

Genomic characterization of three indigenous Slovenian horse breeds

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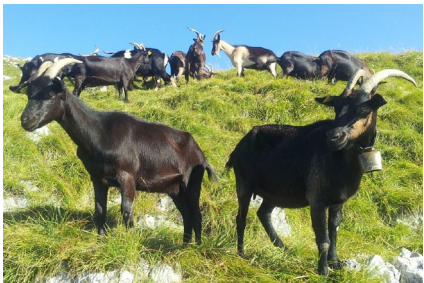
NAČRT ZA
OKREVANJE
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REPUBLIKA SLOVENIJA
MINISTRSTVO ZA KMETIJSTVO,
GOZDARSTVO IN PREHRANO



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Posavje horse (POS)

- Developed from indigenous horse populations in the Sava River basin, straddling the border of Slovenia and Croatia, particularly in the Posavje region
- Crossbred with Percheron, Noriker, and Nonius
- Stud Book: 1993
- ~8% of the total horse population / ~650 breeding animals registered
- Critically endangered
- Robust, adaptable
- Primarily bred for meat production
- Agriculture and forestry, recreational driving, occasional riding, promotional and tourist events
- Suitable for hippotherapy and other therapeutic activities



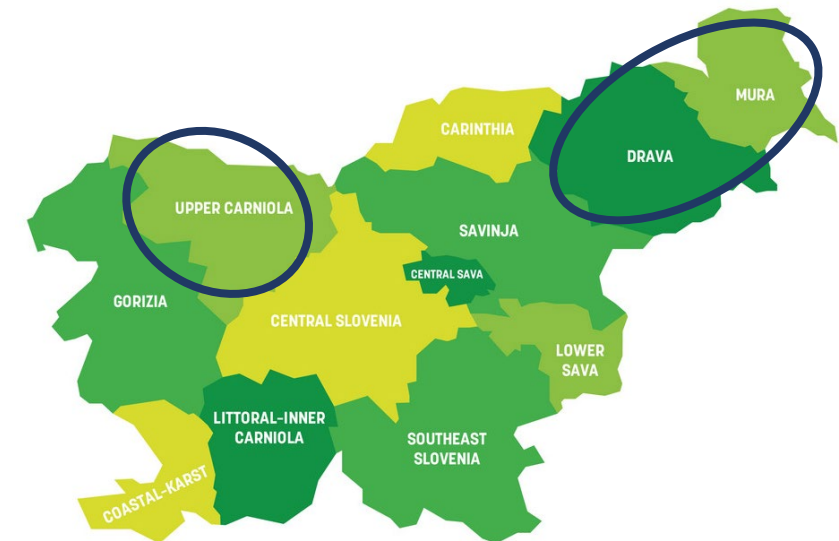
POS - Key Characteristics

- A smaller cold-blooded breed
 - Stallions 145 - 152 cm
 - Mares 135 - 148 cm
- Robust constitution, endurance, disease resistance, early maturity, and good fertility
- Pronounced sexual dimorphism
- Calm temperament, friendly disposition
- Color: Mostly bay and black, with chestnut and grey being rare



Slovenian cold-blood horse (SCH)

- Developed in northeastern Slovenia and Gorenjska
- Local cold-blooded horses crossbred with Percheron, Belgian and Noriker stallions
- Stud Book: 2005
- ~15% of Slovenia's total horse population / ~1,350 registered breeding animals
- Critically endangered
- Calm demeanor, used in agriculture, forestry
- Mainly raised for the production of meat and mare's milk
- Recreational driving and occasionally for riding, promotional and tourist events



SCH - Key Characteristics

- Medium frame
 - Stallions 148 - 160 cm
 - Mares 146 - 158 cm
- Larger individuals of this breed in good condition can weigh over one ton
- Strong constitution, early maturity, good fertility, calm temperament, endurance, strong work ethic
- Color: Mostly bay, chestnut, or black. All colors except for spotted



Lipizzan horse (LIP)

- One of the oldest horse breeds in the world
- Developed by crossbreeding local Karst horses with Spanish, Neapolitan, Kladruber, and Arabian horses
- Lipica Stud Farm, established in 1580
- Widespread across Slovenia and 19 other countries in Europe, as well as in North and South America, Africa, and Australia
- ~6% of the total horse population/~340 breeding animals registered
- Critically endangered
- Elegant, intelligent, famous for classical dressage, for riding and driving
- Excels in trail riding, used by the Slovenian Police
- Also used for hippotherapy, light agricultural work
- For producing mare's milk



LIP - Key Characteristics

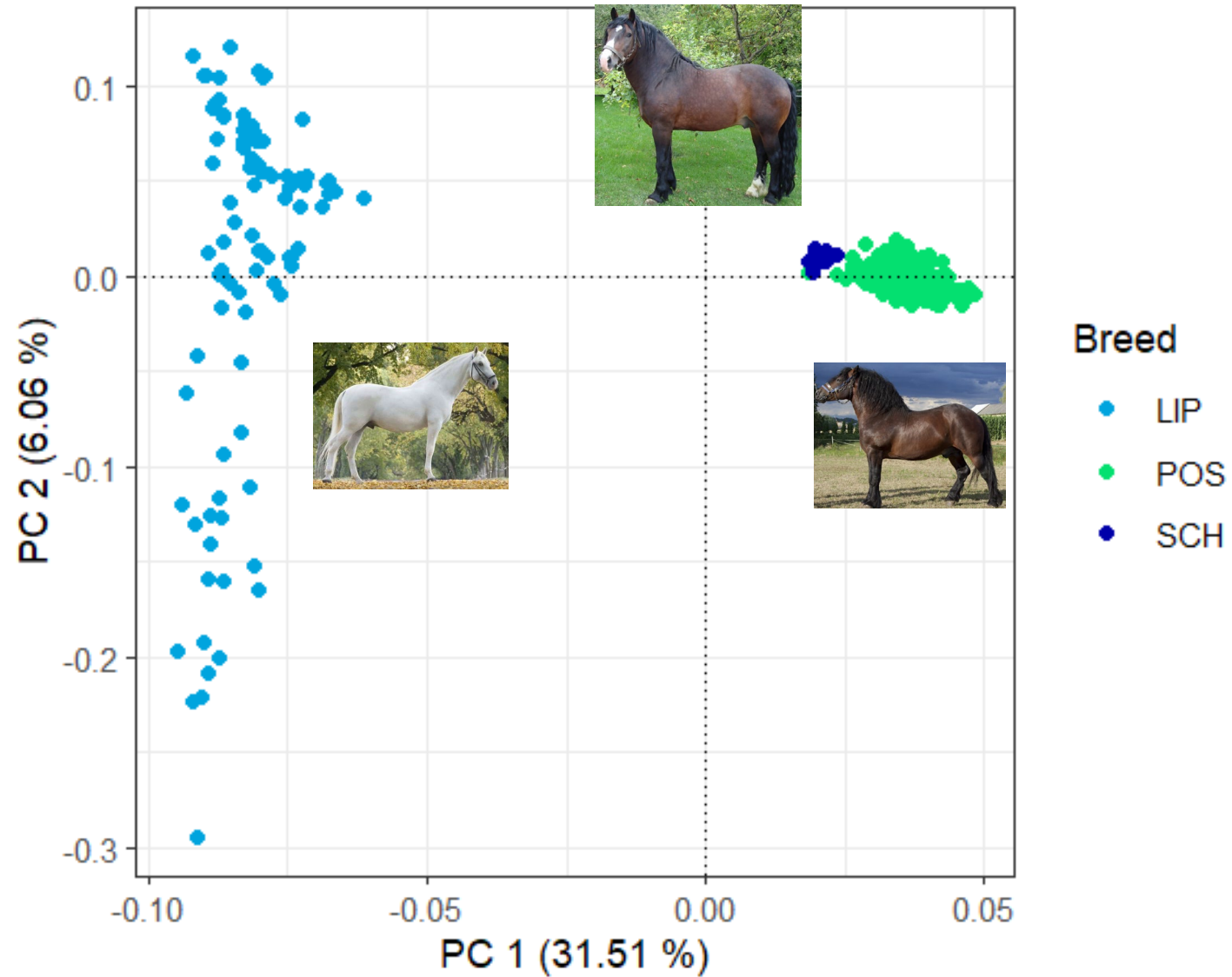
- Well-proportioned and warm-blooded
 - Stallions 155 - 158 cm
 - Mares 153 - 158 cm
- Known for their longevity (25+ years), endurance, and modest needs
- Slight sexual dimorphism
- Color: born black, bay, or chestnut, but most gradually turn grey (appearing white) between 5 and 8 years old



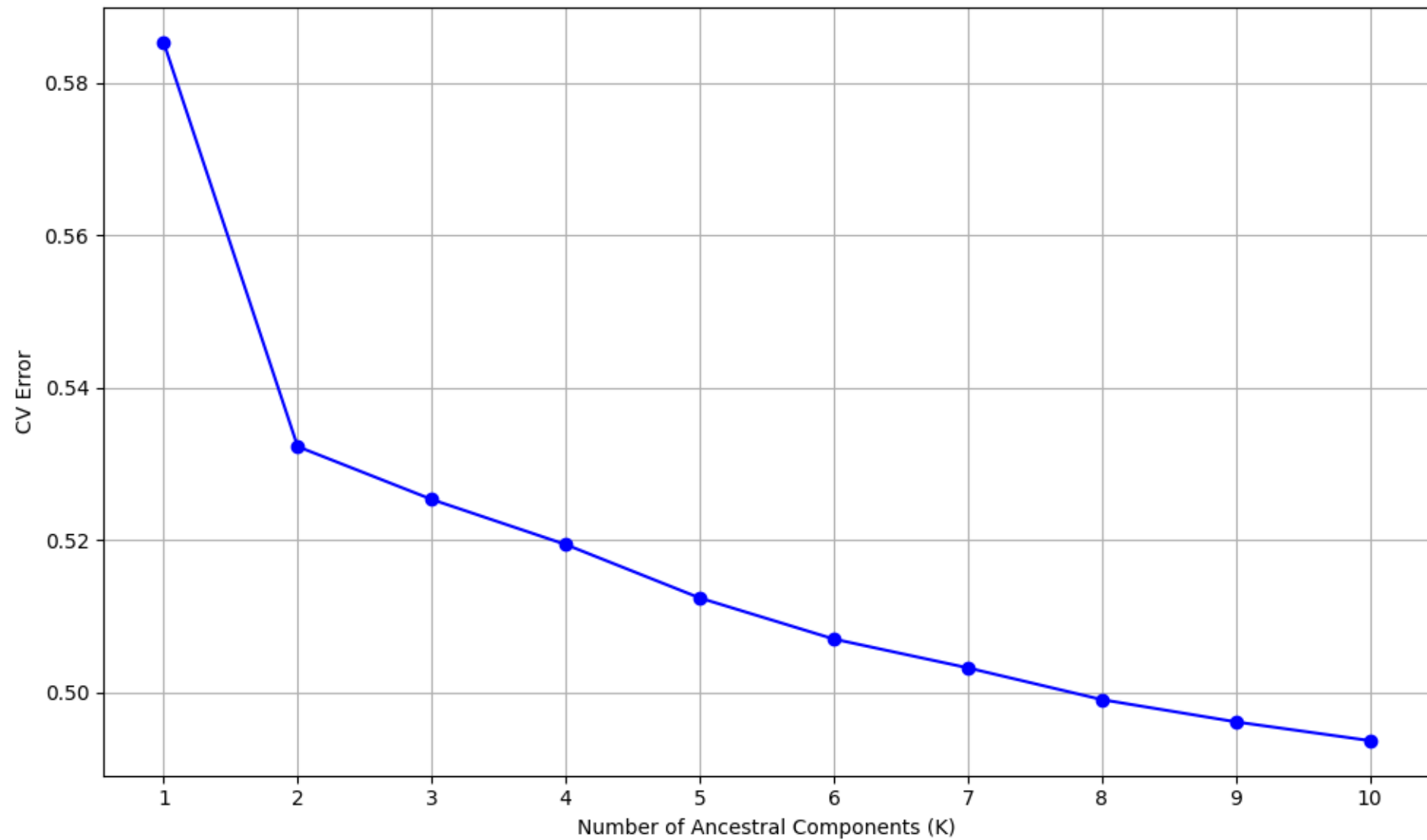
Materials & Analyses

- Hair samples from breeders across the country
- Neogen Equine GeneSeek® Genomic Profiler™ (70k)
- Filtering:
 - variants > 10% missing call rate
 - samples > 10% missing genotypes
 - variants with minor allele frequency below 0.05
 - only autosomes
- 338 horses
 - 11 SHC, 225 POS, 102 LIP
- 53272 variants
- Principal Component Analysis
- Admixture Analysis

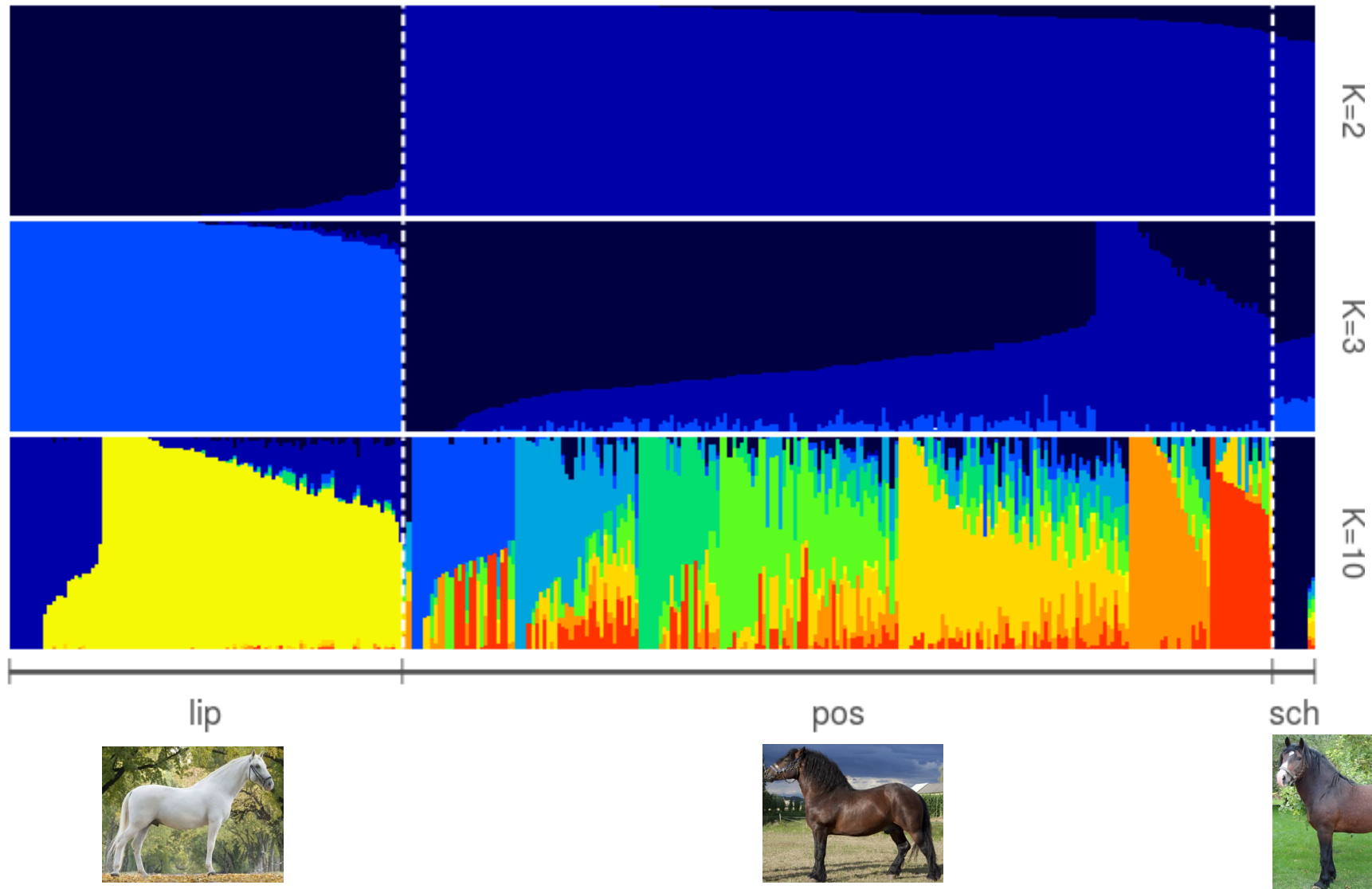
Principal Component Analysis



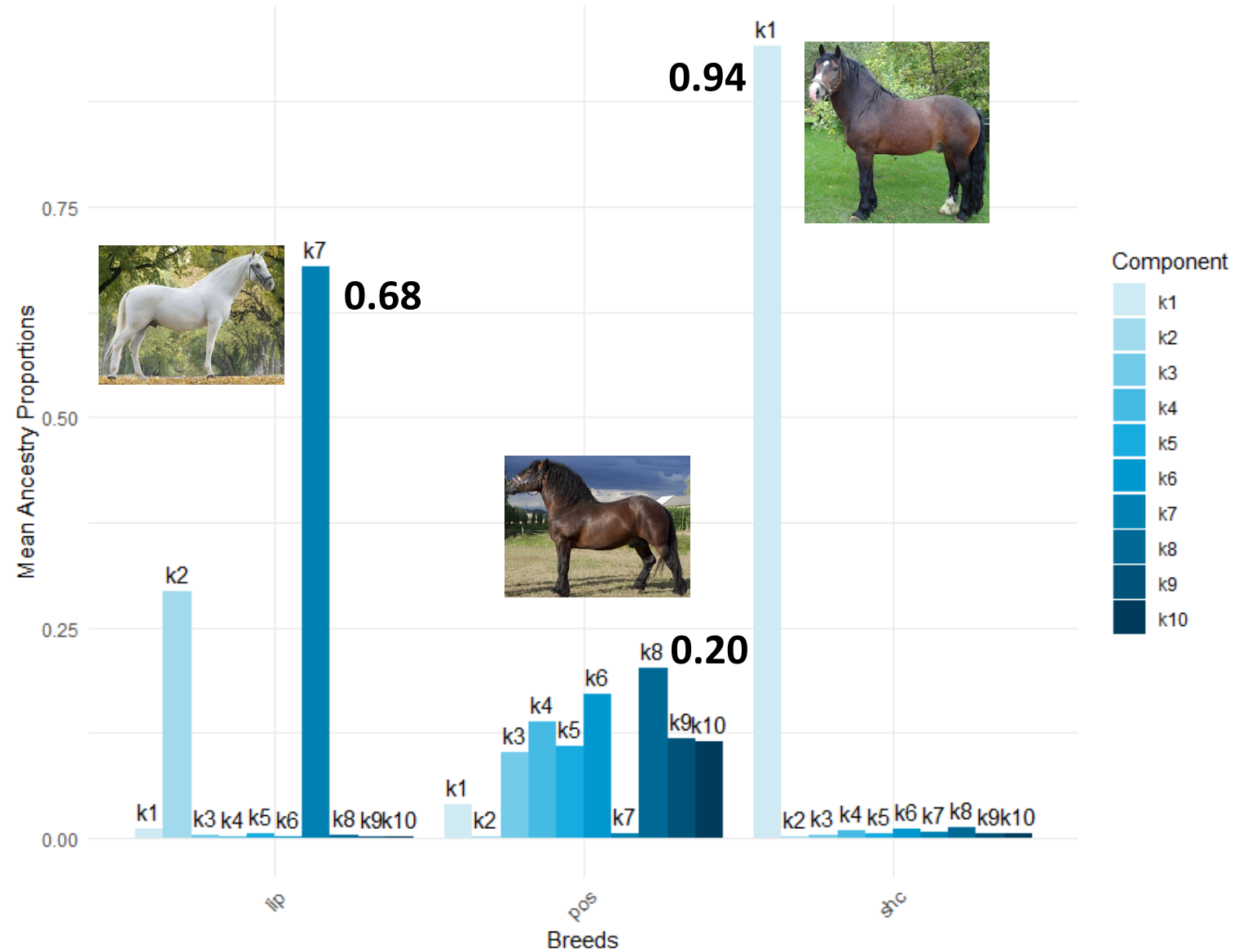
Admixture Cross-Validation Analysis



Admixture-cluster assignments



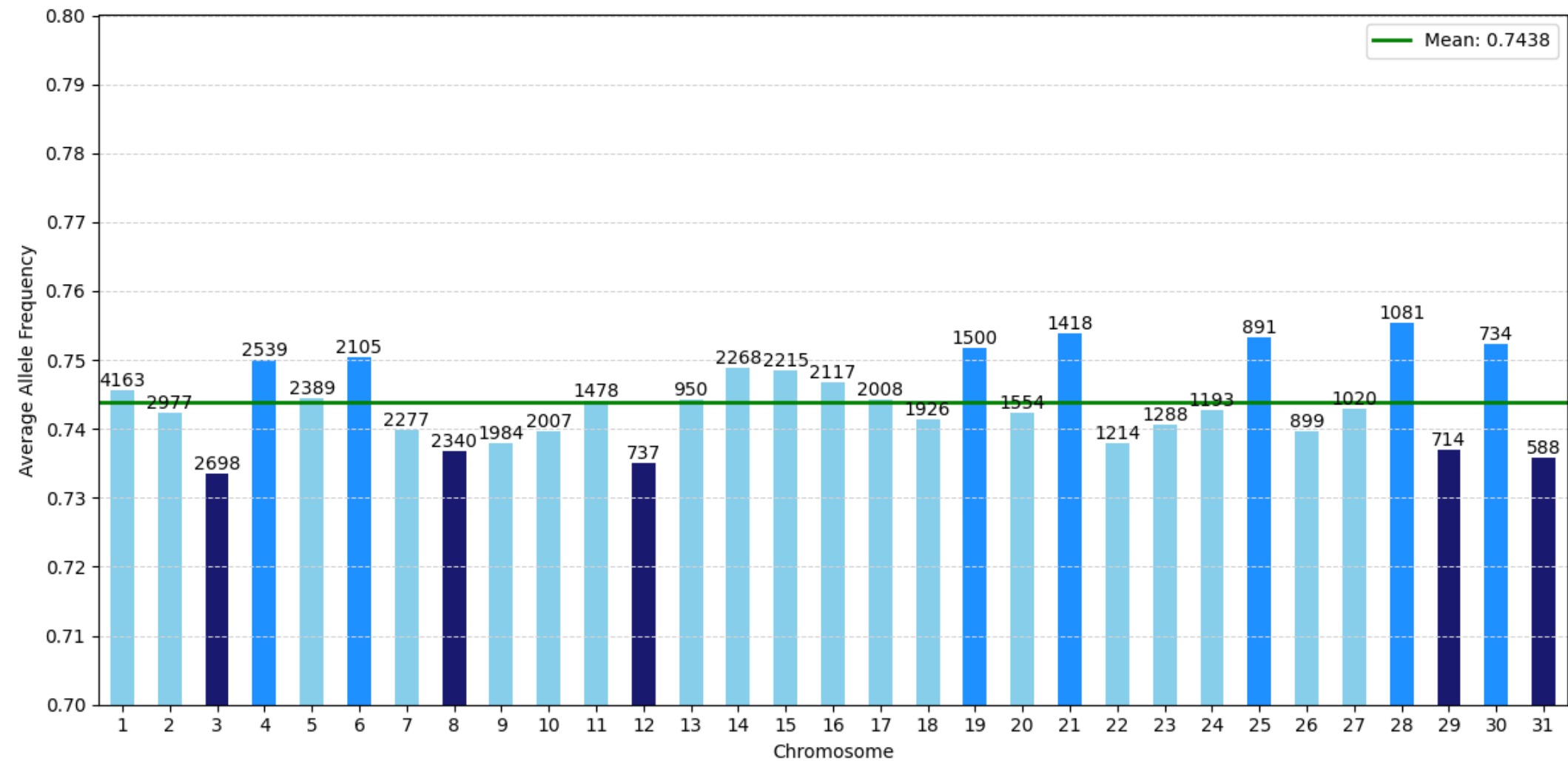
Admixture-Mean Ancestry Proportions



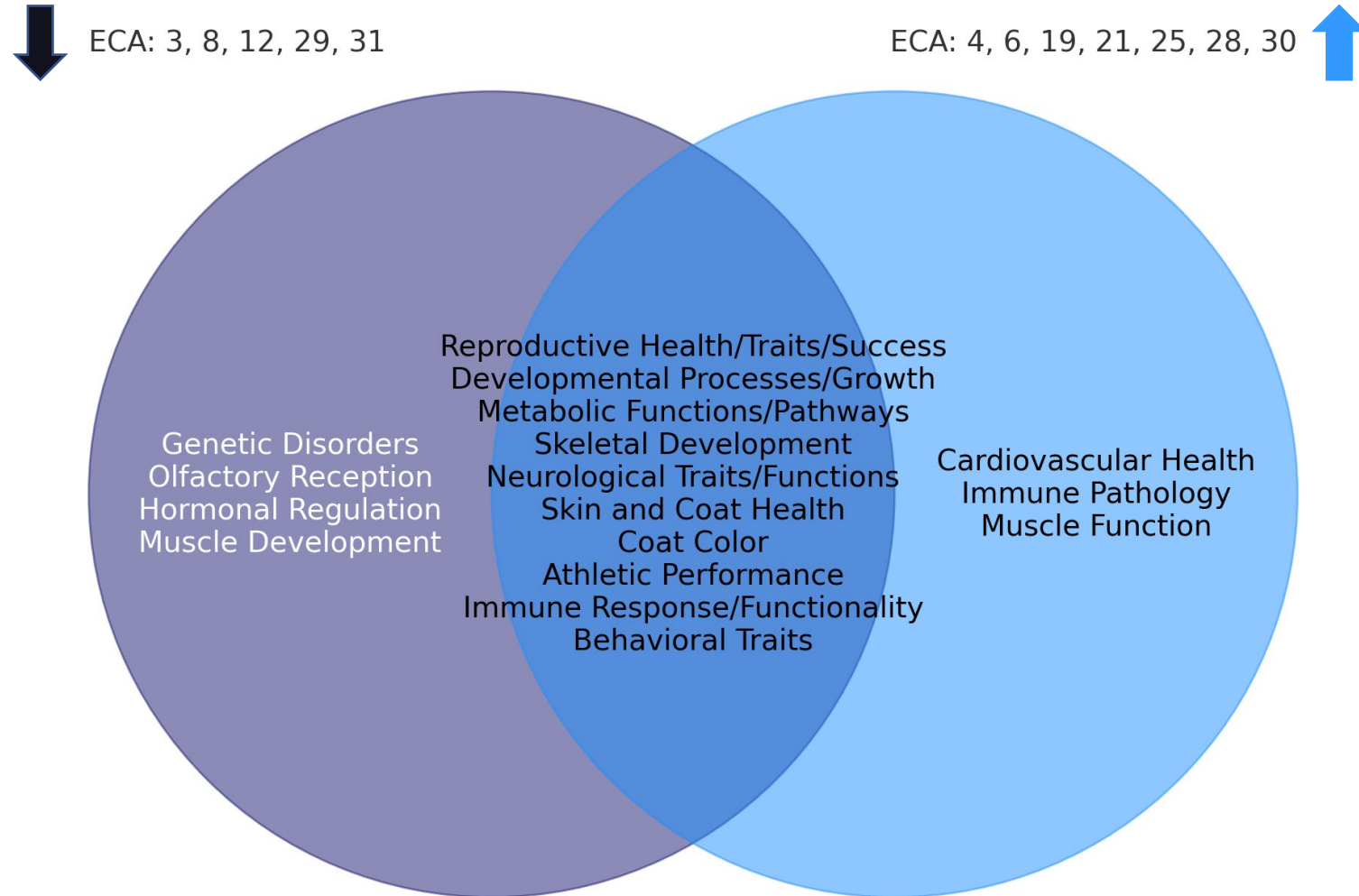
Admixture-Correlations Between Mean Q and Mean P Across Clusters

Breed		corr	p-value
LIP		-0.85	0.002
POS		0.82	0.003
SCH		-0.12	NS

Admixture-Average Allele Frequency by Chromosomes



Functional Genomic Overlaps and Distinctions Across Key Chromosomes



Conclusions

- Lipizzan horse
 - Limited genetic diversity raises concerns about long-term health and adaptability, with risks of inbreeding depression
 - Conservation efforts should focus on enhancing genetic variability
- Posavje horse
 - High admixture could be beneficial for genetic diversity, potentially offering greater resilience and adaptability
 - Careful breeding is needed to maintain specific breed characteristics
- Slovenian Cold-blood Horse
 - A balance between maintaining breed identity and genetic diversity, could be positive for the breed's overall health and sustainability
 - Small sample size
- Targeted efforts to conserve specific alleles and enhance genetic monitoring will be essential in sustaining the health and heritage of these breeds

Thank you!



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