SUPPLEMENTARY MATERIAL

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Genetic and morphological variation of *Halcyon senegalensis* revealing cryptic mitochondrial lineages and patterns of mitochondrial-nuclear discordance

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Supplementary Table 1: DNA sequences included in phylogenetic and genetic diversity analyses as well as haplotype network inference per region for (A) mitochondrial DNA and (B) nuclear DNA regions. Cytochrome oxidase 1 = COI, Cytochrome *b* = CytB, large subunit ribosomal RNA = 16S, recombination activating gene 1 = RAG1 and nuclear b-fibrinogen gene, intron 5 = FIB5.

(A)

Name	Country	Species	COI	Cytb	16S	Concatenated	Reference
60732	Uganda	*Halcyon s. senegalensis*	Yes	Yes	Yes	Yes	This study
60748	Uganda	*Halcyon s. senegalensis*	Yes	Yes	Yes	Yes	This study
60749	Uganda	*Halcyon s. senegalensis*	Yes	Yes	Yes	Yes	This study
60754	Uganda	*Halcyon s. senegalensis*	Yes	Yes	Yes	Yes	This study
60756	Uganda	*Halcyon s. senegalensis*	Yes	Yes	Yes	Yes	This study
60764	Uganda	*Halcyon s. senegalensis*	Yes	Yes	Yes	Yes	This study
65041	Uganda	*Halcyon s. senegalensis*	Yes	Yes	Yes	Yes	This study
65053	Uganda	*Halcyon s. senegalensis*	Yes	Yes	Yes	Yes	This study
65024	Ghana	*Halcyon s. senegalensis*	Yes	Yes	Yes	Yes	This study
65025	Ghana	*Halcyon s. senegalensis*	Yes	Yes	Yes	Yes	This study
65027	Ghana	*Halcyon s. senegalensis*	Yes	Yes	Yes	Yes	This study
65028	Ghana	*Halcyon s. senegalensis*	Yes	Yes	Yes	Yes	This study
65029	Ghana	*Halcyon s. senegalensis*	Yes	Yes	Yes	Yes	This study
65030	Ghana	*Halcyon s. senegalensis*	Yes	Yes	Yes	Yes	This study
65031	Ghana	*Halcyon s. senegalensis*	Yes	Yes	Yes	Yes	This study
KF033	Ghana	*Halcyon s. senegalensis*	Yes	Yes	Yes	Yes	This study
KF034	Ghana	*Halcyon s. senegalensis*	Yes	Yes	Yes	Yes	This study
KF035	Ghana	*Halcyon s. senegalensis*	Yes	Yes	Yes	Yes	This study
63222	South Africa	*Halcyon s. cyanoleuca*	Yes	Yes	-	-	This study
63231	South Africa	*Halcyon s. cyanoleuca*	Yes	Yes	-	-	This study
63238	South Africa	*Halcyon s. cyanoleuca*	Yes	Yes	-	-	This study
63241	South Africa	*Halcyon s. cyanoleuca*	Yes	Yes	Yes	Yes	This study
63243	South Africa	*Halcyon s. cyanoleuca*	Yes	Yes	Yes	Yes	This study
63244	South Africa	*Halcyon s. cyanoleuca*	Yes	Yes	Yes	Yes	This study
63247	South Africa	*Halcyon s. cyanoleuca*	Yes	Yes	Yes	Yes	This study
63248	South Africa	*Halcyon s. cyanoleuca*	Yes	Yes	-	-	This study
63251	South Africa	*Halcyon s. cyanoleuca*	Yes	Yes	-	-	This study
63257	South Africa	*Halcyon s. cyanoleuca*	Yes	Yes	Yes	Yes	This study
63258	South Africa	*Halcyon s. cyanoleuca*	Yes	Yes	Yes	Yes	This study
65301	South Africa	*Halcyon s. cyanoleuca*	-	Yes	Yes	-	This study
65306	South Africa	*Halcyon s. cyanoleuca*	Yes	Yes	Yes	Yes	This study

65314	South Africa	*Halcyon s. cyanoleuca*	Yes	Yes	Yes	Yes	This study
65326	South Africa	*Halcyon s. cyanoleuca*	-	Yes	-	-	This study
65329	South Africa	*Halcyon s. cyanoleuca*	-	Yes	Yes	-	This study
65333	South Africa	*Halcyon s. cyanoleuca*	-	Yes	-	-	This study
65337	South Africa	*Halcyon s. cyanoleuca*	-	Yes	Yes	-	This study
KF001	South Africa	*Halcyon s. cyanoleuca*	Yes	Yes	Yes	Yes	This study
KF002	South Africa	*Halcyon s. cyanoleuca*	Yes	Yes	Yes	Yes	This study
KF003	South Africa	*Halcyon s. cyanoleuca*	Yes	Yes	Yes	Yes	This study
KF004	South Africa	*Halcyon s. cyanoleuca*	Yes	Yes	Yes	Yes	This study
KF005	South Africa	*Halcyon s. cyanoleuca*	Yes	Yes	Yes	Yes	This study
KF006	South Africa	*Halcyon s. cyanoleuca*	Yes	Yes	Yes	Yes	This study
KF007	South Africa	*Halcyon s. cyanoleuca*	Yes	Yes	-	-	This study
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KF012	South Africa	*Halcyon s. cyanoleuca*	Yes	Yes	Yes	Yes	This study
KF013	South Africa	*Halcyon s. cyanoleuca*	Yes	Yes	Yes	Yes	This study
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KF015	South Africa	*Halcyon s. cyanoleuca*	Yes	Yes	Yes	Yes	This study
KF020	South Africa	*Halcyon s. cyanoleuca*	Yes	Yes	Yes	Yes	This study
KF021	South Africa	*Halcyon s. cyanoleuca*	Yes	Yes	Yes	Yes	This study
KF022	South Africa	*Halcyon s. cyanoleuca*	Yes	Yes	Yes	Yes	This study
KF023	South Africa	*Halcyon s. cyanoleuca*	Yes	Yes	Yes	Yes	This study
KF024	South Africa	*Halcyon s. cyanoleuca*	Yes	Yes	Yes	Yes	This study
KF025	South Africa	*Halcyon s. cyanoleuca*	Yes	Yes	Yes	Yes	This study
KF028	South Africa	*Halcyon s. cyanoleuca*	Yes	Yes	Yes	Yes	This study
KF029	South Africa	*Halcyon s. cyanoleuca*	Yes	Yes	Yes	Yes	This study
KF032	South Africa	*Halcyon s. cyanoleuca*	Yes	Yes	Yes	Yes	This study
KY940559.1	-	*Halcyon smyrnensis*	Yes	Yes	Yes	Yes	Wang et al. unpublished
KJ476742.1	-	*Halcyon pileata*	Yes	Yes	-	Yes	Zou et al. unpublished
MN356338.1	Gabon	*Halcyon s.*	Yes	Yes	Yes	Yes	Feng et al. in press
MK327571 MN991500	Malaysia	*Actenoides concretus*	Yes -	- Yes	Yes -	Yes	-
MK060128 MK261810	-	*Dacelo novaeguineae*	 Yes	Yes	Yes	-	-
KJ461938	-	*Ceryle rudis*	Yes	Yes	Yes	Yes	-
JN801563, NC_052793	Brazil -	*Chloroceryle aenea*	Yes Yes	- Yes	- Yes	Yes	-
KY940558	-	*Megaceryle lugubris*	Yes	Yes	Yes	Yes	-
NC_011712	-	*Todiramphus sanctus*	Yes	Yes	Yes	Yes	-

(B)

Name	Country	Species	RAG1	FIB5	Concatenated	Reference
60732	Uganda	*Halcyon s. senegalensis*	Yes	Yes	Yes	This study
60748	Uganda	*Halcyon s. senegalensis*	Yes	Yes	Yes	This study
60749	Uganda	*Halcyon s. senegalensis*	Yes	Yes	Yes	This study
60754	Uganda	*Halcyon s. senegalensis*	Yes	Yes	Yes	This study
60756	Uganda	*Halcyon s. senegalensis*	Yes	Yes	Yes	This study
60764	Uganda	*Halcyon s. senegalensis*	Yes	Yes	Yes	This study
65041	Uganda	*Halcyon s. senegalensis*	Yes	Yes	Yes	This study
65046	Uganda	*Halcyon s. senegalensis*	-	Yes	-	This study
65048	Uganda	*Halcyon s. senegalensis*	Yes	-	-	This study
65049	Uganda	*Halcyon s. senegalensis*	Yes	-	-	This study
65050	Uganda	*Halcyon s. senegalensis*	Yes	-	-	This study
65053	Uganda	*Halcyon s. senegalensis*	Yes	Yes	Yes	This study
65024	Ghana	*Halcyon s. senegalensis*	Yes	Yes	Yes	This study
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65027	Ghana	*Halcyon s. senegalensis*	Yes	Yes	Yes	This study
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65031	Ghana	*Halcyon s. senegalensis*	Yes	Yes	Yes	This study
KF033	Ghana	*Halcyon s. senegalensis*	Yes	Yes	Yes	This study

KF034	Ghana	*Halcyon s. senegalensis*	Yes	Yes	Yes	This study
KF035	Ghana	*Halcyon s. senegalensis*	Yes	Yes	Yes	This study
63222	South Africa	*Halcyon s. cyanoleuca*	Yes	Yes	Yes	This study
63231	South Africa	*Halcyon s. cyanoleuca*	Yes	-	-	This study
63238	South Africa	*Halcyon s. cyanoleuca*	Yes	Yes	Yes	This study
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63248	South Africa	*Halcyon s. cyanoleuca*	Yes	Yes	Yes	This study
63251	South Africa	*Halcyon s. cyanoleuca*	Yes	Yes	Yes	This study
63257	South Africa	*Halcyon s. cyanoleuca*	Yes	Yes	Yes	This study
63258	South Africa	*Halcyon s. cyanoleuca*	Yes	Yes	Yes	This study
65301	South Africa	*Halcyon s. cyanoleuca*	Yes	-	-	This study
65306	South Africa	*Halcyon s. cyanoleuca*	Yes	Yes	Yes	This study
65314	South Africa	*Halcyon s. cyanoleuca*	Yes	Yes	Yes	This study
65326	South Africa	*Halcyon s. cyanoleuca*	Yes	-	-	This study
65329	South Africa	*Halcyon s. cyanoleuca*	Yes	-	-	This study
65333	South Africa	*Halcyon s. cyanoleuca*	-	Yes	-	This study
65337	South Africa	*Halcyon s. cyanoleuca*	-	Yes	-	This study
KF001	South Africa	*Halcyon s. cyanoleuca*	Yes	Yes	Yes	This study
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KF003	South Africa	*Halcyon s. cyanoleuca*	Yes	Yes	Yes	This study
KF004	South Africa	*Halcyon s. cyanoleuca*	Yes	Yes	Yes	This study
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MG008244.1	Ghana (Northern region)	*Halcyon leucocephala*	-	-	Yes	Andersen et al. 2018
MG001221.1	Ghana (Northern region)	*Halcyon leucocephala*	-	-	Yes	Andersen et al. 2018
MK579328.1	-	*Halcyon cyanoleuca*	Yes	-	-	Catanach et al. 2019
DQ111818.1	-	*Halcyon senegalensis*	Yes	-	-	Moyle 2006
MG001233.1	Central African Republic	*Halcyon senegalensis*	-	Yes	-	Andersen et al. 2018
MG001217.1	Liberia	*Halcyon badia*	-	Yes	-	Andersen et al. 2018
MG001218.1	Malawi	*Halcyon chelicuti*	-	Yes	-	Andersen et al. 2018
MG001216.1	Tanzania	*Halcyon albientris*	-	Yes	-	Andersen et al. 2018
MG001221.1	Ghana	*Halcyon leccocephala*	-	Yes	-	Andersen et al. 2018
MG001219.1	Philippines	*Halcyon gularis*	-	Yes	-	Andersen et al. 2018
MG001220.1	Philippines	*Halcyon gularis*	-	Yes	-	Andersen et al. 2018
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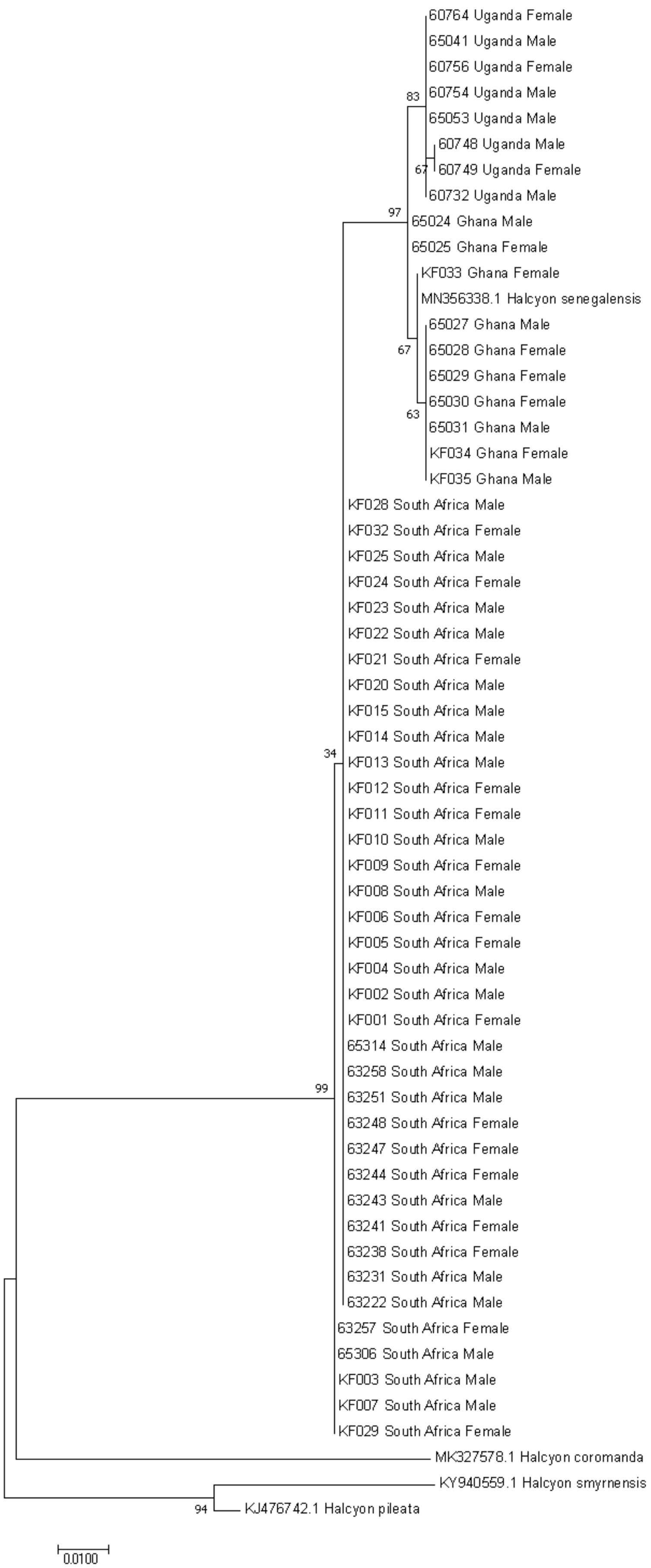
(A)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KY940559.1 Halcyon smyrnensis
KJ476742.1 Halcyon pileata
83
67
97
67
63
34
99
94
0.0100

(B)


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KY940559.1 Halcyon smyrnensis
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0.020

(C)


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KT356219.1 Halcyon coromanda
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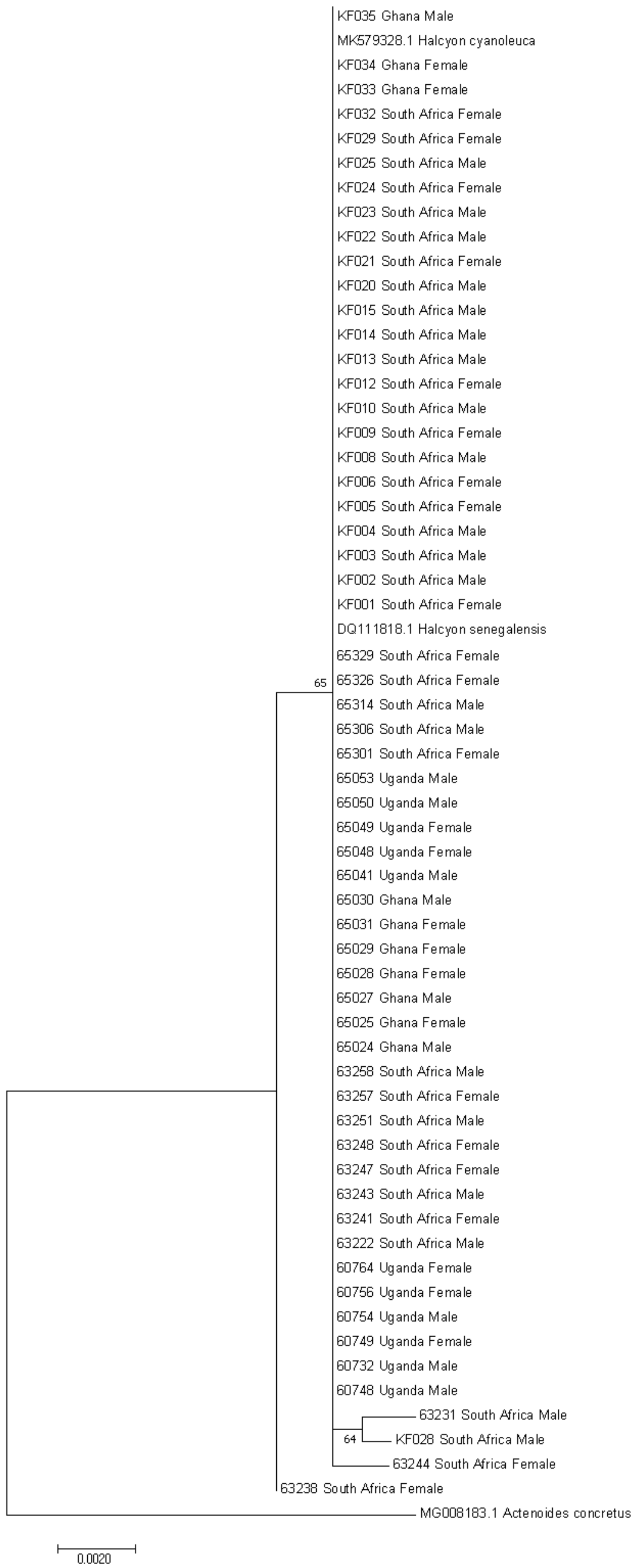
(D)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DQ111818.1 Halcyon senegalensis
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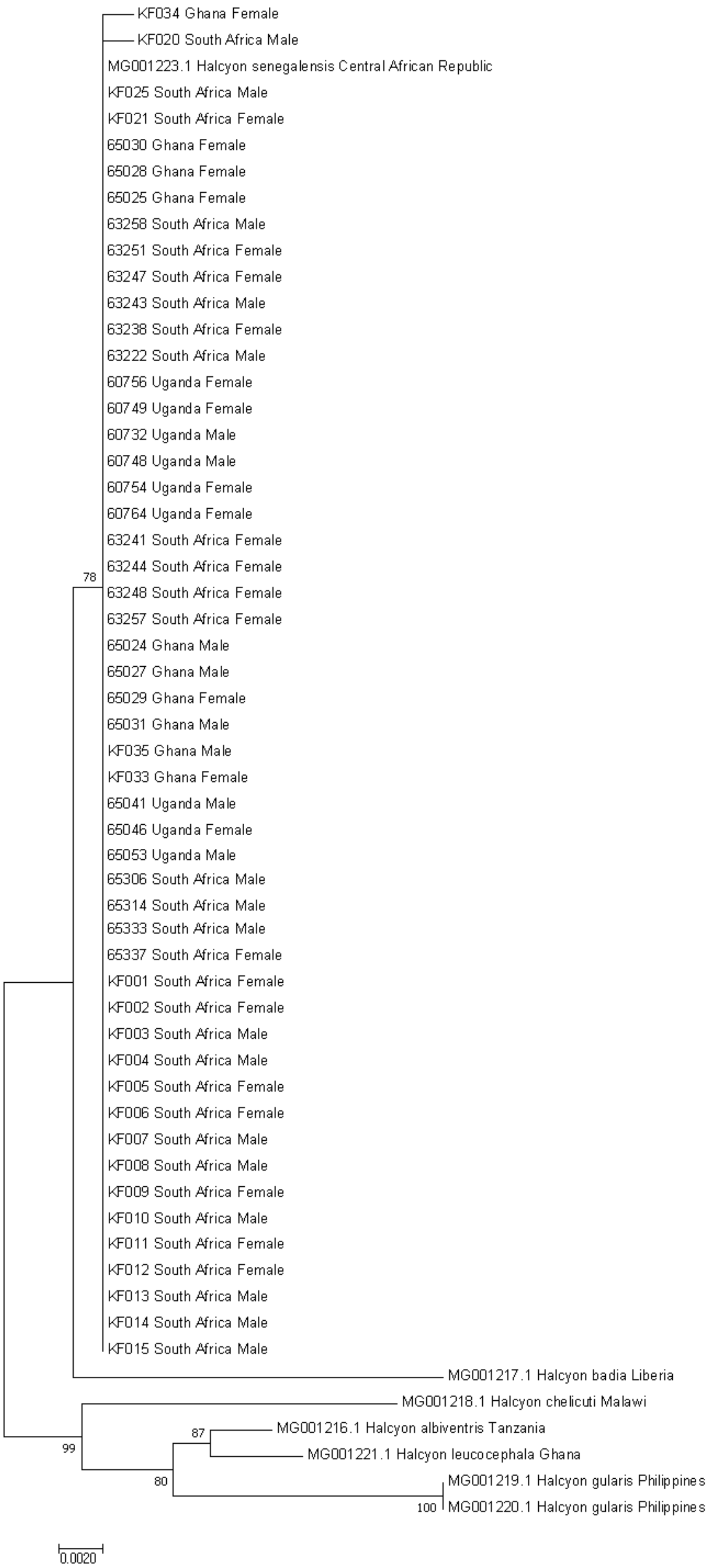
(E)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MG001223.1 Halcyon senegalensis Central African Republic
KF025 South Africa Male
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65028 Ghana Female
65025 Ghana Female
63258 South Africa Male
63251 South Africa Female
63247 South Africa Female
63243 South Africa Male
63238 South Africa Female
63222 South Africa Male
60756 Uganda Female
60749 Uganda Female
60732 Uganda Male
60748 Uganda Male
60754 Uganda Female
60764 Uganda Female
63241 South Africa Female
63244 South Africa Female
63248 South Africa Female
63257 South Africa Female
65024 Ghana Male
65027 Ghana Male
65029 Ghana Female
65031 Ghana Male
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KF033 Ghana Female
65041 Uganda Male
65046 Uganda Female
65053 Uganda Male
65306 South Africa Male
65314 South Africa Male
65333 South Africa Male
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KF011 South Africa Female
KF012 South Africa Female
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KF015 South Africa Male
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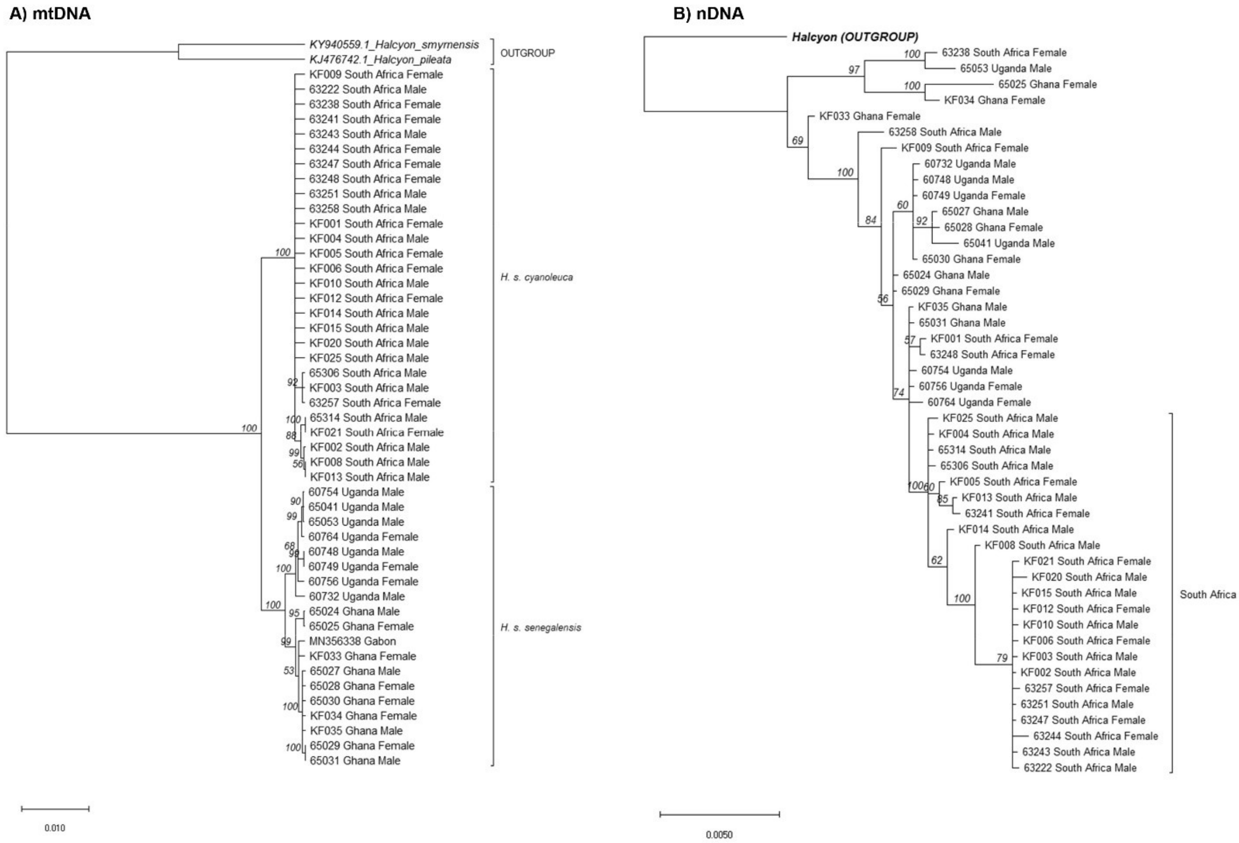
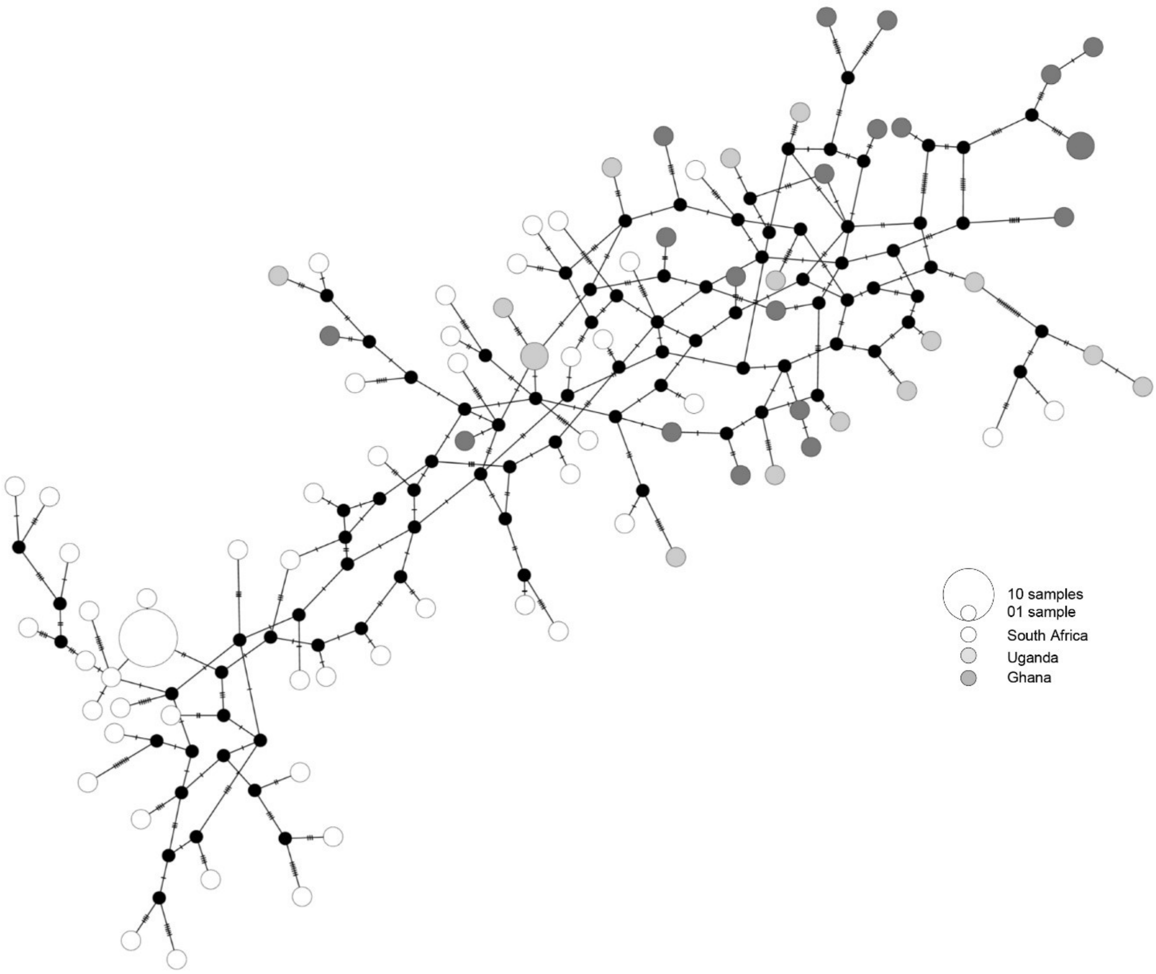
MG001217.1 Halcyon badia Liberia
MG001218.1 Halcyon chelicuti Malawi
87
MG001216.1 Halcyon albiventris Tanzania
MG001221.1 Halcyon leucocephala Ghana
99
80
MG001219.1 Halcyon gularis Philippines
100
MG001220.1 Halcyon gularis Philippines
0.0020

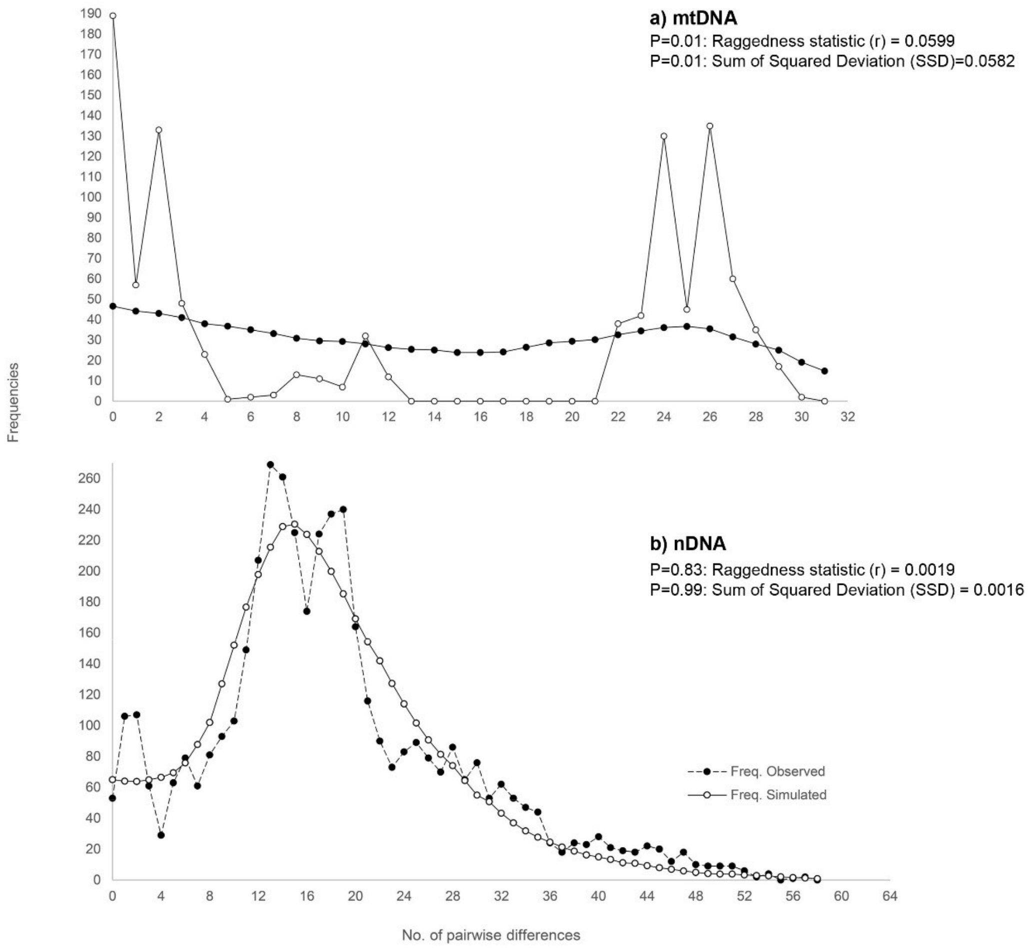
Supplementary Figure 1: Maximum likelihood tree of (A) cytochrome oxidase 1 (COI) and (B) cytochrome *b* (CYTB) based on the Hasegawa-Kishino-Yano (HKY +G) model, (C) large subunit ribosomal RNA (16S) and (D) recombination activating gene 1 (RAG1) based on the Kimura 2-parameter (K2) model and (E) nuclear b-fibrinogen gene, intron 5 (FIB5) based on the Jukes–Cantor (JC) one-parameter model. All trees were constructed in MEGA7 and numbers below branches indicate bootstrap values.



Supplementary Figure 2: Bayesian inference (BI) analysis of a (A) three-locus mitochondrial (COI, CYTB and 16S) dataset and a (B) two-locus (RAG1 and FIB5) dataset. Bayesian posterior probabilities are indicated above the branches.



Supplementary Figure 3: Haplotype network of concatenated nuclear DNA gene regions (RAG1 and FIB5). Different haplogroups are shown in different shades of grey, where circle size corresponds to the haplotype frequency and the number of dashes indicated number of mutation steps between haplotypes.



Supplementary Figure 4: Mismatch distributions of the *H. senegalensis* based on concatenated mitochondrial DNA (a) and nuclear DNA (b) regions under a model of sudden population expansion as estimated in Arlequin.