

Species	Bioproject	data_type	#individuals	publication	Reference genome
<i>Gorilla gorilla</i>	PRJNA189439	Genome	20	Prado-Martinez et al. 2013	Ensembl (release 89)
<i>Homo sapiens</i>	PRJEB8350	Exome	19	Teixeira et al. 2015	Ensembl (release 89)
<i>Pan troglodytes</i>	PRJEB8350	Exome	20	Teixeira et al. 2015	Ensembl (release 89)
<i>Papio anubis</i>	PRJNA54005	Genome	5	unpublished baboon genome project	Ensembl (release 89)
<i>Pongo abelii</i>	PRJNA189439 and PRJEB1675	Genome	10	Prado-Martinez et al. 2013	Ensembl (release 89)
<i>Macaca mulatta</i>	PRJNA251548	Exome	20	Xue et al. 2016	Ensembl (release 89)
<i>Meleagris gallopavo</i>	PRJNA271731	RNA-seq	10	Wright et al. 2015	NA
<i>Phasianus colchicus</i>	PRJNA271731	RNA-seq	11	Wright et al. 2015	NA
<i>Pavo cristatus</i>	PRJNA271731	RNA-seq	10	Wright et al. 2015	NA
<i>Numida meleagris</i>	PRJNA271731	RNA-seq	7	Wright et al. 2015	NA
<i>Anas platyrhynchos</i>	PRJNA271731	RNA-seq	10	Wright et al. 2015	NA
<i>Anser cygnoides</i>	PRJNA271731	RNA-seq	10	Wright et al. 2015	NA
<i>Ficedula albicollis</i>	PRJEB2984	Genome	20	Ellegren et al. 2012	NCBI FicAlb1.5
<i>Geospiza difficilis</i>	PRJNA263122	Genome	8	Lamichhaney et al. 2015	NCBI Geofor1.0
<i>Parus major</i>	PRJNA381923	Genome	10	Corcoran et al. 2017	//ftp.ncbi.nlm.nih.gov/genomes/all/GCF/001/522/545/GCF_001522545.2_Parus_major1.1/GCF_001522545.2_Parus_major1.1_genomic.gff.gz
<i>Corvus sp.</i>	PRJEB9057	Genome	10	Vijay et al. 2017	//ftp.ncbi.nlm.nih.gov/genomes/all/GCF/000/738/735/GCF_000738735.2_ASM73873v2/GCF_000738735.2_ASM73873v2_genomic.gff.gz
<i>Taniopygia guttata</i>	PRJEB10586	Genome	20	Singhal et al. 2016	//ftp.ncbi.nlm.nih.gov/genomes/all/GCF/000/151/805/GCF_000151805.1_Taniopygia_guttata-3.2.4/GCF_000151805.1_Taniopygia_guttata-3.2.4_genomic.gff.gz
<i>Maniola jurtina</i>	PRJNA530965	target capture	20	newly generated	NA
<i>Melanargia galathea</i>	PRJNA530965	target capture	10	newly generated	NA
<i>Aphantopus hyperantus</i>	PRJNA530965	target capture	7	newly generated	NA
<i>Pyronia tithonus</i>	PRJNA530965	target capture	7	newly generated	NA
<i>Pyronia bathseba</i>	PRJNA530965	target capture	8	newly generated	NA

<i>Formica sanguinea</i>	PRJNA530965	target capture	10	newly generated	NA
<i>Formica cunicularia</i>	PRJNA530965	target capture	6	newly generated	NA
<i>Formica pratensis</i>	PRJNA530965	target capture	8	newly generated	NA
<i>Formica fusca</i>	PRJNA530965	target capture	8	newly generated	NA
<i>Allolobophora chlorotica L1</i>	PRJNA530965	target capture	19	newly generated	NA
<i>Allolobophora chlorotica L2</i>	PRJNA530965	target capture	8	newly generated	NA
<i>Allolobophora chlorotica L4</i>	PRJNA530965	target capture	9	newly generated	NA
<i>Aporrectodea icterica</i>	PRJNA530965	target capture	10	newly generated	NA
<i>Lumbricus terrestris</i>	PRJNA530965	target capture	9	newly generated	NA
<i>Lineus lacteus</i>	PRJNA530965	target capture	9	newly generated	NA
<i>Lineus sanguineus</i>	PRJNA530965	target capture	9	newly generated	NA
<i>Lineus longissimus</i>	PRJNA530965	target capture	6	newly generated	NA
<i>Lineus ruber</i>	PRJNA530965	target capture	8	newly generated	NA
<i>Mytilus galloprovincialis</i>	PRJNA530965	target capture	9	newly generated	NA
<i>Mytilus californianus</i>	PRJNA530965	target capture	16	newly generated	NA
<i>Mytilus edulis</i>	PRJNA530965	target capture	10	newly generated	NA
<i>Mytilus trossulus</i>	PRJNA530965	target capture	10	newly generated	NA
<i>Drosophila melanogaster</i>	SRP006733	Genome	10	Pool et al. 2012	ftp://ftp.ncbi.nlm.nih.gov/genomes/all/GCF/000/001/215/GCF_000001215.4_Release_6_plus_ISO1_MT/GCF_000001215.4_Release_6_plus_ISO1_MT_genomic.fna.gz
<i>Drosophila sechellia</i>	PRJNA395473	Genome	8	Schrider et al. 2018	ftp://ftp.ncbi.nlm.nih.gov/genomes/all/GCF/000/005/215/GCF_000005215.3_dsec_caf1/GCF_000005215.3_dsec_caf1_genomic.fna.gz
<i>Drosophila simulans</i>	PRJNA215932	Genome	10	Rogers et al. 2014	ftp://ftp.ncbi.nlm.nih.gov/genomes/all/GCF/000/754/195/GCF_000754195.2_ASM75419v2/GCF_000754195.2_ASM75419v2_genomic.fna.gz
<i>Drosophila santomea</i>	PRJNA395473	Genome	17	Turissini & Matute 2017	ftp://ftp.ncbi.nlm.nih.gov/genomes/all/GCF/000/005/975/GCF_000005975.2_dyak_caf1/GCF_000005975.2_dyak_caf1_genomic.fna.gz
<i>Drosophila yakuba</i>	PRJNA395473	Genome	20	Turissini & Matute 2017	ftp://ftp.ncbi.nlm.nih.gov/genomes/all/GCF/000/005/975/GCF_000005975.2_dyak_caf1/GCF_000005975.2_dyak_caf1_genomic.fna.gz
<i>Drosophila teissieri</i>	PRJNA395473	Genome	11	Turissini & Matute 2017	ftp://ftp.ncbi.nlm.nih.gov/genomes/all/GCF/000/005/975/GCF_000005975.2_dyak_caf1/GCF_000005975.2_dyak_caf1_genomic.fna.gz

<i>Mus musculus castaneus</i>	PRJEB2176	Genome	10	Harr et al. 2016	ftp://ftp.ncbi.nlm.nih.gov/genomes/all/GCF/000/001/635/GCF_000001635.26_GRCm38.p6/GCF_000001635.26_GRCm38.p6_genomic.fna.gz
<i>Mus spretus</i>	PRJEB11742	Genome	8	Harr et al. 2016	ftp://ftp.ncbi.nlm.nih.gov/genomes/all/GCA/001/624/865/GCA_001624865.1_SPRET_Eij_v1/GCA_001624865.1_SPRET_Eij_v1_genomic.fna.gz
<i>Rattus norvegicus</i>	PRJEB2922	Genome	12	Deinum et al. 2015	ftp://ftp.ncbi.nlm.nih.gov/genomes/all/GCF/000/001/895/GCF_000001895.5_Rnor_6.0/GCF_000001895.5_Rnor_6.0_genomic.fna.gz
<i>Microtus ochrogaster</i>	PRJNA428754	RNA-seq	18	NA	NA
<i>Microtus arvalis</i>	PRJNA249058	RNA-seq	7	Romiguier et al. 2014	NA

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Table S1 : Details of the species used in this study and numbers of individuals for each species.

Taxonomic group	minimum orthogroup number	maximum orthogroup number
ants	1249	1261
butterflies	1561	1671
earth worms	796	1460
Ribbon worms	1049	1413
mussels	1525	1525
primates	8604	8604
passerines	6755	6755
fowls	4439	4439
rodents	3994	3994
flies	7900	7900

Table S2: Number of orthogroups for each taxonomic group.

The differences in terms of number of orthogroups comes from the fact that we not only kept orthogroups with all species but also orthogroups with all species but one to estimate dN/dS value for each terminal branches in order to maximize the number of substitutions for data sets generated by exon capture.

species	Number of individuals	Chosen sample size	# non-synonymous SNPs	# synonymous SNPs	# SNPs total	#GC-cons, Non-synonymous SNPs	#GC-cons, Synonymous SNPs	#GC-cons, SNPs total
<i>F. fusca</i>	8	10	4278	6578	10856	270	166	436
<i>F. sanguinea</i>	10	16	3242	5343	8585	363	224	587
<i>F. cunicularia</i>	6	8	4035	6355	10390	212	121	333
<i>F. pratensis</i>	8	12	1773	2235	4008	191	87	278
<i>M. galathea</i>	10	10	1190	3309	4499	621	346	966
<i>M. jurtina</i>	20	32	7310	15926	23235	1863	2036	3898
<i>A. hyperanthus</i>	7	8	1441	2385	3826	734	350	1084
<i>P. tithonus</i>	7	10	1534	2372	3906	369	278	647
<i>P. bathseba</i>	8	10	1611	2676	4287	395	315	710
<i>M. californianus</i>	16	24	6370	13436	19806	1467	2209	3675
<i>M. trossulus</i>	10	14	6329	18994	25323	1665	3382	5047
<i>M. galloprovincialis</i>	9	12	3298	9089	12387	839	1665	2504
<i>M. edulis</i>	10	12	5497	15987	21485	1326	2590	3915
<i>A. chlorotica L1</i>	19	26	1751	3094	4845	472	442	914
<i>A. chlorotica L2</i>	8	8	350	554	904	69	56	126
<i>A. chlorotica L4</i>	9	12	3562	7895	11457	701	808	1508
<i>A. icterica</i>	10	12	1657	3778	5435	360	387	747
<i>L. terrestris</i>	9	8	238	940	1178	38	77	115
<i>L. lacteus</i>	9	12	5896	20421	26317	1292	2495	3788
<i>L. longissimus</i>	6	8	55	99	154	11	7	18
<i>L. sanguineus</i>	9	10	954	3248	4202	192	397	589
<i>L. ruber</i>	8	12	1028	1691	2718	196	168	364
<i>H. sapiens</i>	19	28	2281	2812	5093	264	123	387
<i>P. troglodytes</i>	20	30	4744	6558	11302	559	266	825
<i>G. gorilla</i>	20	30	3649	4842	8491	370	180	550
<i>P. anubis</i>	5	8	2038	4006	6044	242	164	407
<i>P. abelii</i>	10	16	5687	9300	14987	594	360	954
<i>M. mulatta</i>	19	28	5257	9976	15232	608	560	1169
<i>A. platyrhynchos</i>	10	16	3796	13089	16884	206	438	645
<i>A. cygnoides</i>	10	14	1296	4824	6119	103	127	230
<i>M. gallopavo</i>	10	10	1005	3791	4795	61	52	113
<i>N. meleagris</i>	10	16	1319	6241	7560	90	135	224
<i>P. cristatus</i>	10	14	602	2214	2816	48	51	99
<i>P. colchicus</i>	11	14	3051	9703	12754	172	172	343
<i>P. major</i>	10	16	6906	14414	21320	2702	2292	4994
<i>F. albicollis</i>	20	16	16242	20681	36923	2818	2224	5042
<i>Corvus sp.</i>	10	14	817	1355	2172	115	83	197
<i>G. difficilis</i>	8	10	2090	3280	5370	374	232	606
<i>T. guttata</i>	20	16	36318	102249	138567	6588	7775	14363
<i>R. norvegicus</i>	12	18	5023	10224	15246	645	574	1220
<i>M. arvalis</i>	7	10	1783	6351	8134	232	377	609
<i>M. ochrogaster</i>	18	18	2455	5340	7795	448	354	801
<i>M. spretus</i>	8	12	58687	14289	72976	812	921	1733
<i>M. m. castaneus</i>	10	12	5524	17996	23520	778	1068	1846
<i>D. melanogaster</i>	10	16	36213	138306	174518	9574	15862	25436
<i>D. teissieri</i>	11	18	48565	247605	296171	14259	35930	50188
<i>D. santomea</i>	17	28	16104	54878	70982	2374	4142	6516
<i>D. yakuba</i>	20	12	37921	164003	201924	11090	22635	33725
<i>D. simulans</i>	10	16	74864	352964	427828	21397	47094	68490
<i>D. sechellia</i>	8	12	379	591	970	92	61	153

Table S3: SNPs counts for each species.

taxonomic group	tree topologies references
Catarrhine primates	Perelman P, Johnson WE, Roos C, Seuánez HN, Horvath JE, Moreira MA, Kessing B, Pontius J, Roelke M, Rumpler Y, Schneider MP. 2011. A molecular phylogeny of living primates. <i>PLoS genetics</i> . 7(3):e1001342.
Galloanserae	Wright AE, Harrison PW, Zimmer F, Montgomery SH, Pointer MA, Mank JE. 2015. Variation in promiscuity and sexual selection drives avian rate of Faster-Z evolution. <i>Molecular ecology</i> . 24(6):1218-35.
Passeriformes	Barker FK, Barrowclough GF, Groth JG. 2002. A phylogenetic hypothesis for passerine birds: taxonomic and biogeographic implications of an analysis of nuclear DNA sequence data. <i>Proceedings of the Royal Society B: Biological Sciences</i> 269:295–308.
Muroidea	Steppan SJ, Adkins RM, Anderson J, Thorne J. 2004. Phylogeny and Divergence-Date Estimates of Rapid Radiations in Muroid Rodents Based on Multiple Nuclear Genes. <i>Systematic Biology</i> 53:533–553.
Mussels	Distel DL. 2000. Phylogenetic Relationships among Mytilidae (Bivalvia): 18S rRNA Data Suggest Convergence in Mytilid Body Plans. <i>Molecular Phylogenetics and Evolution</i> 15:25–33.
Satyrinae butterflies	Peña C, Wahlberg N, Weingartner E, Kodandaramaiah U, Nylin S, Freitas AV, Brower AV. 2006. Higher level phylogeny of Satyrinae butterflies (Lepidoptera: Nymphalidae) based on DNA sequence data. <i>Molecular phylogenetics and evolution</i> . 40(1):29-49.
Formica ants	J. Romiguier, J. Rolland, C. Morandin, L. Keller. 2018. Phylogenomics of palearctic Formica species suggests a single origin of temporary parasitism and gives insights to the evolutionary pathway toward slave-making behaviour. <i>BMC evolutionary biology</i> 18(1):40.
Earth worms	R. A. King, A. L. Tibble, W. O. C. Symondson. 2008. Opening a can of worms: unprecedented sympatric cryptic diversity within British lumbricid earthworms. <i>Molecular Ecology</i> 17, 4684-4698.
Nemertea	Thollesson, Mikael, and Jon L. Norenburg. 2003. Ribbon worm relationships: a phylogeny of the phylum Nemertea. <i>Proceedings of the Royal Society of London B: Biological Sciences</i> 27(1513): 407-415.
Drosophila	Obbard DJ, Maclennan J, Kim KW, Rambaut A, O'grady PM, Jiggins FM. 2012. Estimating divergence dates and substitution rates in the Drosophila phylogeny. <i>Molecular Biology and Evolution</i> . 29(11):3459-73.

Table S4 : Sources of the tree topologies of each taxonomic group used to estimate branch length and map substitutions.

Species	Propagule size (cm)	source
<i>Formica fusca</i>	14	Forel 1890
<i>Formica sanguinea</i>	10	Forel 1909
<i>Formica cunicularia</i>	8.5	Collingwood 1979
<i>Formica pratensis</i>	10.4	Bolton 1995
<i>Melanargia galathea</i>	0.102	García-Barros 2000
<i>Maniola jurtina</i>	0.0535	García-Barros 2000
<i>Aphantopus hyperantus</i>	0.0792	García-Barros 2000
<i>Pyronia tithonus</i>	0.0628	García-Barros 2000
<i>Pyronia bathseba</i>	0.0802	García-Barros 2000
<i>Mytilus californianus</i>	0.01	Bayne et al. 1983
<i>Mytilus trossulus</i>	0.01	Bayne et al. 1983
<i>Mytilus galloprovincialis</i>	0.01	Bayne et al. 1983
<i>Mytilus edulis</i>	0.01	Bayne et al. 1983
<i>Allolobophora chlorotica L1</i>	0.0238	Eijsackers 2011
<i>Allolobophora chlorotica L2</i>	0.0238	Eijsackers 2011
<i>Allolobophora chlorotica L4</i>	0.0238	Eijsackers 2011
<i>Aporrecta icterica</i>	0.0411	Eijsackers 2011
<i>Lumbricus terrestris</i>	0.5	Cloudsley-Thompson and Sankey 1961
<i>Lineus lacteus</i>	0.02	Bierne, 1983
<i>Lineus longissimus</i>	0.02	Bierne, 1983
<i>Lineus sanguineus</i>	0.02	Bierne, 1983
<i>Lineus ruber</i>	0.5	Bierne, 1983
<i>Homo sapiens</i>	93.4	De Magalhaes and Costa 2009
<i>Pan troglodytes</i>	45.12	De Magalhaes and Costa 2009
<i>Gorilla gorilla</i>	78	De Magalhaes and Costa 2009
<i>Papio anubis</i>	55.95	De Magalhaes and Costa 2009
<i>Pongo abelii</i>	42.48	De Magalhaes and Costa 2009
<i>Macaca mulatta</i>	31.1	De Magalhaes and Costa 2009
<i>Anas platyrhynchos</i>	55	Del Hoyo et al. 1992
<i>Anser cygnoides</i>	87	Del Hoyo et al. 1992
<i>Meleagris gallopavo</i>	90	Del Hoyo et al. 1992
<i>Numida meleagris</i>	53	Del Hoyo et al. 1992
<i>Pavo cristatus</i>	95	Del Hoyo et al. 1992
<i>Phasianus colchicus</i>	57.5	Del Hoyo et al. 1992

<i>Parus major</i>	13.5	Del Hoyo et al. 1992
<i>Ficedula albicollis</i>	13	Del Hoyo et al. 1992
<i>Corvus sp.</i>	50.5	Del Hoyo et al. 1992
<i>Geospiza difficilis</i>	11.5	Del Hoyo et al. 1992
<i>Taniopygia guttata</i>	10	Del Hoyo et al. 1992
<i>Rattus norvegicus</i>	13.717	De Magalhaes and Costa 2009
<i>Microtus arvalis</i>	7.184	De Magalhaes and Costa 2009
<i>Microtus ochrogaster</i>	10.6	De Magalhaes and Costa 2009
<i>Mus musculus musculus</i>	6.06	De Magalhaes and Costa 2009
<i>Mus spretus</i>	6.37	Inferred from De Magalhaes and Costa 2009
<i>Drosophila melanogaster</i>	0.0525	Lott et al. 2007
<i>Drosophila teissieri</i>	NA	NA
<i>Drosophila santomea</i>	NA	NA
<i>Drosophila yakuba</i>	0.0475	Lott et al. 2007
<i>Drosophila simulans</i>	0.05	Lott et al. 2007
<i>Drosophila sechellia</i>	0.06	Lott et al. 2007

Species	adult size (cm)	source
<i>Formica fusca</i>	14	Forel 1890
<i>Formica sanguinea</i>	10	Forel 1909
<i>Formica cunicularia</i>	8.5	Collingwood 1979
<i>Formica pratensis</i>	10.4	Bolton 1995
<i>Melanargia galathea</i>	2.59	García-Barros 2000
<i>Maniola jurtina</i>	2.58	García-Barros 2000
<i>Aphantopus hyperantus</i>	2.12	García-Barros 2000
<i>Pyronia tithonus</i>	1.89	García-Barros 2000
<i>Pyronia bathseba</i>	2.04	García-Barros 2000
<i>Mytilus californianus</i>	7.5	MArine Life Information Network, 2006
<i>Mytilus trossulus</i>	7.5	MArine Life Information Network, 2006
<i>Mytilus galloprovincialis</i>	7.5	MArine Life Information Network, 2006
<i>Mytilus edulis</i>	7.5	MArine Life Information Network, 2006
<i>Allolobophora chlorotica L1</i>	5.5	The Trustees of the Natural

		History Museum,2010
<i>Allolobophora chlorotica</i> L2	5.5	The Trustees of the Natural History Museum,2010
<i>Allolobophora chlorotica</i> L4	5.5	The Trustees of the Natural History Museum,2010
<i>Aporrecta icterica</i>	9.5	Sims and Gerard 1985
<i>Lumbricus terrestris</i>	25	Cloudsley-Thompson and Sankey 1961
<i>Lineus lacteus</i>	17.5	Gontcharoff 1951
<i>Lineus longissimus</i>	1000	Gontcharoff 1951
<i>Lineus sanguineus</i>	NA	NA
<i>Lineus ruber</i>	5	Gontcharoff 1951, Biene 1970
<i>Homo sapiens</i>	163	Ogden et al. 2004
<i>Pan troglodytes</i>	79.6	Jones et al. 2009
<i>Gorilla gorilla</i>	137.5	Wood 1979
<i>Papio anubis</i>	85	Fleagle 2013
<i>Pongo abelii</i>	83	Groves 1971
<i>Macaca mulatta</i>	55.5	Jones et al. 2009
<i>Anas platyrhynchos</i>	55	Del Hoyo et al. 1992
<i>Anser cygnoides</i>	87	Del Hoyo et al. 1992
<i>Meleagris gallopavo</i>	90	Del Hoyo et al. 1992
<i>Numida meleagris</i>	53	Del Hoyo et al. 1992
<i>Pavo cristatus</i>	95	Del Hoyo et al. 1992
<i>Phasianus colchicus</i>	57.5	Del Hoyo et al. 1992
<i>Parus major</i>	13.5	Del Hoyo et al. 1992
<i>Ficedula albicollis</i>	13	Del Hoyo et al. 1992
<i>Corvus sp.</i>	50.5	Del Hoyo et al. 1992
<i>Geospiza difficilis</i>	11.5	Del Hoyo et al. 1992
<i>Taniopygia guttata</i>	10	Del Hoyo et al. 1992
<i>Rattus norvegicus</i>	21.5	Burton and Burton 2002
<i>Microtus arvalis</i>	11.1	Jones et al. 2009
<i>Microtus ochrogaster</i>	15.2	Jones et al. 2009
<i>Mus musculus musculus</i>	8	Berry 1970
<i>Mus spretus</i>	8.6	Palomo et al. 2009
<i>Drosophila melanogaster</i>	0.85	Pitnick et al. 2002
<i>Drosophila teissieri</i>	NA	NA
<i>Drosophila santomea</i>	NA	NA

<i>Drosophila yakuba</i>	NA	NA
<i>Drosophila simulans</i>	1.03	NA
<i>Drosophila sechellia</i>	NA	NA

Species	body mass (g)	source
<i>Formica fusca</i>	NA	NA
<i>Formica sanguinea</i>	NA	NA
<i>Formica cunicularia</i>	NA	NA
<i>Formica pratensis</i>	0.0119	Keller & Passera, 1989
<i>Melanargia galathea</i>	NA	NA
<i>Maniola jurtina</i>	0.05	Svärd & Wiklund, 1989
<i>Aphantopus hyperantus</i>	0.0376	Svärd & Wiklund, 1989
<i>Pyronia tithonus</i>	0,04	Corbet, 2000
<i>Pyronia bathseba</i>	NA	NA
<i>Mytilus californianus</i>	37.5	MArine Life Information Network, 2006
<i>Mytilus trossulus</i>	37.5	MArine Life Information Network 2006
<i>Mytilus galloprovincialis</i>	37.5	MArine Life Information Network, 2006
<i>Mytilus edulis</i>	37.5	MArine Life Information Network, 2006
<i>Allolobophora chlorotica L1</i>	0.3	Butt 1997
<i>Allolobophora chlorotica L2</i>	0.3	Butt 1997
<i>Allolobophora chlorotica L4</i>	0.3	Butt 1997
<i>Aporrecta icterica</i>	0.95	Bouché 1972
<i>Lumbricus terrestris</i>	7.5	Quillin, 1999
<i>Lineus lacteus</i>	NA	NA
<i>Lineus longissimus</i>	NA	NA
<i>Lineus sanguineus</i>	NA	NA
<i>Lineus ruber</i>	NA	NA
<i>Homo sapiens</i>	62000	De Magalhaes and Costa 2009
<i>Pan troglodytes</i>	45000	De Magalhaes and Costa 2009
<i>Gorilla gorilla</i>	93000	De Magalhaes and Costa 2009
<i>Papio anubis</i>	14700	De Magalhaes and Costa 2009
<i>Pongo abelii</i>	45000	De Magalhaes and Costa 2009
<i>Macaca mulatta</i>	8240	De Magalhaes and Costa 2009

<i>Anas platyrhynchos</i>	1027	De Magalhaes and Costa 2009
<i>Anser cygnoides</i>	3150	De Magalhaes and Costa 2009
<i>Meleagris gallopavo</i>	4000	De Magalhaes and Costa 2009
<i>Numida meleagris</i>	1479	De Magalhaes and Costa 2009
<i>Pavo cristatus</i>	3375	De Magalhaes and Costa 2009
<i>Phasianus colchicus</i>	999	De Magalhaes and Costa 2009
<i>Parus major</i>	17	Del Hoyo et al. 1992
<i>Ficedula albicollis</i>	12	Del Hoyo et al. 1992
<i>Corvus sp.</i>	499	Del Hoyo et al. 1992
<i>Geospiza difficilis</i>	16.15	Del Hoyo et al. 1992
<i>Taniopygia guttata</i>	10	Del Hoyo et al. 1992
<i>Rattus norvegicus</i>	320	De Magalhaes and Costa 2009
<i>Microtus arvalis</i>	27.5	De Magalhaes and Costa 2009
<i>Microtus ochrogaster</i>	50	De Magalhaes and Costa 2009
<i>Mus musculus musculus</i>	20.5	De Magalhaes and Costa 2009
<i>Mus spretus</i>	17	Palomo et al. 2009
<i>Drosophila melanogaster</i>	0.00115	Klok et al. 2009
<i>Drosophila teissieri</i>	NA	NA
<i>Drosophila santomea</i>	NA	NA
<i>Drosophila yakuba</i>	NA	NA
<i>Drosophila simulans</i>	NA	NA
<i>Drosophila sechellia</i>	NA	NA

Species	Fecundity (number of offspring per year)	source
<i>Formica fusca</i>	NA	NA
<i>Formica sanguinea</i>	NA	NA
<i>Formica cunicularia</i>	NA	NA
<i>Formica pratensis</i>	NA	NA
<i>Melanargia galathea</i>	NA	NA
<i>Maniola jurtina</i>	NA	NA
<i>Aphantopus hyperantus</i>	140	Lafranchis et al. 2015
<i>Pyronia tithonus</i>	125	Lafranchis et al. 2015
<i>Pyronia bathseba</i>	NA	NA
<i>Mytilus californianus</i>	110000	MArine Life Information

		Network, 2006
<i>Mytilus trossulus</i>	110000	MArine Life Information Network, 2006
<i>Mytilus galloprovincialis</i>	110000	MArine Life Information Network, 2006
<i>Mytilus edulis</i>	110000	MArine Life Information Network, 2006
<i>Allolobophora chlorotica</i> L1	0.74	Edwards & Bohlen 1996
<i>Allolobophora chlorotica</i> L2	0.74	Edwards & Bohlen 1996
<i>Allolobophora chlorotica</i> L4	0.74	Edwards & Bohlen 1996
<i>Aporrecta icterica</i>	2.67	Booth et al. 2000
<i>Lumbricus terrestris</i>	NA	NA
<i>Lineus lacteus</i>	NA	NA
<i>Lineus longissimus</i>	NA	NA
<i>Lineus sanguineus</i>	NA	NA
<i>Lineus ruber</i>	NA	NA
<i>Homo sapiens</i>	0.0008219178	De Magalhaes and Costa 2009
<i>Pan troglodytes</i>	0.0005479452	De Magalhaes and Costa 2009
<i>Gorilla gorilla</i>	0.0008219178	De Magalhaes and Costa 2009
<i>Papio anubis</i>	0.002191781	De Magalhaes and Costa 2009
<i>Pongo abelii</i>	0.0005479452	De Magalhaes and Costa 2009
<i>Macaca mulatta</i>	0.002739726	De Magalhaes and Costa 2009
<i>Anas platyrhynchos</i>	0.02465753	De Magalhaes and Costa 2009
<i>Anser cygnoides</i>	NA	NA
<i>Meleagris gallopavo</i>	0.03013699	De Magalhaes and Costa 2009
<i>Numida meleagris</i>	0.02465753	De Magalhaes and Costa 2009
<i>Pavo cristatus</i>	0.01369863	De Magalhaes and Costa 2009
<i>Phasianus colchicus</i>	0.03013699	De Magalhaes and Costa 2009
<i>Parus major</i>	0.0205	Tomás et al. 2012
<i>Ficedula albicollis</i>	0.0178	Gill and Donsker 2017
<i>Corvus sp.</i>	0.01068	Holyoak 1967
<i>Geospiza difficilis</i>	0.0329	Grant and Grant 1980
<i>Taniopygia guttata</i>	0.0151	Olson et al. 2014
<i>Rattus norvegicus</i>	0.1003562	De Magalhaes and Costa 2009
<i>Microtus arvalis</i>	0.0768	De Magalhaes and Costa 2009
<i>Microtus ochrogaster</i>	0.04164384	De Magalhaes and Costa 2009
<i>Mus musculus musculus</i>	0.104	De Magalhaes and Costa 2009

<i>Mus spretus</i>	NA	NA
<i>Drosophila melanogaster</i>	6.3	Hanson et al. 1929
<i>Drosophila teissieri</i>	NA	NA
<i>Drosophila santomea</i>	NA	NA
<i>Drosophila yakuba</i>	NA	NA
<i>Drosophila simulans</i>	NA	NA
<i>Drosophila sechellia</i>	NA	NA

Species	Longevity (years)	source
<i>Formica fusca</i>	20	Personnal communication
<i>Formica sanguinea</i>	20	Personnal communication
<i>Formica cunicularia</i>	20	Personnal communication
<i>Formica pratensis</i>	6	Personnal communication
<i>Melanargia galathea</i>	1	Lafranchis et al. 2015
<i>Maniola jurtina</i>	1	Lafranchis et al. 2015
<i>Aphantopus hyperantus</i>	1	Lafranchis et al. 2015
<i>Pyronia tithonus</i>	1	Lafranchis et al. 2015
<i>Pyronia bathseba</i>	NA	NA
<i>Mytilus californianus</i>	25	Bayne and Bayne 1976
<i>Mytilus trossulus</i>	25	Bayne and Bayne 1976
<i>Mytilus galloprovincialis</i>	25	Bayne and Bayne 1976
<i>Mytilus edulis</i>	25	Bayne and Bayne 1976
<i>Allolobophora chlorotica L1</i>	1.25	Edwards & Bohlen 1996
<i>Allolobophora chlorotica L2</i>	1.25	Edwards & Bohlen 1996
<i>Allolobophora chlorotica L4</i>	1.25	Edwards & Bohlen 1996
<i>Aporrecta icterica</i>	NA	NA
<i>Lumbricus terrestris</i>	NA	NA
<i>Lineus lacteus</i>	NA	NA
<i>Lineus longissimus</i>	NA	NA
<i>Lineus sanguineus</i>	NA	NA
<i>Lineus ruber</i>	NA	NA
<i>Homo sapiens</i>	123	De Magalhaes and Costa 2009
<i>Pan troglodytes</i>	59.4	De Magalhaes and Costa 2009
<i>Gorilla gorilla</i>	60.1	De Magalhaes and Costa 2009

<i>Papio anubis</i>	37.5	De Magalhaes and Costa 2009
<i>Pongo abelii</i>	59	De Magalhaes and Costa 2009
<i>Macaca mulatta</i>	40	De Magalhaes and Costa 2009
<i>Anas platyrhynchos</i>	29.1	De Magalhaes and Costa 2009
<i>Anser cygnoides</i>	31	De Magalhaes and Costa 2009
<i>Meleagris gallopavo</i>	13	De Magalhaes and Costa 2009
<i>Numida meleagris</i>	NA	NA
<i>Pavo cristatus</i>	23.2	De Magalhaes and Costa 2009
<i>Phasianus colchicus</i>	27	De Magalhaes and Costa 2009
<i>Parus major</i>	15.4	De Magalhaes and Costa 2009
<i>Ficedula albicollis</i>	9.8	De Magalhaes and Costa 2009
<i>Corvus sp.</i>	19.2	De Magalhaes and Costa 2009
<i>Geospiza difficilis</i>	9	Oschadleus et al. 2016
<i>Taniopygia guttata</i>	12	De Magalhaes and Costa 2009
<i>Rattus norvegicus</i>	3.8	De Magalhaes and Costa 2009
<i>Microtus arvalis</i>	4.8	De Magalhaes and Costa 2009
<i>Microtus ochrogaster</i>	5.3	De Magalhaes and Costa 2009
<i>Mus musculus musculus</i>	4	De Magalhaes and Costa 2009
<i>Mus spretus</i>	NA	NA
<i>Drosophila melanogaster</i>	0.16	Linford et al. 2013
<i>Drosophila teissieri</i>	NA	NA
<i>Drosophila santomea</i>	NA	NA
<i>Drosophila yakuba</i>	NA	NA
<i>Drosophila simulans</i>	NA	NA
<i>Drosophila sechellia</i>	NA	NA

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Table S5: Values and sources of the life history traits used in this study.

One of the two estimates of the adaptive rate at group level used in this study, $\omega_{a[A]}$, was obtained by calculating the across-species arithmetic mean of ω_{na} within a group, then subtracting this average from ω . Here we show that $\omega_{a[A]}$ is an unbiased estimate of the adaptive rate with fluctuating population size if the pace of fluctuations is sufficiently slow. We justify this strategy by making the hypothesis that the present variation in population sizes between closely related species represents well the possible range of population size fluctuations that one population experienced during the time period of its divergence with its sister species. Under our model, ω_{na} for an individual species is

$$(1) \quad \omega_{na} = (\widehat{D}_N^{na}/L_N)/(D_S/L_S),$$

where \widehat{D}_N^{na} is the expected number of non-synonymous substitutions:

$$(2) \quad \widehat{D}_N^{na} = 2L_N N_e t \mu \int_{-\infty}^0 \phi(s) f(N_e, s) ds$$

where L_N is the number of non-synonymous sites, t is the divergence time, $\phi(s)$ is the fixation probability of a mutation with a selection coefficient s , and $f(N_e, s)$ is the DFE, in a population of size N_e .

Then, if we have sampled n closely related species, and we call $N_{e1}, N_{e2}, N_{e3}, \dots, N_{en}$ their respective present effective population size, then, making the hypothesis that the shape of the DFE and the mutation rate μ remains constant in time, one can express the expected number of non-synonymous substitutions, \widehat{D}_N^{na} , as :

$$(3) \quad \widehat{D}_N^{na} = \frac{t}{n} \sum_i^n 2L_N N_{ei} \mu \int_{-\infty}^0 \phi(s) f(N_{ei}, s) ds$$

Equation (3) is equivalent to assuming that, as the considered species were diverging, they have randomly fluctuated between the n regimes of selection/drift we currently observe, spending the same amount of time in the n regimes. Under this assumption, the group level \widehat{D}_N^{na} is simply the arithmetic mean of \widehat{D}_N^{na} estimated across individual species. Then, using L_N, L_S and D_S of the total subtree of the considered species, we can use the arithmetic mean of ω_{na} across individual species, $\omega_{na[A]}$, as representative of the average non-adaptive selective regime during their divergence. Subtracting $\omega_{na[A]}$ from the dN/dS ratio estimated using all branches of the tree, we obtain an estimate of the adaptive substitution rate for the whole group, $\omega_{a[A]}$.

Box S1: Rationale of the estimation of the per group adaptive substitution rate “A”.

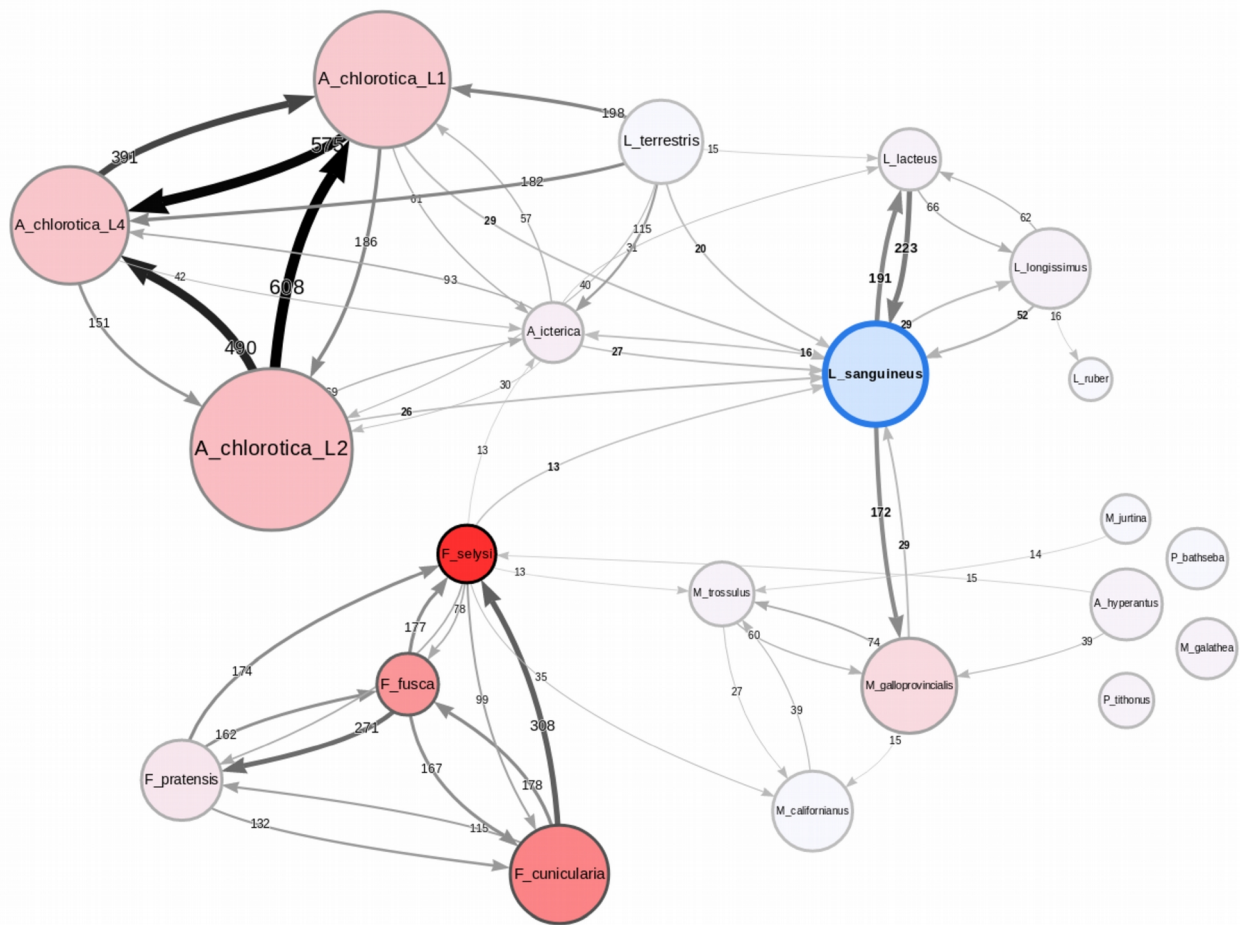


Figure S1: Cross contamination network for de novo assemblies from exon capture.

Circles represent the assemblies, and arrows and their corresponding numbers represent the number of cross contaminants. Most cross contamination events occur between closely-related species and are therefore likely false positive cases.

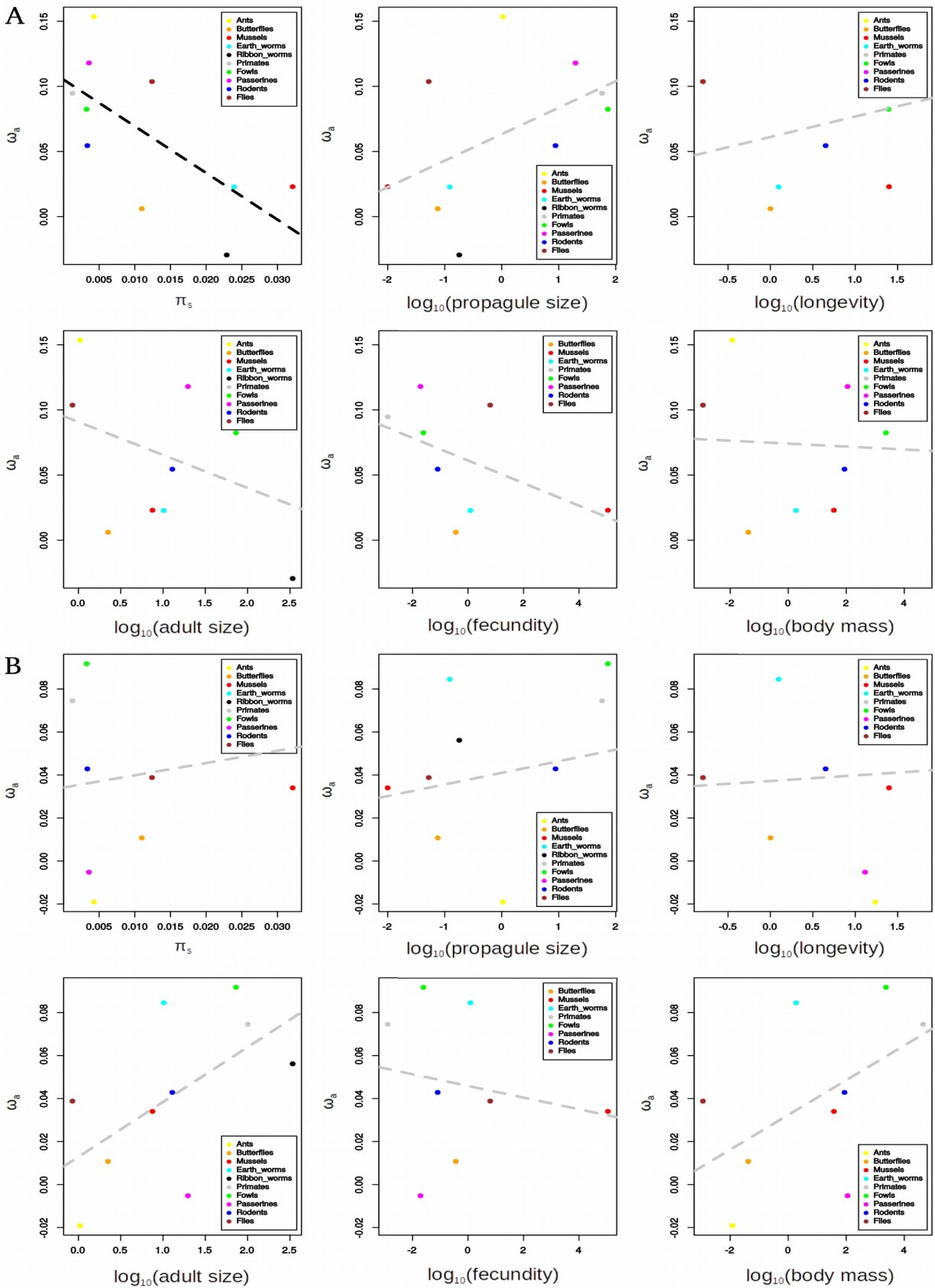


Figure S2: Relationship between $\omega_{a[P]}$ and π_s and \log_{10} transformed life history traits.

$\omega_{a[P]}$ is estimated using all mutations and substitutions (A) or using only GC-conservative mutations and substitutions (B). Group level π_s and life history traits are estimated by averaging species level estimates across closely related species. Black dotted lines represent significant regressions across taxonomic groups and grey dotted lines non-significant ones.

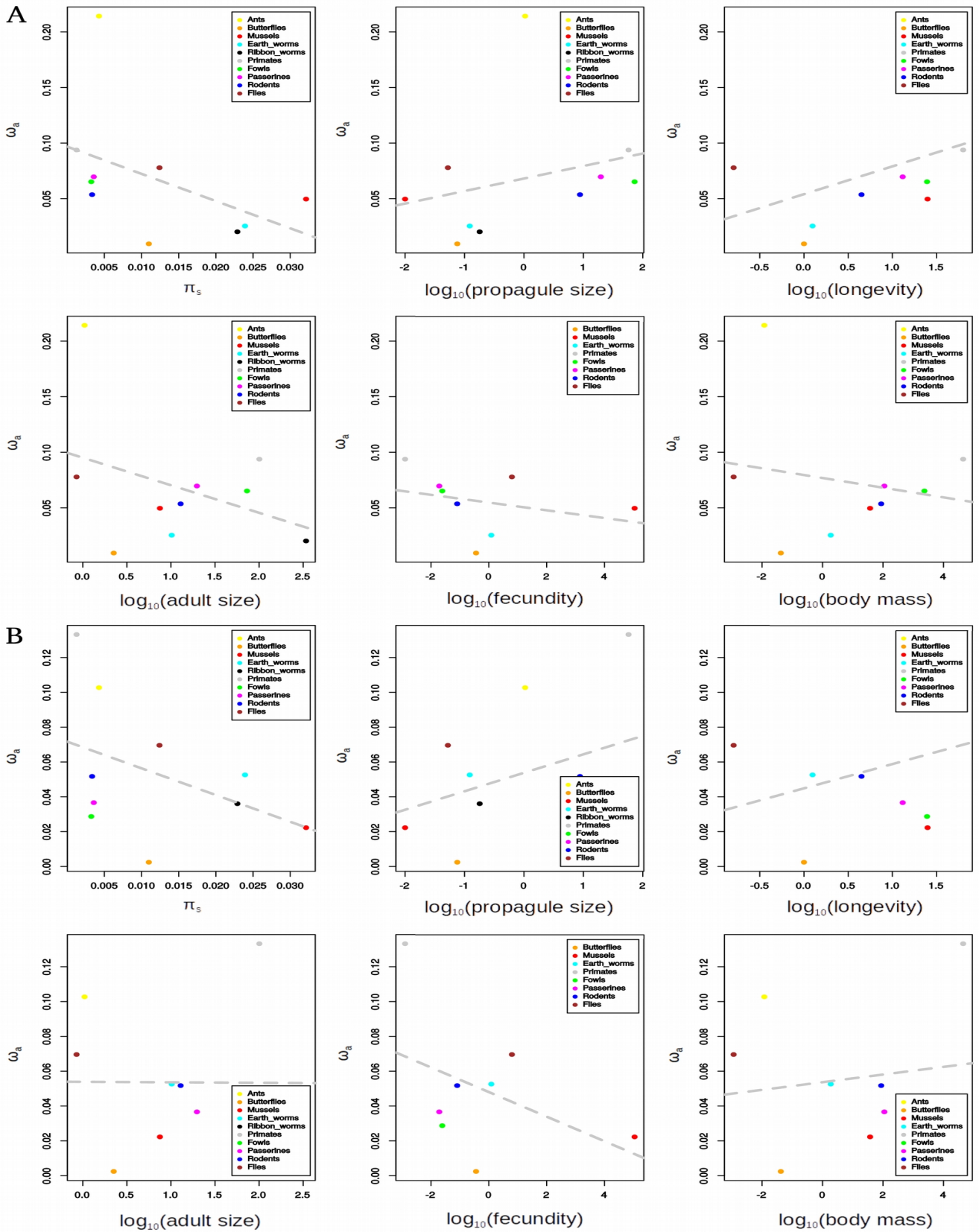


Figure S3: Relationship between $\omega_{a[A]}$ and π_s and \log_{10} transformed life history traits.

$\omega_{a[A]}$ is estimated using all mutations and substitutions (A) or using only GC-conservative mutations and substitutions (B). Group level π_s and life history traits are estimated by averaging species level estimates across closely related species. Black dotted lines represent significant regressions across taxonomic groups and grey dotted lines non-significant ones.

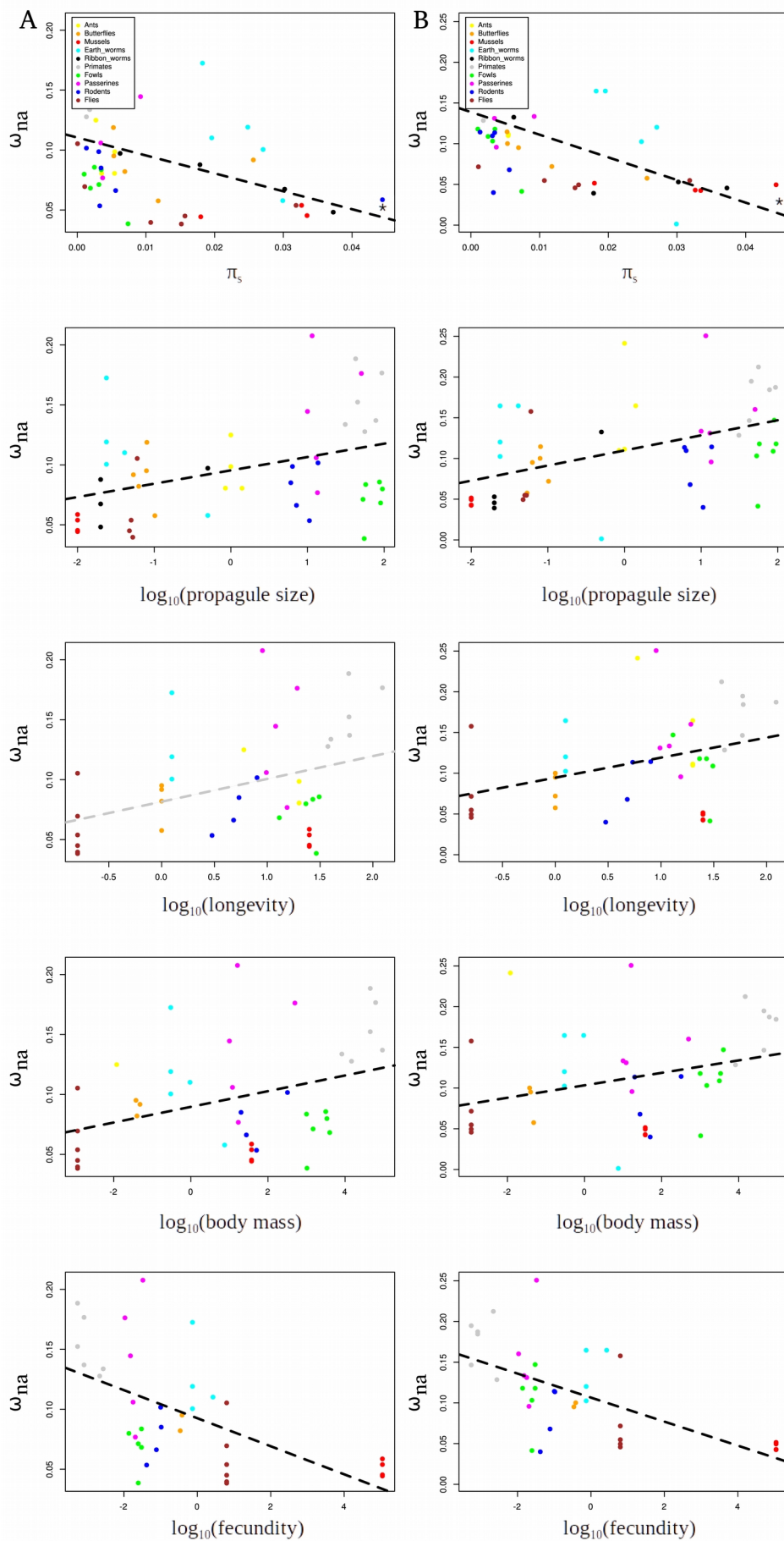


Figure S4: Relationship between species-level ω_{na} and π_s or \log_{10} transformed life history traits. ω_{na} is estimated using all mutations and substitutions (A) or using only GC-conservative mutations and substitutions (B). Black dotted lines represent significant regressions across taxonomic groups and grey dotted lines non-significant ones.

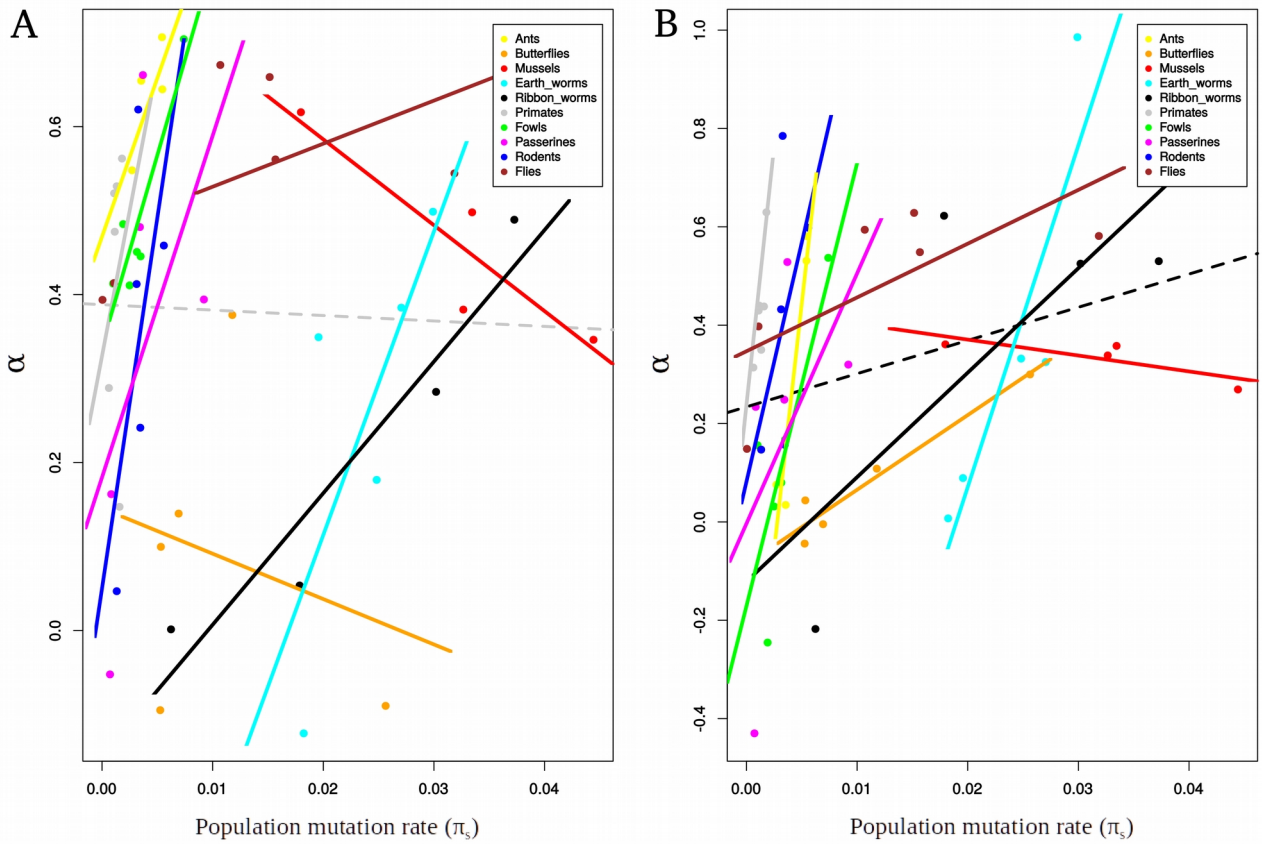


Figure S5: Relationship between species-level α and π_s .

α is estimated using all mutations and substitutions (A) or using only GC-conservative mutations and substitutions (B). The dotted line represents the regression across all species, and full lines represent the regression within each taxonomic groups. Black dotted lines represent significant regressions across taxonomic groups and grey dotted lines non-significant ones.

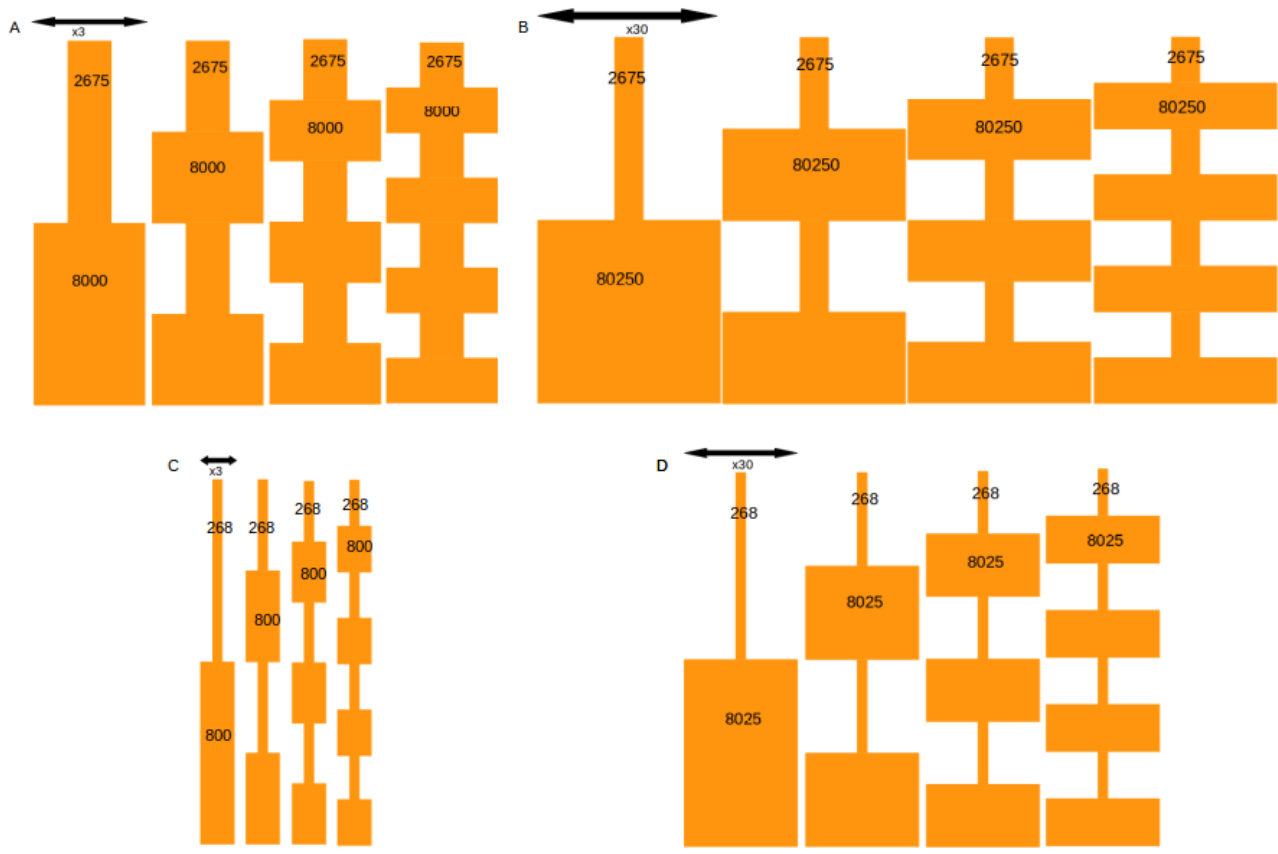


Figure S6: Design of the simulations of fluctuation of population size.

A: three fold ratio between low and high population size and high long-term population size.

B: thirty fold ratio between low and high population size and high long-term population size.

C: three fold ratio between low and high population size and low long-term population size.

D: thirty fold ratio between low and high population size and low long-term population size.

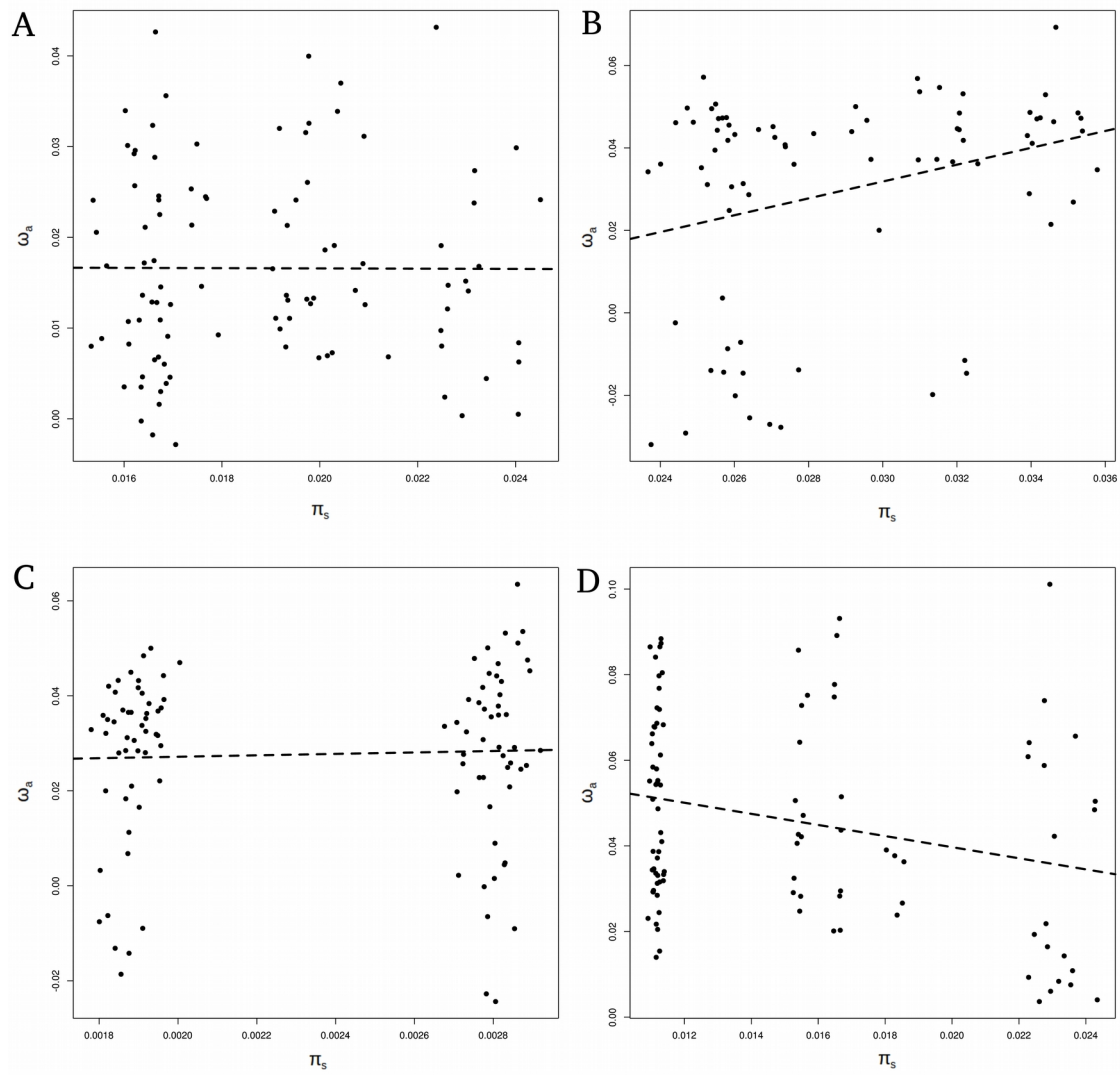


Figure S7: Relationship between ω_a and π_s in simulated scenarios of fluctuating population size.

A: three fold ratio between low and high population size and high long-term population size (scenario A in figure S1)

B: thirty fold ratio between low and high population size and high long-term population size (scenario B in figure S1)

C: three fold ratio between low and high population size and low long-term population size (scenario C in figure S1)

D: thirty fold ratio between low and high population size and low long-term population size (scenario D in figure S1)