

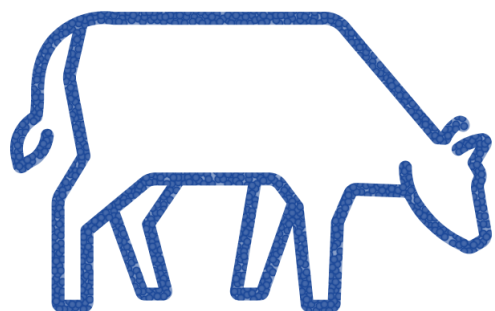
Pedigree and genomic-based inbreeding in Italian Holstein dairy cows

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Inbreeding in Holstein cattle



Key words:

- Inbreeding
- Holstein
- Cattle
- Genomic

162 Publications
83 Publications



Inbreeding in Italian Holstein cattle

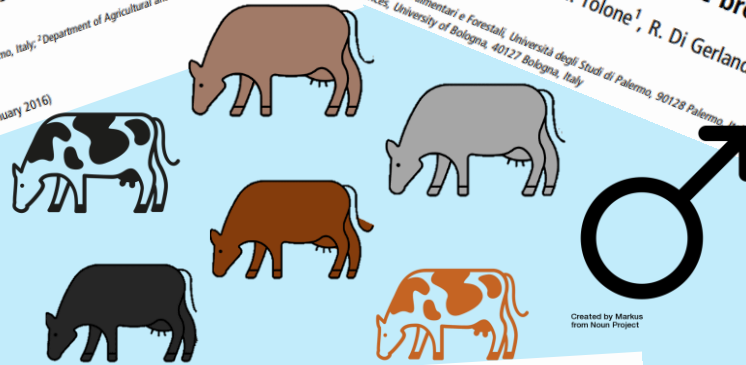


Key words:
Inbreeding
Holstein
Cattle
Genomic
Italian

Results:
3 Publications

Genomic inbreeding estimation in small populations: evaluation of runs of homozygosity in three local dairy cattle breeds
S. Mastrangelo^{1†}, M. Tolone¹, R. Di Gerlando¹, L. Fontanesi², M. T. Sardina¹ and B. Portolano¹
¹Dipartimento Scienze Agrarie e Forestali, University of Palermo, Viale delle Scienze, 90128 Palermo, Italy; ²Department of Agricultural and Food Sciences, Division of Animal Sciences, University of Bologna, Viale Fanin 46, 40127 Bologna, Italy
(Received 25 May 2015; Accepted 26 November 2015; First published online 6 January 2016)

Genome-wide identification of runs of homozygosity islands and associated genes in local dairy cattle breeds
S. Mastrangelo^{1†} and B. Portolano¹, M. T. Sardina¹, M. Tolone¹, R. Di Gerlando¹, A. M. Sutura¹, L. Fontanesi²
¹Dipartimento Scienze Agrarie, Alimentari e Forestali, Università degli Studi di Palermo, 90128 Palermo, Italy; ²Department of Agricultural and Food Sciences, Division of Animal Sciences, University of Bologna, 40127 Bologna, Italy



ANIMAL GENETICS
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Analysis of runs of homozygosity and their relationship with inbreeding in five cattle breeds farmed in Italy

Gabriele Marras, Giustino Gaspa ✉, Silvia Sorbolini, Corrado Dimauro, Paolo Ajmone-Marsan, Alessio Valentini, John L. Williams, Nicolò P. P. Macciotta

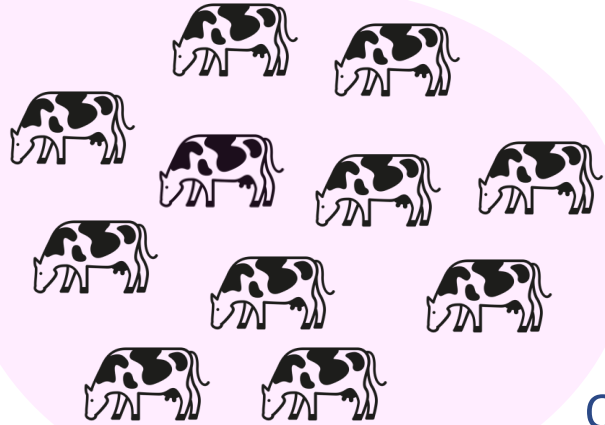
First published: 22 December 2014 | <https://doi.org/10.1111/age.12259> | Citations: 59

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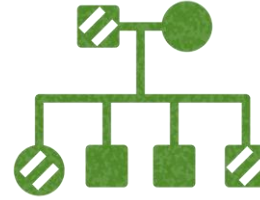
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SECTIONS

Aim of the study



Created by Kirsh
from Noun Project



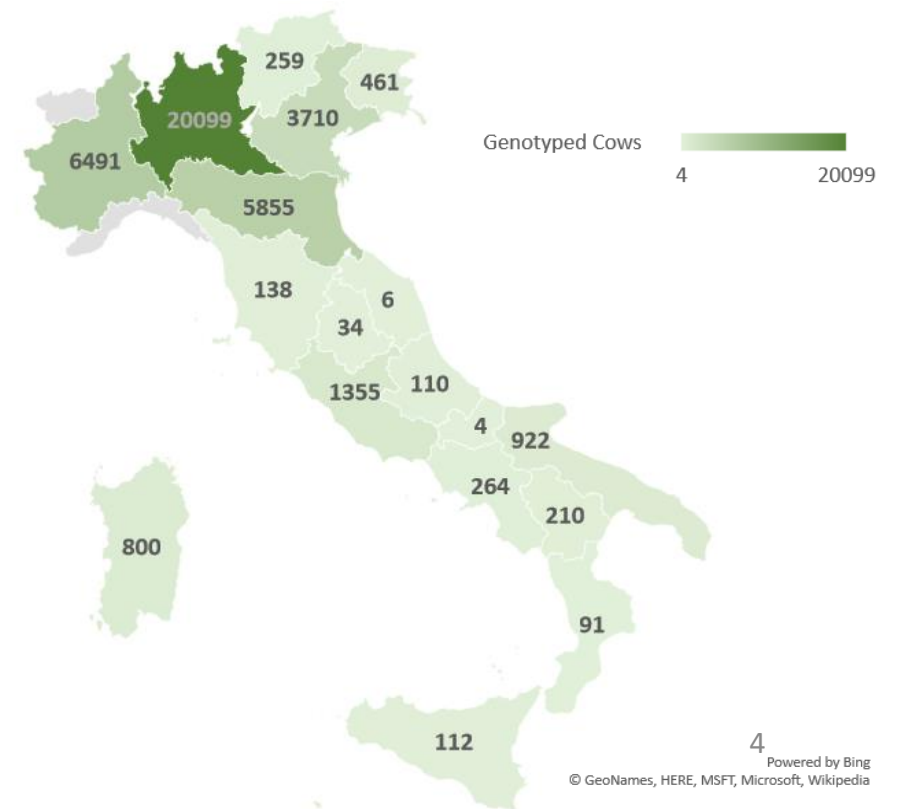
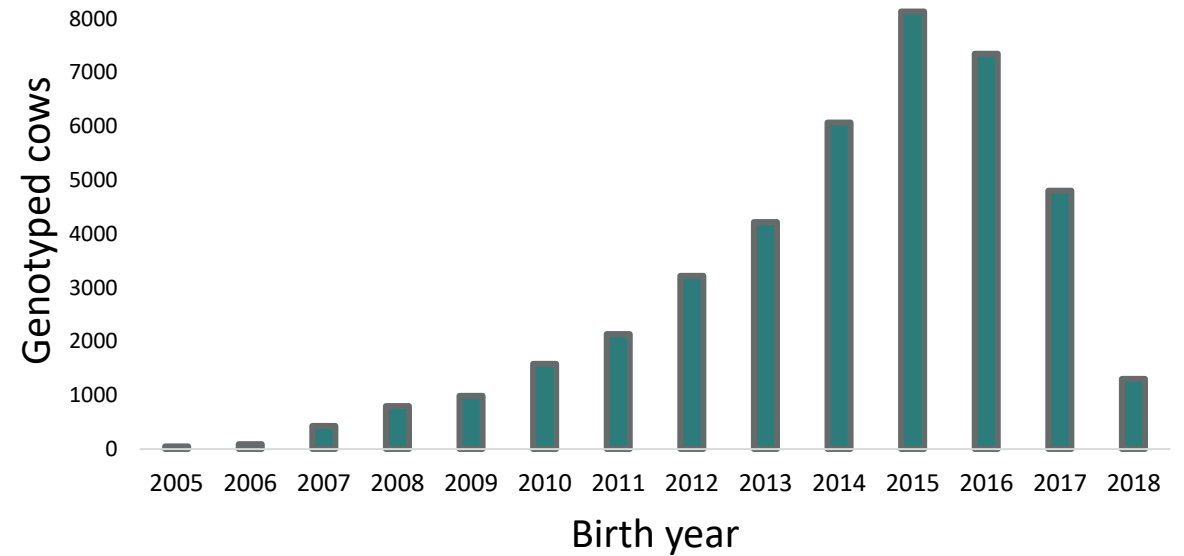
Over 40,000 Italian Holstein cows

Research questions

- 1) Inbreeding based on Pedigree (F_{PED}) and Runs of homozygosity (F_{ROH}) data
- 2) Correlation between inbreeding measured based on F_{PED} and F_{ROH}
- 3) Inbreeding trend throughout a period of 14 years

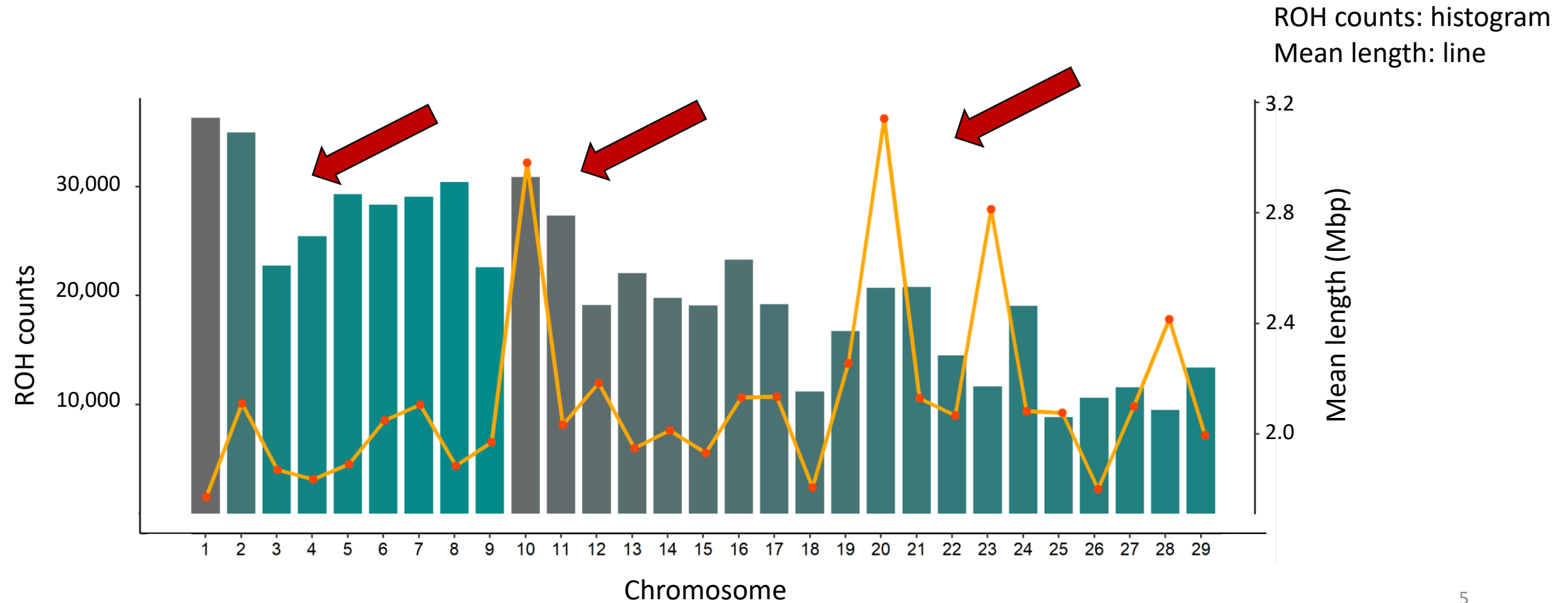
Material and methods

- 40,921 Italian Holstein dairy cows with imputed SNPs data
- 245,600 Italian Holstein animals in the pedigree
- F_{PED} and complete generation equivalent (CGE) calculated in ENDOG 4.8
- F_{ROH} calculated using *DetectRUNS* in R (Biscarini et al., 2019) following Doekes et al., 2019 (Criteria: Length > 1Mbp, minimum 10 SNPs, minimum density of 1 SNP per 100 kb, a maximum of one heterozygous call with a ROH)



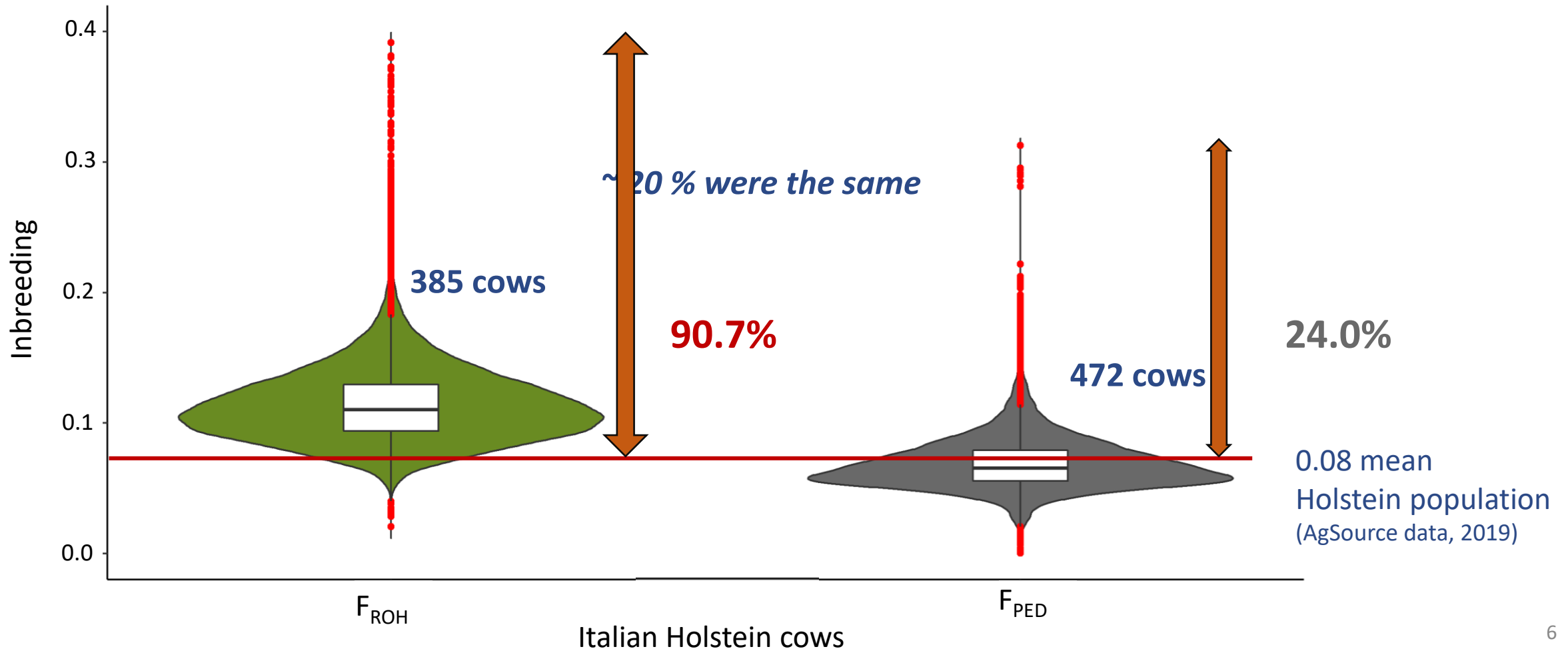
Results

ROH counts and average length per chromosome



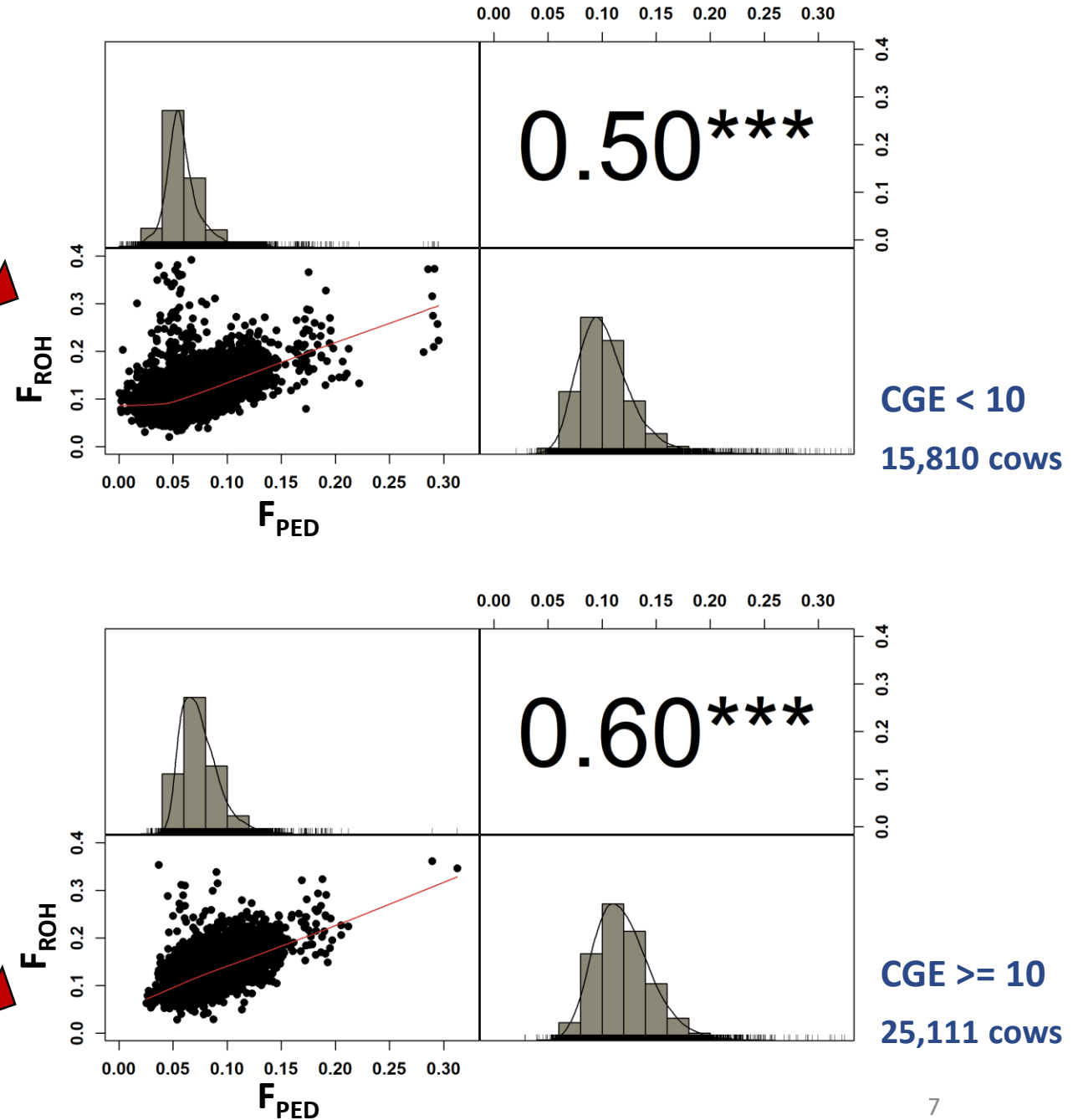
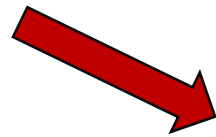
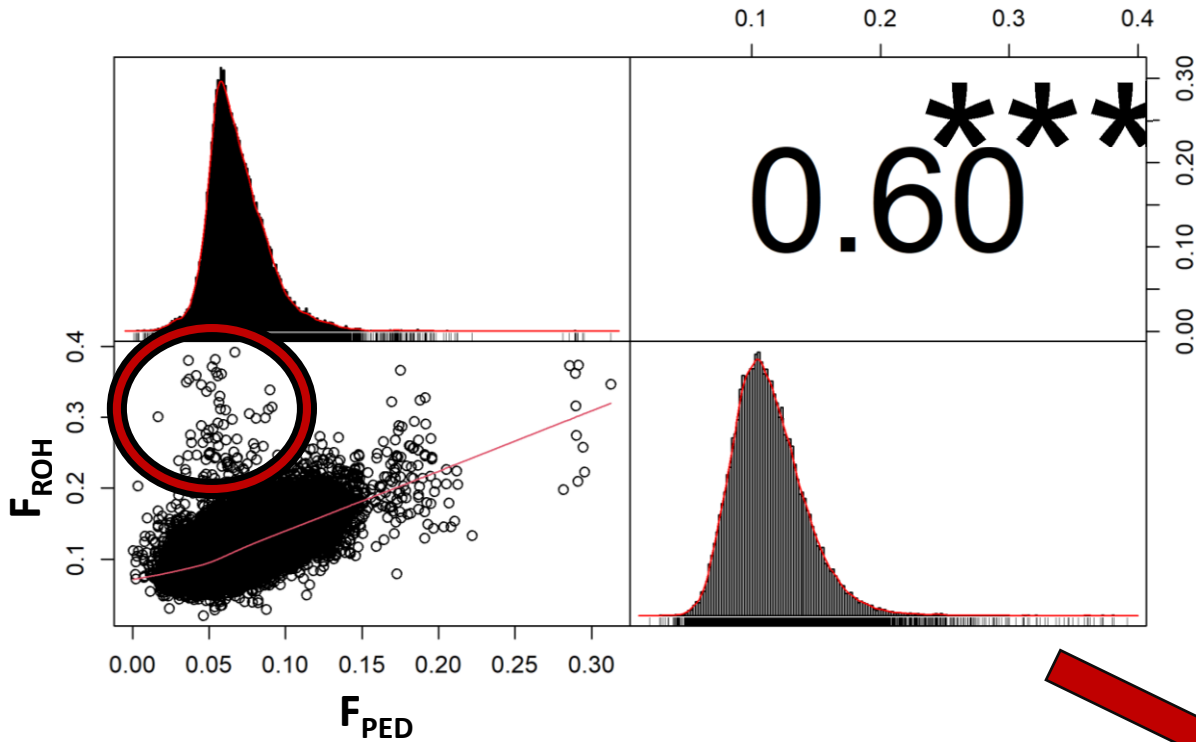
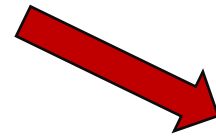
Results

Inbreeding from F_{ROH} and F_{PED}



Results

Comparison between F_{ROH} and F_{PED}



Results

Inbreeding trend per year based on F_{ROH} and F_{PED}

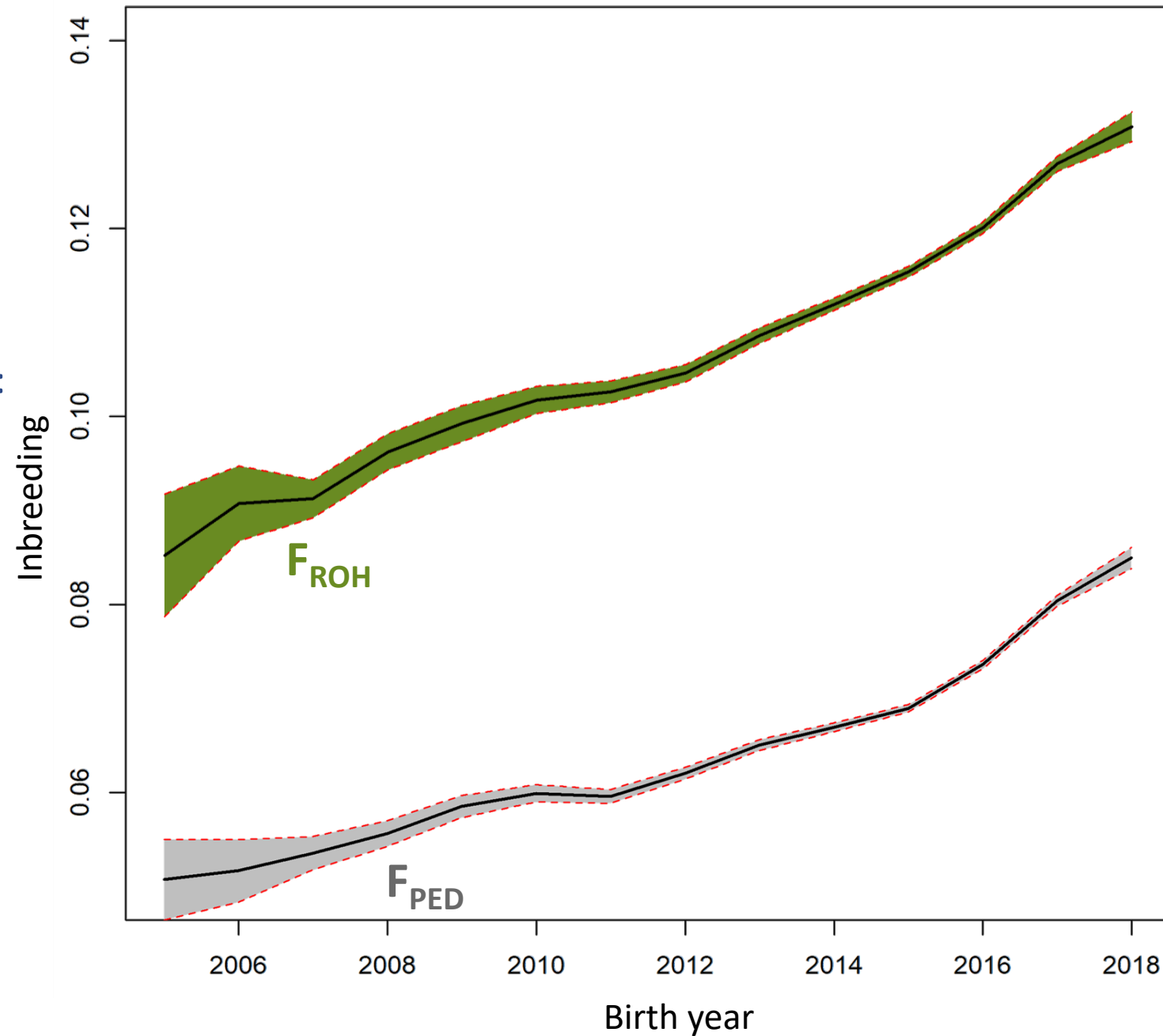
- Mean difference among the two methods:
 ~ 0.04 [0.044, 0.045]

- ΔF calculation:

$$\Delta F_y = 1 - e^{(slope)}$$

ROH ΔF_y per year: + 0.37% ***

Pedigree ΔF_y per year: + 0.28% ***



Results

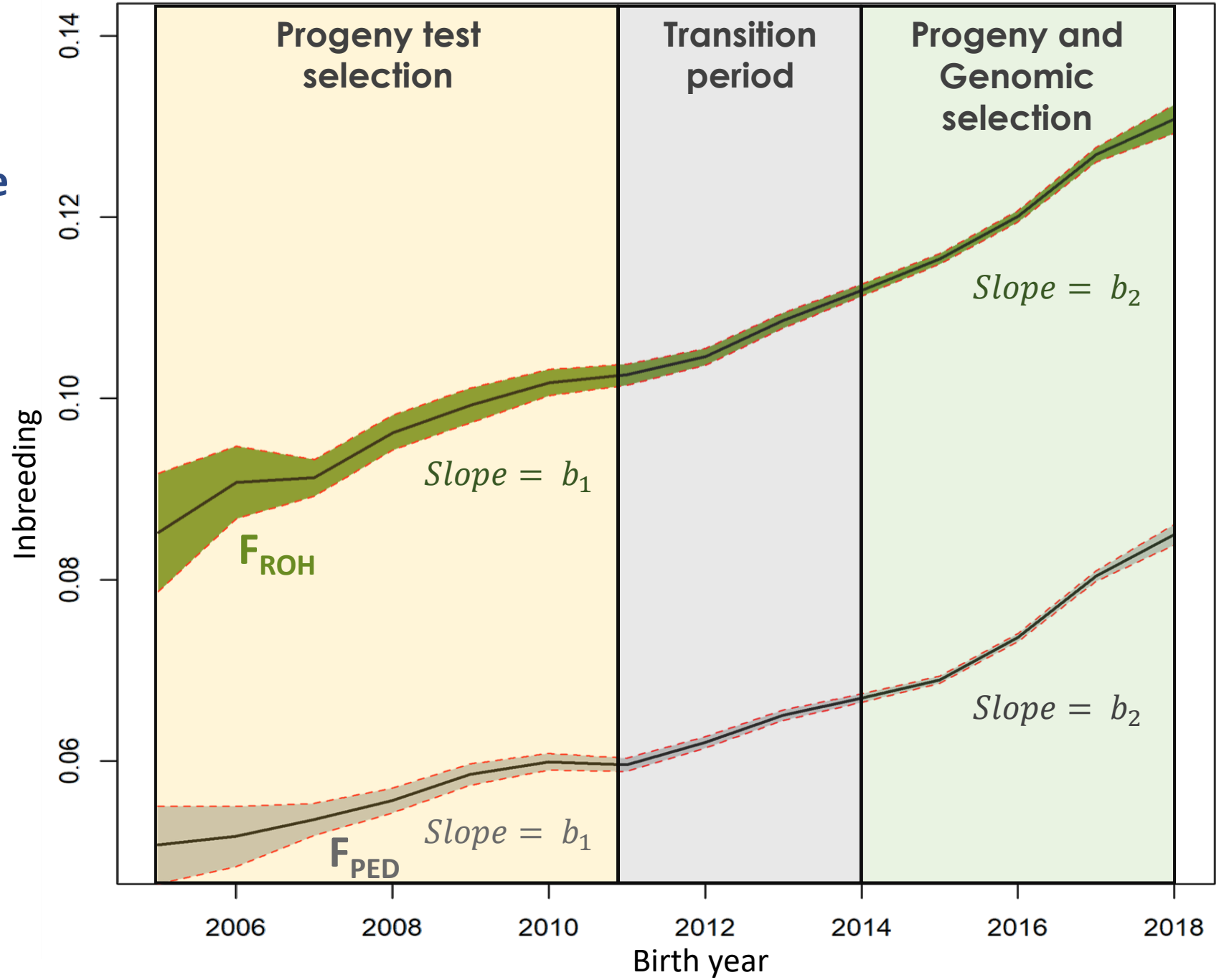
Further evaluation of the studied period

Relative change in slope:

$$\frac{b_2 - b_1}{b_1}$$

Relative change of ΔF based on ROH = + 1.26

Relative change of ΔF based on Pedigree = + 3.02



Conclusion

- F_{ROH} ↑ higher than F_{PED} ↓
- Moderate correlation (0.60) between F_{ROH} and F_{PED}
- Lower CGE, ↓ lower correlation between F_{ROH} and F_{PED} ↓
- ΔF per year showed an increasing trend ↗
- Acceleration in ΔF comparing progeny test selection only to the current scenario



Practical and innovative applications for farmers

What to do next?


- Different methodologies and define best one to be used as routine measurement
 - Threshold to define highly inbred animals?
 - The effect of targeted selection on specific chromosomes
- Further understand the role of genomic selection



Thank you for listening!

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Picture from:
<https://www.depoda.it/animali/frisona/>

Supplementary

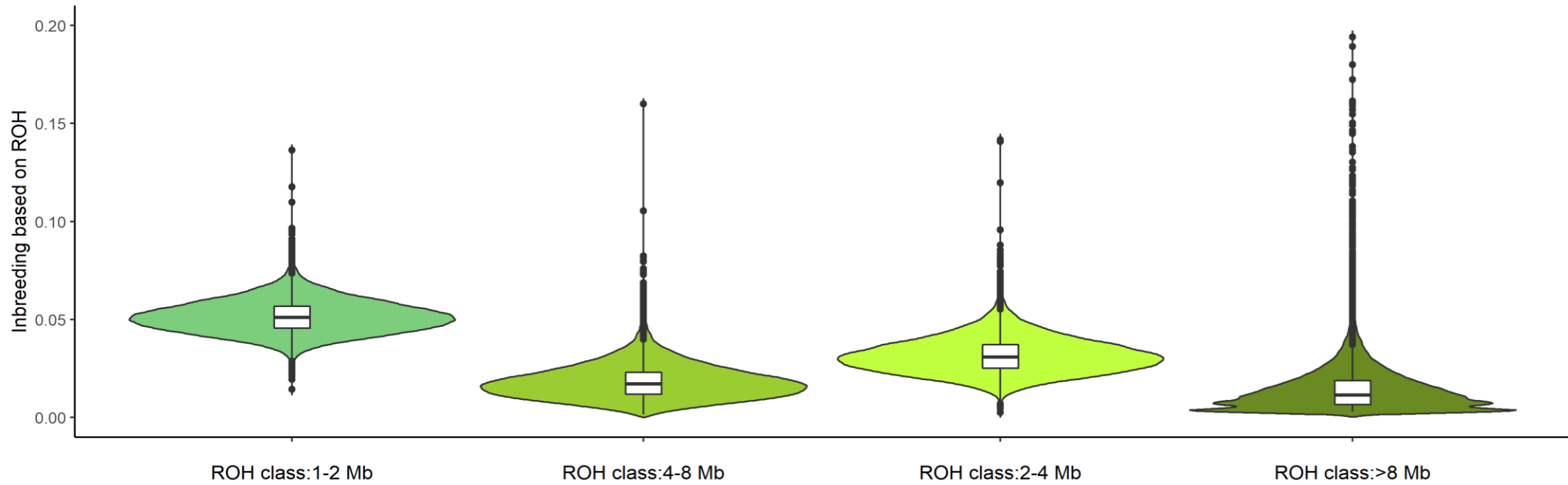
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ROH Class	Mean	Min.	Max.	SD	Highly inbred
1-2 Mbp	0.05	0.01	0.14	0.008	> 0.08 (309)
2-4 Mbp	0.03	0.00	0.21	0.009	> 0.06 (356)
4-8 Mbp	0.02	0.00	0.16	0.008	> 0.05 (385)
>8 Mbp	0.01	0.00	0.21	0.008	> 0.04 (1866)

Mean=10.2

