Supplementary Information

Combining next-generation sequencing and online databases for microsatellite development in non-model organisms

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Supplementary Table 1. Details of the 40 microsatellite markers developed or optimized for multiplex. Forty eight individuals of normal whitefish from all lakes (N=9 fish/lake and 3 positive controls) were used for this analyses. Locus identity, type of florescence dye in the forward primer, Panel numbers indicate loci sharing a multiplex in the PCR reaction, primer sequences, (O) primer orientation, (SSR) repeat motif, [C] primer concentrations in μM in the primer mix, (N_A) number of alleles found in, (S_{FS}) size in base pairs of the flanking sequences, range of allele sizes, (N_S) number of repeated units in the smallest allele (N_L) number of repeated units in the largest allele, (H_O) observed and (H_E) expected heterozygosities, (PIC) polymorphism information content, (NAF) null-allele frequency and GenBank accession numbers. Annealing temperatures for each panel were as follows: Kit 5= 61ºC, Kit 3= 60ºC, Kits 1,2,4 & 7= 58ºC, Kits 6 & 8= 54ºC.

Locus ID	Flouro	Panel	PCR Primers	O	SSR	[C]	N_A	S_{FS}	Range	N_S	N_L	H_O	H_E	PIC	NAF	GenBank
BWF-1‡	6-FAM	1	GTACAGAGAAATACACACAACGCATCAA	F	(GT)	5.0	8	165	207-225	21	30	0.519	0.549	0.491	-0.015	Ref 23
			CAGAGGTTCCATTACTGAGCAC	R												
Cocl-Lav18*	VIC	1	AACAAACTAAAACATCCCAAGTC	F	(CT)	5.0	4	127	149-159	11	16	0.392	0.364	0.314	-0.036	AY453203
			TTAGATTGGGGCCTACCTTG	R												
Cocl-Lav19*	VIC	1	TCACTGTACAACAGAATAGGGAAA	F	(GT)	2.5	6	226	256-266	15	20	0.247	0.259	0.293	-0.088	AY453204
			ATCCCTGATAAGCAGCCTCA	R												
Cocl-Lav22*	PET	1	GAGAGGGGGTATGTCTGT	F	(CA)	1.2	13	105	105-139	0	17	0.594	0.568	0.499	-0.125	AY453205
			ATCGGAGTTTAGTAACCAC	R												
Cocl-Lav6*	NED	1	GCCATCATCCTCCCAGGAAAC	F	(CA)	1.2	8	102	126-140	12	19	0.382	0.405	0.391	-0.020	AY453199
			CAGGGAATCTGCACTGGAGC	R												
Cocl-Lav32*	VIC	2	CCCCACGTCTCTCCCTTAAT	F	(CT)	3.0	12	188	248-270	30	41	0.320	0.319	0.300	0.014	AY453209
			CGCTGTCAACTTTCCCTCTC	R												
Cocl-Lav32a*	VIC	2	CCCCACGTCTCTCCCTTAAT	F	(CT)		18	211	271-305	30	47	0.513	0.560	0.373	-0.032	
			CGCTGTCAACTTTCCCTCTC	R												
Cocl-Lav49*	PET	2	AGCCAGTTGGAGGCTATTTG	F	(GT)	2.0	21	157	173-249	8	46	0.368	0.378	0.290	-0.039	AY453212
			AGGGCTGCTGTTGAAGTCAT	R												
Osmo-5‡	6-FAM	2	GTTGACTTAGATGATGGCTT	F	(GT)	2.0	15	136	152-188	8	26	0.592	0.571	0.515	-0.037	Ref 24
			GGTATCAGTCTCAGTGGT	R												
Cisco-200‡	6-FAM	3	GGTTAGGAGTTAGGGAAAATATG	F	(GT)	5.0	21	222	240-282	9	30	0.714	0.779	0.819	-0.052	Ref 22
			GTTGTGAGGTAGGCCTGG	R												

Cocl11	NED	3	CAATGACAATATGCACCCACA	F	(GTT)	1.2	13	204	219-267	5	21	0.539	0.621	0.497	0.066	KC172084
			CATCTCATCCCAGTCACTTCC	R												
Cocl11a	NED	3	CAATGACAATATGCACCCACA	F	(GTT)		2	204	243-246	13	14	0.329	0.471	0.562	0.057	
			CATCTCATCCCAGTCACTTCC	R												
Cocl15	PET	3	CAGATCAGTGGCTGTGGCTA	F	(GT)	5.0	9	220	246-274	13	27	0.637	0.599	0.471	-0.104	KC172087
			ACAACCCATTGATGCCAAGT	R												
Cocl28**§**	VIC	3	TGTTTAGGGTTTTGATGATTGAA	F	(AC)	1.2	8	213	221-241	4	14	***0.337***	***0.600***	0.600	***0.269***	KC172092
			ATCATGGCCGTTGCAGTAAT	R												
Cocl33	6-FAM	3	TGTTGCAGTGAGACAGGGTA	F	(GT)	2.5	11	101	123-151	11	25	0.647	0.671	0.532	0.131	KC172096
			TTCACATGGTGTTGCCAAAG	R												
Cocl20	6-FAM	4	TCATCCCAGTCACTTCCACA	F	(CAA)	5.0	15	85	88-142	1	19	0.647	0.675	0.501	-0.024	KC172089
			TTCAAATTCTGTGAATGGCATC	R												
Cocl32	VIC	4	GTCCATGCCTGGGAGTTCTA	F	(GA)	3.0	25	267	287-343	10	38	0.841	0.835	0.879	0.027	KC172095
			GGTGCTCTGTCTCTCGCTTT	R												
Cocl-Lav224*	6-FAM	4	GTGGCAGGCAGCCATGAAG	F	(CA)	3.5	21	174	206-246	6	26	0.617	0.643	0.688	-0.073	AY453224
			GACGTTAGTCACTGCTTTCC	R												
Cocl-Lav41*	NED	4	AAACAAACAGTGGTGGAGTGG	F	(GA)	3.0	19	128	186-226	29	49	0.655	0.720	0.568	0.065	AY453210
			CAGCCAGCACTCTCATGCTTTT	R												
Cocl-Lav72*	VIC	4	CTCTCAAGATATCTAAGGAGG	F	(TG)	2.0	13	130	152-180	11	25	0.470	0.560	0.408	-0.037	AY453217
			CGGAGTTTAGTAACCACATTG	R												
Cocl-Lav8*	PET	4	GCTGGAGCCACATGACATTA	F	(GT)	3.0	11	178	224-246	23	34	0.619	0.599	0.537	-0.104	AY453200
			ATGTTTTTCCATTGCCCAGA	R												
Cocl13	VIC	5	GTCGATGGTGATCTGAGCAA	F	(CTGT)	4.0	22	171	215-307	11	33	0.691	0.833	0.784	0.061	KC172085
			AGAGCGCGAGACAGACAGAC	R												
Cocl14**§**	6-FAM	5	TATCCCAGATACGCCAAAGC	F	(AG)	4.0	9	351	363-383	6	16	***0.115***	***0.321***	0.492	***0.756***	KC172086
			GCCTTTCCCAGTATCCTTCC	R												
Cocl27	6-FAM	5	GACCACTGGCTTTTTCTTCG	F	(GT)	1.5	5	256	282-292	13	18	0.316	0.302	0.122	-0.028	KC172091
			ATAGCCAACATCCCACATCC	R												
Cocl42	6-FAM	5	GGGGAGGGATATTGACCCTA	F	(GT)	4.0	4	145	175-181	15	18	0.883	0.541	0.418	-0.213	KC172102
			CTCCTAATAACACACGCACACA	R												
Cocl44	6-FAM	5	CAAAGGCTTCGGCTTTGTTA	F	(AG)	1.5	5	144	150-162	3	9	0.674	0.526	0.500	-0.148	KC172103
			CCCTCTATCCACCCCACTCT	R												
Cocl24	6-FAM	6	TTCTTGCCACCTTGTCCTCT	F	(CA)	2.5	8	238	256-272	9	17	0.320	0.354	0.441	0.085	KC172090
			CTCCTCTTTTCCCCCTTTTG	R												
Cocl29	6-FAM	6	AAAAAGGCCACATCGGTATT	F	(GA)	2.0	4	294	312-320	9	13	0.053	0.056	0.073	-0.011	KC172093
			GGGTCCGTACGAGGTACTTG	R												
Cocl34	NED	6	AAACAGCACTCTACCACCAGTTT	F	(CT)	3.0	17	175	207-245	16	35	0.656	0.642	0.580	-0.034	KC172097
			GCGGATGCTTCGTAACAGAT	R												

Sfo-8-1‡	PET	6	CAACGAGCACAGAACAGG	F	(GT)	2.5	8	141	173-189	16	24	0.149	0.147	0.422	-0.072	Ref 25
			CTTCCCCTGGAGAGGAAA	R												
Sfo-8-2‡	PET	6	CAACGAGCACAGAACAGG	F	(GT)		5	184	214-222	15	19	0.321	0.396	0.395	-0.078	
			CTTCCCCTGGAGAGGAAA	R												
Cocl30	6-FAM	7	CGCAACTCCATCCGTAATCT	F	(GA)	3.0	8	322	334-354	6	16	0.117	0.126	0.038	-0.003	KC172094
			TGTGGTGACATGGATTTCGT	R												
Cocl36	NED	7	AAACCCCGGGAGTCATTATC	F	(AC)	2.0	15	87	101-147	7	30	0.562	0.580	0.369	0.000	KC172098
			CTGTGTTGGGTGGGTCTTTG	R												
Cocl37	PET	7	TTCCAGGGATAAGTGGCTTG	F	(CT)	2.0	7	184	208-220	12	18	0.483	0.466	0.515	0.037	KC172099
			AACGGAGGCAAGGTGTGTAT	R												
Cocl40	6-FAM	7	CAGCAACAGACGGGTGACTA	F	(GT)	2.0	6	216	232-244	8	14	0.157	0.210	0.369	0.134	KC172101
			GGAATGGAACGTCGAGTGAT	R												
Cocl5	6-FAM	7	TCTGTCCCAAGAGGTAGATTCC	F	(CT)	1.5	6	80	240-255	5	12	0.359	0.367	0.350	-0.097	KC172082
			AGGAGAGAGGGTGGGATGAG	R												
Cocl-Lav4*	6-FAM	7	TGGTGTAATGGCTTTTCCTG	F	(GT)	1.5	7	123	143-155	11	16	0.425	0.441	0.336	-0.054	AY453197
			GGGAGCAACATTGGACTCTC	R												
Cocl17	6-FAM	8	CAGGAAACTGTGGAGAAGATGA	F	(GA)	3.3	7	241	273-299	16	29	0.524	0.485	0.438	-0.024	KC172088
			AGGTACACACAATTCAACTAGTCTCC	R												
Cocl39	6-FAM	8	AAGGGCTCTCCATCTGAACA	F	(GT)	1.8	6	203	215-229	6	13	0.344	0.437	0.175	0.054	KC172100
			GTTGCCGTGGTAGCGACTAT	R												
Cocl8	6-FAM	8	TGTCGCACTACTGCTGAAGA	F	(CA)	3.3	2	183	201-203	9	10	0.243	0.256	0.224	0.008	KC172083
			TTTTTCGTTTTGGCAATAGGT	R												

§ Denotes loci with significant heterozygous deficit.

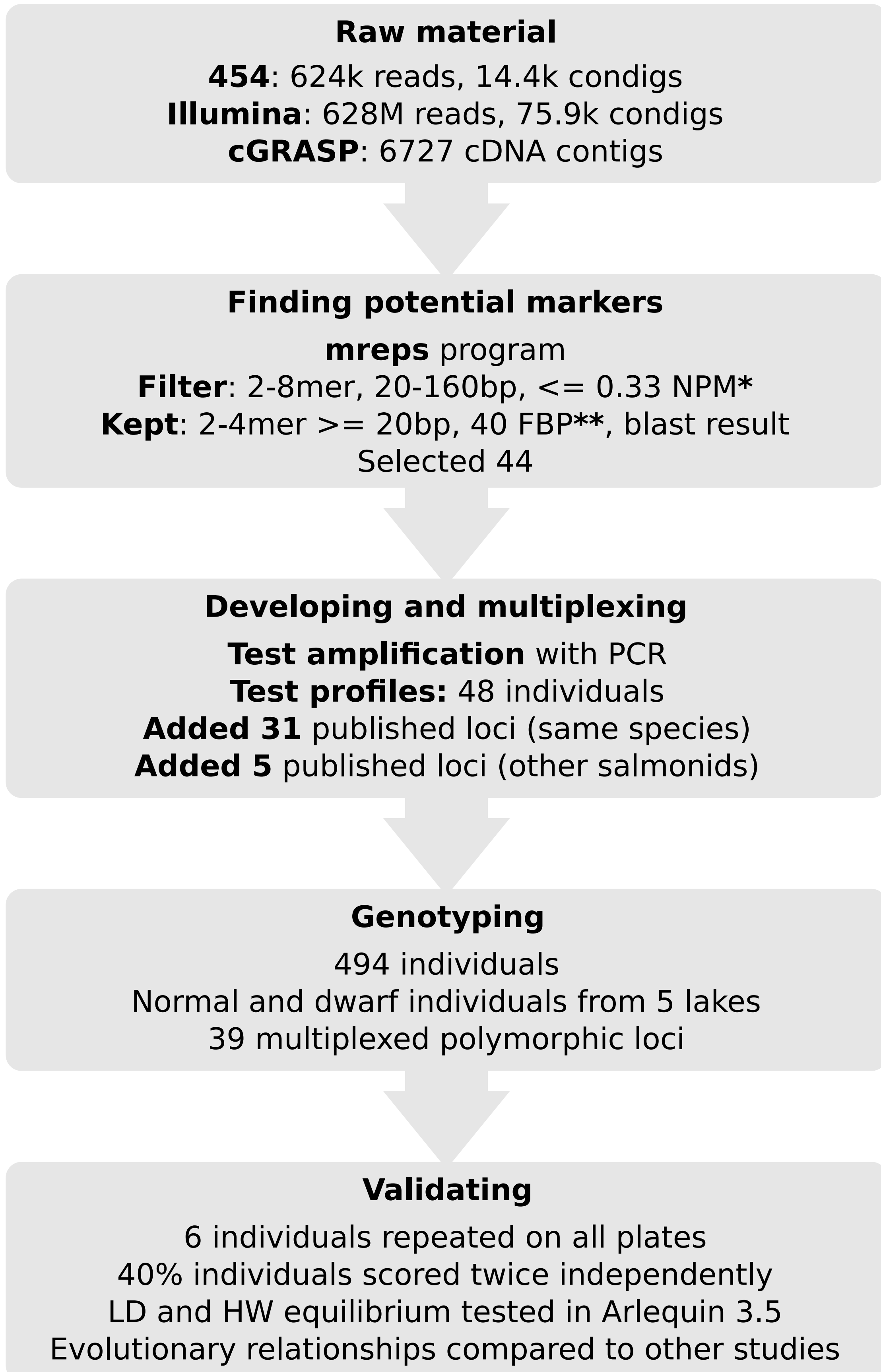
* Denotes loci previously developed in whitefish[21]

‡ Denotes loci previously developed in other salmonidae species[22-25]

Supplementary Table 2. Genetic diversity at 494 lake whitefish. Observed (H_O) and expected heterozygosities (H_E) and number (N) of genotyped dwarf and normal whitefish from lakes Webster, Témiscouata, East and Cliff and Indian pond from the Saint-John River Basin. Values in bold and italic denote significant deviations from Hardy-Weinberg equilibrium (P<0.05). The maximum number of missing data was set at 5%.

Locus ID	D_Webster			N_Webster			D_Témiscouata			N_Témiscouata			D_East		
	N	H_O	H_E	N	H_O	H_E	N	H_O	H_E	N	H_O	H_E	N	H_O	H_E
CoclLAV6	46	***0.46***	***0.52***	51	0.43	0.43	81	0.58	0.58	42	0.64	0.60	57	0.35	0.35
CoclLAV8	46	0.63	0.62	51	0.75	0.62	81	0.48	0.55	42	0.48	0.49	58	0.59	0.52
Cocl11	45	0.62	0.70	51	0.47	0.54	82	***0.60***	***0.79***	38	0.71	0.77	58	0.66	0.72
Cocl13	46	0.80	0.90	50	0.70	0.81	82	0.72	0.82	42	0.69	0.83	58	***0.86***	***0.91***
Cocl14	46	***0.17***	***0.38***	49	***0.08***	***0.58***	81	0	0	42	0	0	58	***0.40***	***0.56***
Cocl15	46	0.78	0.67	51	0.67	0.56	81	0.67	0.63	42	0.62	0.62	58	0.57	0.52
CoclLAV18	46	0.28	0.27	51	0.39	0.36	82	0.06	0.06	42	0.10	0.09	58	0.09	0.08
CoclLAV19	46	0.26	0.24	51	0.35	0.31	82	0.32	0.31	42	0.19	0.20	58	0.22	0.21
Cocl20	46	0.83	0.79	51	0.57	0.54	80	0.83	0.82	41	0.80	0.78	58	0.83	0.76
CoclLAV22	46	0.76	0.61	51	0.67	0.56	82	0.55	0.48	42	0.52	0.57	58	0.50	0.48
Cocl27	46	0.17	0.16	50	0.14	0.13	81	0.30	0.29	42	***0.29***	***0.41***	58	0.10	0.10
Cocl28	46	***0.48***	***0.63***	51	0.37	0.67	82	0.44	0.74	42	***0.33***	***0.77***	58	***0.33***	***0.61***
CoclLAV32	46	0.63	0.70	50	0.32	0.32	81	0.77	0.75	41	0.76	0.76	57	0.67	0.76
Cocl32	46	0.93	0.91	51	0.84	0.90	80	0.79	0.84	39	0.79	0.81	57	0.89	0.89
Cocl33	46	0.72	0.74	51	0.47	0.61	82	0.80	0.70	38	0.71	0.71	56	0.66	0.71
CoclLav41	46	0.70	0.75	51	0.55	0.63	82	0.70	0.81	42	0.88	0.81	58	0.69	0.83
Cocl42	46	0.52	0.43	51	0.78	0.52	82	0.29	0.28	42	0.38	0.39	58	0.29	0.28
Cocl44	46	0.65	0.52	51	0.73	0.57	82	0.67	0.59	42	0.50	0.51	58	0.67	0.54
Cocl32a	44	0.64	0.62	50	0.56	0.63	82	0.67	0.72	38	***0.58***	***0.77***	58	0.66	0.74
Cocl11a	46	0.39	0.50	51	0.53	0.50	81	0.43	0.44	39	0.31	0.47	57	0.35	0.50
CoclLAV49	46	0.57	0.59	51	0.33	0.31	81	0.35	0.34	37	0.41	0.41	55	0.18	0.19
CoclLAV72	46	0.46	0.51	51	0.47	0.45	78	0.46	0.48	42	0.45	0.55	58	***0.33***	***0.55***
CoclLAV224	46	0.74	0.72	51	0.84	0.74	82	0.65	0.72	42	0.67	0.76	58	0.67	0.70
BWF-1	46	0.61	0.65	51	0.59	0.58	80	0.51	0.59	42	0.43	0.59	58	0.45	0.52
Cisco-200	46	0.83	0.83	51	0.92	0.85	82	0.72	0.84	42	0.88	0.82	58	***0.45***	***0.82***
Osmo-5	46	0.46	0.41	51	0.57	0.55	82	0.73	0.70	42	0.62	0.59	58	0.78	0.76
Cocl4	46	0.57	0.50	51	0.43	0.39	82	0.43	0.48	42	0.40	0.53	58	0.43	0.44
Cocl5	46	0.30	0.32	51	0.51	0.43	81	0.54	0.48	38	0.58	0.47	58	0.38	0.36
Cocl17	46	0.74	0.52	51	0.57	0.54	78	***0.22***	***0.71***	42	0.31	0.38	57	0.63	0.46
Cocl24	46	0.48	0.43	51	0.45	0.55	82	0.34	0.37	40	0.33	0.36	55	0.25	0.26
Cocl29	46	0.04	0.04	51	0.08	0.08	82	0.16	0.19	40	0.03	0.03	55	0.18	0.19
Cocl30	46	0.13	0.12	51	0.04	0.04	82	0.09	0.08	42	0.07	0.12	58	0.28	0.27
Cocl34	46	0.72	0.73	51	0.69	0.65	81	0.65	0.65	40	0.65	0.71	55	0.84	0.80
Cocl36	46	0.61	0.60	50	0.40	0.41	78	***0.68***	***0.74***	39	0.72	0.73	58	0.79	0.67
Cocl37	46	0.54	0.54	50	0.54	0.58	78	0.28	0.27	38	0.37	0.38	58	0.52	0.53
Cocl39	45	0.18	0.27	46	0.17	0.20	80	0.54	0.51	42	0.52	0.53	57	0.35	0.34
Cocl40	46	0.22	0.32	51	0.37	0.49	79	0.10	0.10	41	0.10	0.09	58	0.22	0.21
Sfo-1-8	46	0.30	0.32	51	0.53	0.48	82	0.02	0.02	40	0.13	0.12	55	0.05	0.05
Sfo-1-2	46	0.37	0.51	51	0.59	0.51	82	0.33	0.40	41	0.32	0.31	56	0.25	0.45
$\bar{x}$	45,9	0,52	0,53	50,67	0,50	0,50	80,9	0,47	0,51	40,82	0,47	0,51	57,36	0,47	0,50
σ	0,38	0,23	0,21	0,90	0,21	0,19	1,59	0,24	0,25	1,60	0,24	0,25	1,06	0,24	0,24

Locus ID	N_East			D_Indian			N_Indian			D_Cliff			N_Cliff		
	N	H_O	H_E	N	H_O	H_E	N	H_O	H_E	N	H_O	H_E	N	H_O	H_E
CoclLAV6	44	0.32	0.33	38	0.24	0.22	40	0.18	0.16	47	0.45	0.52	49	0.29	0.37
CoclLAV8	44	0.86	0.74	38	0.61	0.58	40	0.60	0.49	47	0.62	0.65	48	0.56	0.66
Cocl11	43	0.44	0.54	38	0.61	0.76	40	0.68	0.54	47	0.53	0.78	50	0.08	0.08
Cocl13	44	0.61	0.84	36	0.58	0.88	40	0.53	0.73	47	0.70	0.87	50	0.56	0.62
Cocl14	43	***0.09***	***0.31***	38	***0.08***	***0.34***	39	***0.10***	***0.23***	45	***0.16***	***0.33***	49	**0.04**	**0.50**
Cocl15	44	0.52	0.51	38	0.68	0.63	40	0.63	0.64	47	0.74	0.68	48	0.58	0.54
CoclLAV18	44	0.09	0.09	38	0.03	0.03	40	0.05	0.05	47	0	0	49	0.24	0.25
CoclLAV19	44	0.27	0.29	38	0.18	0.24	40	0.03	0.07	47	0.40	0.45	49	0.22	0.20
Cocl20	44	0.64	0.65	38	0.63	0.77	40	0.55	0.52	47	0.70	0.80	50	0.18	0.28
CoclLAV22	44	0.52	0.52	38	0.76	0.60	39	0.74	0.55	47	0.49	0.69	47	0.47	0.61
Cocl27	44	0.14	0.17	38	0.50	0.49	40	0.43	0.37	47	0.51	0.45	48	0.44	0.35
Cocl28	44	***0.14***	***0.61***	38	***0.24***	***0.51***	39	***0.26***	***0.56***	47	0.26	0.31	49	***0.43***	***0.57***
CoclLAV32	44	0.59	0.58	38	0.66	0.73	40	0.15	0.27	47	0.74	0.72	47	0.62	0.62
Cocl32	43	0.86	0.80	38	0.97	0.91	40	0.93	0.85	47	0.68	0.82	49	0.73	0.63
Cocl33	44	0.68	0.75	38	0.71	0.73	40	0.50	0.69	47	0.62	0.61	50	0.54	0.45
CoclLav41	44	0.68	0.81	38	0.82	0.85	40	0.48	0.49	47	0.72	0.76	48	0.38	0.43
Cocl42	44	0.57	0.43	38	0.34	0.29	39	0.28	0.32	47	0.11	0.10	50	0.82	0.50
Cocl44	44	0.73	0.54	38	0.55	0.44	40	0.93	0.55	47	0.70	0.57	49	0.39	0.32
Cocl32a	44	0.32	0.41	38	0.50	0.52	40	0.40	0.38	47	0.81	0.78	50	0.14	0.13
Cocl11a	44	***0.09***	***0.51***	38	0.11	0.46	40	0.30	0.46	47	0.34	0.47	50	0.36	0.45
CoclLAV49	44	0.30	0.27	38	0.63	0.54	40	0.15	0.23	47	0.62	0.73	48	0.08	0.08
CoclLAV72	44	0.25	0.43	38	0.58	0.69	39	0.36	0.50	47	0.51	0.65	50	0.78	0.74
CoclLAV224	44	0.48	0.49	38	0.53	0.56	40	0.63	0.66	47	0.47	0.42	46	0.52	0.57
BWF-1	44	0.55	0.62	38	0.68	0.69	40	0.83	0.67	46	0.54	0.56	46	0.02	0.02
Cisco-200	44	0.82	0.83	38	0.82	0.82	38	0.76	0.81	47	0.55	0.74	48	0.56	0.49
Osmo-5	44	0.82	0.75	38	0.45	0.50	40	0.23	0.21	47	0.68	0.71	48	0.50	0.47
Cocl4	44	0.34	0.40	38	0.47	0.49	40	0.60	0.44	47	0.36	0.34	48	0.35	0.44
Cocl5	44	0.25	0.22	38	0.29	0.35	40	0.18	0.39	47	0.51	0.61	50	0.06	0.06
Cocl17	44	0.64	0.47	35	0.34	0.36	40	0.28	0.24	45	0.84	0.61	47	0.57	0.41
Cocl24	43	0.37	0.41	36	0.22	0.23	40	0.55	0.67	47	0.13	0.12	50	0.14	0.13
Cocl29	43	0.02	0.02	36	0	0	40	0	0	47	0.02	0.02	50	0	0
Cocl30	44	0.11	0.11	38	0.18	0.17	38	0.16	0.20	47	0.09	0.08	50	0.04	0.04
Cocl34	43	0.65	0.65	35	0.80	0.78	40	0.45	0.38	47	0.79	0.70	50	0.34	0.39
Cocl36	43	0.63	0.65	37	0.70	0.80	40	0.38	0.41	47	0.66	0.65	46	0.11	0.11
Cocl37	44	0.30	0.32	37	0.59	0.56	40	0.80	0.65	47	0.47	0.41	48	0.48	0.51
Cocl39	44	0.36	0.55	34	0.35	0.59	40	0.23	0.50	45	0.24	0.32	49	0.33	0.50
Cocl40	44	0.09	0.09	38	0.26	0.23	40	0.08	0.07	47	0.02	0.02	47	0.13	0.50
Sfo-1-8	43	0.12	0.11	36	0.19	0.18	40	0.10	0.14	47	0.06	0.06	48	0	0
Sfo-1-2	42	***0.05***	***0.39***	35	0.34	0.50	40	0.43	0.43	47	0.06	0.06	50	0.24	0.30
$\bar{x}$	43,7	0,42	0,47	37,4	0,47	0,51	39,8	0,41	0,42	46,8	0,46	0,49	48,7	0,34	0,37
σ	0,50	0,26	0,23	1,12	0,25	0,25	0,54	0,26	0,22	0,56	0,26	0,27	1,28	0,23	0,21



*** Non-perfect matches** **** Flanking base pairs**

Supplementary Figure 1. Flowchart of the procedures followed to identify and validate the microsatellite loci used in this study