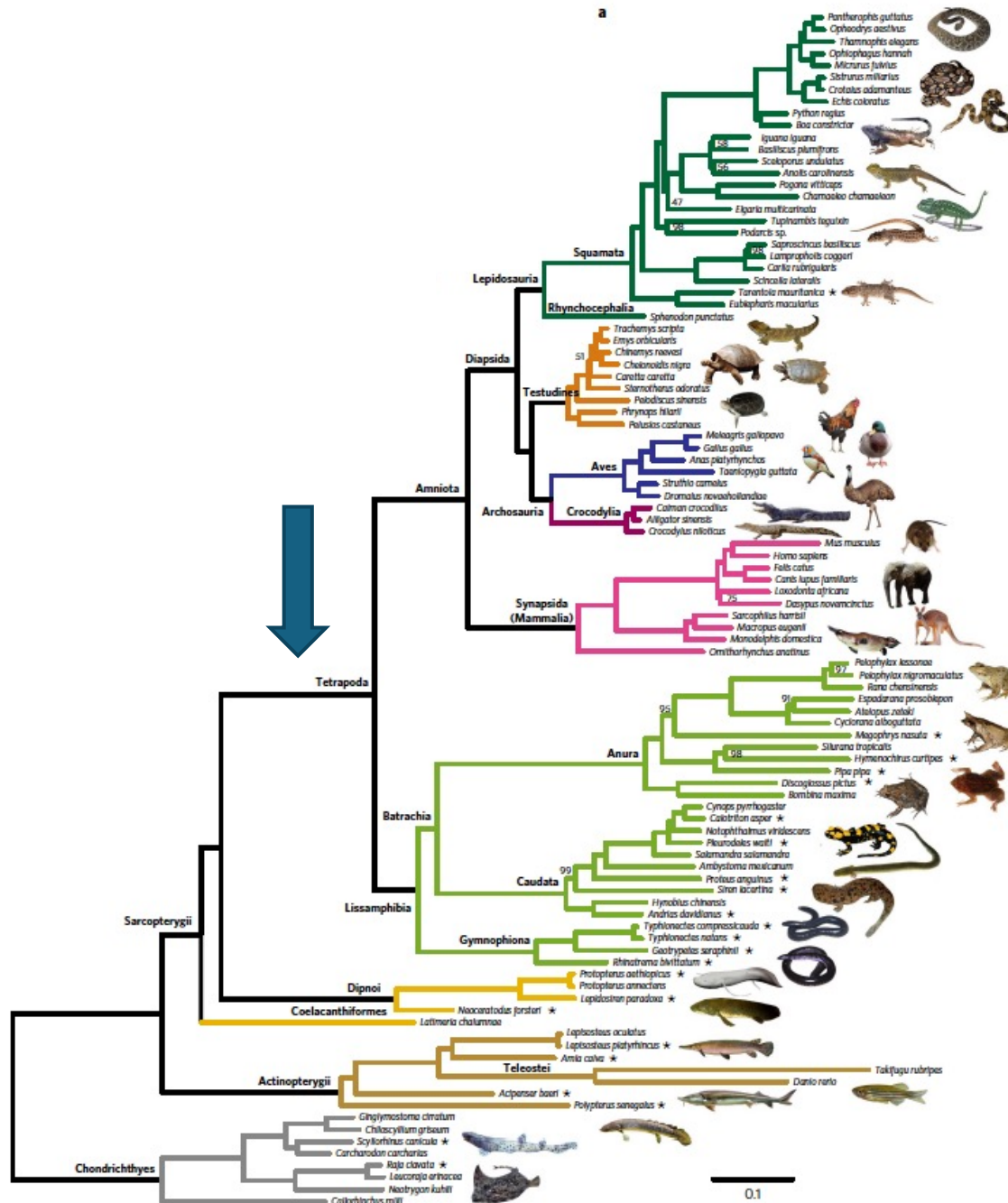**Our case study: a jawed vertebrate phylogeny**

a

lizards & snakes

turtles

birds
crocodiles

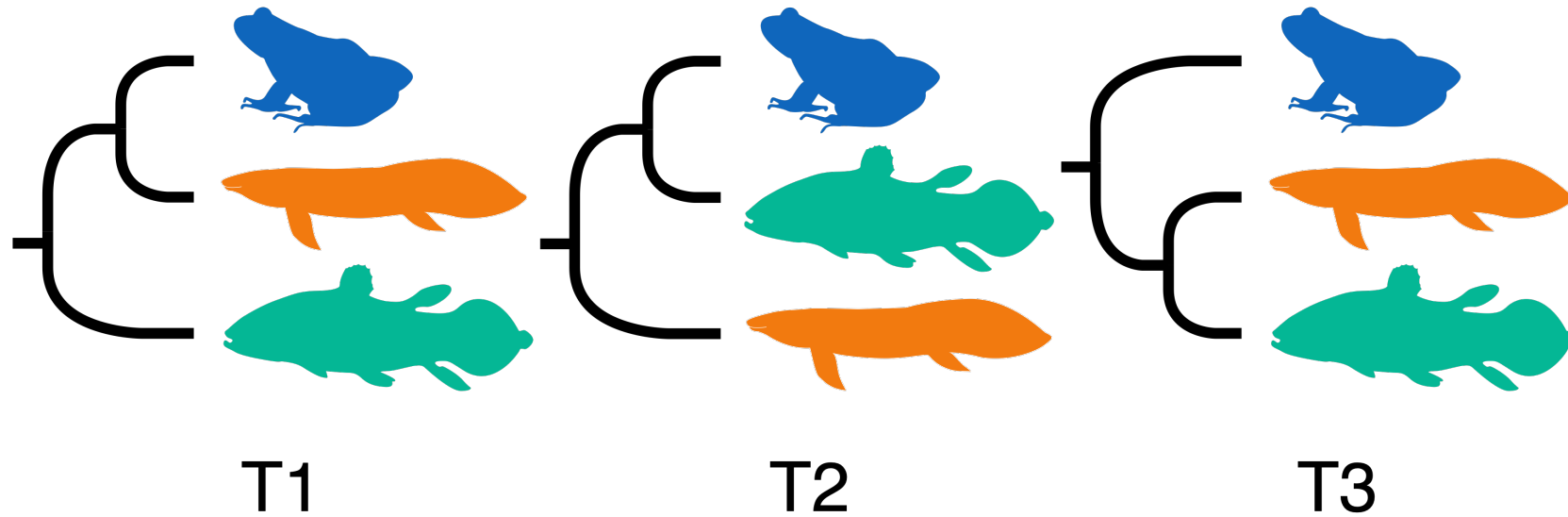mammals

amphibians

lobe-finned fish

ray-finned fish

cartilaginous fish
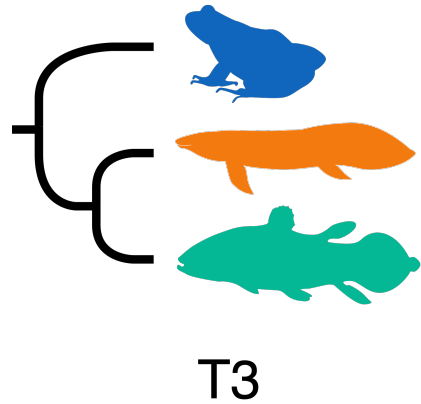
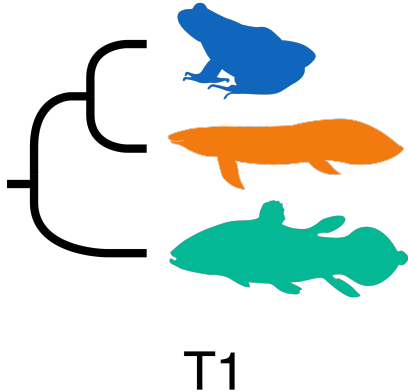Irisarri et al. 2017 Nat Ecol Evol

Lungfishes: closest living relatives of tetrapods

T1

T2

T3

Morphology
Limited data

Systematic error:
Among-lineage rate variation (LBA)
Compositional heterogeneity

Irisarri & Meyer 2016 Syst Biol
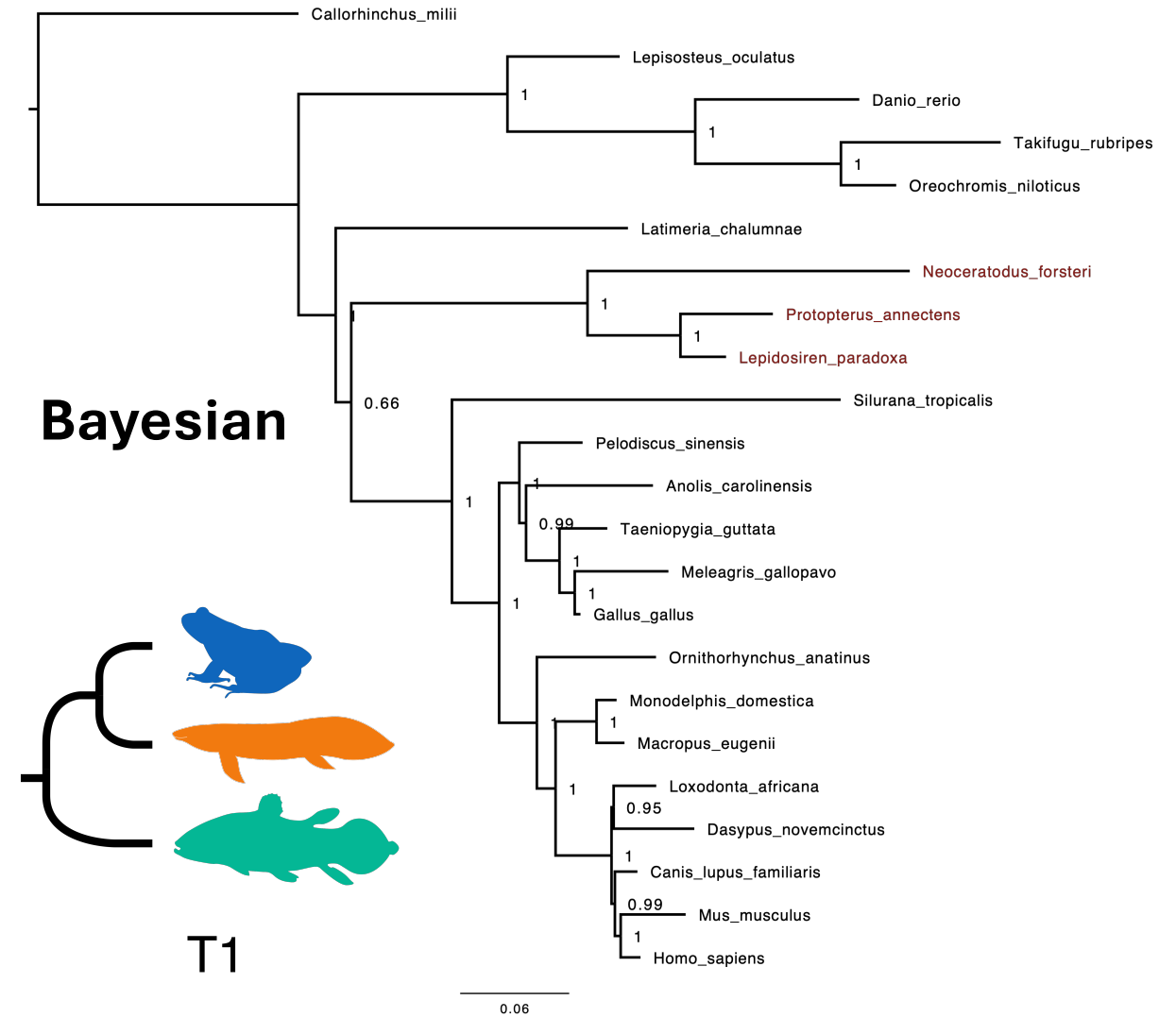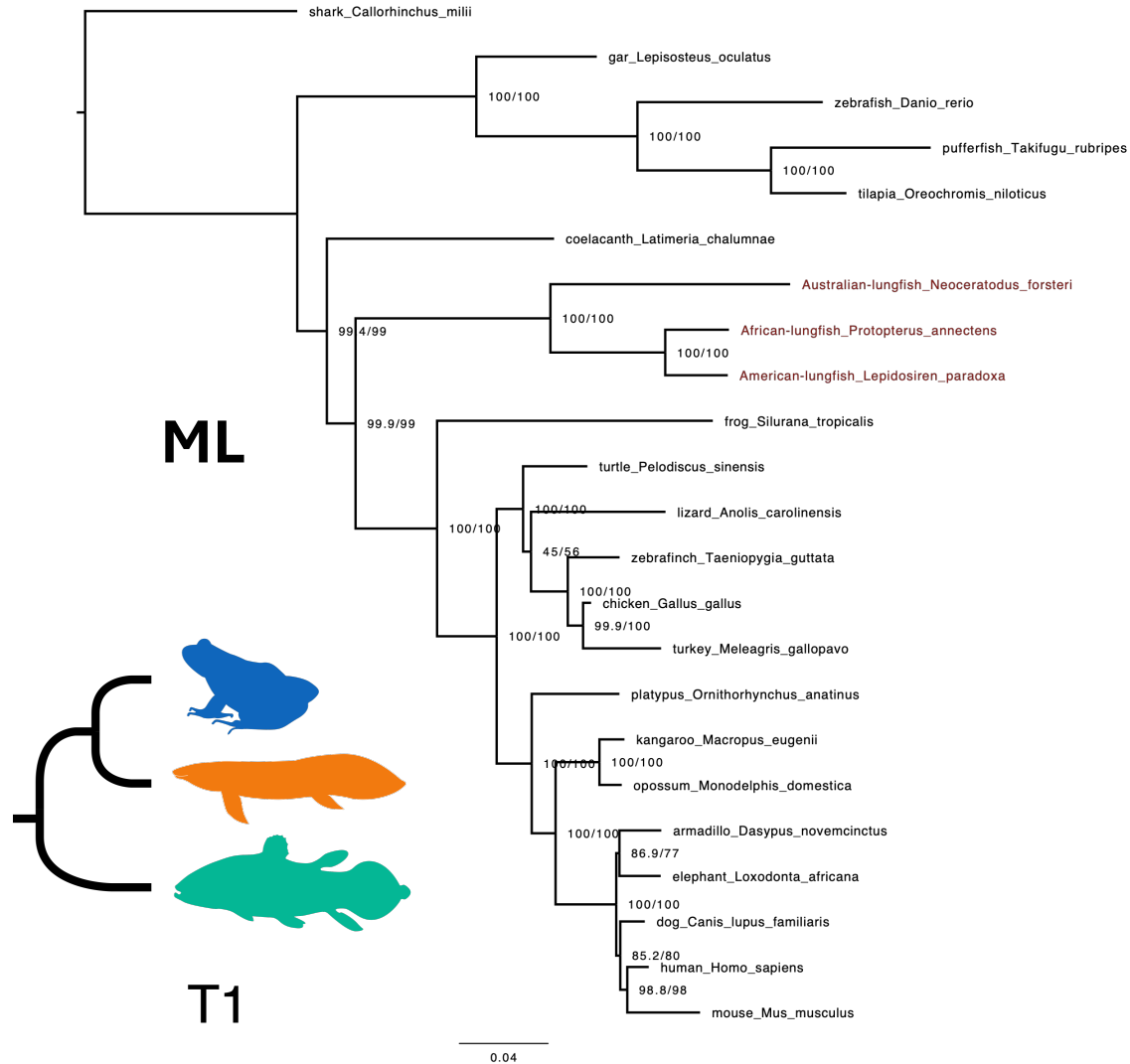
Systematic error: precision vs. accuracy

Site-homogeneous model (LG)
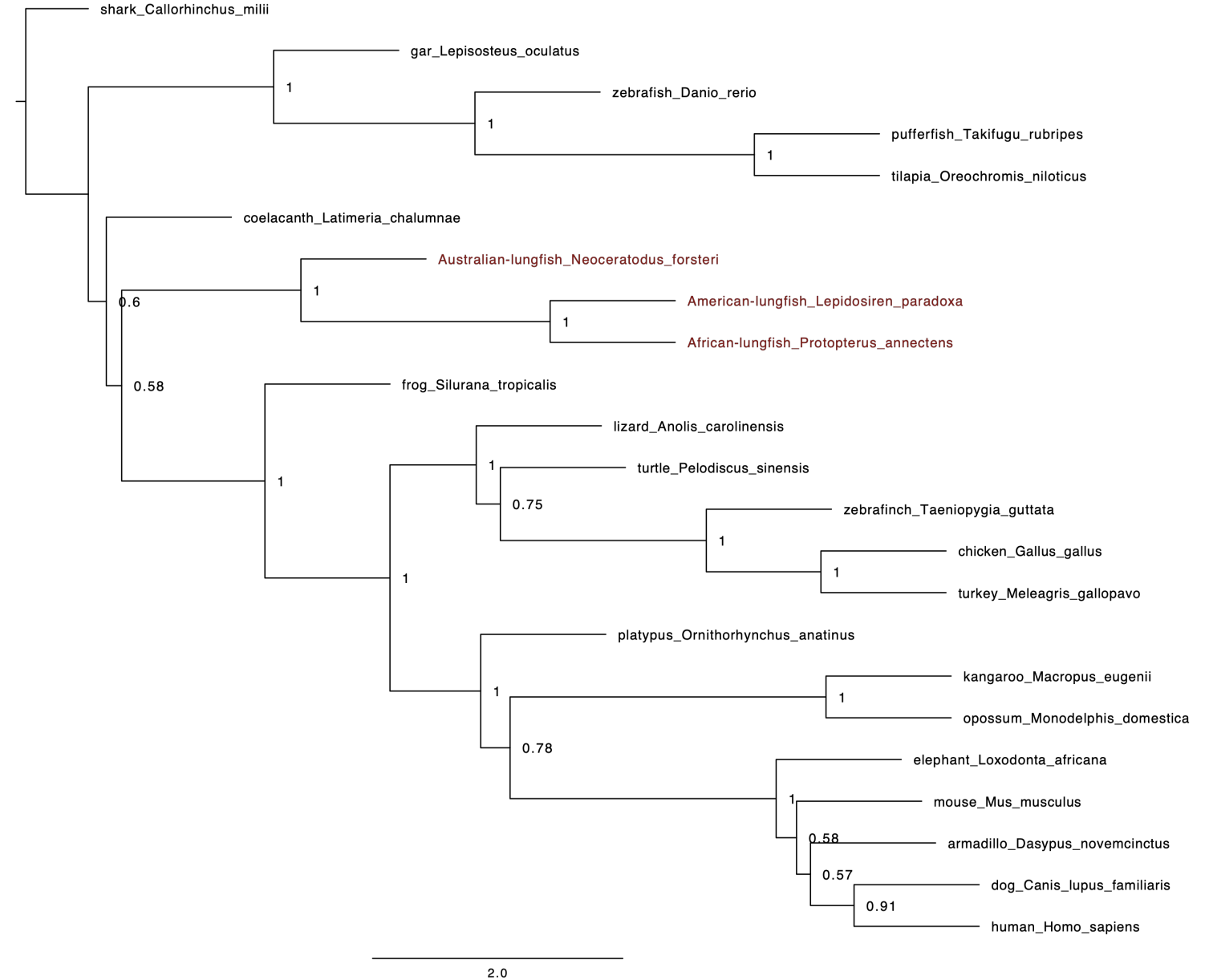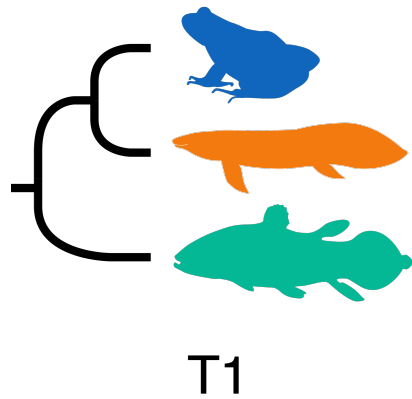Removal of fast-evolving positions

Complex mixture models (CAT-GTR)
Remove fast-evolving lineage (actinopterygians)
Break-up long branch (add slow-evolving gar)
Reduce compositional heterogeneity (SymTest)

Our results

Our results

shark_Callorhinchus_milii

gar_Lepisosteus_oculatus

1

zebrafish_Danio_rerio

1

pufferfish_Takifugu_rubripes

1

tilapia_Oreochromis_niloticus

coelacanth_Latimeria_chalumnae

0.6

Australian-lungfish_Neoceratodus_forsteri

1

American-lungfish_Lepidosiren_paradoxa

1

African-lungfish_Protopterus_annectens

0.58

frog_Silurana_tropicalis

lizard_Anolis_carolinensis

1

turtle_Pelodiscus_sinensis

0.75

zebrafinch_Taeniopygia_guttata

1

chicken_Gallus_gallus

1

turkey_Meleagris_gallopavo

1

platypus_Ornithorhynchus_anatinus

1

kangaroo_Macropus_eugenii

1

opossum_Monodelphis_domestica

0.78

elephant_Loxodonta_africana

1

mouse_Mus_musculus

0.58

armadillo_Dasypus_novemcinctus

0.57

dog_Canis_lupus_familiaris

0.91

human_Homo_sapiens

2.0

Coalescence method

T1

a)

BPP

JKK

0.66
65

0.97
98

0.91
94

b)

BP%   SHS

JKK   ML%

59 34
48

99

83

Mus
Homo
Canis
Dasypus
Loxodonta
Monodelphis
Macropus
Ornithorhynchus
Meleagris
Gallus
Taeniopygia
Pelodiscus
Anolis
Silurana
Protopterus
Lepidosiren
Neoceratodus
Latimeria
Takifugu
Oreochromis
Danio
Lepisosteus
Callorhinchus

0.05

0.05