

Table S1. Information of 20 polymorphic microsatellite loci for *C. carpio*.

Primer	Forward	Backward	Reference
MFW29	FGTTGACCAAGAAACCAACATGC	GAAGCTTTGCTCTAATCCACG	[1]
Koi09	TGGTTATGGTTATGAATGAG	CTTCAGGGACAGATGGTTTG	[2]
Koi29	CTGACCCTGAAGAGAACAAC	GCCTCATCAAAGACATCAAG	[2]
Koi49	CAGAGGGGAAGAAGTGAG	GGACAAGGATTTTCAGACA	[2]
Koi55	TGCCCTCTCTTTCCTTCATC	CAGGCTTCAACACAAACACA	[2]
Koi57	TGTCCTTTATTGCTCAGAAC	CCACCACATTCATCACAT	[2]
HLJ04	TCAAATAGCCTTGGTGAGCTT	TTCTCCTCTTCAACCCAACG	[3]
HLJ09	GGGGTCTGTGTGTTGGTCTT	CGGGGGAAATGTGTTTAAAGT	[3]
HLJ10	TAGTGGGCACTGCAACTGTC	CATTCATTGTCATTTTGAGAAAGG	[3]
HLJ11	TTAGCCAGCCAGAGACAAGC	CACTGCCACAAACCCATCTA	[3]
CCE24	TGCAAACGAGCAAATTGAGT	ATTTTGCTTGTAGCCCGTTG	[4]
CCE26	TGTGAGAAGCAGAGCGATATT	TCAGTATTTATGTGTTGTTTCCA	[4]
CCE29	CAGCAACAGACAGGAGGACA	CCGCAATTAACAATCCCAAC	[4]
Cca02	ATGCAGGGCTCATGTTGCTCATAG	GCAGACAGACACGTTGCTCTCG	[5]
Cca07	CCATTGCGCTGTAATATGAGGTTT	CGCTTCAACACCAGGGGACTG	[5]
Cca12	ACGCGTCCGGCTGACATTAGAGC	ACAACCCCCGATCCCCAACACA	[5]
Cca14	GCAAAGTCCCATTCTACCCACTCA	CTGCCACCTGCTGTTTCATTCATAA	[5]
Cca16	AATGTTTTTCGCTAATTTGACACC	ACAGCATCATTATACACCGATTCA	[5]
Cca59	TTTGCCAAATTTGCTACTGTTATG	TTTGCGGAAAATTACTTCCAGA	[5]
Cca72	CAGGCCAGATCTATCATCATCAA	CTGCTGTTGGATATGCACTACATC	[5]

Table S2. Source data in meta-analysis of the effect of aquaculture on aquatic animals (weighted by the inverse of variance).

No.	Species	Effect size (Na)	Var	Effect size (He)	Var	Reference
Study 1	<i>Salmon salar</i>	0	0.0044	-0.0057	0.0038	[6]
Study 2	<i>Oncorhynchus mykiss</i>	0.0151	0.0057	0.0219	0.0012	[7]
Study 3	<i>Scophthalmus maximus</i>	0.236	0.0589	-0.0221	0.0016	[8]
Study 4	<i>Oreochromis shiranus</i>	-0.5005	0.0282	-0.0496	0.014	[9]

Study 5	<i>Salmo salar</i>	-0.1767	0.0465	-0.0833	0.0028	[10]
Study 6	<i>Penaeus monodon</i>	-0.6208	0.2987	-0.0709	0.0074	[11]
Study 7	<i>Salmo salar</i>	-0.2451	0.016	-0.0244	0.0054	[12]
Study 8	<i>Paralichthys olivaceus</i>	-0.6509	0.0311	-0.1222	0.0033	[13]
Study 9	<i>Sparus aurata</i>	-0.2723	0.006	-0.0209	0.0003	[14]
Study 10	<i>Haliotis midae</i>	-0.3398	0.1123	0.0225	0.0089	[15]
Study 11	<i>Oncorhynchus tshawytscha</i>	-0.5556	0.0148	-0.1007	0.0011	[16]
Study 12	<i>Haliotis discus hannai</i>	-1.4165	0.0822	-0.2243	0.0051	[17]
Study 13	<i>Salvelinus namaycush</i>	0.047	0.0037	0.0005	0.0009	[18]
Study 14	<i>Salmo salar</i>	-0.5578	0.0061	-0.1119	0.001	[19]
Study 15	<i>Cyprinus carpio</i>	0.0141	0.0414	-0.0256	0.0018	[20]
Study 16	<i>Salvelinus alpinus</i>	-0.6206	0.0286	-0.1129	0.0031	[21]
Study 17	<i>Oncorhynchus mykiss</i>	-0.2614	0.0137	-0.0785	0.0428	[22]
Study 18	<i>Oncorhynchus mykiss</i>	-0.0618	0.0002	0.0079	0	[23]
Study 19	<i>Gadus morhua</i>	-0.2064	0.0016	-0.0184	0	[24]
Study 20	<i>Ostrea edulis</i>	-0.2278	0.0083	-0.0385	0.0008	[25]
Study 21	<i>Macrobrachium rosenbergii</i>	0.0146	0.0037	0.0043	0.001	[26]
Study 22	<i>Oncorhynchus mykiss</i>	0.2592	0.5065	0.3825	0.502	[27]
Study 23	<i>Cyprinus carpio</i>	-0.5257	0.0288	-0.1478	0.0057	[28]
Study 24	<i>Patinopecten yessoensis</i>	-0.3323	0.0121	-0.1429	0.0005	[29]
Study 25	<i>Cyprinus carpio</i>	-0.2263	0.0047	-0.1623	0.001	[30]
Study 26	<i>Oncorhynchus tshawytscha</i>	-0.3646	0.0033	-0.0629	0.0002	[31]
Study 27	<i>Clupea pallasii</i>	-0.127	0.0954	-0.0184	0.0016	[33]
Study 28	<i>Plagopterus argentissimus</i>	-0.133	0.0022	-0.0169	0	[34]
Study 29	<i>Patella caerulea</i>	-0.0663	0.0003	-0.036	0.0002	[35]
Study 30	<i>Pangasianodon hypophthalmus</i>	-0.1094	0.0062	-0.0173	0.0003	[36]
Study 31	<i>Pagrosomus major</i>	-0.2544	0.0958	na	na	[37]
Study 32	<i>Clupea pallasii</i>	-0.4473	0.0033	-0.1173	0.0004	[38]
Study 33	<i>Pinctada maxima</i>	0.0429	0.0376	-0.0293	0.008	[39]
Study 34	<i>Ctenopharyngodon idella</i>	0.2094	0.0373	-0.009	0.0023	[40]
Study 35	<i>Pangasianodon hypophthalmus</i>	0.0294	0.0032	0.0483	0.0017	[41]
Study 36	<i>Lates calcarifer</i>	-0.603	0.0304	-0.2264	0.0062	[42]
Study 37	<i>Cirrhinus cirrhosus</i>	0.0113	0.0249	0.0155	0.0038	[43]
Study 38	<i>Nodipecten subnodosus</i>	-0.8908	0.087	-0.206	0.007	[44]
Study 39	<i>Sebastes inermis</i>	-0.0403	0.0048	-0.0028	0	[45]
Study 40	<i>Haliotis discus hannai</i>	-0.1586	0.0133	-0.0193	0.0005	[46]
Study 41	<i>Crassostrea gigas</i>	-0.1829	0.001	-0.0443	0.0005	[47]
Study 42	<i>Perna viridis</i>	-0.082	0.0183	-0.0223	0.0005	[48]
Study 43	<i>Cirrhinus molitorella</i>	-0.7531	0.0557	-0.1629	0.0198	[49]
Study 44	<i>Larimichthys crocea</i>	-0.0765	0.0015	-0.0116	0.0019	[50]
Study 45	<i>Oncorhynchus masou</i>	-0.3471	0.0016	-0.2084	0.001	[51]
Study 46	<i>Thamnaconus modestus</i>	-0.252	0.0051	-0.0439	0.0003	[52]
Study 47	<i>Cyprinus carpio</i>	-0.1319	0.0021	-0.0125	0.0002	[53]
Study 48	<i>Platichthys stellatus</i>	-0.4609	0.0222	-0.0058	0.0008	[54]

Study 49	<i>Oncorhynchus mykiss</i>	-0.196	0.0117	-0.0626	0.0038	[55]
Study 50	<i>Oncorhynchus tshawytscha</i>	-0.1456	0.0005	-0.014	0	[56]
Study 51	<i>Crassostrea gigas</i>	-0.0323	0.0008	-0.0126	0.0003	[57]
Study 52	<i>Oncorhynchus keta</i>	-0.2193	0.0003	0.0091	0	[58]
Study 53	<i>Ruditapes philippinarum</i>	-0.0477	0.0004	-0.0106	0	[59]
Study 54	<i>Mercenaria mercenaria</i>	-0.1465	0.0004	-0.0367	0.0005	[60]
Study 55	<i>Melanotaenia boesemani</i>	0.0167	0.0156	0.0075	0.0009	[61]
Study 56	<i>Culter alburnus</i>	-0.2378	0.0194	-0.0163	0.0132	[62]
Study 57	<i>Macrobrachium rosenbergii</i>	-0.1823	0.0241	-0.1038	0.018	[63]
Study 58	<i>Siniperca chuatsi</i>	-0.0561	0.0051	-0.0198	0.0001	[64]
Study 59	<i>Salvelinus alpinus</i>	-0.5961	0.0095	-0.6015	0.0034	[65]
Study 60	<i>Dicentrarchus labrax</i>	0.3729	0.0075	-0.0669	0.0003	[105]
Study 61	<i>Percocypris pingi</i>	-0.0574	0.0193	-0.0229	0.0037	[106]
Study 62	<i>Paracentrotus lividus</i>	-0.3252	0.0002	-0.0606	0.0013	[107]
Study 63	<i>Lates calcarifer</i>	-0.023	0.007	-0.0622	0.0007	[108]
Study 64	<i>Crassostrea virginica</i>	-0.4626	0.0131	-0.1074	0.002	[109]
Study 65	<i>Piaractus mesopotamicus</i>	-0.0429	0.1299	-0.0511	0.1269	[110]
Study 66	<i>Rhabdosargus sarba</i>	-0.4537	0.032	-0.0526	0.0008	[111]
Study 67	<i>Arapaima gigas</i>	-0.0362	0.0045	-0.1947	0.2293	[112]
Study 68	<i>Salmo ischchan</i>	0.1125	0.0436	0.0861	0.0239	[113]
Study 69	<i>Oncorhynchus mykiss</i>	-0.4963	0.0301	-0.0618	0.0018	[114]
Study 70	<i>Salvelinus fontinalis</i>	-0.3248	0.0324	-0.1215	0.0035	[115]
Study 71	<i>Salmo trutta</i>	0.5673	0.0305	0.5465	0.0199	[116]
Study 72	<i>Arapaima gigas</i>	-0.2379	0.0328	-0.0855	0.0072	[117]
Study 73	<i>Piaractus brachypomus</i>	0.1861	0.0133	-0.0683	0.0122	[118]
Study 74	<i>Hyphessobrycon eques</i>	0.1301	0.0352	-0.0332	0.0154	[119]
Study 75	<i>Crassostrea sikamea</i>	0.1996	0.0067	0.1015	0.0009	[120]
Study 76	<i>Clarias gariepinus</i>	-0.2798	0.0284	-0.0591	0.0071	[121]
Study 77	<i>Sander lucioperca</i>	0.0126	0.0159	0.7368	0.3125	[122]

Table S3. Source data in meta-analysis of the effect of aquaculture on aquatic animals (weighted by population replicates).

No.	Species	Effect size (Na)	Effect size (He)	Weight	Reference
Study 1	<i>Salmon salar</i>	0.0000	0.0057	1.0000	[6]
Study 2	<i>Oncorhynchus mykiss</i>	-0.0151	-0.0219	6.0000	[7]
Study 3	<i>Scophthalmus maximus</i>	0.2360	0.0221	1.0000	[8]
Study 4	<i>Oreochromis shiranus</i>	0.5005	0.0496	2.2500	[9]
Study 5	<i>Salmo salar</i>	0.1767	0.0833	1.7143	[10]
Study 6	<i>Penaeus monodon</i>	0.6208	0.0709	1.3333	[11]
Study 7	<i>Salmo salar</i>	0.2451	0.0244	2.5455	[12]
Study 8	<i>Paralichthys olivaceus</i>	0.6509	0.1222	1.5000	[13]
Study 9	<i>Sparus aurata</i>	0.2723	0.0209	2.7273	[14]
Study 10	<i>Haliotis midae</i>	0.3398	-0.0225	1.0000	[15]
Study 11	<i>Oncorhynchus tshawytscha</i>	0.5556	0.1007	1.0000	[16]
Study 12	<i>Haliotis discus hannai</i>	1.4165	0.2243	1.2000	[17]
Study 13	<i>Salvelinus namaycush</i>	-0.0470	-0.0005	3.6000	[18]
Study 14	<i>Salmo salar</i>	0.5578	0.1119	2.5455	[19]
Study 15	<i>Cyprinus carpio</i>	-0.0141	0.0256	1.5000	[20]
Study 16	<i>Salvelinus alpinus</i>	0.6206	0.1129	2.3077	[21]
Study 17	<i>Oncorhynchus mykiss</i>	0.2614	0.0785	2.5455	[22]
Study 18	<i>Oncorhynchus mykiss</i>	0.0618	-0.0079	1.5000	[23]
Study 19	<i>Gadus morhua</i>	0.2064	0.0184	1.5000	[24]
Study 20	<i>Ostrea edulis</i>	0.2278	0.0385	2.4000	[25]
Study 21	<i>Macrobrachium rosenbergii</i>	-0.0146	-0.0043	1.4286	[26]
Study 22	<i>Oncorhynchus mykiss</i>	-0.2592	-0.3825	1.5000	[27]
Study 23	<i>Cyprinus carpio</i>	0.5257	0.1478	1.3333	[28]
Study 24	<i>Patinopecten yessoensis</i>	0.3323	0.1429	1.2000	[29]
Study 25	<i>Cyprinus carpio</i>	0.2263	0.1623	4.2000	[30]
Study 26	<i>Oncorhynchus tshawytscha</i>	0.3646	0.0629	4.6316	[31]
Study 27	<i>Apostichopus japonicus</i>	-0.0861	0.0336	1.4286	[32]
Study 28	<i>Clupea pallasii</i>	0.1270	0.0184	1.6000	[33]
Study 29	<i>Plagopterus argentissimus</i>	0.1330	0.0169	2.2222	[34]
Study 30	<i>Patella caerulea</i>	0.0663	0.0360	3.4286	[35]
Study 31	<i>Pangasianodon hypophthalmus</i>	0.1094	0.0173	1.7143	[36]
Study 32	<i>Clupea pallasii</i>	0.2544	na	1.5000	[37]
Study 33	<i>Pinctada maxima</i>	0.4473	0.1173	1.8750	[38]
Study 34	<i>Ctenopharyngodon idella</i>	-0.0429	0.0293	2.2222	[39]
Study 35	<i>Pangasianodon hypophthalmus</i>	-0.2094	0.0090	2.0000	[40]
Study 36	<i>Oncorhynchus mykiss</i>	-0.0294	-0.0483	3.2143	[41]
Study 37	<i>Lates calcarifer</i>	0.6030	0.2264	2.2222	[42]
Study 38	<i>Cirrhinus cirrhosus</i>	-0.0113	-0.0155	2.5000	[43]
Study 39	<i>Nodipecten subnodosus</i>	0.8908	0.2060	2.9167	[44]
Study 40	<i>Sebastes inermis</i>	0.0403	0.0028	1.5000	[45]
Study 41	<i>Haliotis discus hannai</i>	0.1586	0.0193	2.1818	[46]

Study 42	<i>Crassostrea gigas</i>	0.1829	0.0443	1.5000	[47]
Study 43	<i>Perna viridis</i>	0.0820	0.0223	1.2000	[48]
Study 44	<i>Cirrhinus molitorella</i>	0.7531	0.1629	2.5455	[49]
Study 45	<i>Haliotis midae</i>	0.0765	0.0116	1.5000	[50]
Study 46	<i>Larimichthys crocea</i>	0.3471	0.2084	1.8750	[51]
Study 47	<i>Oncorhynchus masou</i>	0.2520	0.0439	2.1818	[52]
Study 48	<i>Thamnaconus modestus</i>	0.1319	0.0125	1.3333	[53]
Study 49	<i>Cyprinus carpio</i>	0.4609	0.0058	2.5000	[54]
Study 50	<i>Platichthys stellatus</i>	0.1960	0.0626	1.7143	[55]
Study 51	<i>Oncorhynchus mykiss</i>	0.1456	0.0140	4.0000	[56]
Study 52	<i>Oncorhynchus tshawytscha</i>	0.0323	0.0126	2.4000	[57]
Study 53	<i>Crassostrea gigas Thunberg</i>	0.2193	-0.0091	1.2000	[58]
Study 54	<i>Oncorhynchus keta</i>	0.0477	0.0106	9.3947	[59]
Study 55	<i>Ruditapes philippinarum</i>	0.1465	0.0367	1.3333	[60]
Study 56	<i>Mercenaria mercenaria</i>	-0.0167	-0.0075	2.4000	[61]
Study 57	<i>Melanotaenia boesemani</i>	0.2378	0.0163	1.5000	[62]
Study 58	<i>Culter alburnus</i>	0.1823	0.1038	1.4286	[63]
Study 59	<i>Macrobrachium rosenbergii</i>	0.0561	0.0198	1.5000	[64]
Study 60	<i>Siniperca chuatsi</i>	0.5961	0.6015	3.6000	[65]
Study 61	<i>Chrysichthys nigrodigitatus</i>	0.9502	0.1031	0.8000	[66]
Study 62	<i>Hippoglossus hippoglossus</i>	0.3977	0.0591	0.8000	[67]
Study 63	<i>Haliotis rubra</i>	1.1904	0.1031	0.8000	[68]
Study 64	<i>Brycon opalinus</i>	-0.1684	0.0963	0.8750	[69]
Study 65	<i>Crassostrea virginica</i>	0.5656	0.1288	0.5000	[70]
Study 66	<i>Solea senegalensis</i>	0.2091	0.0227	0.5000	[71]
Study 67	<i>Lates calcarifer</i>	-0.0706	0.0134	0.6667	[72]
Study 68	<i>Argopecten irradians</i>	0.2513	0.0714	0.6667	[73]
Study 69	<i>Oncorhynchus mykiss gairdneri</i>	0.6061	0.1511	0.5000	[74]
Study 70	<i>Pagrosomus major</i>	0.5967	0.0147	0.8000	[75]
Study 71	<i>Cirrhinus molitorella</i>	0.1546	0.1200	0.5000	[76]
Study 72	<i>Pagrosomus major</i>	0.5967	na	0.8000	[77]
Study 73	<i>Haliotis kamtschatkana</i>	0.8495	0.1920	0.7500	[78]
Study 74	<i>Acanthopagrus schlegelii</i>	0.1684	0.0196	0.5000	[79]
Study 75	<i>Haliotis discus hannai</i>	0.3361	0.1275	0.5000	[80]
Study 76	<i>Polydactylus sexfilis</i>	-0.1241	-0.0070	0.5000	[81]
Study 77	<i>Platichthys stellatus</i>	0.3939	0.1011	0.5000	[82]
Study 78	<i>Stephanolepis cirrhifer</i>	0.0706	0.0214	0.5000	[83]
Study 79	<i>Atrina pectinata</i>	0.0924	0.0036	0.5000	[84]
Study 80	<i>Thamnaconus modestus</i>	0.2183	0.0149	0.5000	[85]
Study 81	<i>Phalacrotonus bleekeri</i>	0.5388	0.1200	0.6667	[86]
Study 82	<i>Larimichthys crocea</i>	0.1621	0.0958	0.8333	[87]
Study 83	<i>Miichthys miiuy</i>	1.0954	0.1041	0.5000	[88]
Study 84	<i>Haliotis diversicolor supertexta</i>	0.0387	0.0161	0.5000	[89]
Study 85	<i>Alosa sapidissima</i>	0.1427	0.0059	0.5000	[90]

Study 86	<i>Solea senegalensis</i>	0.5539	0.0964	0.5000	[91]
Study 87	<i>Stichopus japonicus</i>	0.5223	-0.0080	0.5000	[92]
Study 88	<i>Lateolabrax maculatus</i>	0.2427	0.0498	0.5000	[93]
Study 89	<i>Crassostrea gigas</i>	-0.0586	-0.0065	0.5000	[94]
Study 90	<i>Haplozenys nitens</i>	0.6824	0.1759	0.5000	[95]
Study 91	<i>Salmo trutta</i>	0.2148	0.0492	0.5000	[96]
Study 92	<i>Ruditapes decussatus</i>	0.1568	0.0280	2.9167	[97]
Study 93	<i>Dicentrarchus labrax</i>	0.1075	0.1170	0.6667	[98]
Study 94	<i>Pleuronectes yokohamae</i>	-0.4700	0.0529	0.5000	[99]
Study 95	<i>Haliotis midae</i>	0.3446	0.0843	0.5000	[100]
Study 96	<i>Mylopharyngodon piceus</i>	0.2298	0.3072	0.5000	[101]
Study 97	<i>Salvelinus fontinalis</i>	0.1603	0.0423	0.9000	[102]
Study 98	<i>Panopea generosa</i>	0.1431	0.0213	0.5000	[103]
Study 99	<i>Oncorhynchus masou masou</i>	-0.0896	-0.0700	0.6667	[104]
Study 100	<i>Dicentrarchus labrax</i>	0.3729	-0.0669	3.7500	[105]
Study 101	<i>Percocypris pingi</i>	-0.0574	-0.0229	1.0000	[106]
Study 102	<i>Paracentrotus lividus</i>	-0.3252	-0.0606	1.3333	[107]
Study 103	<i>Lates calcarifer</i>	-0.0230	-0.0622	2.1818	[108]
Study 104	<i>Crassostrea virginica</i>	-0.4626	-0.1074	3.0769	[109]
Study 105	<i>Piaractus mesopotamicus</i>	-0.0429	-0.0511	2.6667	[110]
Study 106	<i>Rhabdosargus sarba</i>	-0.4537	-0.0526	1.6364	[111]
Study 107	<i>Arapaima gigas</i>	-0.0362	-0.1947	2.1000	[112]
Study 108	<i>Salmo ischchan</i>	0.1125	0.0861	13.2000	[113]
Study 109	<i>Oncorhynchus mykiss</i>	-0.4963	-0.0618	1.0000	[114]
Study 110	<i>Salvelinus fontinalis</i>	-0.3248	-0.1215	4.3750	[115]
Study 111	<i>Salmo trutta</i>	0.5673	0.5465	2.6087	[116]
Study 112	<i>Arapaima gigas</i>	-0.2379	-0.0855	1.7143	[117]
Study 113	<i>Piaractus brachypomus</i>	0.1861	-0.0683	13.0370	[118]
Study 114	<i>Hyphessobrycon eques</i>	0.1301	-0.0332	4.0000	[119]
Study 115	<i>Crassostrea sikamea</i>	0.1996	0.1015	1.5556	[120]
Study 116	<i>Clarias gariepinus</i>	-0.2798	-0.0591	2.0000	[121]
Study 117	<i>Sander lucioperca</i>	0.0126	0.7368	2.1000	[122]

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