Data References Table

from "Interpreting the pervasive observation of U-shaped Site Frequency Spectra"

Fabian Freund, Elise Kerdoncuff, Sebastian Matuszewski, Marguerite Lapierre Marcel Hildebrandt, Jeffrey D. Jensen, Luca Ferretti, Amaury Lambert, Timothy B. Sackton and Guillaume Achaz

February 2, 2023

Corresponding author: guillaume.achaz@mnhn.fr

| Species | Outgroup | u | Outgroup | Polarized | \neq outgroup | Diallelic# | Source | Outgroup source |
|-----------------------------------|---|---------|---------------|---------------|-----------------|-----------------|---|--------------------------------------|
| | | | size | $_{ m SNPs}$ | | outgroup | | (or same as sample) |
| $A cineto bacter\ baumannii$ | A. nosocomialis | 79 | 1 | 78175 | 9009 | | $[RdSB^{+}18]^*$ | NCBI RefSeq• - Nov 2016 |
| $Aptenodytes\ patagonicus$ | $A.\ forsteri$ | 20 | 2 | 1278 | 12 | 32 | $[{ m RGB}^+14]^{\dot+}$ | [FBRG14] |
| $A rabidopsis\ thaliana$ | A. lyrata | 345 | 1 | 10322757 | 1023148 | 398365 | $[ABAB^{+}16]$ | Public directoryo |
| $Armadillidium\ vulgare$ | A. nasatum | 20 | 4 | 23323 | 745 | | $[{ m RGB}^{+}14]^{+}$ | same |
| $Artemia\ franciscana$ | A. sinica | 20 | 4 | 5548 | 247 | | $[{ m RGB}^{+}14]^{+}$ | same |
| $Athene\ cunicularia$ | Strix occidentalis | 40 | 2 | 11268203 | 383702 | 68196 | $[MKB^+18]\star$ | $[\mathrm{HHW}^+17]$ |
| $Bacillus\ subtilis$ | $B. \ atrophaeus$ | 38 | 1 | 105523 | 29934 | | $[{ m RdSB}^+18]^*$ | NCBI RefSeq• - Nov 2016 |
| $Caenorhab ditis\ brenneri$ | Caenorhabditis sp. 10 | 20 | 4 | 1339 | 106 | | $[{ m RGB}^{+}14]^{+}$ | same |
| Caenorhabditis elegans (Orsay) | C. elegans ECA396 ECA723 ECA744 | 573 | 3 | 165 | 2 | 22 | $[\mathrm{RZL}^{+}18]$ | same |
| $Chlamydia \ trachomatis$ | $C.\ muridarum$ | 29 | 1 | 9924 | 1694 | | $[{ m RdSB}^+18]^*$ | NCBI RefSeq• - Nov 2016 |
| $Ciona\ intestinalis\ A$ | C. intestinalis B | 20 | 20 | 1491 | 63 | 377 | $[{ m RGB}^{+}14]^{+}$ | same |
| $Ciona\ intestinalis\ B$ | C. intestinalis A | 20 | 20 | 2186 | 29 | 139 | $[RGB^{+}14]^{+}$ | same |
| $Clostridium\ difficile$ | Anaerococcus prevotii | 11 | 1 | 192 | 49 | | $[RdSB^{+}18]*$ | NCBI RefSeq• - Nov 2016 |
| Corvus cornix | $C.\ monedula$ | 38 | 20 | 7551159 | 49479 | 269096 | $[PVB^+14]\star$ | $[{\rm VBP}^{+}16, {\rm PVB}^{+}14]$ |
| $Coturnix\ japonica$ | Gallus varius | 20 | 14 | 5061864 | 69028 | 220450 | $[WZH^+18]\star$ | $[\mathrm{UKMF}^+16]$ |
| $Culex\ pipiens$ | $C.\ torrentium$ | 20 | 4 | 5442 | 106 | | $[RGB^{+}14]^{+}$ | same |
| $Drosophila\ melanogaster$ | D. simulans | 196 | 1 | 4662706 | 151138 | | $[LCC^+15]$ | [SK16] |
| $Egretta\ garzetta$ | Pelecanus crispus | 10 | 2 | 9318499 | 361539 | 10242 | $[\mathrm{LLC}^{+}14]\star$ | $[\mathrm{ZLL}^+14]$ |
| $Emys\ orbicularis$ | $Trachemys\ scripta$ | 20 | 4 | 515 | 14 | | $[RGB^{+}14]^{+}$ | same |
| $Escherichia\ coli$ | $E.\ fergusonii$ | 62 | 1 | 84222 | 6903 | | NCBI RefSeq• used in [LBL+16] | same |
| $Ficedula\ albicollis$ | F. hypoleuca | 24 | 2 | 14697230 | 269430 | 229260 | [ESB ⁺ 12, KHM ⁺ 16, SMQE16, BNK ⁺ 15] \star | $[\mathrm{BNK}^+15]$ |
| Gorilla gorilla | ancestral allele call from [PMSK ⁺ 13] | 54 | Inferred | 9878547 | 42 | 569321 | $[PMSK^{+}13]$ | same |
| $Halictus \ scabiosae$ | $H\ simplex$ | 22 | 2 | 712 | 10 | | $[RGB^{+}14]^{+}$ | [Gal16] |
| $Helicobacter\ pylori$ | H. felis | 20 | 1 | 27498 | 8235 | | $[RdSB^{+}18]*$ | NCBI RefSeq• - Nov 2016 |
| Homo sapiens (Yoruba) | ancestral allele call from [Con15] | 216 | Inferred | 19441528 | 105146 | | [Con15] | same |
| $Klebsiella\ pneumoniae$ | $K. \ varicola$ | 156 | 1 | 203601 | 375 | | $[{ m RdSB}^+18]^*$ | NCBI RefSeq• - Nov 2016 |
| $Lepus\ granatensis$ | L americanus | 20 | 2 | 692 | 31 | 1 | $[{ m RGB}^{+}14]^{+}$ | $[\mathrm{GMFG}^{+}13]$ |
| $Melitaea\ cinxia$ | $M\ didyma$ | 18 | | 1695 | 101 | | $[{ m RGB}^{+}14]^{+}$ | same |
| $Messor\ barbarus$ | $M\ structor$ | 20 | œ | 9651 | 50 | | $[{ m RGB}^{+}14]^{+}$ | [Gal16] |
| $My cobacterium\ tuber colosis$ | MYCN001 - MYCN005 | 33 | 2 | 7142 | 13 | 78 | NCBI RefSeq• - Nov 2013 | same |
| $Nipponia\ nippon$ | Pelecanus crispus | 16 | 2 | 1140694 | 44153 | 2034 | $[\mathrm{LLC}^+14]\star$ | $[{ m ZLL}^+14]$ |
| $Ostrea\ edulis$ | O. chilensis | 20 | 4 | 939 | 28 | | $[{ m RGB}^{+}14]^{+}$ | same |
| Pan paniscus | ancestral allele call from [PMSK+13] | 56 | Inferred | 6293657 | 63 | 284527 | $[\mathrm{PMSK}^+13]$ | same |
| $Pan\ troglodytes\ ellioti$ | ancestral allele call from [PMSK ⁺ 13] | 20 | Inferred | 10009190 | 44 | 459884 | $[\mathrm{PMSK}^{+}13]$ | same |
| $Parus\ caeruleus$ | P. major | 20 | 2 | 998 | 51 | 19 | $[{ m RGB}^{+}14]^{+}$ | $[{ m FBRG14}]$ |
| $Parus\ major$ | $Cyanistes\ caeruleus$ | 54 | 2 | 14174305 | 143760 | 126876 | $[QTH^{+}15, LGS^{+}16] \star$ | [MKTK16] |
| $Passer\ domesticus$ | $P.\ montanus$ | 16 | 2 | 18501992 | 90623 | 633399 | [RTE ⁺ 18, ETT ⁺ 17, RET ⁺ 18]★ | $[\mathrm{ETT}^+17]$ |
| $Phylloscopus\ trochilus$ | P. tristis | 24 | 40 | 33401127 | 8605 | 6092936 | $[\mathrm{LLL}^+17]\star$ | $[{ m TKS}^+17]$ |
| $Physa\ acuta$ | P. gyrina | 18 | 4 | 4286 | 176 | | $[RGB^{+}14]^{+}$ | same |
| $Pseudomonas \ aeruginosa$ | P. knackmussii | 98 | 1 | 90258 | 17208 | | $[{ m RdSB}^+18]^*$ | NCBI RefSeq• - Nov 2016 |
| $Sepia\ officinalis$ | Sepiella japonica | 18 | 2 | 1740 | 52 | | $[{ m RGB}^{+}14]^{+}$ | [Gal16] |
| $Staphylococcus\ aureus$ | $S.\ epidermis$ | 152 | 1 | 30052 | 8694 | | $[{ m RdSB}^+18]^*$ | NCBI RefSeq• - Nov 2016 |
| $Streptococcus\ pneumoniae$ | S. mitis | 32 | 1 | 49917 | 2468 | | $[{ m RdSB}^+18]^*$ | NCBI RefSeq• - Nov 2016 |
| $Taeniopygia\ guttata$ | $Poephila\ acuticauda$ | 38 | 40 | 53263038 | 118506 | 4346767 | $[\mathrm{SLS}^+15]\star$ | same |
| Zea mays | $Tripsacum\ dactyloides$ | 99 | 1 | 520310 | 214398 | 1 | $[\mathrm{BMHR}^+17]$ | same |
| *Core genomes were computed and a | *Core genomes were computed and aligned as is [RdSB ⁺ 18], we added to the set of a species genome one further genome from the closest species (to be able to orient the changes). | et of a | species genom | e one further | genome from th | e closest speci | es (to be able to orient the changes). | |

^{*}Core genomes were computed and aligned as is [RdSB⁺18], we added to the set of a species genome one further genome from the closest species (to be able to orient the changes). # number of positions where the outgroup was diallelic (such positions are excluded, since we cannot set the ancestral allele to the outgroup allele then)

^{*} https://github.com/harvardinformatics/shortRead_mapping_variantCalling +SFS were extracted from transcriptomes as described in [RGB⁺14].

 $[\]bullet \ \mathrm{NCBI} \ \mathrm{RefSeq} \ \mathtt{ftp://ftp.ncbi.nih.gov/genomes/} \ [\mathrm{TCF}^{+}14]$

o pipeline.lbl.gov/data/araTha04_Araly1/

References

- [ABAB⁺16] Carlos Alonso-Blanco, Jorge Andrade, Claude Becker, Felix Bemm, Joy Bergelson, Karsten M. Borgwardt, Jun Cao, Eunyoung Chae, Todd M. Dezwaan, Wei Ding, Joseph R. Ecker, Moises Exposito-Alonso, Ashley Farlow, Joffrey Fitz, Xiangchao Gan, Dominik G. Grimm, Angela M. Hancock, Stefan R. Henz, Svante Holm, Matthew Horton, Mike Jarsulic, Randall A. Kerstetter, Arthur Korte, Pamela Korte, Christa Lanz, Cheng-Ruei Lee, Dazhe Meng, Todd P. Michael, Richard Mott, Ni Wayan Muliyati, Thomas Nägele, Matthias Nagler, Viktoria Nizhynska, Magnus Nordborg, Polina Yu. Novikova, F. Xavier Picó, Alexander Platzer, Fernando A. Rabanal, Alex Rodriguez, Beth A. Rowan, Patrice A. Salomé, Karl J. Schmid, Robert J. Schmitz, Ümit Seren, Felice Gianluca Sperone, Mitchell Sudkamp, Hannes Svardal, Matt M. Tanzer, Donald Todd, Samuel L. Volchenboum, Congmao Wang, George Wang, Xi Wang, Wolfram Weckwerth, Detlef Weigel, and Xuefeng Zhou. 1,135 genomes reveal the global pattern of polymorphism in arabidopsis thaliana. Cell, 166(2):481–491, 2016.
- [BMHR⁺17] Jean-Tristan Brandenburg, Tristan Mary-Huard, Guillem Rigaill, Sarah J. Hearne, Hélène Corti, Johann Joets, Clémentine Vitte, Alain Charcosset, Stéphane D. Nicolas, and Maud I. Tenaillon. Independent introductions and admixtures have contributed to adaptation of european maize and its american counterparts. *PLOS Genetics*, 13(3):e1006666, Mar 2017.
 - [BNK⁺15] Reto Burri, Alexander Nater, Takeshi Kawakami, Carina F Mugal, Pall I Olason, Linnea Smeds, Alexander Suh, Ludovic Dutoit, Stanislav Bureš, Laszlo Z Garamszegi, et al. Linked selection and recombination rate variation drive the evolution of the genomic landscape of differentiation across the speciation continuum of ficedula flycatchers. *Genome research*, 25(11):1656–1665, 2015.
 - [Con15] The 1000 Genomes Project Consortium. A global reference for human genetic variation. *Nature*, 526(7571):68–74, 2015.
 - [ESB+12] Hans Ellegren, Linnea Smeds, Reto Burri, Pall I Olason, Niclas Backström, Takeshi Kawakami, Axel Künstner, Hannu Mäkinen, Krystyna Nadachowska-Brzyska, Anna Qvarnström, et al. The genomic landscape of species divergence in ficedula flycatchers. *Nature*, 491(7426):756–760, 2012.
 - [ETT+17] Tore O Elgvin, Cassandra N Trier, Ole K Tørresen, Ingerid J Hagen, Sigbjørn Lien, Alexander J Nederbragt, Mark Ravinet, Henrik Jensen, and Glenn-Peter Sætre. The genomic mosaicism of hybrid speciation. Science advances, 3(6):e1602996, 2017.
 - [FBRG14] Emeric Figuet, Marion Ballenghien, Jonathan Romiguier, and Nicolas Galtier. Biased Gene Conversion and GC-Content Evolution in the Coding Sequences of Reptiles and Vertebrates. Genome Biology and Evolution, 7(1):240–250, 12 2014.
 - [Gal16] Nicolas Galtier. Adaptive protein evolution in animals and the effective population size hypothesis. *PLOS Genetics*, 12(1):e1005774, jan 2016.
- [GMFG⁺13] Philippe Gayral, José Melo-Ferreira, Sylvain Glémin, Nicolas Bierne, Miguel Carneiro, Benoit Nabholz, Joao M. Lourenco, Paulo C. Alves, Marion Ballenghien, Nicolas Faivre, Khalid Belkhir, Vincent Cahais, Etienne Loire, Aurélien Bernard, and Nicolas Galtier. Reference-free population genomics from next-generation transcriptome data and the vertebrate-invertebrate gap. PLOS Genetics, 9(4):1–15, 04 2013.

- [HHW⁺17] Zachary R Hanna, James B Henderson, Jeffrey D Wall, Christopher A Emerling, Jérôme Fuchs, Charles Runckel, David P Mindell, Rauri CK Bowie, Joseph L DeRisi, and John P Dumbacher. Northern spotted owl (strix occidentalis caurina) genome: divergence with the barred owl (strix varia) and characterization of light-associated genes. *Genome biology and evolution*, 9(10):2522–2545, 2017.
- [KHM+16] Marty Kardos, Arild Husby, S Eryn McFarlane, Anna Qvarnström, and Hans Ellegren. Whole-genome resequencing of extreme phenotypes in collared flycatchers highlights the difficulty of detecting quantitative trait loci in natural populations. *Molecular Ecology Resources*, 16(3):727–741, 2016.
- [LBL⁺16] Marguerite Lapierre, Camille Blin, Amaury Lambert, Guillaume Achaz, and Eduardo PC Rocha. The impact of selection, gene conversion, and biased sampling on the assessment of microbial demography. *Molecular biology and evolution*, 33(7):1711–1725, 2016.
- [LCC+15] Justin B Lack, Charis M Cardeno, Marc W Crepeau, William Taylor, Russell B Corbett-Detig, Kristian A Stevens, Charles H Langley, and John E Pool. The Drosophila Genome Nexus: A Population Genomic Resource of 623 Drosophila melanogaster Genomes, Including 197 from a Single Ancestral Range Population. Genetics, 199(4):1229-1241, 01 2015.
- [LGS+16] Veronika N Laine, Toni I Gossmann, Kyle M Schachtschneider, Colin J Garroway, Ole Madsen, Koen JF Verhoeven, Victor De Jager, Hendrik-Jan Megens, Wesley C Warren, Patrick Minx, et al. Evolutionary signals of selection on cognition from the great tit genome and methylome. Nature communications, 7(1):1–9, 2016.
- [LLC+14] Shengbin Li, BO Li, Cheng Cheng, Zijun Xiong, Qingbo Liu, Jianghua Lai, Hannah V Carey, Qiong Zhang, Haibo Zheng, Shuguang Wei, et al. Genomic signatures of near-extinction and rebirth of the crested ibis and other endangered bird species. Genome biology, 15(12):1–17, 2014.
- [LLL⁺17] Max Lundberg, Miriam Liedvogel, Keith Larson, Hanna Sigeman, Mats Grahn, Anthony Wright, Susanne Åkesson, and Staffan Bensch. Genetic differences between willow warbler migratory phenotypes are few and cluster in large haplotype blocks. *Evolution Letters*, 1(3):155–168, 2017.
- [MKB+18] Jakob C Mueller, Heiner Kuhl, Stefan Boerno, Jose L Tella, Martina Carrete, and Bart Kempenaers. Evolution of genomic variation in the burrowing owl in response to recent colonization of urban areas. Proceedings of the Royal Society B: Biological Sciences, 285(1878):20180206, 2018.
- [MKTK16] Jakob C Mueller, Heiner Kuhl, Bernd Timmermann, and Bart Kempenaers. Characterization of the genome and transcriptome of the blue tit c yanistes caeruleus: polymorphisms, sex-biased expression and selection signals. *Molecular ecology resources*, 16(2):549–561, 2016.
- [PMSK+13] Javier Prado-Martinez, Peter H. Sudmant, Jeffrey M. Kidd, Heng Li, Joanna L. Kelley, Belen Lorente-Galdos, Krishna R. Veeramah, August E. Woerner, Timothy D. O'Connor, Gabriel Santpere, Alexander Cagan, Christoph Theunert, Ferran Casals, Hafid Laayouni, Kasper Munch, Asger Hobolth, Anders E. Halager, Maika Malig, Jessica Hernandez-Rodriguez, Irene Hernando-Herraez, Kay Prüfer, Marc Pybus, Laurel Johnstone, Michael Lachmann, Can Alkan,

Dorina Twigg, Natalia Petit, Carl Baker, Fereydoun Hormozdiari, Marcos Fernandez-Callejo, Marc Dabad, Michael L. Wilson, Laurie Stevison, Cristina Camprubí, Tiago Carvalho, Aurora Ruiz-Herrera, Laura Vives, Marta Mele, Teresa Abello, Ivanela Kondova, Ronald E. Bontrop, Anne Pusey, Felix Lankester, John A. Kiyang, Richard A. Bergl, Elizabeth Lonsdorf, Simon Myers, Mario Ventura, Pascal Gagneux, David Comas, Hans Siegismund, Julie Blanc, Lidia Agueda-Calpena, Marta Gut, Lucinda Fulton, Sarah A. Tishkoff, James C. Mullikin, Richard K. Wilson, Ivo G. Gut, Mary Katherine Gonder, Oliver A. Ryder, Beatrice H. Hahn, Arcadi Navarro, Joshua M. Akey, Jaume Bertranpetit, David Reich, Thomas Mailund, Mikkel H. Schierup, Christina Hvilsom, Aida M. Andrés, Jeffrey D. Wall, Carlos D. Bustamante, Michael F. Hammer, Evan E. Eichler, and Tomas Marques-Bonet. Great ape genetic diversity and population history. *Nature*, 499(7459):471–475, 2013.

- [PVB+14] Jelmer W Poelstra, Nagarjun Vijay, Christen M Bossu, Henrik Lantz, Bettina Ryll, Inge Müller, Vittorio Baglione, Per Unneberg, Martin Wikelski, Manfred G Grabherr, et al. The genomic landscape underlying phenotypic integrity in the face of gene flow in crows. Science, 344(6190):1410-1414, 2014.
- [QTH⁺15] Yanhua Qu, Shilin Tian, Naijian Han, Hongwei Zhao, Bin Gao, Jun Fu, Yalin Cheng, Gang Song, Per GP Ericson, Yong E Zhang, et al. Genetic responses to seasonal variation in altitudinal stress: whole-genome resequencing of great tit in eastern himalayas. *Scientific Reports*, 5(1):1–10, 2015.
- [RdSB+18] Olaya Rendueles, Jorge A. Moura de Sousa, Aude Bernheim, Marie Touchon, and Eduardo P. C. Rocha. Genetic exchanges are more frequent in bacteria encoding capsules. *PLOS Genetics*, 14(12):1–25, 12 2018.
- [RET⁺18] Mark Ravinet, Tore Oldeide Elgvin, Cassandra Trier, Mansour Aliabadian, Andrey Gavrilov, and Glenn-Peter Sætre. Signatures of human-commensalism in the house sparrow genome. *Proceedings of the Royal Society B*, 285(1884):20181246, 2018.
- [RGB+14] J. Romiguier, P. Gayral, M. Ballenghien, A. Bernard, V. Cahais, A. Chenuil, Y. Chiari, R. Dernat, L. Duret, N. Faivre, and et al. Comparative population genomics in animals uncovers the determinants of genetic diversity. *Nature*, 515(7526):261–263, Aug 2014.
- [RTE+18] Anna Runemark, Cassandra N Trier, Fabrice Eroukhmanoff, Jo S Hermansen, Michael Matschiner, Mark Ravinet, Tore O Elgvin, and Glenn-Peter Sætre. Variation and constraints in hybrid genome formation. Nature Ecology & Evolution, 2(3):549-556, 2018.
- [RZL⁺18] Aurélien Richaud, Gaotian Zhang, Daehan Lee, Junho Lee, and Marie-Anne Félix. The local coexistence pattern of selfing genotypes in caenorhabditis elegans natural metapopulations. *Genetics*, 208(2):807–821, 2018.
 - [SK16] Craig E. Stanley and Rob J. Kulathinal. Genomic signatures of domestication on neurogenetic genes in drosophila melanogaster. *BMC Evolutionary Biology*, 16(1):6, 2016.
- [SLS+15] Sonal Singhal, Ellen M Leffler, Keerthi Sannareddy, Isaac Turner, Oliver Venn, Daniel M Hooper, Alva I Strand, Qiye Li, Brian Raney, Christopher N Balakrishnan, et al. Stable recombination hotspots in birds. Science, 350(6263):928-932, 2015.

- [SMQE16] Linnéa Smeds, Carina F Mugal, Anna Qvarnström, and Hans Ellegren. High-resolution mapping of crossover and non-crossover recombination events by whole-genome re-sequencing of an avian pedigree. *PLoS genetics*, 12(5):e1006044, 2016.
- [TCF+14] Tatiana Tatusova, Stacy Ciufo, Scott Federhen, Boris Fedorov, Richard McVeigh, Kathleen O'Neill, Igor Tolstoy, and Leonid Zaslavsky. Update on RefSeq microbial genomes resources. Nucleic Acids Research, 43(D1):D599-D605, 12 2014.
- [TKS+17] Venkat Talla, Faheema Kalsoom, Daria Shipilina, Irina Marova, and Niclas Backström. Heterogeneous patterns of genetic diversity and differentiation in european and siberian chiffchaff (phylloscopus collybita abietinus/p. tristis). G3: Genes, Genomes, Genetics, 7(12):3983-3998, 2017.
- [UKMF+16] Maria Ulfah, Ryouka Kawahara-Miki, Achmad Farajalllah, Muladno Muladno, Ben Dorshorst, Alison Martin, and Tomohiro Kono. Genetic features of red and green junglefowls and relationship with indonesian native chickens sumatera and kedu hitam. BMC genomics, 17(1):1-9, 2016.
 - [VBP+16] Nagarjun Vijay, Christen M Bossu, Jelmer W Poelstra, Matthias H Weissensteiner, Alexander Suh, Alexey P Kryukov, and Jochen BW Wolf. Evolution of heterogeneous genome differentiation across multiple contact zones in a crow species complex. *Nature communications*, 7(1):13195, 2016.
- [WZH⁺18] Yan Wu, Yaolei Zhang, Zhuocheng Hou, Guangyi Fan, Jinsong Pi, Shuai Sun, Jiang Chen, Huaqiao Liu, Xiao Du, Jie Shen, et al. Population genomic data reveal genes related to important traits of quail. *GigaScience*, 7(5):giy049, 2018.
- [ZLL+14] Guojie Zhang, Cai Li, Qiye Li, Bo Li, Denis M Larkin, Chul Lee, Jay F Storz, Agostinho Antunes, Matthew J Greenwold, Robert W Meredith, et al. Comparative genomics reveals insights into avian genome evolution and adaptation. Science, 346(6215):1311–1320, 2014.