016-10	0	NA	I	3	29032	633	199
AQ29	A	4S-0m	production	2016-10	0	NA	I	3	44264	507	175
AQ3	B	3S-20m	fallow	2016-09	20	23	III	NA	19372	1895	198
AQ30	A	4S-20m	production	2016-10	20	NA	II	3	27404	964	228
AQ31	A	4S-20m	production	2016-10	20	NA	II	3	32370	1581	257
AQ32	A	4S-20m	production	2016-10	20	NA	II	3	19223	1057	222
AQ33	A	4S-40m	production	2016-10	40	NA	III	3	18897	2169	193
AQ34	A	4S-120m	production	2016-10	120	NA	III	3	25642	1668	202
AQ35	A	4W-0m	production	2016-10	0	NA	II	3	21838	1370	227
AQ36	A	4W-0m	production	2016-10	0	NA	II	3	19698	1271	206
AQ37	A	4W-0m	production	2016-10	0	NA	II	3	36741	1828	244
AQ38	A	4W-20m	production	2016-10	20	NA	I	3	38992	385	115
AQ39	A	4W-20m	production	2016-10	20	NA	I	3	50298	434	130
AQ4	B	3S-20m	fallow	2016-09	20	23	III	NA	18631	2113	204

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AQ40	A	4W-20m	production	2016-10	20	NA	I	3	50481	926	225
AQ41	A	1N-5m	production	2016-10	5	NA	II	3	31305	1265	210
AQ42	A	1N-5m	production	2016-10	5	NA	II	3	30184	1110	203
AQ43	A	1N-5m	production	2016-10	5	NA	II	3	25858	1140	223
AQ44	A	Center Cage	production	2016-10	0	NA	I	3	31973	639	189
AQ49	B	4W-0M	fallow	2017-06	0	35	I	NA	136	20	NA*
AQ5	B	3S-20m	fallow	2016-09	20	23	III	NA	19233	2523	190
AQ50	B	3S-0m	fallow	2017-06	0	35	I	NA	53297	1458	287
AQ51	B	3S-0m	fallow	2017-06	0	35	I	NA	50536	1414	280
AQ52	B	3S-20m	fallow	2017-06	20	35	IV	NA	58444	2587	262
AQ53	B	3S-40m	fallow	2017-06	40	35	IV	NA	73941	2675	264
AQ54	B	3S-40m	fallow	2017-06	40	35	IV	NA	63420	2514	267
AQ55	B	3S-40m	fallow	2017-06	40	35	I	NA	71478	1078	217
AQ56	B	3S-40m	fallow	2017-06	40	35	I	NA	280	48	NA*
AQ57	B	3S-80m	fallow	2017-06	80	35	IV	NA	32705	1733	247
AQ58	B	3S-80m	fallow	2017-06	80	35	IV	NA	108	18	NA*
AQ59	B	3S-120m	fallow	2017-06	120	35	I	NA	58048	1918	301
AQ6	B	3S-40m	fallow	2016-09	40	23	IV	NA	27466	1646	231

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AQ60	B	3S-120m	fallow	2017-06	120	35	I	NA	50880	1647	286
AQ61	B	3S-160m	fallow	2017-06	160	35	III	NA	43836	3415	197
AQ62	B	3S-160m	fallow	2017-06	160	35	III	NA	46967	3186	207
AQ63	B	8W-80m	fallow	2017-06	80	35	III	NA	52420	3553	196
AQ64	B	8W-40m	fallow	2017-06	40	35	III	NA	39207	2457	205
AQ65	B	8W-20m	fallow	2017-06	20	35	III	NA	61463	2669	216
AQ66	B	8W-20m	fallow	2017-06	20	35	III	NA	49394	2248	215
AQ67	B	8W-0m	fallow	2017-06	0	35	IV	NA	61686	2169	268
AQ68	B	10S-120m	fallow	2017-06	120	35	III	NA	25024	2440	206
AQ69	B	10S-120m	fallow	2017-06	120	35	III	NA	64042	3796	185
AQ7	B	3S-40m	fallow	2016-09	40	23	IV	NA	28917	1558	197
AQ70	A	1N-0m	production	2017-06	0	NA	I	12	55910	354	123
AQ71	A	1N-0m	production	2017-06	0	NA	I	12	82688	712	168
AQ72	A	1N-0m	production	2017-06	0	NA	I	12	54332	1109	251
AQ73	A	1N-20m	production	2017-06	20	NA	I	12	41229	915	204
AQ74	A	1N-20m	production	2017-06	20	NA	I	12	65870	543	162
AQ75	A	1N-40m	production	2017-06	40	NA	IV	12	48032	1975	202
AQ76	A	1N-40m	production	2017-06	40	NA	II	12	59619	1730	219

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AQ77	A	4S-40m	production	2017-06	40	NA	II	12	73291	2357	216
AQ78	A	Center Cage	production	2017-06	0	NA	II	12	74317	1767	220
AQ79	A	Center Cage	production	2017-06	0	NA	II	12	74228	1588	205
AQ8	B	3S-40m	fallow	2016-09	40	23	IV	NA	23460	1530	207
AQ80	A	4W-0m	production	2017-06	0	NA	IV	12	222	65	NA*
AQ81	C	T4-0m	production	2017-06	0	NA	IV	12	200	42	NA*
AQ82	C	T4-0m	production	2017-06	0	NA	IV	12	58235	2297	251
AQ83	C	T4-0m	production	2017-06	0	NA	IV	12	41782	2301	266
AQ84	C	T4-20m	production	2017-06	20	NA	IV	12	29228	2001	231
AQ85	C	T4-40m	production	2017-06	40	NA	IV	12	56928	2964	283
AQ86	C	T4-80m	production	2017-06	80	NA	III	12	53662	3711	249
AQ87	C	T4-80m	production	2017-06	80	NA	III	12	53781	3654	274
AQ88	C	T4-80m	production	2017-06	80	NA	III	12	21440	2605	190
AQ89	C	T4-120m	production	2017-06	120	NA	III	12	89	20	NA*
AQ9	B	3S-80m	fallow	2016-09	80	23	III	NA	24621	1989	208
AQ90	C	T4-120m	production	2017-06	120	NA	III	12	95	18	NA*
AQ91	C	T4-160m	production	2017-06	160	NA	III	12	21921	2799	165
AQ92	C	T2-M1	production	2017-06	0	NA	I	12	64267	283	79

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AQ93	C	T2-M1	production	2017-06	0	NA	I	12	56187	389	131
AQ94	C	T2-M1	production	2017-06	0	NA	I	12	91118	345	107
AQ95	C	T2-M1	production	2017-06	0	NA	I	12	62069	882	220
AQ96	C	T3-0m	production	2017-06	0	NA	I	12	105	28	NA*
AQ97	C	T3-0m	production	2017-06	0	NA	I	12	167	41	NA*
AQ98	C	T3-20m	production	2017-06	20	NA	IV	12	40424	2133	233
AQ99	C	T3-20m	production	2017-06	20	NA	IV	12	39551	1780	245
AQF1	A	4S-0m	water production	2016-10	0	NA	V	3	23730	1071	225
AQF2	A	4S-180m	water production	2016-10	180	NA	V	3	32783	776	136
AQF3	B	3S-0m	water fallow	2016-09	0	23	V	NA	9906	455	96
AQF4	B	3S-200m	water fallow	2016-09	200	23	V	NA	22900	992	168

CE: Cage edge, **R:** Far-field “reference” site, **NA:** Not available/applicable, *: Sample excluded due to low read count, [§]: sample previously described in Verhoeven et al (2015).

Supplementary Table S2: Measurement of percentage total organic carbon within samples of distinct aquaculture impact clusters.

Site	Transect - Station	Average %TOC	Standard deviation	N samples	Impact group
B	8W-0m	22.79	1.12	5	High
A	Center cage	19.78	3.62	3	High
A	4S-0m	26.44	2.81	2	High
A	4W-20m	38.40	1.08	2	High
B	3S-0m	15.67	0.22	2	High
B	3S-40m	32.33	1.51	2	High
B	3S-120m	25.20	0.78	2	High
A	1N-0m	33.94	1.09	2	High
A	1N-0m	38.34	0.14	2	High
A	1N-20m	36.69	1.08	2	High
B	3S-0m	5.61	0.19	2	Intermediate
B	3S-40m	5.73	0.15	2	Intermediate
B	4W CE	9.19	0.66	3	Intermediate
B	4W CE	7.58	0.86	2	Intermediate
B	3S-20m	9.05	0.35	2	Intermediate
B	3S-40m	9.32	0.57	2	Intermediate
B	3S-80m	7.33	0.32	2	Intermediate
B	8W-0m	9.22	0.45	2	Intermediate
A	1N-40m	8.83	0.44	2	Intermediate
B	3S-0m	7.69	0.83	4	Low
B	3S-20 m	4.45	0.97	2	Low
B	3S-80m	5.38	0.58	4	Low
B	3S-120	4.79	1.70	2	Low
B	3S-160	3.57	0.18	2	Low
B	8W-40m	4.16	NA	1	Low
B	8W-80	3.58	0.27	2	Low
REF	REF	0.93	0.11	2	Low
B	3S-160m	3.11	0.07	2	Low
B	8W-80m	3.96	0.21	2	Low
B	8W-40m	6.37	0.84	2	Low
B	8W-20m	6.33	1.02	2	Low
B	10S-120m	6.18	0.86	2	Low

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REF	REF	1.23	0.17	2	Low
A	4S-20m	15.78	1.21	5	Recently disturbed
A	1N-5m	13.32	2.13	3	Recently disturbed
A	4W-0m	42.69	0.17	2	Recently disturbed
A	Center cage	18.05	2.22	2	Recently disturbed
A	Center cage	16.29	0.62	2	Recently disturbed
A	4W-0m	2.72	0.14	2	Recently disturbed
A	1N-40m	5.11	0.73	2	Recently disturbed
A	4S-40m	3.86	0.40	2	Recently disturbed

%TOC: Percentage total organic carbon, **REF:** Samples collected from far-field “reference” stations