Supplementary Table 1: List of 76 mt genomes for birds.

species	accession number	*Ka/Ks*	*Ka*	*Ks*	speed(m/s)	Ln S	group * *
			13 mt genes				
Acrocephalus scirpaceus	NC 010227	0.0464	0.0288	0.6228	6.6[d]	1.8871	2
Alectura lathami	NC 007227	0.0343	0.032	0.9311			2
Anas platyrhynchos	NC 009684	0.0252	0.0073	0.2873	18.5[a]	2.9178	2
Anomalopteryx didiformis (die out)	NC 002779	0.0508	0.0027	0.054			1
Anser albifrons	NC 004539	0.0468	0.0088	0.1856	16.1[a]	2.7788	2
Anseranas semipalmata	NC 005933	0.0364	0.0207	0.5628			2
Apteryx haastii	NC 002782	0.0599	0.0273	0.4561			1
Apus apus	NC 008540	0.0401	0.0241	0.6431	10.6[a]	2.3609	2
Archilochus colubris	NC 010094	0.0397	0.0382	0.9242			2
Ardea novaehollandiae	NC 008551	0.0423	0.0067	0.1552	10.2[c#]	2.322	2
Arenaria interpres	NC 003712	0.0378	0.0213	0.581			2
Aythya americana	NC 000877	0.0309	0.0092	0.2987	24.4[b]	3.1946	2
*Bambusicola thoracica**	EU165706	0.0503	0.0144	0.2872			1
Branta canadensis	NC 007011	0.0444	0.0092	0.206	16.7[a]	2.8154	2
Buteo buteo	NC 003128	0.049	0.0167	0.3337	11.6[a]	2.451	2
Casuarius casuarius	NC 002778	0.028	0.0085	0.3048	13.9[f]	2.6319	2
Cathartes aura * * * *	NC 007628	0.0468	0.0239	0.4676	10.6[c]	2.3609	2
Ciconia boyciana	NC 002196	0.0539	0.0031	0.0563			2
Ciconia ciconia	NC 002197	0.0501	0.0029	0.0572	9.1[d]	2.2083	2
Cnemotriccus fuscatus	NC 007975	0.0369	0.038	1.0476			2
Corvus frugilegus	NC 002069	0.0428	0.0298	0.6526	13[a]	2.5649	2
Coturnix chinensis	NC 004575	0.0325	0.0122	0.3762			2

Coturnix japonica	NC 003408	0.0432	0.0128	0.2962			2
Cygnus columbianus	NC 007691	0.0327	0.0089	0.2702	18.5[a]	2.9178	2
Dinornis giganteus (die out)	NC 002672	0.0467	0.0052	0.1105			1
Diomedea melanophris	NC 007172	0.0444	0.0188	0.4157	13.3[c]	2.5878	2
Dromaius novaehollandiae	NC 002784	0.0305	0.0094	0.3074	13.9[e]	2.6319	2
Dryocopus pileatus	NC 008546	0.0521	0.0339	0.6755	,		2
Egretta eulophotes	NC 009736	0.0533	0.0058	0.1112	9.5[a,c#]	2.251	2
Emeus crasssus (die out)	NC 002673	0.0496	0.0028	0.057			1
Eudromia elegans	NC 002772	0.045	0.0383	0.8517			2
Eudyptes chrysocome	NC 008138	0.0565	0.0115	0.2059			1
Eudyptula minor	NC 004538	0.0535	0.0131	0.2493			1
Falco peregrinus	NC 000878	0.0456	0.0114	0.2562	12.1[a]	2.4932	2
Falco sparverius	NC 008547	0.0544	0.0121	0.2243	12[a#]	2.485	2
*Francolinus pintadeanus**	EU 165707	0.0389	0.0147	0.3787			2
Gallus gallus	NC 001323	0.0576	0.004	0.0697			1
Gallus lafayettei	NC 007239	0.0607	0.0054	0.0882			1
Gallus sonneratii	NC 007240	0.0506	0.0044	0.0876			1
Gallus varius	NC 007238	0.081	0.0057	0.0697			1
Gavia pacifica	NC 008139	0.0409	0.0086	0.2117	19.3[a]	2.9601	2
Gavia stellata	NC 007007	0.0536	0.0129	0.2428	18.6[a]	2.9232	2
Haematopus ater	NC 003713	0.0477	0.0228	0.5119			2
Larus dominicanus	NC 007006	0.0396	0.0172	0.4339	13.1[a#]	2.573	2
*Lophura nycthemera**	EU 417810	0.0434	0.0162	0.3738			1
Meleagris gallopavo	NC 010195	0.0484	0.0234	0.4836			1
Melopsittacus undulatus	NC 009134	0.0515	0.0284	0.545			2
Menura novaehollandiae	NC 007883	0.0363	0.03	0.8206			2

Micrastur gilvicollis	NC 008548	0.0641	0.0295	0.4761			2
Ninox novaeseelandiae * * *	NC 005932						2
Nipponia nippon	NC 008132	0.0463	0.0129	0.497			2
Nipponia nippon * * *	NC 008132						2
Nisaetus alboniger	NC 007599	0.0611	0.0036	0.0587			2
Nisaetus nipalensis	NC 007598	0.0808	0.0043	0.0542			2
Numida meleagris	NC 006382	0.0413	0.0201	0.4922			1
Pandion haliaetus	NC 008550	0.0632	0.039	0.6144	11.4[d]	2.4336	2
*Pavo muticus**	EU 417811	0.0523	0.0212	0.4042			1
Phaethon rubricauda * * *	NC 007979						2
Phoenicopterus ruber roseus	NC 010089	0.0381	0.0123	0.3145	15.2[a]	2.7213	2
*Polyplectron bicalcaratum**	EU 417812	0.0532	0.0266	0.4996			1
Porphyrio hochstetteri * * * *	NC 010092	0.0573	0.0561	0.9792			1
Pterocnemia pennata	NC 002783	0.0443	0.0061	0.1369	16.6[i]	2.8094	2
Pterodroma brevirostris	NC 007174	0.0563	0.0241	0.4445			2
Pterogloss azara flavirostris	NC 008549	0.0563	0.0424	0.7477			2
Rhea americana	NC 000846	0.0364	0.0063	0.1739	16[h]	2.7726	2
Rhynochetos jubatus * * * *	NC 010091	0.0577	0.0554	0.9604			1
Smithornis sharpei	NC 000879	0.0701	0.055	0.805			2
Strigops habroptilus	NC 005931	0.0428	0.0205	0.4915			1
Struthio camelus	NC 002785	0.0413	0.0291	0.7033	16.9[g]	2.8273	2
Sylvia atricapilla	NC 010228	0.0448	0.0234	0.5213	8.2[d]	2.1041	2
Sylvia crassirostris	NC 010229	0.046	0.0212	0.4617			2
Synthliboramphus antiquus	NC 007978	0.0477	0.0185	0.3933			2
Tachybaptus novaehollandiae	NC 010095	0.0594	0.0263	0.4509			2
Taeniopygia guttata	NC 007897	0.0376	0.0146	0.4042			2
Tinamus major	NC 002781	0.0556	0.0434	0.7806			1

Vidua chalybeata	NC 00880	0.0612	0.0332	0.5333	2

note: * means those mt genomes were sequenced in this study;

* *group 1 means weakly locomotive group;
group 2 means strongly locomotive group ;

* * * represents those birds with ambiguous phylogenetic position, although we have proofread our tree with the recent published phylogeny reveailed by Hackett et al. (Science, 320,1763-1768);

* * * * represents those species with ambiguous phylogenetic positions in our mtDNA phylogenetic tree, but have a relative stable positions in the recent published phylogeny reveailed by Hackett et al. (Science, 320,1763-1768);

means average speed;

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