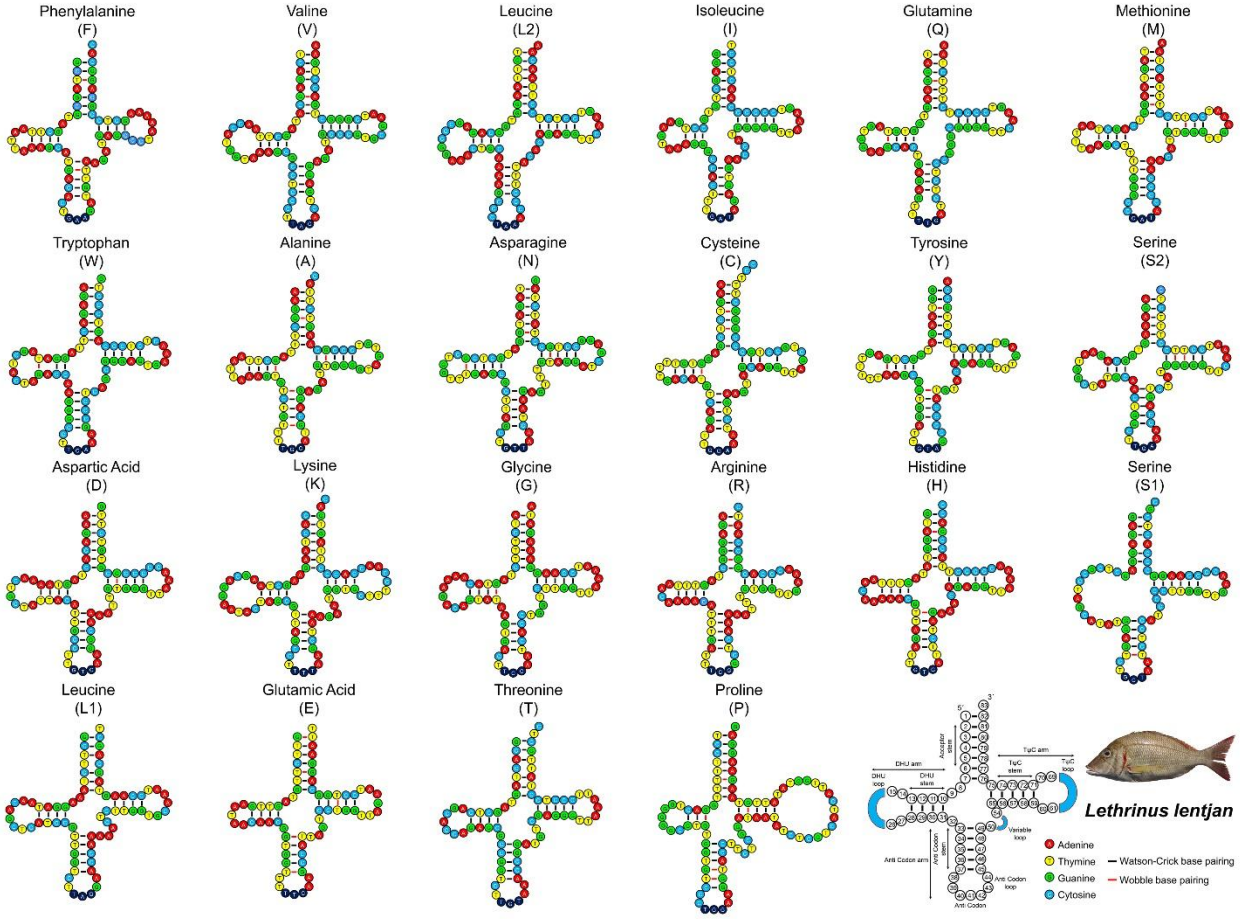
Supplementary Information



Supplementary Figure S1. The predicted secondary structures of the tRNAs in *L. lentjan*, demonstrating the canonical cloverleaf configuration. The Watson–Crick base pairs are indicated in black, while wobble and non-canonical interactions are highlighted in red, illustrating structural variation among the tRNA genes.

Supplementary Table S1. The annotation of *L. lentjan* mitogenome, detailing gene boundaries, strand orientations, and gene lengths.

Gene	Start	End	Strand	Size (bp)
tRNA-Phe (F)	1	69	H	69
12S rRNA	69	1023	H	955
tRNA-Val (V)	1024	1097	H	74
16S rRNA	1098	2904	H	1807
tRNA-Leu (L2)	2905	2978	H	74
ND1	2979	3950	H	972
tRNA-Ile (I)	3955	4024	H	70
tRNA-Gln (Q)	4024	4094	L	71
tRNA-Met (M)	4094	4163	H	70
ND2	4164	5209	H	1046
tRNA-Trp (W)	5210	5281	H	72
tRNA-Ala (A)	5282	5350	L	69
tRNA-Asn (N)	5352	5424	L	73
tRNA-Cys (C)	5462	5529	L	68
tRNA-Tyr (Y)	5530	5600	L	71
COI	5602	7152	H	1551
tRNA-Ser (S2)	7154	7224	L	71
tRNA-Asp (D)	7228	7299	H	72
COII	7307	7997	H	691
tRNA-Lys (K)	7998	8073	H	76
ATP8	8075	8242	H	168
ATP6	8256	8938	H	683
COIII	8939	9723	H	785
tRNA-Gly (G)	9724	9795	H	72
ND3	9796	10144	H	349
tRNA-Arg (R)	10145	10213	H	69
ND4L	10214	10510	H	297
ND4	10504	11884	H	1381
tRNA-His (H)	11885	11953	H	69
tRNA-Ser (S1)	11954	12023	H	70

tRNA-Leu (L1)	12028	12100	H	73
ND5	12101	13939	H	1839
ND6	13936	14457	L	522
tRNA-Glu (E)	14458	14526	L	69
Cytb	14531	15671	H	1141
tRNA-Thr (T)	15672	15743	H	72
tRNA-Pro (P)	15743	15811	L	69
Control Region	15812	16784	H	973

Supplementary Table S2. Intergenic spacers (ISs) and overlapping regions (ORs) in the mitogenomes of the 17 *Lethrinus* species.

Gene	*Lethrinus lentjan*			*Lethrinus amboinensis*			*Lethrinus atkinsoni*			*Lethrinus atlanticus*			*Lethrinus erythracanthus*			*Lethrinus erythropterus*		
	Start	End	IS/OR	Start	End	IS/OR	Start	End	IS/OR	Start	End	IS/OR	Start	End	IS/OR	Start	End	IS/OR
tRNA-Phe (F)	1	69	-1	1	68	0	1	68	0	1	68	0	1	68	0	1	68	0
12S rRNA	69	1023	0	69	1026	0	69	1022	0	69	1024	0	69	1022	0	69	1023	0
tRNA-Val (V)	1024	1097	0	1027	1100	88	1023	1096	96	1025	1098	0	1023	1096	97	1024	1097	101
16S rRNA	1098	2904	0	1189	2903	0	1193	2902	0	1099	2899	0	1194	2903	0	1199	2901	0
tRNA-Leu (L2)	2905	2978	0	2904	2977	0	2903	2976	0	2900	2973	0	2904	2977	0	2902	2975	0
ND1	2979	3950	4	2978	3949	4	2977	3948	4	2974	3945	4	2978	3949	4	2976	3947	4
tRNA-Ile (I)	3955	4024	-1	3954	4023	-1	3953	4022	-1	3950	4019	-1	3954	4023	-1	3952	4022	-1
tRNA-Gln (Q)	4024	4094	-1	4023	4093	-1	4022	4092	-1	4019	4089	-1	4023	4093	-1	4022	4092	-1
tRNA-Met (M)	4094	4163	0	4093	4162	0	4092	4161	0	4089	4158	0	4093	4162	0	4092	4161	0
ND2	4164	5209	0	4163	5208	0	4162	5207	0	4159	5205	-1	4163	5208	0	4162	5207	0
tRNA-Trp (W)	5210	5281	0	5209	5281	0	5208	5280	0	5205	5277	0	5209	5281	0	5208	5280	0
tRNA-Ala (A)	5282	5350	1	5282	5350	1	5281	5349	1	5278	5346	1	5282	5350	1	5281	5349	1
tRNA-Asn (N)	5352	5424	37	5352	5424	37	5351	5423	37	5348	5420	37	5352	5425	37	5351	5423	37
tRNA-Cys (C)	5462	5529	0	5462	5530	0	5461	5528	0	5458	5526	0	5463	5531	0	5461	5529	0
tRNA-Tyr (Y)	5530	5600	1	5531	5600	1	5529	5599	1	5527	5596	1	5532	5601	1	5530	5599	1
COI	5602	7152	1	5602	7152	1	5601	7151	1	5598	7148	1	5603	7153	1	5601	7151	14
tRNA-Ser (S2)	7154	7224	3	7154	7224	3	7153	7223	3	7150	7220	3	7155	7225	3	7166	7236	3
tRNA-Asp (D)	7228	7299	7	7228	7299	7	7227	7298	7	7224	7295	7	7229	7300	7	7240	7311	7
COII	7307	7997	0	7307	7997	-1	7306	7996	0	7303	7993	0	7308	7998	0	7319	8009	0
tRNA-Lys (K)	7998	8073	1	7997	8073	1	7997	8072	1	7994	8068	1	7999	8074	1	8010	8085	1
ATP8	8075	8242	13	8075	8242	13	8074	8241	13	8070	8237	13	8076	8243	13	8087	8254	13
ATP6	8256	8938	0	8256	8939	-1	8255	8938	-1	8251	8934	-1	8257	8940	-1	8268	8951	-1
COIII	8939	9723	0	8939	9723	0	8938	9722	0	8934	9719	-1	8940	9724	0	8951	9735	0
tRNA-Gly (G)	9724	9795	0	9724	9794	0	9723	9794	0	9719	9790	0	9725	9796	0	9736	9807	0
ND3	9796	10144	0	9795	10143	0	9795	10143	0	9791	10141	-2	9797	10145	0	9808	10156	0
tRNA-Arg (R)	10145	10213	0	10144	10212	0	10144	10212	0	10140	10208	0	10146	10215	0	10157	10226	0
ND4L	10214	10510	-7	10213	10509	-7	10213	10509	-7	10209	10505	-7	10216	10512	0	10227	10523	-7
ND4	10504	11884	0	10503	11883	0	10503	11883	0	10499	11879	0	10506	11886	0	10517	11897	0

tRNA-His (H)	11885	11953	0	11884	11952	0	11884	11952	0	11880	11948	0	11887	11955	0	11898	11966	0
tRNA-Ser (S1)	11954	12023	4	11953	12022	5	11953	12022	4	11949	12018	4	11956	12025	5	11967	12036	5
tRNA-Leu (L1)	12028	12100	0	12028	12100	0	12027	12099	0	12023	12095	0	12031	12103	0	12042	12114	0
ND5	12101	13939	-4	12101	13939	-4	12100	13938	-4	12096	13934	-4	12104	13942	-4	12115	13953	-4
ND6	13936	14457	0	13936	14457	0	13935	14456	0	13931	14452	0	13939	14460	1	13950	14471	1
tRNA-Glu (E)	14458	14526	4	14458	14526	4	14457	14525	4	14453	14521	4	14462	14530	4	14473	14541	4
Cytb	14531	15671	0	14531	15671	0	14530	15670	0	14526	15666	0	14535	15675	0	14546	15686	0
tRNA-Thr (T)	15672	15743	-1	15672	15744	-1	15671	15742	-1	15667	15738	-1	15676	15748	-1	15687	15759	-1
tRNA-Pro (P)	15743	15811	0	15744	15812	0	15742	15810	0	15738	15806	0	15748	15816	0	15759	15827	0
Control Region	15812	16784	-	15813	16794	-	15811	16787	-	15807	16789	-	15817	16794	-	15828	16810	-
Gene	*Lethrinus genivittatus*			*Lethrinus harak*			*Lethrinus laticaudis*			*Lethrinus microdon*			*Lethrinus nebulosus*			*Lethrinus obsoletus*		
	Start	End	IS/OR	Start	End	IS/OR	Start	End	IS/OR	Start	End	IS/OR	Start	End	IS/OR	Start	End	IS/OR
tRNA-Phe (F)	1	68	0	1	68	0	1	68	0	1	68	0	1	68	0	1	68	0
12S rRNA	69	1024	0	69	1022	0	69	1023	-1	69	1024	0	69	1023	0	69	1023	0
tRNA-Val (V)	1025	1098	96	1023	1096	0	1023	1101	-2	1025	1098	94	1024	1097	97	1024	1097	96
16S rRNA	1195	2898	0	1097	2903	0	1100	2905	0	1193	2905	0	1195	2905	0	1194	2902	0
tRNA-Leu (L2)	2899	2972	0	2904	2977	0	2906	2981	-1	2906	2979	0	2906	2979	0	2903	2976	0
ND1	2973	3944	4	2978	3949	4	2981	3952	4	2980	3951	4	2980	3951	4	2977	3948	4
tRNA-Ile (I)	3949	4018	-1	3954	4023	-1	3957	4026	-1	3956	4025	-1	3956	4025	-1	3953	4022	-1
tRNA-Gln (Q)	4018	4088	-1	4023	4093	-1	4026	4096	-2	4025	4095	-1	4025	4095	-1	4022	4092	-1
tRNA-Met (M)	4088	4157	0	4093	4162	0	4095	4166	-1	4095	4164	0	4095	4164	0	4092	4161	0
ND2	4158	5203	0	4163	5208	0	4166	5211	2	4165	5210	0	4165	5210	0	4162	5207	0
tRNA-Trp (W)	5204	5276	0	5209	5281	0	5214	5284	-1	5211	5283	0	5211	5283	0	5208	5280	0
tRNA-Ala (A)	5277	5345	1	5282	5350	1	5284	5352	2	5284	5352	1	5284	5352	1	5281	5349	1
tRNA-Asn (N)	5347	5419	36	5352	5424	37	5355	5427	37	5354	5426	37	5354	5426	37	5351	5423	37
tRNA-Cys (C)	5456	5522	0	5462	5529	0	5465	5531	1	5464	5532	0	5464	5531	0	5461	5529	-1
tRNA-Tyr (Y)	5523	5592	1	5530	5600	1	5533	5602	8	5533	5602	1	5532	5602	1	5529	5599	1
COI	5594	7144	1	5602	7152	1	5611	7155	2	5604	7154	1	5604	7154	1	5601	7151	1
tRNA-Ser (S2)	7146	7216	3	7154	7224	3	7158	7227	3	7156	7226	3	7156	7226	3	7153	7223	3
tRNA-Asp (D)	7220	7291	7	7228	7299	7	7231	7302	7	7230	7301	7	7230	7301	7	7227	7298	7
COII	7299	7989	0	7307	7997	0	7310	8000	0	7309	7999	0	7309	7999	0	7306	7996	0
tRNA-Lys (K)	7990	8065	1	7998	8073	1	8001	8077	0	8000	8075	1	8000	8075	1	7997	8072	1
ATP8	8067	8234	12	8075	8242	13	8078	8245	12	8077	8244	13	8077	8244	13	8074	8241	13
ATP6	8247	8929	0	8256	8939	-1	8258	8941	-1	8258	8941	-1	8258	8940	0	8255	8937	0

COIII	8930	9714	0	8939	9723	0	8941	9726	0	8941	9725	0	8941	9725	0	8938	9722	0
tRNA-Gly (G)	9715	9786	0	9724	9795	0	9727	9797	0	9726	9797	0	9726	9797	0	9723	9794	0
ND3	9787	10135	0	9796	10144	0	9798	10148	0	9798	10146	0	9798	10146	0	9795	10143	0
tRNA-Arg (R)	10136	10204	0	10145	10213	0	10149	10213	2	10147	10215	0	10147	10215	0	10144	10211	1
ND4L	10205	10501	-7	10214	10510	-7	10216	10512	-7	10216	10512	-7	10216	10512	-7	10213	10509	-7
ND4	10495	11875	0	10504	11884	0	10506	11886	0	10506	11886	0	10506	11886	0	10503	11883	0
tRNA-His (H)	11876	11944	0	11885	11953	0	11887	11955	1	11887	11955	0	11887	11955	0	11884	11952	0
tRNA-Ser (S1)	11945	12014	4	11954	12023	4	11957	12013	16	11956	12025	5	11956	12025	5	11953	12022	3
tRNA-Leu (L1)	12019	12091	0	12028	12100	0	12030	12102	0	12031	12103	0	12031	12103	0	12026	12098	0
ND5	12092	13930	-4	12101	13939	-4	12103	13941	-4	12104	13942	-4	12104	13942	-4	12099	13937	-4
ND6	13927	14448	0	13936	14457	0	13938	14459	0	13939	14460	0	13939	14460	0	13934	14455	0
tRNA-Glu (E)	14449	14517	4	14458	14526	4	14460	14528	4	14461	14529	4	14461	14529	4	14456	14524	4
Cytb	14522	15662	0	14531	15671	0	14533	15673	0	14534	15674	0	14534	15674	0	14529	15669	0
tRNA-Thr (T)	15663	15734	-1	15672	15743	-1	15674	15746	-2	15675	15747	-1	15675	15746	-1	15670	15741	-1
tRNA-Pro (P)	15734	15802	0	15743	15811	0	15745	15814	0	15747	15815	0	15746	15814	0	15741	15809	0
Control Region	15803	16831	-	15812	16782	-	15815	16758	-	15816	16797	-	15815	16785	-	15810	16779	-

Gene	*Lethrinus olivaceus*			*Lethrinus ornatus*			*Lethrinus reticulatus*			*Lethrinus rubrioperculatus*			*Lethrinus xanthochilus*		
	Start	End	IS/OR	Start	End	IS/OR	Start	End	IS/OR	Start	End	IS/OR	Start	End	IS/OR
tRNA-Phe (F)	1	68	0	1	68	0	1	68	0	1	68	0	1	68	0
12S rRNA	69	1023	1	69	1027	0	69	1023	0	69	1024	0	69	1024	0
tRNA-Val (V)	1025	1186	39	1028	1101	97	1024	1097	87	1025	1098	87	1025	1098	87
16S rRNA	1226	2894	5	1199	2907	0	1185	2893	0	1186	2892	0	1186	2892	0
tRNA-Leu (L2)	2900	2973	0	2908	2981	0	2894	2967	0	2893	2966	0	2893	2966	0
ND1	2974	3945	4	2982	3953	4	2968	3939	4	2967	3938	4	2967	3938	4
tRNA-Ile (I)	3950	4019	-1	3958	4027	-1	3944	4013	-1	3943	4012	-1	3943	4012	-1
tRNA-Gln (Q)	4019	4089	-1	4027	4097	-1	4013	4083	-1	4012	4082	-1	4012	4082	-1
tRNA-Met (M)	4089	4158	0	4097	4166	0	4083	4152	0	4082	4152	0	4082	4152	0
ND2	4159	5204	0	4167	5212	0	4153	5198	0	4153	5198	0	4153	5198	0
tRNA-Trp (W)	5205	5277	0	5213	5285	0	5199	5271	1	5199	5271	0	5199	5271	1
tRNA-Ala (A)	5278	5346	1	5286	5354	1	5273	5341	1	5272	5340	1	5273	5341	1
tRNA-Asn (N)	5348	5420	37	5356	5428	37	5343	5415	37	5342	5414	37	5343	5415	37
tRNA-Cys (C)	5458	5526	0	5466	5533	-1	5453	5521	0	5452	5520	0	5453	5521	0
tRNA-Tyr (Y)	5527	5596	1	5533	5603	1	5522	5591	1	5521	5590	1	5522	5591	1
COI	5598	7148	1	5605	7155	1	5593	7143	1	5592	7142	1	5593	7143	1

tRNA-Ser (S2)	7150	7220	3	7157	7227	3	7145	7215	3	7144	7214	3	7145	7215	3
tRNA-Asp (D)	7224	7295	7	7231	7302	7	7219	7290	7	7218	7289	7	7219	7290	7
COII	7303	7993	0	7310	8000	0	7298	7988	0	7297	7969	21	7298	7970	21
tRNA-Lys (K)	7994	8069	1	8001	8076	1	7989	8064	1	7991	8066	1	7992	8067	1
ATP8	8071	8238	13	8078	8245	13	8066	8233	13	8068	8235	13	8069	8236	13
ATP6	8252	8935	-1	8259	8941	0	8247	8930	-1	8249	8932	-1	8250	8932	0
COIII	8935	9719	0	8942	9726	0	8930	9714	0	8932	9716	0	8933	9717	0
tRNA-Gly (G)	9720	9790	0	9727	9797	0	9715	9785	0	9717	9787	0	9718	9788	0
ND3	9791	10139	0	9798	10146	0	9786	10134	0	9788	10136	0	9789	10137	0
tRNA-Arg (R)	10140	10208	0	10147	10215	0	10135	10203	0	10137	10205	0	10138	10206	0
ND4L	10209	10505	-7	10216	10512	-7	10204	10500	-7	10206	10502	-7	10207	10503	-7
ND4	10499	11879	0	10506	11886	0	10494	11874	0	10496	11876	0	10497	11877	0
tRNA-His (H)	11880	11948	0	11887	11955	0	11875	11943	0	11877	11945	0	11878	11946	0
tRNA-Ser (S1)	11949	12018	5	11956	12025	4	11944	12014	5	11946	12016	5	11947	12017	5
tRNA-Leu (L1)	12024	12096	0	12030	12102	0	12020	12092	0	12022	12094	0	12023	12095	0
ND5	12097	13935	-4	12103	13941	-4	12093	13931	-4	12095	13933	-4	12096	13934	-4
ND6	13932	14453	0	13938	14459	0	13928	14449	0	13930	14451	0	13931	14452	0
tRNA-Glu (E)	14454	14522	4	14460	14528	4	14450	14518	4	14452	14520	4	14453	14521	4
Cytb	14527	15667	0	14533	15673	0	14523	15663	0	14525	15665	0	14526	15666	0
tRNA-Thr (T)	15668	15740	-1	15674	15745	-1	15664	15736	-1	15666	15738	-1	15667	15739	-1
tRNA-Pro (P)	15740	15808	0	15745	15813	0	15736	15804	0	15738	15806	0	15739	15807	0
Control Region	15809	16792	.	15814	16787	-	15805	16785	-	15807	16788	-	15808	16791	-

Supplementary Table S3. The mitogenome size and nucleotide characteristics of the 17 *Lethrinus* species, incorporating AT and GC content and strand asymmetry.

Species Name	Accession No.	Size (bp)	A%	T%	G%	C%	A+T%	AT-Skew	GC-Skew
Lethrinus lentjan	PZ719881	16784	26.95	25.06	17.02	30.98	52.01	0.036	-0.291
Lethrinus amboinensis	PZ319390	16794	26.73	26.12	17.32	29.83	52.85	0.012	-0.265
Lethrinus atkinsoni	PZ310938	16787	26.71	25.79	17.35	30.15	52.50	0.018	-0.269
Lethrinus atlanticus	OQ420716	16789	27.20	25.90	17.02	29.88	53.11	0.024	-0.274
Lethrinus erythracanthus	PZ310939	16794	27.25	25.08	16.98	30.70	52.33	0.041	-0.288
Lethrinus erythropterus	PZ213525	16810	28.11	25.83	16.17	29.89	53.94	0.042	-0.298
Lethrinus genivittatus	PZ574241	16831	26.45	25.96	17.50	30.09	52.42	0.009	-0.265
Lethrinus harak	PZ310940	16782	26.64	25.24	17.42	30.71	51.88	0.027	-0.276
Lethrinus laticaudis	KU530221	16758	26.98	25.63	17.10	30.30	52.61	0.026	-0.279
Lethrinus microdon	PZ213532	16797	26.70	25.43	17.38	30.48	52.13	0.024	-0.274
Lethrinus nebulosus	PZ574246	16785	26.74	25.37	17.30	30.59	52.11	0.026	-0.278
Lethrinus obsoletus	AP009165	16779	26.77	25.24	17.26	30.73	52.01	0.029	-0.281
Lethrinus olivaceus	PV872036	16792	26.75	26.08	17.32	29.85	52.83	0.013	-0.265
Lethrinus ornatus	PZ574250	16787	26.68	25.31	17.43	30.58	51.99	0.026	-0.274
Lethrinus reticulatus	PZ319379	16785	26.93	26.08	17.12	29.88	53.01	0.016	-0.272
Lethrinus rubrioperculatus	PZ310945	16788	27.30	25.92	16.90	29.87	53.22	0.026	-0.277
Lethrinus xanthochilus	PZ697365	16791	27.05	25.82	17.08	30.05	52.87	0.023	-0.275

Supplementary Table S4. Both AT and GC content of the 13 PCGs across the 17 *Lethrinus* species, expressed as percentages.

AT%													
Species Name	*ATP6*	*ATP8*	*COI*	*COII*	*COIII*	*Cytb*	*ND1*	*ND2*	*ND3*	*ND4*	*ND4L*	*ND5*	*ND6*
Lethrinus lentjan	48.17	57.14	50.81	55.72	51.08	51.27	50.10	49.43	51.29	51.05	45.12	51.77	53.15
Lethrinus amboinensis	49.42	55.36	52.61	53.84	50.96	52.94	52.06	49.90	51.58	51.85	44.44	53.45	54.21
Lethrinus atkinsoni	50.44	52.38	51.58	54.99	50.32	53.11	51.23	48.28	50.72	51.34	46.80	51.88	53.83
Lethrinus atlanticus	50.29	55.36	53.13	54.70	51.15	54.34	51.65	49.47	49.57	53.66	44.78	53.34	55.56
Lethrinus erythracanthus	50.88	54.17	50.87	54.85	52.23	52.41	51.54	49.90	50.14	50.62	48.15	52.09	53.07
Lethrinus erythropterus	50.88	54.76	53.64	54.41	53.89	53.11	51.54	51.82	54.44	53.66	49.83	54.49	54.02
Lethrinus genivittatus	47.73	52.98	52.61	53.98	51.59	50.66	50.51	49.52	51.29	52.14	48.15	52.58	53.45
Lethrinus harak	49.12	51.79	50.23	55.14	51.72	50.74	50.93	49.62	49.86	50.98	45.12	51.50	51.53
Lethrinus laticaudis	53.22	54.76	52.30	55.86	51.65	51.97	50.51	49.62	51.00	50.91	45.79	51.82	53.64
Lethrinus microdon	48.98	52.98	51.52	53.55	49.81	52.85	51.75	48.76	50.14	51.70	45.79	52.20	53.07
Lethrinus nebulosus	48.90	52.98	52.16	55.43	51.21	51.97	50.72	48.66	51.29	49.96	46.46	51.22	52.68
Lethrinus obsoletus	50.51	53.57	51.45	54.99	50.06	50.83	49.79	49.24	50.43	51.27	43.77	51.22	53.45
Lethrinus olivaceus	49.56	55.36	52.61	53.84	50.70	53.11	51.85	49.81	51.58	51.70	44.44	53.51	54.51
Lethrinus ornatus	48.90	54.17	51.26	56.01	50.45	51.80	50.41	48.66	49.28	50.18	45.12	52.37	53.45
Lethrinus reticulatus	50.15	53.57	52.10	54.70	50.96	52.85	54.01	50.38	52.72	52.21	48.48	53.40	54.79
Lethrinus rubrioperculatus	51.75	55.36	52.03	54.53	51.85	53.37	51.65	51.34	51.58	52.35	46.80	53.83	54.02
Lethrinus xanthochilus	50.22	55.95	51.84	54.98	51.21	52.67	51.44	50.57	51.58	51.77	47.14	53.07	54.02
GC%													
Species Name	*ATP6*	*ATP8*	*COI*	*COII*	*COIII*	*Cytb*	*ND1*	*ND2*	*ND3*	*ND4*	*ND4L*	*ND5*	*ND6*
Lethrinus lentjan	51.83	42.86	49.19	44.28	48.92	48.73	49.90	50.57	48.71	48.95	54.88	48.23	46.85
Lethrinus amboinensis	50.58	44.64	47.39	46.16	49.04	47.06	47.94	50.10	48.42	48.15	55.56	46.55	45.79
Lethrinus atkinsoni	49.56	47.62	48.42	45.01	49.68	46.89	48.77	51.72	49.28	48.66	53.20	48.12	46.17
Lethrinus atlanticus	49.71	44.64	46.87	45.30	48.85	45.66	48.35	50.53	50.43	46.34	55.22	46.66	44.44
Lethrinus erythracanthus	49.12	45.83	49.13	45.15	47.77	47.59	48.46	50.10	49.86	49.38	51.85	47.91	46.93
Lethrinus erythropterus	49.12	45.24	46.36	45.59	46.11	46.89	48.46	48.18	45.56	46.34	50.17	45.51	45.98
Lethrinus genivittatus	52.27	47.02	47.39	46.02	48.41	49.34	49.49	50.48	48.71	47.86	51.85	47.42	46.55
Lethrinus harak	50.88	48.21	49.77	44.86	48.28	49.26	49.07	50.38	50.14	49.02	54.88	48.50	48.47
Lethrinus laticaudis	46.78	45.24	47.70	44.14	48.35	48.03	49.49	50.38	49.00	49.09	54.21	48.18	46.36
Lethrinus microdon	51.02	47.02	48.48	46.45	50.19	47.15	48.25	51.24	49.86	48.30	54.21	47.80	46.93
Lethrinus nebulosus	51.10	47.02	47.84	44.57	48.79	48.03	49.28	51.34	48.71	50.04	53.54	48.78	47.32

Lethrinus obsoletus	49.49	46.43	48.55	45.01	49.94	49.17	50.21	50.76	49.57	48.73	56.23	48.78	46.55
Lethrinus olivaceus	50.44	44.64	47.39	46.16	49.30	46.89	48.15	50.19	48.42	48.30	55.56	46.49	45.49
Lethrinus ornatus	51.10	45.83	48.74	43.99	49.55	48.20	49.59	51.34	50.72	49.82	54.88	47.63	46.55
Lethrinus reticulatus	49.85	46.43	47.90	45.30	49.04	47.15	45.99	49.62	47.28	47.79	51.52	46.60	45.21
Lethrinus rubrioperculatus	48.25	44.64	47.97	45.47	48.15	46.63	48.35	48.66	48.42	47.65	53.20	46.17	45.98
Lethrinus xanthochilus	49.78	44.05	48.16	45.02	48.79	47.33	48.56	49.43	48.42	48.23	52.86	46.93	45.98

Supplementary Table S5. The start and stop codons of the 13 PCGs across the 17 *Lethrinus* species.

Species Name	*ND1*		*ND2*		*COI*		*COII*		*ATP8*	
	Start Codon	Stop Codon	Start Codon	Stop Codon	Start Codon	Stop Codon	Start Codon	Stop Codon	Start Codon	Stop Codon
Lethrinus lentjan	ATG	TAA	ATG	TA-	GTG	TAA	ATG	T--	ATG	TAA
Lethrinus amboinensis	ATG	TAG	ATG	TA-	GTG	TAG	ATG	T--	ATG	TAA
Lethrinus atkinsoni	ATG	TAG	ATG	TA-	GTG	TAA	ATG	T--	ATG	TAA
Lethrinus atlanticus	ATG	TAG	ATG	TAA	GTG	TAA	ATG	T--	ATG	TAA
Lethrinus erythracanthus	ATG	TAA	ATG	TA-	GTG	TAA	ATG	T--	ATG	TAA
Lethrinus erythropterus	ATG	TAA	ATG	TA-	GTG	TAA	ATG	T--	ATG	TAA
Lethrinus genivittatus	ATG	TAG	ATG	TA-	GTG	TAA	ATG	T--	ATG	TAA
Lethrinus harak	ATG	TAA	ATG	TA-	GTG	TAA	ATG	T--	ATG	TAA
Lethrinus laticaudis	ATG	TAA	ATG	TA-	ATT	TAA	ATG	T--	ATG	TAA
Lethrinus microdon	ATG	TAA	ATG	TA-	GTG	TAA	ATG	T--	ATG	TAA
Lethrinus nebulosus	ATG	TAA	ATG	TA-	GTG	TAA	ATG	T--	ATG	TAA
Lethrinus obsoletus	ATG	TAA	ATG	TA-	GTG	TAG	ATG	T--	ATG	TAA
Lethrinus olivaceus	ATG	TAG	ATG	TA-	GTG	TAG	ATG	T--	ATG	TAA
Lethrinus ornatus	ATG	TAG	ATG	TA-	GTG	TAA	ATG	T--	ATG	TAA
Lethrinus reticulatus	ATG	TAA	ATG	TA-	GTG	TAA	ATG	T--	ATG	TAA
Lethrinus rubrioperculatus	ATG	TAG	ATG	TA-	GTG	TAG	ATG	T--	ATG	TAA
Lethrinus xanthochilus	ATG	TAG	ATG	TA-	GTG	TAG	ATG	T--	ATG	TAA

Species Name	*ATP6*		*COIII*		*ND3*		*ND4L*	
	Start Codon	Stop Codon	Start Codon	Stop Codon	Start Codon	Stop Codon	Start Codon	Stop Codon
Lethrinus lentjan	ATG	TA-	ATG	TA-	ATG	T--	ATG	TAA
Lethrinus amboinensis	ATG	TAA	ATG	TA-	ATG	T--	ATG	TAA
Lethrinus atkinsoni	ATG	TAA	ATG	TA-	ATG	T--	ATG	TAA
Lethrinus atlanticus	ATG	TAA	ATG	TAA	ATG	TAG	ATG	TAA
Lethrinus erythracanthus	ATG	TAA	ATG	TA-	ATG	T--	ATG	TAA
Lethrinus erythropterus	ATG	TAA	ATG	TAA	ATG	T--	ATG	TAA
Lethrinus genivittatus	ATG	TA-	ATG	TA-	ATG	T--	ATT	TAA
Lethrinus harak	ATG	TAA	ATG	TA-	ATG	T--	ATG	TAA
Lethrinus laticaudis	ATG	TAA	ATG	TAA	ATG	TAG	ATG	TAA
Lethrinus microdon	ATG	TAA	ATG	TA-	ATG	T--	ATG	TAA
Lethrinus nebulosus	ATG	TA-	ATG	TA-	ATG	T--	ATG	TAA

Lethrinus obsoletus	ATG	TA-	ATG	TA-	ATG	T--	ATG	TAA
Lethrinus olivaceus	ATG	TAA	ATG	TA-	ATG	T--	ATG	TAA
Lethrinus ornatus	ATG	TA-	ATG	TA-	ATG	T--	ATG	TAA
Lethrinus reticulatus	ATG	TAA	ATG	TA-	ATG	T--	ATG	TAA
Lethrinus rubrioperculatus	ATG	TAA	ATG	TA-	ATG	T--	GTG	TAA
Lethrinus xanthochilus	ATG	TA-	ATG	TA-	ATG	T--	ATG	TAA
Species Name	*ND4*		*ND5*		*ND6*		*Cytb*	
	Start Codon	Stop Codon	Start Codon	Stop Codon	Start Codon	Stop Codon	Start Codon	Stop Codon
Lethrinus lentjan	ATG	T--	ATG	TAA	ATG	TAA	ATG	T--
Lethrinus amboinensis	ATG	T--	ATG	TAG	ATG	TAG	ATG	T--
Lethrinus atkinsoni	ATG	T--	ATG	TAG	ATG	TAA	ATG	T--
Lethrinus atlanticus	ATG	T--	ATG	TAA	ATG	TAG	ATG	T--
Lethrinus erythracanthus	ATG	T--	ATG	TAA	ATG	TAG	ATG	T--
Lethrinus erythropterus	ATG	T--	ATG	TAA	ATG	TAG	ATG	T--
Lethrinus genivittatus	ATG	T--	ATG	TAA	ATA	TAG	ATG	T--
Lethrinus harak	ATG	T--	ATG	TAA	ATG	TAG	ATG	T--
Lethrinus laticaudis	ATG	T--	ATG	TAA	ATA	TAG	ATG	T--
Lethrinus microdon	ATG	T--	ATG	TAA	ATG	TAG	ATG	T--
Lethrinus nebulosus	ATG	T--	ATG	TAA	ATG	TAG	ATG	T--
Lethrinus obsoletus	ATG	T--	ATG	TAG	GTG	TAA	ATG	T--
Lethrinus olivaceus	ATG	T--	ATG	TAG	ATG	TA-	ATG	T--
Lethrinus ornatus	ATG	T--	ATG	TAA	ATG	TAA	ATG	T--
Lethrinus reticulatus	ATG	T--	ATG	TAA	ATG	TAG	ATG	T--
Lethrinus rubrioperculatus	ATG	T--	ATG	TAA	ATG	TAG	ATG	T--
Lethrinus xanthochilus	ATG	T--	ATG	TAA	ATG	TAG	ATG	T--

Supplementary Table S6. The anticodon composition of the 22 tRNA genes across the 17 *Lethrinus* species.

Gene	*Lethrinus lentjan*	*Lethrinus amboinensis*	*Lethrinus atkinsoni*	*Lethrinus atlanticus*	*Lethrinus erythracanthus*	*Lethrinus erythropterus*
tRNA-Phe (F)	GAA	GAA	GAA	GAA	GAA	GAA
tRNA-Val (V)	TAC	TAC	TAC	TAC	TAC	TAC
tRNA-Leu (L2)	TAA	TAA	TAA	TAA	TAA	TAA
tRNA-Ile (I)	GAT	GAT	GAT	GAT	GAT	GAT
tRNA-Gln (Q)	TTG	TTG	TTG	TTG	TTG	TTG
tRNA-Met (M)	CAT	CAT	CAT	CAT	CAT	CAT
tRNA-Trp (W)	TCA	TCA	TCA	TCA	TCA	TCA
tRNA-Ala (A)	TGC	TGC	TGC	TGC	TGC	TGC
tRNA-Asn (N)	GTT	GTT	GTT	GTT	GTT	GTT
tRNA-Cys (C)	GCA	GCA	GCA	GCA	GCA	GCA
tRNA-Tyr (Y)	GTA	GTA	GTA	GTA	GTA	GTA
tRNA-Ser (S2)	TGA	TGA	TGA	TGA	TGA	TGA
tRNA-Asp (D)	GTC	GTC	GTC	GTC	GTC	GTC
tRNA-Lys (K)	TTT	TTT	TTT	TTT	TTT	TTT
tRNA-Gly (G)	TCC	TCC	TCC	TCC	TCC	TCC
tRNA-Arg (R)	TCG	TCG	TCG	TCG	TCG	TCG
tRNA-His (H)	GTG	GTG	GTG	GTG	GTG	GTG
tRNA-Ser (S1)	GCT	GCT	GCT	GCT	GCT	GCT
tRNA-Leu (L1)	TAG	TAG	TAG	TAG	TAG	TAG
tRNA-Glu (E)	TTC	TTC	TTC	TTC	TTC	TTC
tRNA-Thr (T)	TGT	TGT	TGT	TGT	TGT	TGT
tRNA-Pro (P)	TGG	TGG	TGG	TGG	TGG	TGG
Gene	*Lethrinus genivittatus*	*Lethrinus harak*	*Lethrinus laticaudis*	*Lethrinus microdon*	*Lethrinus nebulosus*	*Lethrinus obsoletus*
tRNA-Phe (F)	GAA	GAA	GAA	GAA	GAA	GAA
tRNA-Val (V)	TAC	TAC	TAC	TAC	TAC	TAC
tRNA-Leu (L2)	TAA	TAA	TAA	TAA	TAA	TAA
tRNA-Ile (I)	GAT	GAT	GAT	GAT	GAT	GAT
tRNA-Gln (Q)	TTG	TTG	TTG	TTG	TTG	TTG
tRNA-Met (M)	CAT	CAT	CAT	CAT	CAT	CAT
tRNA-Trp (W)	TCA	TCA	TCA	TCA	TCA	TCA
tRNA-Ala (A)	TGC	TGC	TGC	TGC	TGC	TGC

tRNA-Asn (N)	GTT	GTT	GTT	GTT	GTT	GTT
tRNA-Cys (C)	GCA	GCA	GCA	GCA	GCA	GCA
tRNA-Tyr (Y)	GTA	GTA	GTA	GTA	GTA	GTA
tRNA-Ser (S2)	TGA	TGA	TGA	TGA	TGA	TGA
tRNA-Asp (D)	GTC	GTC	GTC	GTC	GTC	GTC
tRNA-Lys (K)	TTT	TTT	TTT	TTT	TTT	TTT
tRNA-Gly (G)	TCC	TCC	TCC	TCC	TCC	TCC
tRNA-Arg (R)	TCG	TCG	TCG	TCG	TCG	TCG
tRNA-His (H)	GTG	GTG	GTG	GTG	GTG	GTG
tRNA-Ser (S1)	GCT	GCT	GCT	GCT	GCT	GCT
tRNA-Leu (L1)	TAG	TAG	TAG	TAG	TAG	TAG
tRNA-Glu (E)	TTC	TTC	TTC	TTC	TTC	TTC
tRNA-Thr (T)	TGT	TGT	TGT	TGT	TGT	TGT
tRNA-Pro (P)	TGG	TGG	TGG	TGG	TGG	TGG
Gene	*Lethrinus olivaceus*	*Lethrinus ornatus*	*Lethrinus reticulatus*	*Lethrinus rubrioperculatus*	*Lethrinus xanthochilus*	
tRNA-Phe (F)	GAA	GAA	GAA	GAA	GAA	
tRNA-Val (V)	TAC	TAC	TAC	TAC	TAC	
tRNA-Leu (L2)	TAA	TAA	TAA	TAA	TAA	
tRNA-Ile (I)	GAT	GAT	GAT	GAT	GAT	
tRNA-Gln (Q)	TTG	TTG	TTG	TTG	TTG	
tRNA-Met (M)	CAT	CAT	CAT	CAT	CAT	
tRNA-Trp (W)	TCA	TCA	TCA	TCA	TCA	
tRNA-Ala (A)	TGC	TGC	TGC	TGC	TGC	
tRNA-Asn (N)	GTT	GTT	GTT	GTT	GTT	
tRNA-Cys (C)	GCA	GCA	GCA	GCA	GCA	
tRNA-Tyr (Y)	GTA	GTA	GTA	GTA	GTA	
tRNA-Ser (S2)	TGA	TGA	TGA	TGA	TGA	
tRNA-Asp (D)	GTC	GTC	GTC	GTC	GTC	
tRNA-Lys (K)	TTT	TTT	TTT	TTT	TTT	
tRNA-Gly (G)	TCC	TCC	TCC	TCC	TCC	
tRNA-Arg (R)	TCG	TCG	TCG	TCG	TCG	
tRNA-His (H)	GTG	GTG	GTG	GTG	GTG	
tRNA-Ser (S1)	GCT	GCT	GCT	GCT	GCT	
tRNA-Leu (L1)	TAG	TAG	TAG	TAG	TAG	

tRNA-Glu (E)	TTC	TTC	TTC	TTC	TTC
tRNA-Thr (T)	TGT	TGT	TGT	TGT	TGT
tRNA-Pro (P)	TGG	TGG	TGG	TGG	TGG

Supplementary Table S7. The Pearson correlation matrix among the ENC, GC proportion at different codon positions, overall GC content, and CAI.

Parameter	ENC	GC1	GC2	GC3	GC12	Overall GC	CAI
ENC							
GC1	0.223						
GC2	0.002	0.769					
GC3	0.324	0.760	0.834				
GC12	0.139	0.959	0.918	0.839			
Overall GC	0.226	0.912	0.919	0.945	0.971		
CAI	0.368	0.644	0.646	0.732	0.685	0.734	

Supplementary Table S8. The CAI profiles for each PCG across the 17 *Lethrinus* species.

Species Name	*ATP6*	*ATP8*	*COI*	*COII*	*COIII*	*Cytb*	*ND1*	*ND2*	*ND3*	*ND4*	*ND4L*	*ND5*	*ND6*
Lethrinus lentjan	0.546	0.554	0.606	0.515	0.580	0.594	0.551	0.558	0.531	0.563	0.550	0.601	0.561
Lethrinus amboinensis	0.534	0.609	0.576	0.567	0.594	0.582	0.555	0.558	0.567	0.535	0.562	0.574	0.578
Lethrinus atkinsoni	0.523	0.572	0.591	0.546	0.580	0.595	0.535	0.567	0.574	0.553	0.516	0.602	0.544
Lethrinus atlanticus	0.525	0.574	0.579	0.564	0.580	0.578	0.546	0.568	0.578	0.524	0.611	0.578	0.541
Lethrinus erythracanthus	0.514	0.573	0.614	0.567	0.578	0.586	0.552	0.560	0.586	0.551	0.513	0.599	0.548
Lethrinus erythropterus	0.514	0.620	0.574	0.541	0.548	0.584	0.558	0.539	0.523	0.513	0.525	0.565	0.539
Lethrinus genivittatus	0.540	0.642	0.577	0.549	0.581	0.615	0.546	0.542	0.552	0.559	0.559	0.593	0.564
Lethrinus harak	0.553	0.602	0.622	0.538	0.563	0.613	0.550	0.545	0.567	0.534	0.549	0.597	0.570
Lethrinus laticaudis	0.490	0.594	0.594	0.530	0.578	0.591	0.548	0.561	0.564	0.541	0.572	0.592	0.551
Lethrinus microdon	0.544	0.650	0.591	0.571	0.595	0.583	0.543	0.542	0.541	0.541	0.543	0.597	0.566
Lethrinus nebulosus	0.542	0.590	0.594	0.531	0.574	0.593	0.554	0.578	0.576	0.567	0.534	0.601	0.569
Lethrinus obsoletus	0.519	0.586	0.613	0.554	0.587	0.597	0.565	0.563	0.543	0.537	0.599	0.604	0.564
Lethrinus olivaceus	0.532	0.586	0.575	0.564	0.599	0.583	0.556	0.558	0.567	0.539	0.562	0.573	0.577
Lethrinus ornatus	0.520	0.575	0.607	0.527	0.594	0.592	0.561	0.547	0.571	0.540	0.560	0.580	0.552
Lethrinus reticulatus	0.514	0.619	0.589	0.550	0.584	0.603	0.528	0.550	0.552	0.567	0.541	0.575	0.548
Lethrinus rubrioperculatus	0.502	0.581	0.583	0.550	0.580	0.588	0.542	0.532	0.539	0.531	0.538	0.568	0.549
Lethrinus xanthochilus	0.537	0.589	0.594	0.550	0.596	0.597	0.549	0.543	0.541	0.535	0.525	0.582	0.550
Average	0.526	0.596	0.593	0.548	0.582	0.593	0.549	0.553	0.557	0.543	0.551	0.587	0.557
STDEV	0.017	0.027	0.015	0.016	0.013	0.010	0.009	0.012	0.018	0.015	0.027	0.013	0.012

Supplementary Table S9. The RSCU values of the 13 PCGs across the 17 *Lethrinus* species.

RSCU	*Lethrinus lentjan*	*Lethrinus amboinensis*	*Lethrinus atkinsoni*	*Lethrinus atlanticus*	*Lethrinus erythracanthus*	*Lethrinus erythropterus*
UUU(F)	0.90	1.02	0.93	0.98	0.91	0.95
UUC(F)	1.10	0.98	1.07	1.02	1.09	1.05
UUA(L)	0.50	0.58	0.50	0.58	0.49	0.50
UUG(L)	0.37	0.38	0.38	0.40	0.39	0.31
CUU(L)	1.73	1.71	1.73	1.70	1.58	1.62
CUC(L)	1.46	1.38	1.44	1.41	1.56	1.49
CUA(L)	1.25	1.21	1.24	1.20	1.22	1.35
CUG(L)	0.71	0.75	0.72	0.71	0.76	0.72
AUU(I)	0.97	0.98	0.98	1.04	1.03	1.02
AUC(I)	1.03	1.02	1.02	0.96	0.97	0.98
AUA(M)	0.91	1.04	0.98	0.92	0.96	1.08
AUG(M)	1.09	0.96	1.02	1.08	1.04	0.92
GUU(V)	1.28	1.25	1.19	1.18	1.23	1.34
GUC(V)	1.34	1.35	1.37	1.26	1.30	1.34
GUA(V)	1.03	0.99	1.05	1.16	1.13	1.06
GUG(V)	0.35	0.42	0.38	0.41	0.34	0.26
UCU(S)	1.39	1.41	1.41	1.37	1.40	1.46
UCC(S)	1.23	1.31	1.24	1.27	1.24	1.30
UCA(S)	0.90	0.82	0.86	0.93	0.86	0.85
UCG(S)	0.53	0.48	0.54	0.47	0.49	0.45
CCU(P)	1.82	1.79	1.81	1.80	1.80	1.79
CCC(P)	1.16	1.13	1.18	1.15	1.15	1.11
CCA(P)	0.75	0.85	0.77	0.82	0.80	0.89
CCG(P)	0.27	0.23	0.24	0.22	0.25	0.21
ACU(T)	1.06	1.17	1.04	1.09	1.16	1.11
ACC(T)	1.22	1.17	1.29	1.23	1.18	1.20
ACA(T)	1.35	1.29	1.31	1.29	1.34	1.32
ACG(T)	0.36	0.37	0.35	0.40	0.32	0.37

GCU(A)	1.09	1.09	1.14	1.06	1.05	1.12
GCC(A)	1.73	1.71	1.63	1.71	1.71	1.66
GCA(A)	0.99	0.98	1.01	1.06	1.04	1.07
GCG(A)	0.19	0.22	0.21	0.17	0.20	0.14
UAU(Y)	0.93	0.88	0.87	0.93	0.90	0.95
UAC(Y)	1.07	1.12	1.13	1.07	1.10	1.05
CAU(H)	0.87	0.88	0.93	0.89	0.91	0.89
CAC(H)	1.13	1.12	1.07	1.11	1.09	1.11
CAA(Q)	1.36	1.32	1.37	1.43	1.36	1.37
CAG(Q)	0.64	0.68	0.63	0.57	0.64	0.63
AAU(N)	1.01	1.07	1.01	1.04	0.99	0.98
AAC(N)	0.99	0.93	0.99	0.96	1.01	1.02
AAA(K)	1.60	1.54	1.61	1.61	1.64	1.61
AAG(K)	0.40	0.46	0.39	0.39	0.36	0.39
GAU(D)	0.76	0.78	0.88	0.76	0.83	0.83
GAC(D)	1.24	1.22	1.12	1.24	1.17	1.17
GAA(E)	1.35	1.42	1.38	1.46	1.37	1.46
GAG(E)	0.65	0.58	0.62	0.54	0.63	0.54
UGU(C)	0.71	0.67	0.68	0.60	0.62	0.67
UGC(C)	1.29	1.33	1.32	1.40	1.38	1.33
UGG(W)	0.65	0.72	0.69	0.64	0.72	0.63
CGU(R)	0.83	0.98	0.94	1.00	0.85	0.89
CGC(R)	1.25	1.12	1.18	1.12	1.18	1.16
CGA(R)	1.19	1.16	1.21	1.18	1.21	1.27
CGG(R)	0.72	0.74	0.67	0.69	0.76	0.68
AGU(S)	0.65	0.61	0.66	0.66	0.67	0.62
AGC(S)	1.30	1.36	1.29	1.29	1.34	1.32
AGA(R)	1.04	1.03	0.97	1.03	1.02	1.02
AGG(R)	1.31	1.32	1.33	1.36	1.33	1.37
GGU(G)	0.64	0.70	0.70	0.82	0.65	0.69
GGC(G)	1.43	1.33	1.40	1.29	1.42	1.42

GGA(G)	1.05	1.03	0.89	1.05	1.02	1.08
GGG(G)	0.87	0.93	1.01	0.84	0.92	0.82
RSCU	*Lethrinus genivittatus*	*Lethrinus harak*	*Lethrinus laticaudis*	*Lethrinus microdon*	*Lethrinus nebulosus*	*Lethrinus obsoletus*
UUU(F)	0.96	0.94	0.93	0.95	0.89	0.84
UUC(F)	1.04	1.06	1.08	1.05	1.11	1.16
UUA(L)	0.52	0.49	0.61	0.45	0.50	0.55
UUG(L)	0.38	0.42	0.31	0.38	0.36	0.38
CUU(L)	1.73	1.67	1.57	1.66	1.66	1.77
CUC(L)	1.52	1.51	1.62	1.48	1.57	1.44
CUA(L)	1.17	1.34	1.25	1.27	1.24	1.17
CUG(L)	0.69	0.57	0.64	0.77	0.67	0.69
AUU(I)	1.02	0.94	1.12	1.11	0.96	1.02
AUC(I)	0.98	1.06	0.88	0.89	1.04	0.98
AUA(M)	0.98	0.89	0.88	0.95	0.76	0.86
AUG(M)	1.02	1.11	1.12	1.05	1.24	1.14
GUU(V)	1.30	1.46	1.18	1.05	1.29	1.22
GUC(V)	1.35	1.11	1.38	1.41	1.26	1.28
GUA(V)	0.98	0.97	1.04	1.16	0.99	0.93
GUG(V)	0.37	0.46	0.39	0.39	0.47	0.57
UCU(S)	1.35	1.44	1.48	1.39	1.41	1.43
UCC(S)	1.22	1.23	1.36	1.25	1.23	1.38
UCA(S)	0.97	0.94	0.85	0.86	0.91	0.81
UCG(S)	0.55	0.52	0.49	0.46	0.56	0.48
CCU(P)	1.88	1.75	1.75	1.78	1.78	1.82
CCC(P)	1.13	1.21	1.20	1.17	1.19	1.16
CCA(P)	0.75	0.74	0.76	0.85	0.72	0.71
CCG(P)	0.25	0.30	0.29	0.20	0.31	0.31
ACU(T)	1.16	0.97	1.15	1.05	0.92	0.95
ACC(T)	1.21	1.30	1.24	1.38	1.20	1.30
ACA(T)	1.24	1.36	1.29	1.22	1.52	1.36
ACG(T)	0.39	0.37	0.32	0.36	0.35	0.38

GCU(A)	1.09	0.95	1.14	0.93	1.11	1.06
GCC(A)	1.72	1.83	1.63	1.74	1.73	1.66
GCA(A)	0.95	1.00	1.09	1.05	1.02	1.09
GCG(A)	0.25	0.22	0.15	0.28	0.14	0.20
UAU(Y)	0.88	0.93	0.91	0.87	0.90	1.03
UAC(Y)	1.12	1.07	1.09	1.13	1.10	0.97
CAU(H)	0.88	0.93	0.98	0.96	0.90	0.83
CAC(H)	1.12	1.07	1.02	1.04	1.10	1.17
CAA(Q)	1.33	1.29	1.31	1.37	1.35	1.33
CAG(Q)	0.67	0.71	0.69	0.63	0.65	0.67
AAU(N)	1.06	0.98	1.09	1.17	0.99	1.02
AAC(N)	0.94	1.02	0.91	0.83	1.01	0.98
AAA(K)	1.62	1.56	1.67	1.52	1.64	1.60
AAG(K)	0.38	0.44	0.33	0.48	0.36	0.40
GAU(D)	0.85	0.72	0.81	0.77	0.69	0.52
GAC(D)	1.15	1.28	1.19	1.23	1.31	1.48
GAA(E)	1.44	1.30	1.23	1.40	1.37	1.31
GAG(E)	0.56	0.70	0.77	0.60	0.63	0.69
UGU(C)	0.70	0.63	0.73	0.63	0.61	0.75
UGC(C)	1.30	1.37	1.27	1.37	1.39	1.25
UGG(W)	0.71	0.63	0.67	0.72	0.48	0.64
CGU(R)	0.99	1.03	0.90	0.93	1.05	0.78
CGC(R)	1.09	1.24	1.35	1.24	1.08	1.45
CGA(R)	1.17	1.12	1.13	1.05	1.02	1.01
CGG(R)	0.75	0.62	0.61	0.78	0.86	0.76
AGU(S)	0.64	0.65	0.54	0.60	0.65	0.67
AGC(S)	1.28	1.23	1.27	1.44	1.23	1.22
AGA(R)	1.10	1.04	0.93	0.97	1.03	0.94
AGG(R)	1.31	1.29	1.41	1.26	1.34	1.46
GGU(G)	0.78	0.68	0.59	0.84	0.82	0.76
GGC(G)	1.32	1.59	1.55	1.36	1.40	1.59

GGA(G)	1.04	0.78	0.88	0.80	0.82	0.91
GGG(G)	0.86	0.96	0.98	1.01	0.96	0.74
RSCU	*Lethrinus olivaceus*	*Lethrinus ornatus*	*Lethrinus reticulatus*	*Lethrinus rubrioperculatus*	*Lethrinus xanthochilus*	
UUU(F)	1.08	0.83	1.04	0.91	0.94	
UUC(F)	0.92	1.17	0.96	1.09	1.06	
UUA(L)	0.67	0.45	0.55	0.48	0.49	
UUG(L)	0.38	0.38	0.42	0.34	0.38	
CUU(L)	1.74	1.61	1.76	1.73	1.66	
CUC(L)	1.33	1.58	1.39	1.37	1.46	
CUA(L)	1.13	1.26	1.17	1.40	1.27	
CUG(L)	0.74	0.71	0.72	0.68	0.76	
AUU(I)	0.98	1.10	0.97	0.94	0.99	
AUC(I)	1.02	0.90	1.03	1.06	1.01	
AUA(M)	1.07	0.77	0.98	0.98	1.04	
AUG(M)	0.93	1.23	1.02	1.02	0.96	
GUU(V)	1.29	1.37	1.26	1.15	1.20	
GUC(V)	1.29	1.21	1.18	1.24	1.39	
GUA(V)	0.95	1.00	1.21	1.27	1.07	
GUG(V)	0.46	0.42	0.34	0.33	0.34	
UCU(S)	1.30	1.41	1.63	1.55	1.45	
UCC(S)	1.44	1.13	1.28	1.28	1.24	
UCA(S)	0.81	0.99	0.75	0.83	0.84	
UCG(S)	0.46	0.58	0.38	0.43	0.49	
CCU(P)	1.71	1.78	1.78	1.80	1.88	
CCC(P)	1.14	1.18	1.09	1.16	1.10	
CCA(P)	0.90	0.75	0.86	0.81	0.80	
CCG(P)	0.25	0.29	0.27	0.23	0.21	
ACU(T)	1.21	1.02	1.17	1.09	1.13	
ACC(T)	1.19	1.22	1.17	1.18	1.16	
ACA(T)	1.27	1.35	1.36	1.33	1.30	
ACG(T)	0.33	0.42	0.29	0.39	0.40	

GCU(A)	0.99	1.08	1.08	1.07	1.20
GCC(A)	1.78	1.73	1.78	1.74	1.63
GCA(A)	1.00	0.97	0.94	0.98	0.96
GCG(A)	0.23	0.22	0.19	0.20	0.21
UAU(Y)	0.96	0.97	0.95	0.86	0.80
UAC(Y)	1.04	1.03	1.05	1.14	1.20
CAU(H)	0.89	0.90	0.81	0.85	0.87
CAC(H)	1.11	1.10	1.19	1.15	1.13
CAA(Q)	1.33	1.39	1.38	1.40	1.33
CAG(Q)	0.67	0.61	0.63	0.60	0.67
AAU(N)	1.09	0.94	1.08	1.10	1.07
AAC(N)	0.91	1.06	0.92	0.90	0.93
AAA(K)	1.52	1.62	1.56	1.54	1.58
AAG(K)	0.48	0.38	0.44	0.46	0.42
GAU(D)	0.68	0.83	0.93	0.69	0.84
GAC(D)	1.32	1.17	1.07	1.31	1.16
GAA(E)	1.27	1.39	1.44	1.48	1.53
GAG(E)	0.73	0.61	0.56	0.52	0.47
UGU(C)	0.68	0.62	0.59	0.54	0.65
UGC(C)	1.32	1.38	1.41	1.46	1.35
UGG(W)	0.76	0.74	0.66	0.60	0.71
CGU(R)	1.13	0.90	1.00	0.81	0.87
CGC(R)	1.17	1.23	1.00	1.05	1.10
CGA(R)	0.98	1.05	1.34	1.40	1.29
CGG(R)	0.72	0.81	0.66	0.74	0.74
AGU(S)	0.56	0.65	0.63	0.62	0.66
AGC(S)	1.43	1.25	1.33	1.29	1.32
AGA(R)	1.02	1.06	1.02	1.01	1.04
AGG(R)	1.38	1.36	1.29	1.32	1.30
GGU(G)	0.77	0.75	0.77	0.51	0.64
GGC(G)	1.28	1.41	1.30	1.51	1.40

GGA(G)	1.04	0.89	0.95	1.26	1.04
GGG(G)	0.91	0.95	0.99	0.72	0.91

Supplementary Table S10. The amino acid distribution of the 13 PCGs across the 17 *Lethrinus* species.

Amino Acid	*Lethrinus lentjan*	*Lethrinus amboinensis*	*Lethrinus atkinsoni*	*Lethrinus atlanticus*	*Lethrinus erythracanthus*	*Lethrinus erythropterus*
Ala	234	228	235	231	225	223
Arg	128	116	128	130	132	119
Asn	146	141	147	147	150	154
Asp	79	81	80	79	78	77
Cys	77	80	78	71	69	77
Gln	100	98	100	98	100	98
Glu	71	70	71	73	69	70
Gly	184	188	189	183	185	178
His	166	150	160	164	160	155
Ile	189	193	196	192	195	200
Leu	539	540	544	542	548	537
Lys	87	86	87	85	88	87
Met	122	123	123	128	123	130
Phe	161	162	161	167	159	158
Pro	393	396	388	385	389	381
Ser	237	238	238	235	237	249
Thr	275	271	267	271	281	274
Trp	101	105	100	101	98	104
Tyr	127	142	131	136	133	141
Val	148	154	146	148	145	145
Amino Acid	*Lethrinus genivittatus*	*Lethrinus harak*	*Lethrinus laticaudis*	*Lethrinus microdon*	*Lethrinus nebulosus*	*Lethrinus obsoletus*
Ala	234	253	243	241	259	246
Arg	136	136	124	129	130	143
Asn	138	143	160	139	148	159
Asp	77	75	72	83	78	69
Cys	73	79	77	73	75	72
Gln	98	101	104	98	107	107
Glu	72	74	73	70	67	70

Gly	187	201	196	191	200	194
His	163	170	162	156	172	163
Ile	195	186	190	202	191	183
Leu	540	546	542	549	536	542
Lys	83	82	86	88	90	90
Met	122	121	121	122	116	118
Phe	158	157	160	150	166	152
Pro	378	389	374	403	384	392
Ser	253	229	246	231	234	238
Thr	267	271	275	256	260	273
Trp	99	95	98	106	96	100
Tyr	133	127	129	131	127	122
Val	156	140	142	145	146	147

Amino Acid	*Lethrinus olivaceus*	*Lethrinus ornatus*	*Lethrinus reticulatus*	*Lethrinus rubrioperculatus*	*Lethrinus xanthochilus*
Ala	231	240	229	216	224
Arg	106	133	116	114	124
Asn	139	144	137	146	142
Asp	79	82	82	72	83
Cys	82	71	78	63	77
Gln	101	108	96	97	95
Glu	71	69	71	65	68
Gly	193	202	182	156	180
His	144	167	162	149	156
Ile	189	187	194	190	195
Leu	540	530	545	524	540
Lys	87	90	86	87	85
Met	121	115	122	124	125
Phe	163	164	162	151	160
Pro	403	388	382	383	391
Ser	228	233	243	237	244
Thr	275	279	276	267	268

Trp	111	100	106	94	101
Tyr	150	134	137	132	132
Val	155	152	152	132	153

Supplementary Table S11. The pairwise d_N/d_S (ω) for the 13 PCGs across the 17 *Lethrinus* species.

Species Name	*ND1*	*ND2*	*COI*	*COII*	*ATP8*	*ATP6*	*COIII*	*ND3*	*ND4L*	*ND4*	*ND5*	*ND6*	*Cytb*
Lethrinus amboinensis	0.018	0.040	0.006	0.016	0.113	0.031	0.011	0.000	0.035	0.025	0.032	0.057	0.006
Lethrinus atkinsoni	0.004	0.027	0.005	0.010	0.129	0.102	0.004	0.028	0.000	0.005	0.012	0.016	0.002
Lethrinus atlanticus	0.019	0.030	0.003	0.003	0.130	0.021	0.011	0.007	0.020	0.030	0.025	0.069	0.010
Lethrinus erythracanthus	0.039	0.051	0.004	0.013	0.067	0.037	0.008	0.013	0.087	0.033	0.031	0.092	0.006
Lethrinus erythropterus	0.026	0.079	0.003	0.005	0.047	0.025	0.010	0.019	0.041	0.027	0.039	0.105	0.011
Lethrinus genivittatus	0.015	0.040	0.005	0.007	0.089	0.047	0.018	0.019	0.020	0.043	0.021	0.061	0.009
Lethrinus harak	0.011	0.038	0.002	0.006	0.148	0.020	0.009	0.026	0.000	0.008	0.015	0.022	0.002
Lethrinus laticaudis	0.011	0.030	0.004	0.010	0.281	0.045	0.014	0.014	0.015	0.017	0.028	0.019	0.007
Lethrinus microdon	0.018	0.022	0.004	0.007	0.057	0.054	0.016	0.017	0.015	0.016	0.032	0.050	0.005
Lethrinus nebulosus	0.003	0.023	0.003	0.000	0.048	0.025	0.023	0.000	0.000	0.005	0.021	0.026	0.003
Lethrinus obsoletus	0.026	0.032	0.004	0.018	0.150	0.022	0.015	0.035	0.000	0.015	0.025	0.032	0.009
Lethrinus olivaceus	0.018	0.041	0.006	0.016	0.113	0.031	0.011	0.000	0.035	0.025	0.034	0.056	0.006
Lethrinus ornatus	0.007	0.035	0.004	0.000	0.082	0.095	0.027	0.030	0.000	0.012	0.020	0.018	0.003
Lethrinus reticulatus	0.023	0.031	0.005	0.005	0.048	0.028	0.012	0.000	0.000	0.021	0.028	0.060	0.008
Lethrinus rubrioperculatus	0.019	0.029	0.004	0.011	0.084	0.028	0.016	0.000	0.020	0.020	0.036	0.055	0.006
Lethrinus xanthochilus	0.020	0.036	0.003	0.010	0.075	0.035	0.015	0.009	0.020	0.016	0.037	0.043	0.007
Average	0.017	0.036	0.004	0.009	0.104	0.040	0.014	0.014	0.019	0.020	0.027	0.049	0.006
STDEV	0.009	0.014	0.001	0.006	0.059	0.025	0.006	0.012	0.023	0.010	0.008	0.026	0.003

Supplementary Table S12. The molecular selection analyses of the 13 PCGs across the 17 *Lethrinus* species using the HyPhy framework, with the FEL, FUBAR, MEME, and aBSREL methods. *Note: p*-values reveal statistical significance, with a threshold of $p \leq 0.1$, whereas PP denotes posterior probability, with a threshold of PP ≥ 0.9.

Gene	FEL				FUBAR		MEME	aBSREL
	Codon Sites	Non-Invariant Sites Tested	Sites Under Purifying Selection ($p \leq 0.1$)	Sites Under Diversifying Positive Selection ($p \leq 0.1$)	Pervasive Negative/ Purifying Selection (PP ≥ 0.9)	Pervasive Positive/ Diversifying Selection (PP ≥ 0.9)	Sites Subject to Episodic Diversifying Selection ($p \leq 0.1$)	Branches with Evidence of Episodic Diversifying Selection ($p \leq 0.1$)
ATP6	227	211	183	2	183	0	2	0
ATP8	55	48	32	0	28	0	0	0
COI	516	450	422	0	444	0	0	0
COII	230	196	181	0	183	0	0	0
COIII	261	223	212	0	212	0	0	0
Cytb	380	357	344	0	345	0	1	0
ND1	323	305	285	0	288	0	2	0
ND2	348	326	294	0	303	0	3	0
ND3	116	112	96	0	98	0	0	0
ND4	460	439	407	0	412	0	1	0
ND4L	98	90	79	1	74	0	0	0
ND5	612	561	516	0	527	0	4	0
ND6	173	151	120	0	118	0	0	0

Supplementary Table S13. The overall mean genetic distances and numbers of variable sites at the nucleotide and amino acid levels for each PCG among the 17 *Lethrinus* species.

Gene	Overall Mean Distance	Variable Sites	
		Nucleotide	Amino Acid
ATP6	0.20	279	49
ATP8	0.18	77	21
COI	0.14	486	9
COII	0.13	222	12
COIII	0.14	247	15
Cytb	0.16	400	17
ND1	0.18	361	26
ND2	0.19	441	68
ND3	0.17	140	16
ND4	0.19	576	82
ND4L	0.16	110	9
ND5	0.16	695	86
ND6	0.17	215	37

Supplementary Table S14. The pairwise interspecific genetic distances for the 13 PCGs among the 17 *Lethrinus* species. The lower-left triangle presents K2P genetic distances, while the upper-right triangle shows uncorrected *p*-distances.

Species Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Lethrinus lentjan		0.077	0.080	0.089	0.098	0.100	0.102	0.142	0.144	0.146	0.153	0.154	0.155	0.155	0.160	0.161	0.171
Lethrinus nebulosus	0.082		0.082	0.081	0.091	0.093	0.100	0.140	0.142	0.149	0.153	0.155	0.153	0.153	0.161	0.161	0.169
Lethrinus ornatus	0.086	0.089		0.093	0.102	0.105	0.106	0.150	0.146	0.154	0.161	0.162	0.157	0.160	0.167	0.167	0.173
Lethrinus harak	0.097	0.087	0.102		0.104	0.103	0.110	0.150	0.150	0.156	0.159	0.161	0.158	0.160	0.167	0.166	0.174
Lethrinus obsoletus	0.107	0.098	0.112	0.114		0.108	0.117	0.150	0.152	0.159	0.160	0.163	0.160	0.160	0.171	0.171	0.173
Lethrinus laticaudis	0.110	0.102	0.116	0.113	0.120		0.116	0.152	0.152	0.156	0.159	0.162	0.161	0.161	0.169	0.168	0.180
Lethrinus atkinsoni	0.112	0.110	0.117	0.122	0.130	0.129		0.147	0.154	0.155	0.160	0.161	0.160	0.161	0.167	0.167	0.176
Lethrinus atlanticus	0.162	0.159	0.172	0.173	0.171	0.175	0.168		0.159	0.155	0.162	0.166	0.163	0.164	0.168	0.168	0.172
Lethrinus erythracanthus	0.164	0.162	0.167	0.171	0.174	0.174	0.177	0.184		0.140	0.147	0.151	0.151	0.151	0.158	0.158	0.170
Lethrinus erythropterus	0.166	0.171	0.176	0.179	0.183	0.179	0.178	0.178	0.160		0.155	0.158	0.158	0.158	0.159	0.159	0.175
Lethrinus rubrioperculatus	0.176	0.176	0.186	0.184	0.184	0.182	0.185	0.187	0.168	0.178		0.087	0.106	0.046	0.132	0.133	0.177
Lethrinus reticulatus	0.176	0.179	0.188	0.186	0.188	0.187	0.186	0.194	0.173	0.183	0.095		0.112	0.089	0.133	0.133	0.179
Lethrinus microdon	0.178	0.176	0.181	0.181	0.185	0.185	0.185	0.189	0.174	0.182	0.118	0.124		0.107	0.130	0.130	0.171
Lethrinus xanthochilus	0.179	0.176	0.185	0.185	0.184	0.186	0.187	0.191	0.173	0.183	0.048	0.097	0.119		0.132	0.132	0.178
Lethrinus amboinensis	0.185	0.187	0.195	0.194	0.200	0.197	0.195	0.195	0.182	0.183	0.150	0.151	0.147	0.150		0.003	0.176
Lethrinus olivaceus	0.186	0.186	0.195	0.194	0.199	0.196	0.194	0.195	0.183	0.184	0.150	0.151	0.147	0.150	0.003		0.177
Lethrinus genivittatus	0.198	0.196	0.202	0.203	0.201	0.211	0.206	0.200	0.198	0.204	0.207	0.210	0.199	0.208	0.206	0.206	

Supplementary Table S15. The sequence dataset of Lethrinidae species, including newly generated and retrieved from GenBank.

No.	Valid Species	Subfamily	Accession No.	Length (bp)	Reference
1	*Lethrinus lentjan*	Lethrininae	PZ719881	16,784	This Study
2	*Lethrinus amboinensis*	Lethrininae	PZ319390	16,794	Unpublished
3	*Lethrinus atkinsoni*	Lethrininae	PZ310938	16,787	Unpublished
4	*Lethrinus atlanticus*	Lethrininae	OQ420716	16,789	Kundu et al. 2024
5	*Lethrinus erythracanthus*	Lethrininae	PZ310939	16,794	Unpublished
6	*Lethrinus erythropterus*	Lethrininae	PZ213525	16,810	Unpublished
7	*Lethrinus genivittatus*	Lethrininae	PZ574241	16,831	Unpublished
8	*Lethrinus harak*	Lethrininae	PZ310940	16,782	Unpublished
9	*Lethrinus laticaudis*	Lethrininae	KU530221	16,758	Taillebois et al. 2016
10	*Lethrinus microdon*	Lethrininae	PZ213532	16,797	Unpublished
11	*Lethrinus nebulosus*	Lethrininae	PZ574246	16,785	Unpublished
12	*Lethrinus obsoletus*	Lethrininae	AP009165	16,779	Yamanoue et al. 2007
13	*Lethrinus olivaceus*	Lethrininae	PV872036	16,792	Chen et al. 2025
14	*Lethrinus ornatus*	Lethrininae	PZ574250	16,787	Unpublished
15	*Lethrinus reticulatus*	Lethrininae	PZ319379	16,785	Unpublished
16	*Lethrinus rubrioperculatus*	Lethrininae	PZ310945	16,788	Unpublished
17	*Lethrinus xanthochilus*	Lethrininae	PZ697365	16,791	Unpublished
18	*Gnathodentex aureolineatus*	Monotaxinae	OM302214	16,940	Guo et al. 2023
19	*Gymnocranius elongatus*	Monotaxinae	PX508910	16,501	Unpublished
20	*Gymnocranius grandoculis*	Monotaxinae	PZ319386	16,527	Unpublished
21	*Gymnocranius griseus*	Monotaxinae	PZ319387	16,522	Unpublished
22	*Gymnocranius microdon*	Monotaxinae	PZ319392	16,523	Unpublished
23	*Monotaxis grandoculis*	Monotaxinae	AP009166	16,174	Yamanoue et al. 2007
24	*Monotaxis heterodon*	Monotaxinae	PZ319376	16,527	Unpublished
25	*Wattsia mossambica*	Monotaxinae	PZ310949	16,857	Unpublished
Outgroup	*Lobotes surinamensis* (Family Lobotidae)		PP032980	16,485	Alvarenga et al. 2024

Supplementary Table S16. The best-fit nucleotide substitution models for each PCG across the 17 *Lethrinus* species, adopted according to the lowest BIC values.

Gene	Model	BIC Score
ATP6	TN93+G+I	9196.259
ATP8	HKY+I	2238.796
COI	HKY+G+I	16924.224
COII	HKY+G+I	7012.645
COIII	HKY+G+I	8327.772
Cytb	HKY+G+I	13514.954
ND1	TN93+G+I	11970.354
ND2	TN93+G+I	6314.007
ND3	TN93+G+I	13428.949
ND4	TN93+G+I	18203.832
ND4L	HKY+G	3512.566
ND5	HKY+G+I	21089.780
ND6	HKY+G+I	6314.007

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