

EAAP Virtual Annual Meeting | 1st to 4th December 2020

Genomic analysis of indigenous Croatian sheep breeds based on a high-density SNP chip

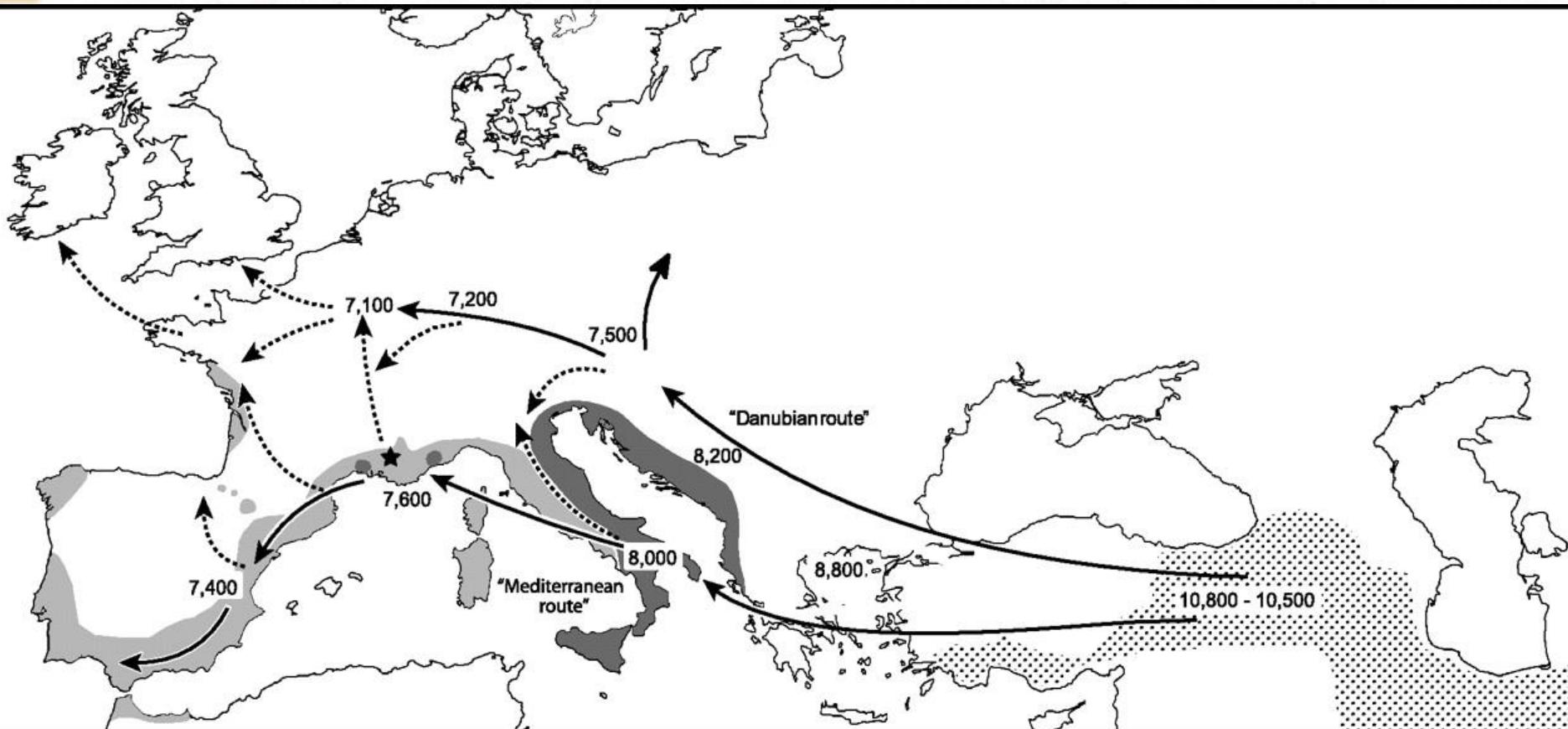
*Drzaic I., Brajkovic V., Gianni M., Lukić B.,
Ferenčaković M., Curik I., Cubric-Curik V.*



EAAP
European Federation of Animal Science



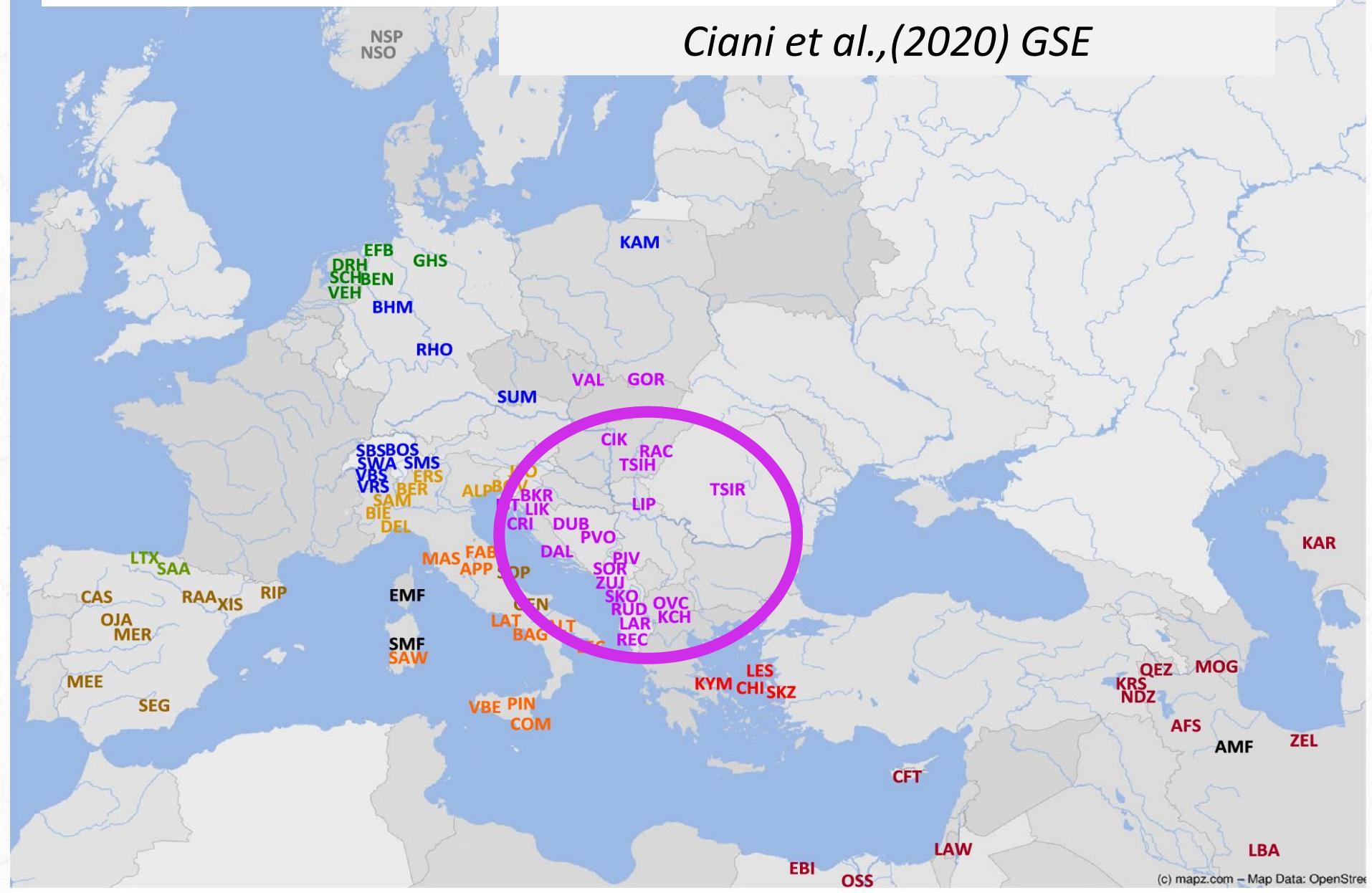
Domestication and migration



Fernandez et al.,(2006) PNAS

On the origin of European sheep as revealed by the diversity of the Balkan breeds ...

Ciani et al., (2020) GSE



To genetically characterize Croatian sheep breeds:

a) positioning Croatian breeds in the Mediterranean context

- Principal component analysis – using large data set
- Neighbour net – Nei distance (SplitsTree v4.6)
- Admixture (Admixture v1.1)

b) determination of conservation status for Croatian native sheep breeds

- Effective population size:
 - a) N_e – linkage disequilibrium (LD), Snep v1.1. (Barbato et.al., 2015)
 - b) N_{eI} – inbreeding; using ΔF
- Inbreeding – runs of homozygosity, (Ferenčaković et al., 2013)
- Fixation indeks (Fst)

Data and genotyping

East Adriatic sheep

- 120 individuals
- Infinium OvineHD BeadChip, IGCS
(606 006 SNPs)

Quality Control:

GenTrain Score ≥ 0.4 ; GC Score > 0.8 ;
-- geno 0.9; -- mind 0.05; no sex, 0 and
non-Oar4.0 SNPs: **457 616 SNPs and
118 individuals**

PIS (25)



ISS (25)



NMS (7)



DPS (25)



DRS (26)

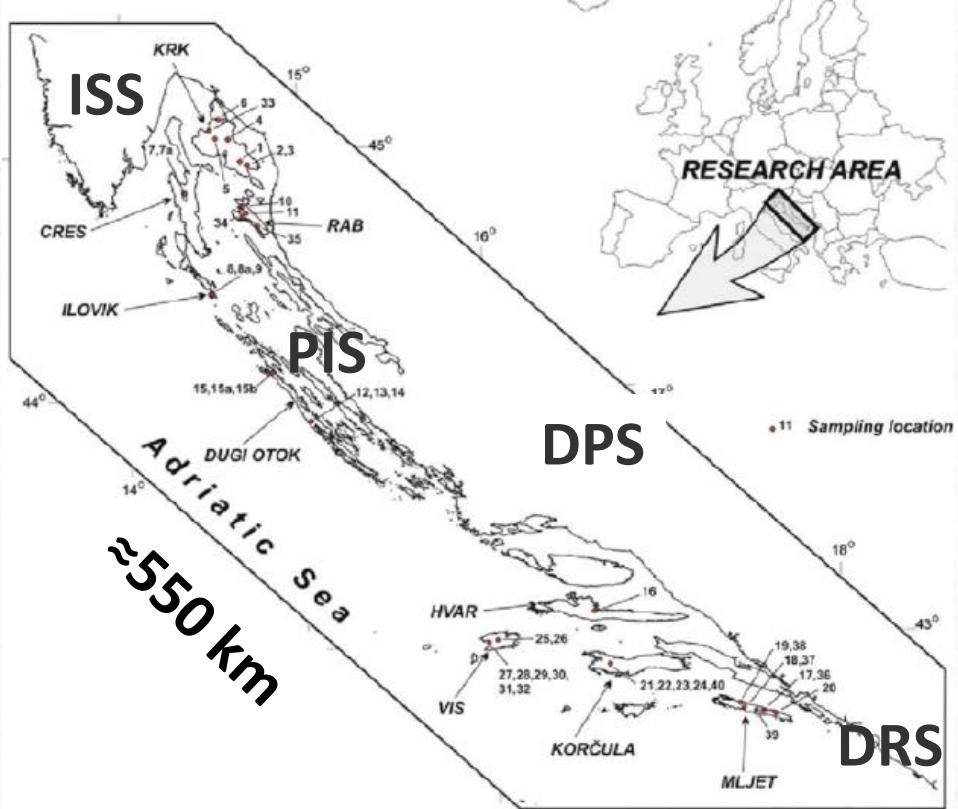


EMF (10)



East Adriatic sheep breeds

Additional data



Public database

Italian (2), Cao et al., (2020)

French(25), Rochus et al., (2018)

Spanish (1) Chitneedi et al., (2017)

African (1), Greyvenstein et al., (2016)

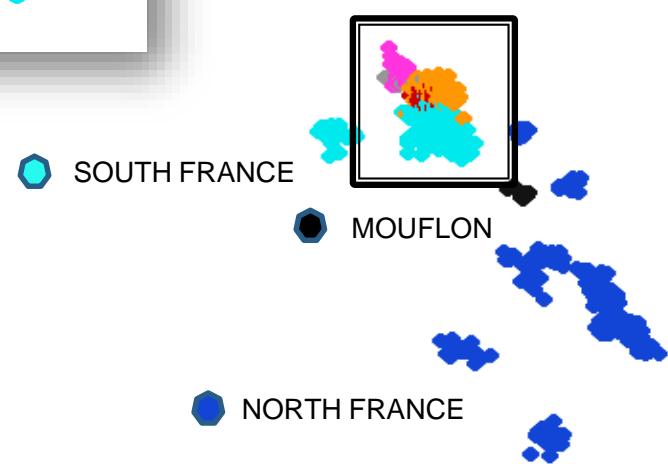
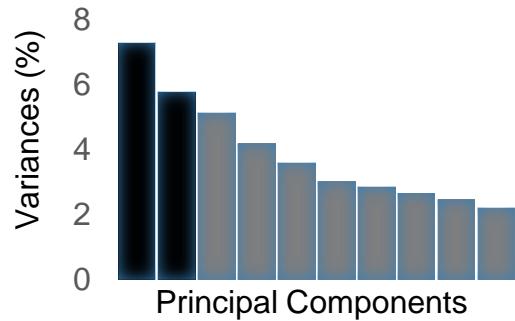
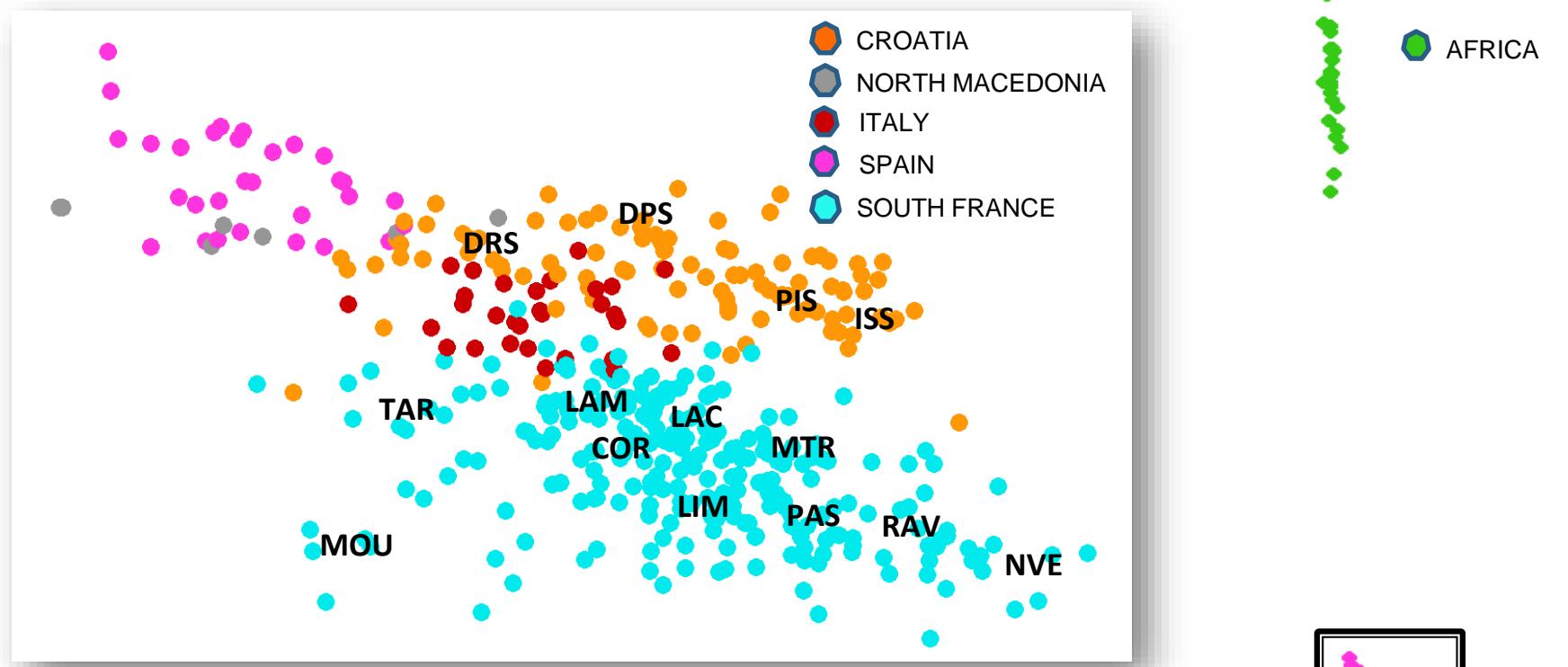
Quality Control:

Merging datasets

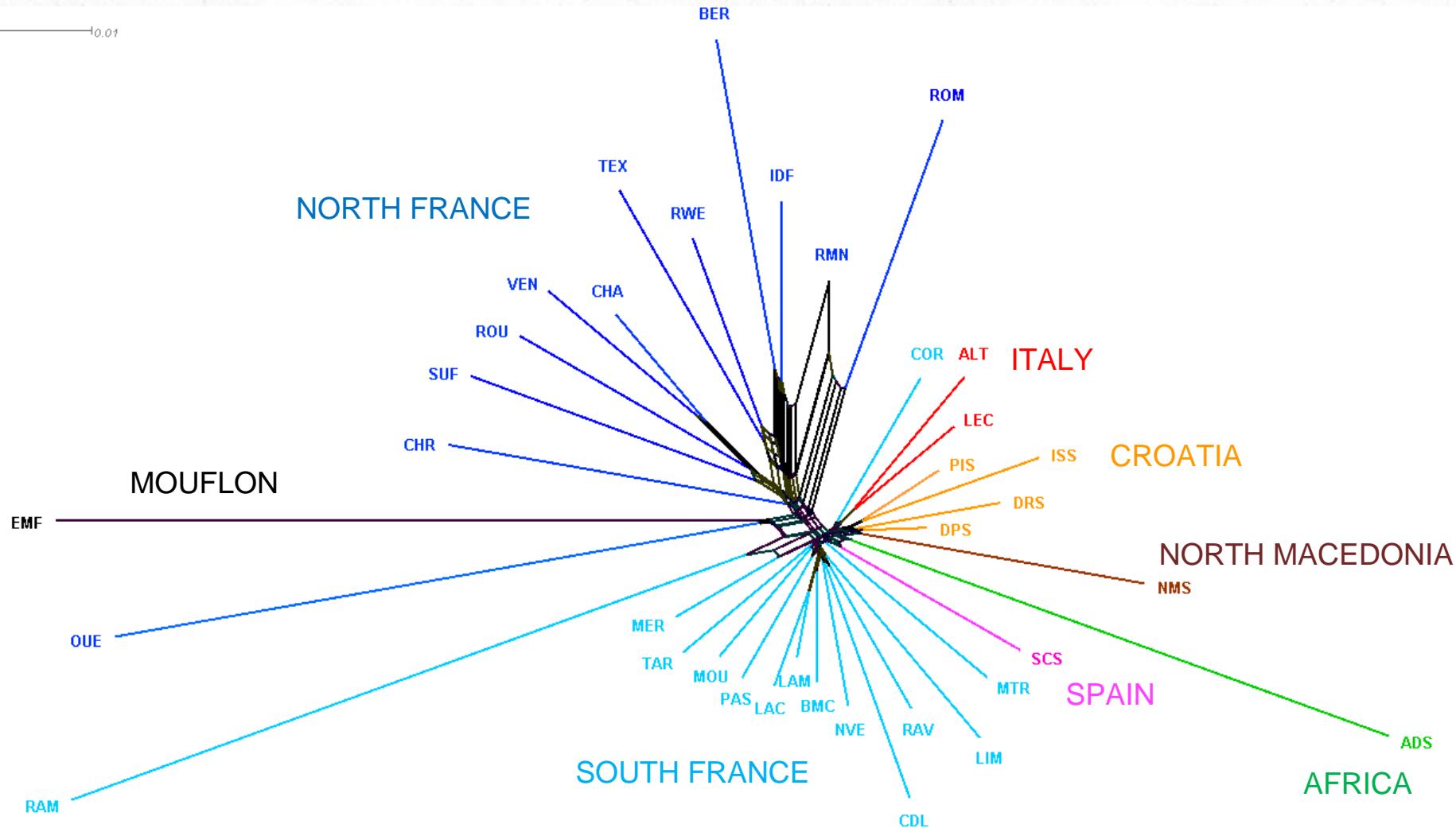
-- geno 0.9; -- mind 0.05; no sex, 0
and non-Oar4.0 SNPs: **366 112 SNP**
and 750 sheep

Results

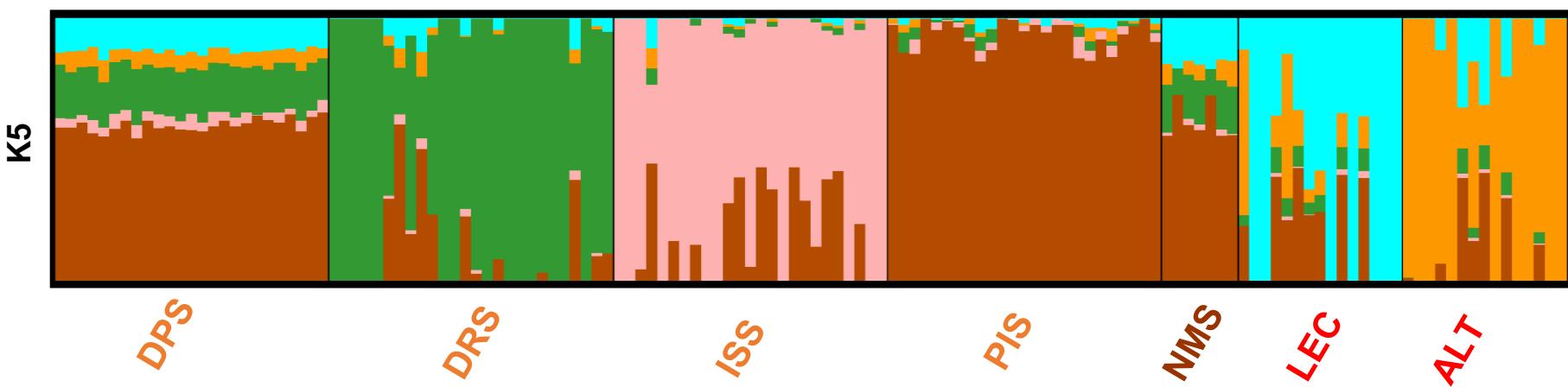
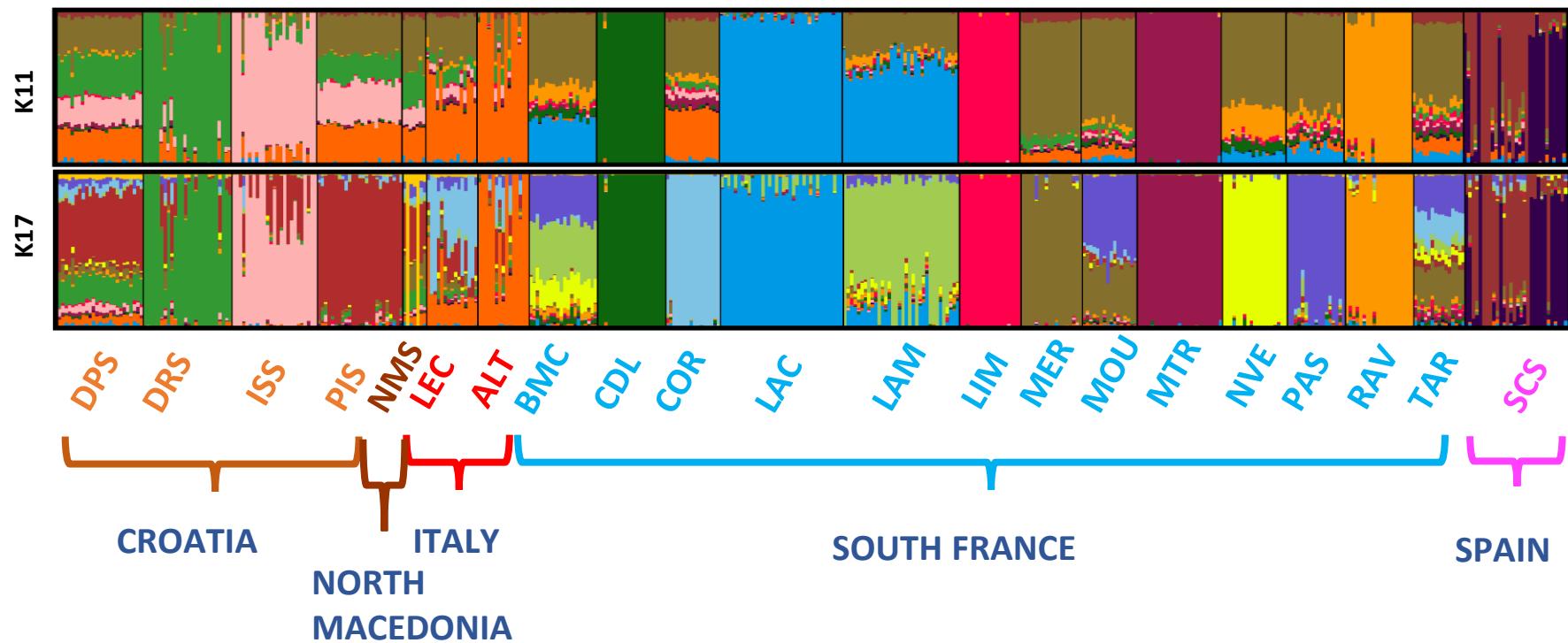
Principal Component Analysis



Neighbour net



Population admixture



Fixation indeks (FST)

Breed	DPS	DRS	ISS	PIS	NMS	LEC	ALT
DRS	0,026	.					
ISS	0,040	0,065	.				
PIS	0,016	0,040	0,042	.			
NMS	0,023	0,047	0,065	0,037	.		
LEC	0,023	0,045	0,057	0,031	0,040	.	
ALT	0,034	0,055	0,068	0,042	0,052	0,030	.
COR	0,033	0,054	0,066	0,038	0,052	0,036	0,046

<0.3

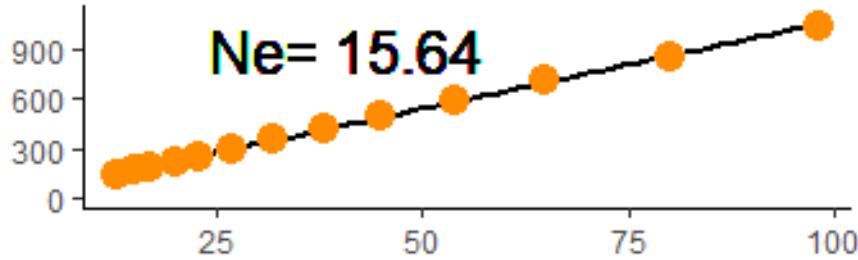
0.3 – 0.6

>0.6

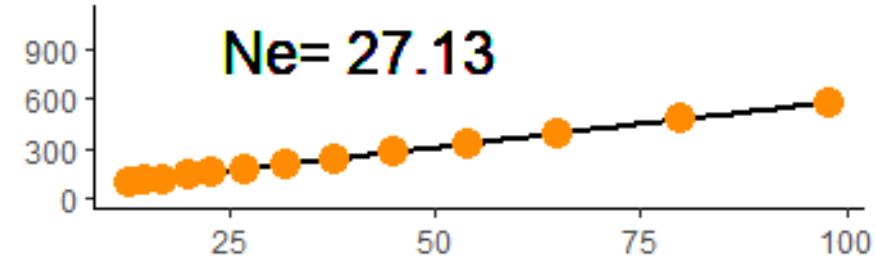
Ne_{LD} – linkage disequilibrium

Effective population size

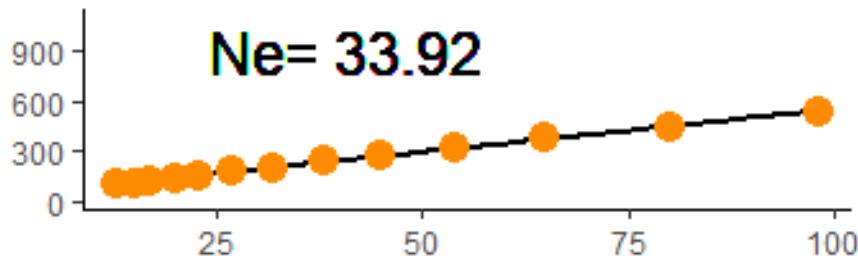
DPS



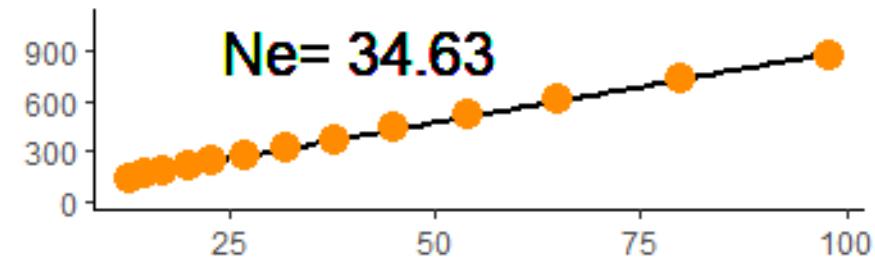
DRS



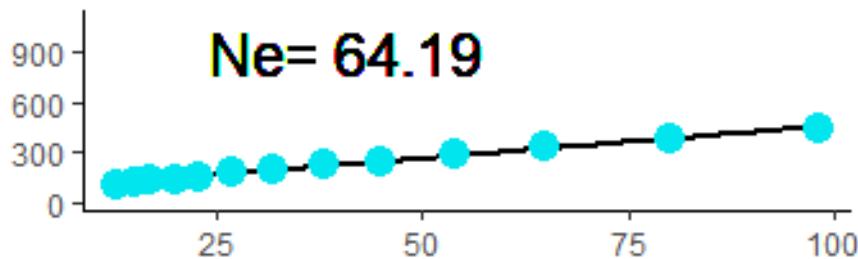
ISS



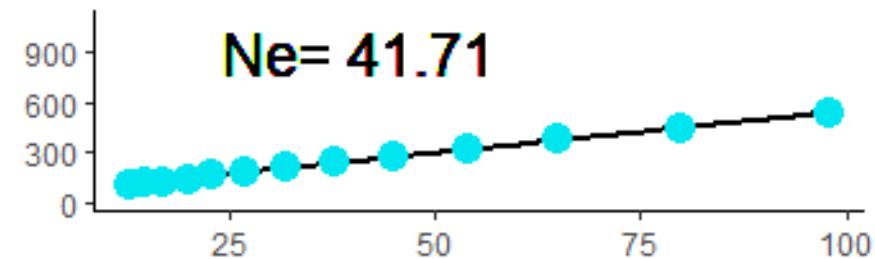
PIS



CHA



MTR



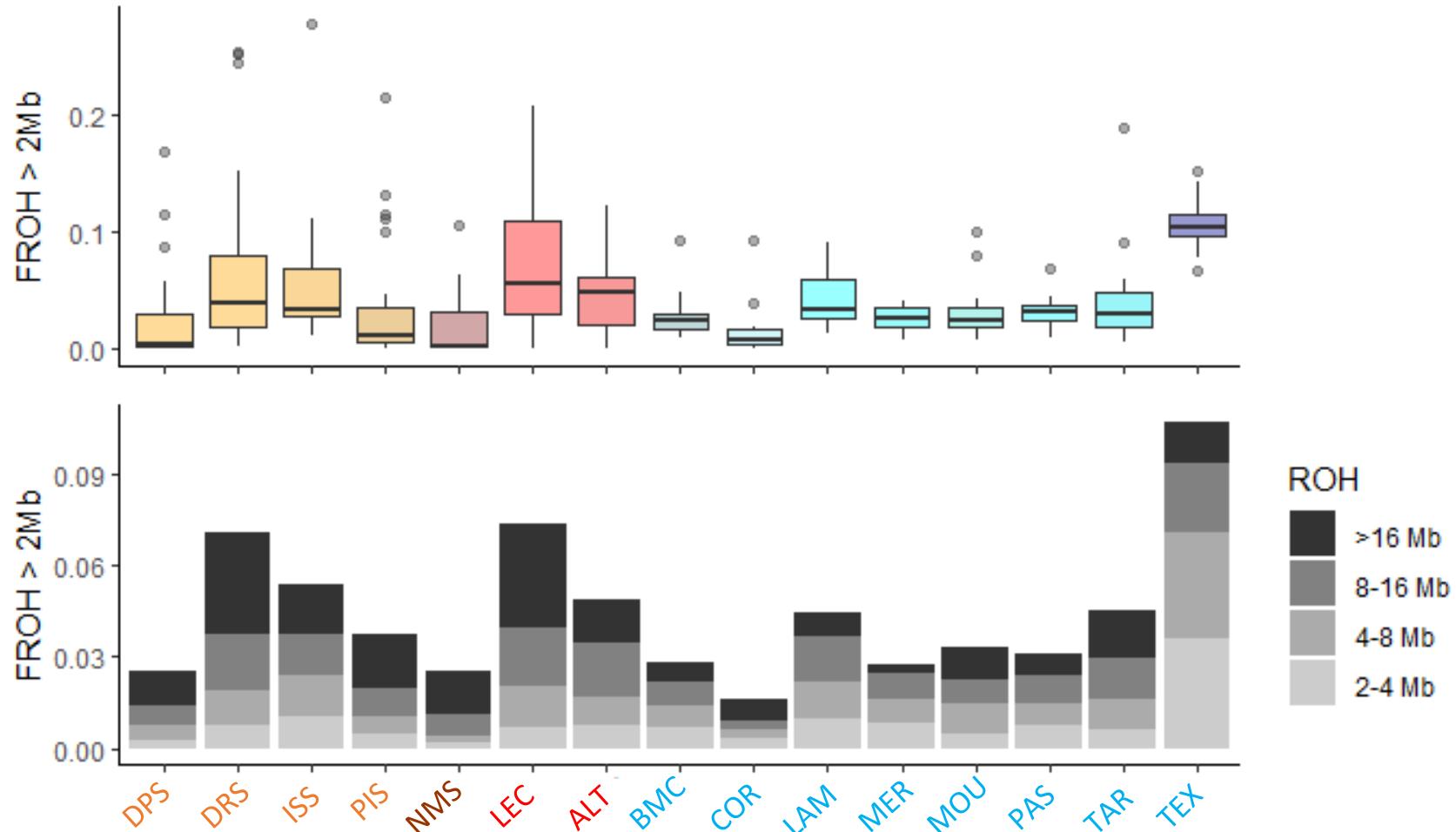
Generations ago

Ne_F – inbreeding

$$Ne_F = \frac{1}{2\Delta F}$$

BREED	Ne_F	Ne_{ID}	ΔNe
DPS	278,4098	15,64	-262,77
DRS	99,28556	27,13	-72,1556
ISS	145,2401	33,92	-111,32
PIS	193,2848	34,63	-158,655
CHA	140,3147	64,19	-76,1247
MTR	144,5902	41,71	-102,88

Runs of Homozygosity



Conclusion

- ✓ Croatian sheep breeds related to Corsican and Italian breeds
- ✓ Some breeds have lower Ne_{LD} , but larger inbreeding effective size
- ✓ Lower inbreeding present in Croatian breeds but higher recent inbreeding ($FROH_{16Mb}$)

Future work

- additional four East Adriatic breeds (+ new 100 individuals)
- inclusion of other European sheep breeds and ancient samples

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Europska unija
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Thank you for your attention!