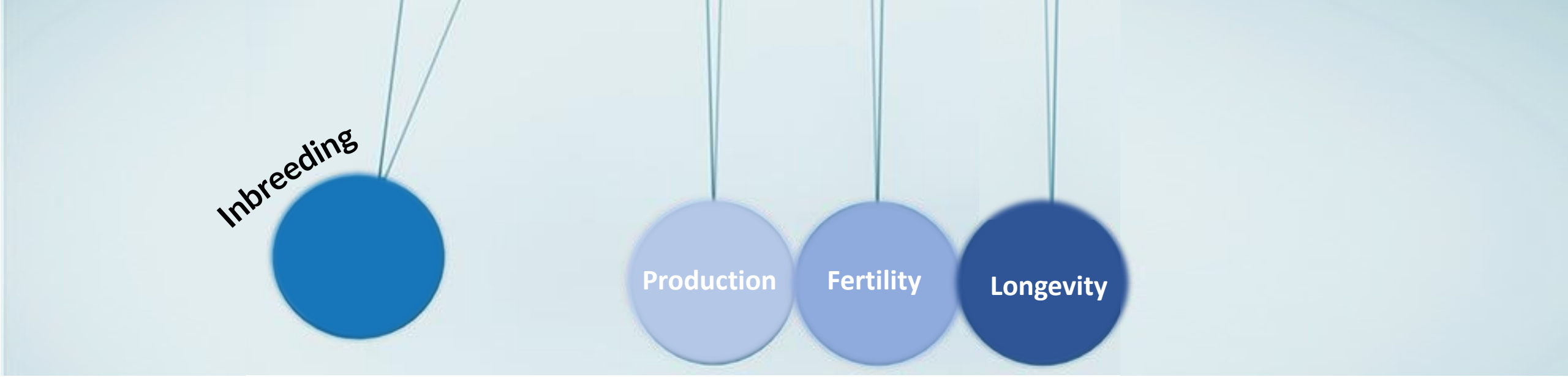

The impact of inbreeding in the Italian Holstein breed

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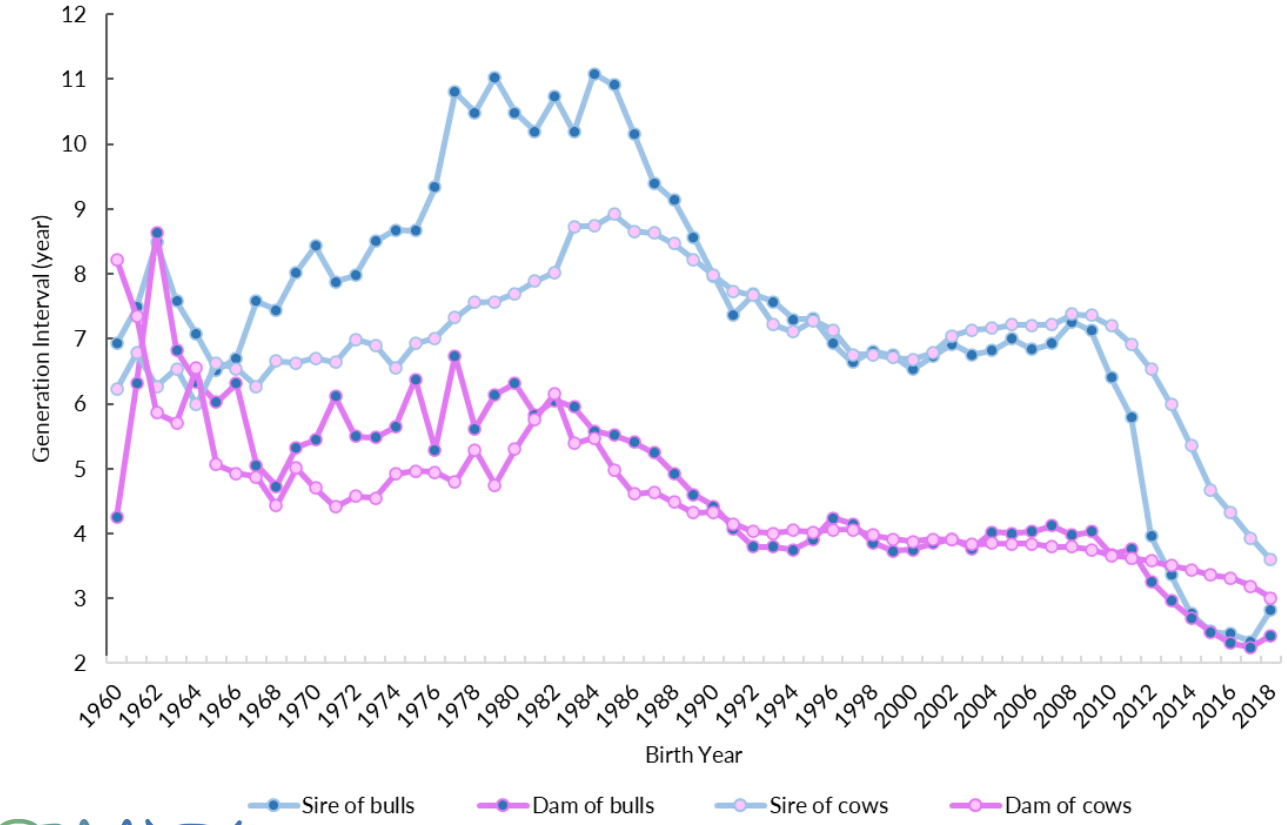
OF THE ANIMAL SCIENCE AND PRODUCTION ASSOCIATION
ANIMAL SCIENCE AND SOCIETY CONCERNS
SEPTEMBER 21-24, 2021 PADOVA (ITALY)

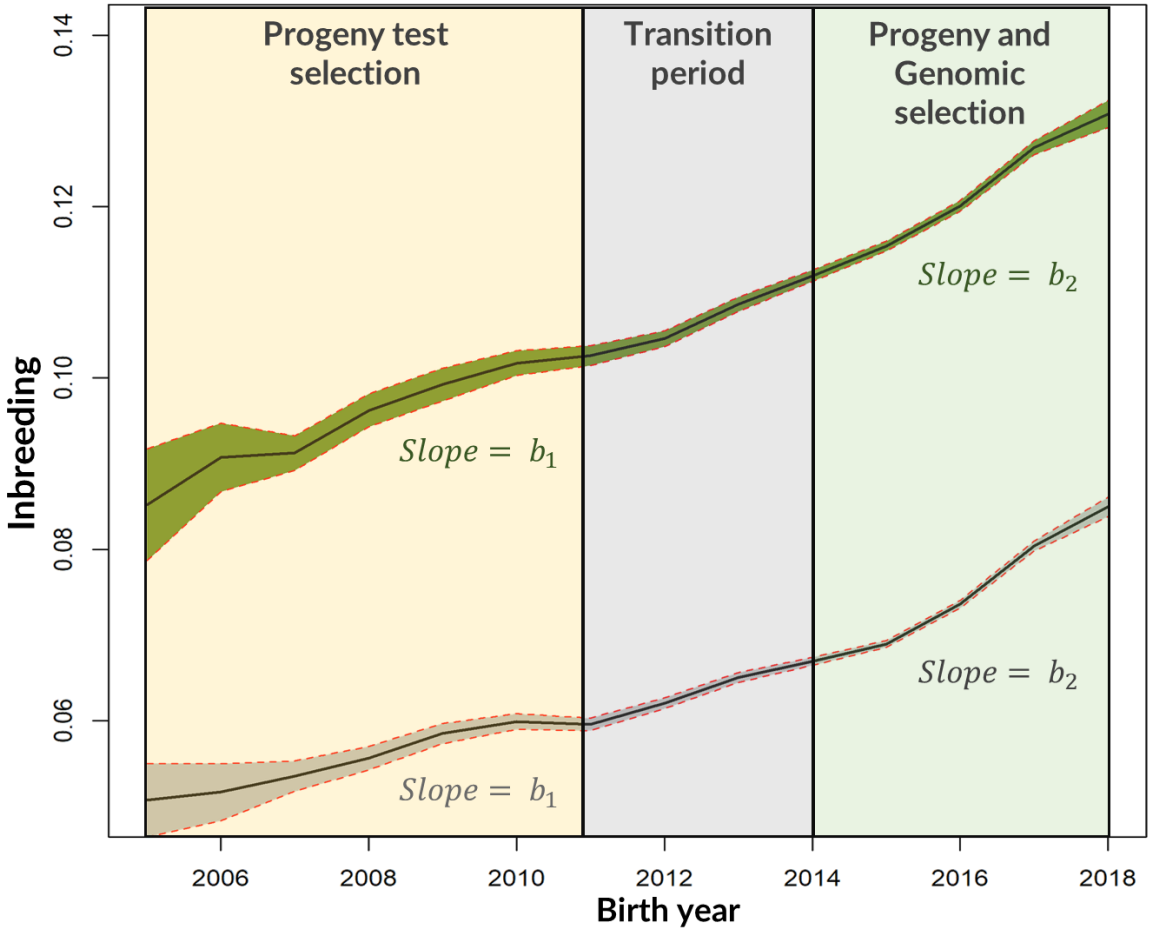
Context: Genetic diversity in the Italian Holstein cattle

In a previous study…

1) Generation Interval: from ~ 7 to ~ 3 years



2) ΔF_{year} +0.27% and +0.44% for F_{PED} and F_{ROH}



Ablondi et al. 2020

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Research question

…Thus:

Do we have inbreeding depression in the Italian Holstein breed?

Aims of the study:

1) Estimate the inbreeding in 27,735 Italian Holstein dairy cows from pedigree and genotype data

2) Investigate the effect of inbreeding on production, fertility and functional traits

Material and Methods

A total of 27,735 Italian Holstein cows with:

- Pedigree data
- Imputed genotype data (85k)
- Production, fertility and functional traits

305-day milk, fat and protein yield (kg)

1

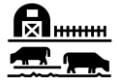
Inbreeding estimations:

F_{ped} and F_{ROH}

Optisel and DetectRuns in R

2

Linear mixed models:

-  x  herd-year
-  month of calving
-  parity
-  cow

&

A) F_{ped} and F_{ROH} as β regression

B) F_{ped} and F_{ROH} as percentile classes

C) F_{ROH} divided by length classes

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Results and Discussion

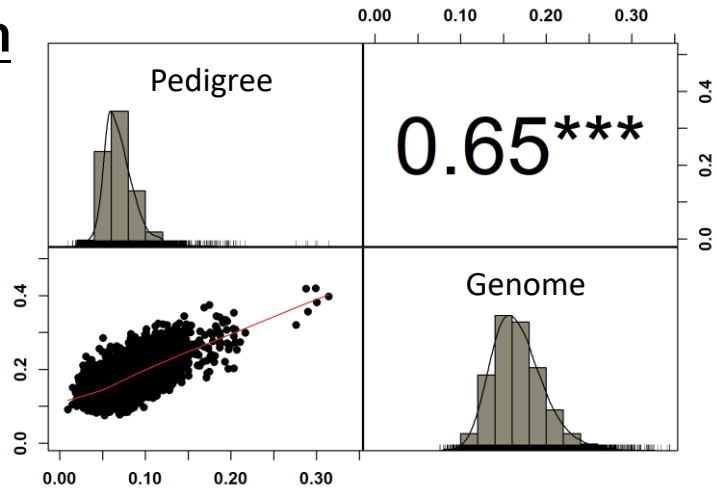
Results and Discussion

1

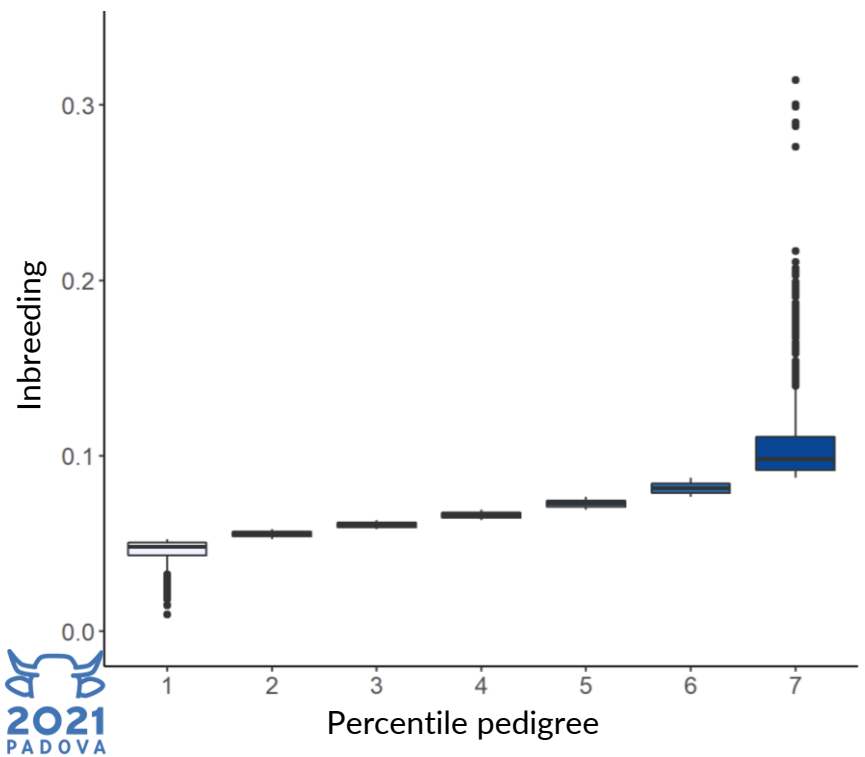
Inbreeding estimations

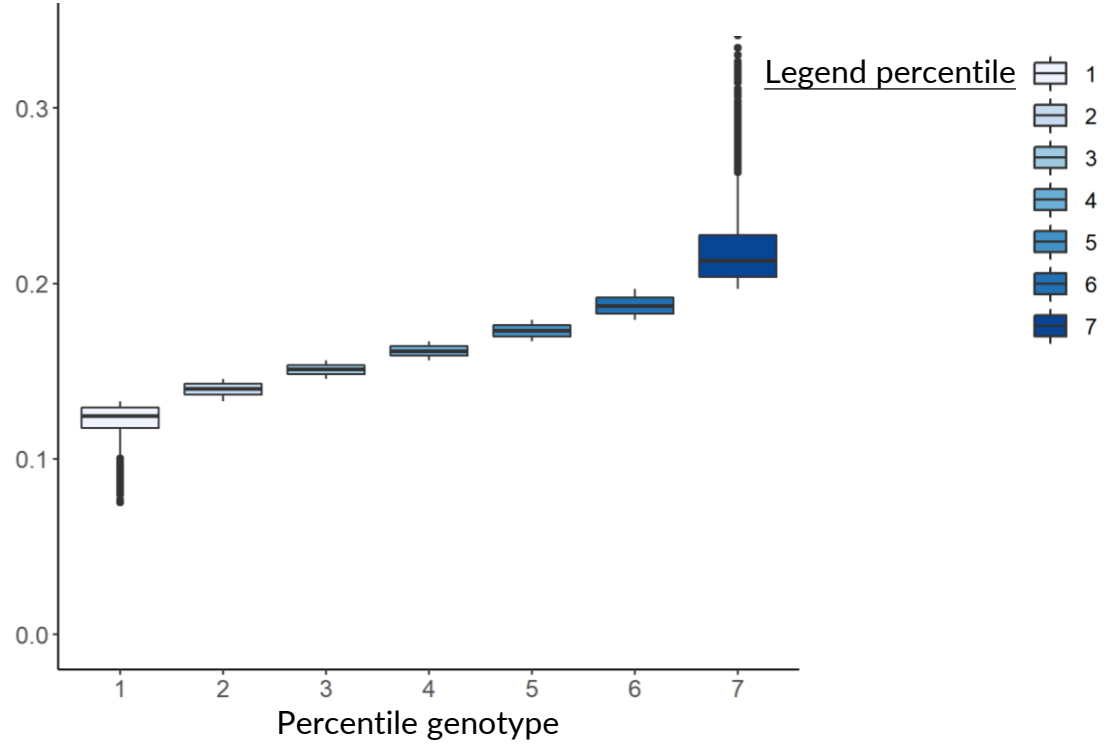
Inbreeding	Mean	SD
F_{ped}	0.07	0.02
F_{ROH}	0.16	0.03

Correlation



Percentile based on F_{ped} and F_{ROH}





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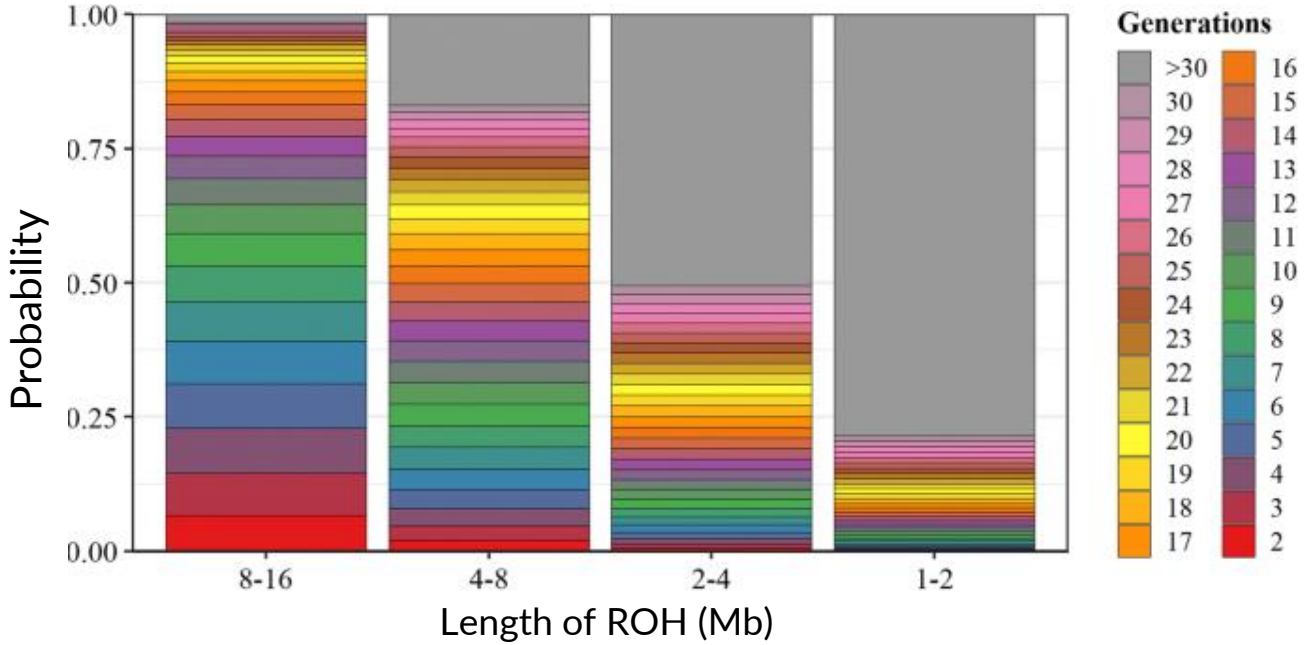
Results and Discussion

1 Inbreeding estimations

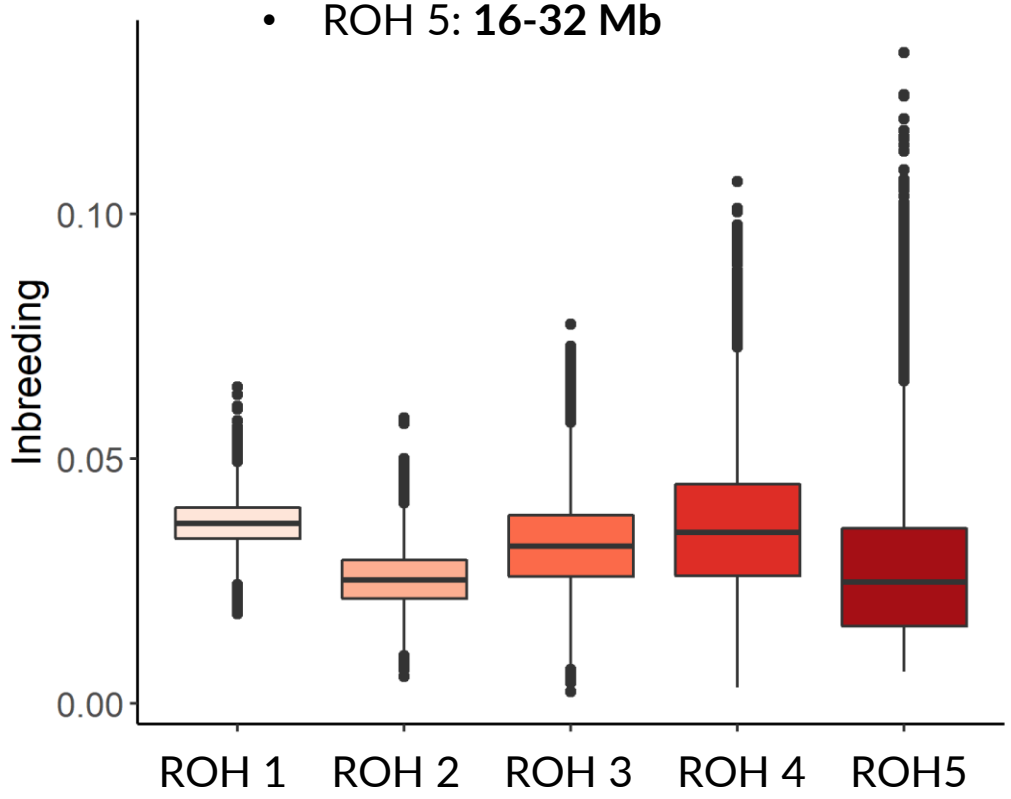
Length of ROH – Expected age of inbreeding



Doekes et al. 2021 (https://doi.org/10.1186/s12711-019-0497-z)

F_{ROH} divided by length classes

- ROH 1: **1-2 Mb**
- ROH 2: **2-4 Mb**
- ROH 3: **4-8 Mb**
- ROH 4: **8-16 Mb**
- ROH 5: **16-32 Mb**



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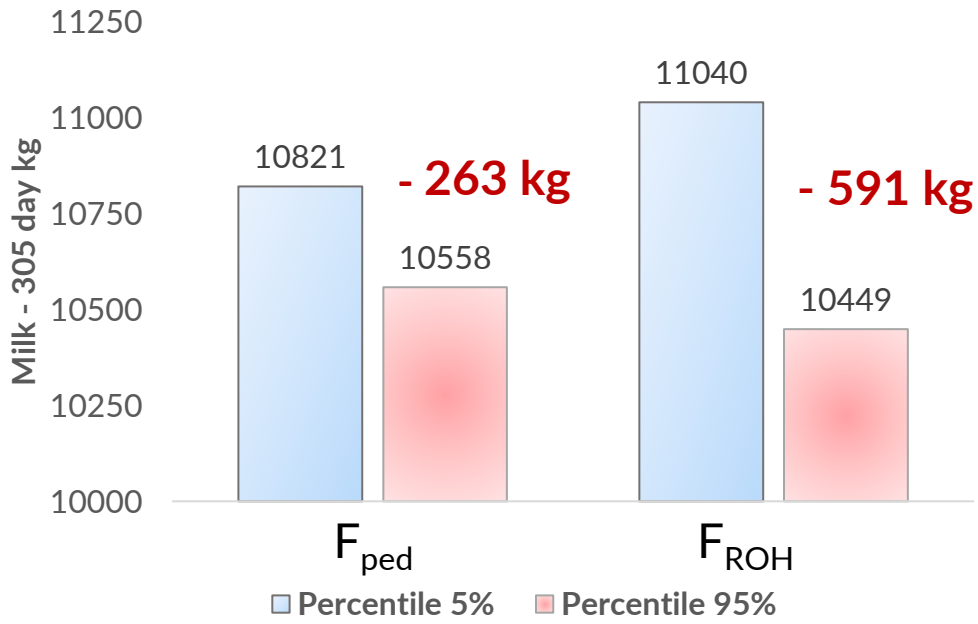
Results and Discussion

2A **F_{ped} and F_{ROH} as β regression**

1% increase in F_{ped} and F_{ROH}

- 61 and - 44 kg of milk per lactation
- 2.45 and - 1.31 kg of fat per lactation
- 2.0 and - 1.41 kg of protein per lactation

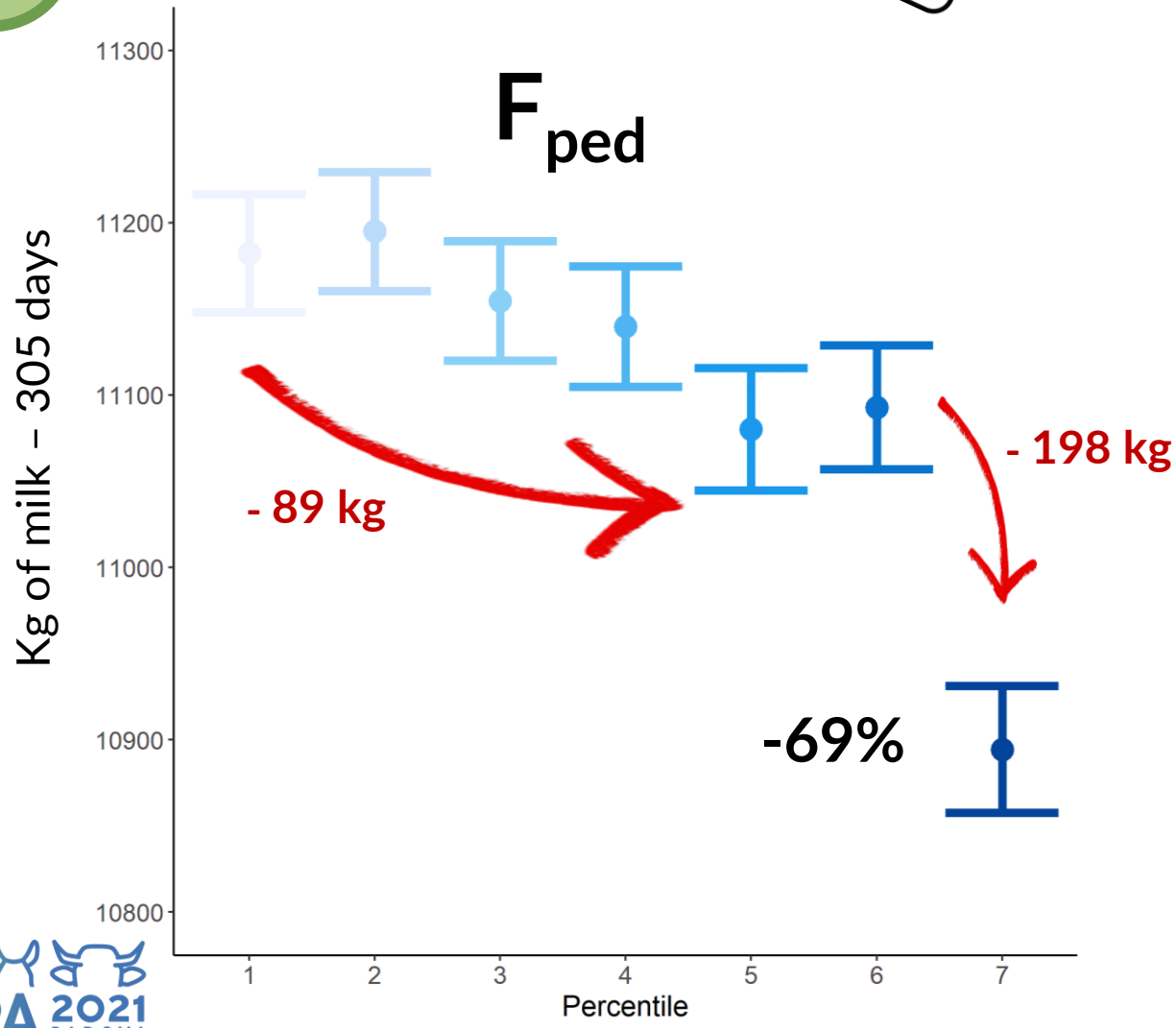
Difference between expected phenotypes of cows with low and high inbreeding (5% and 95%)

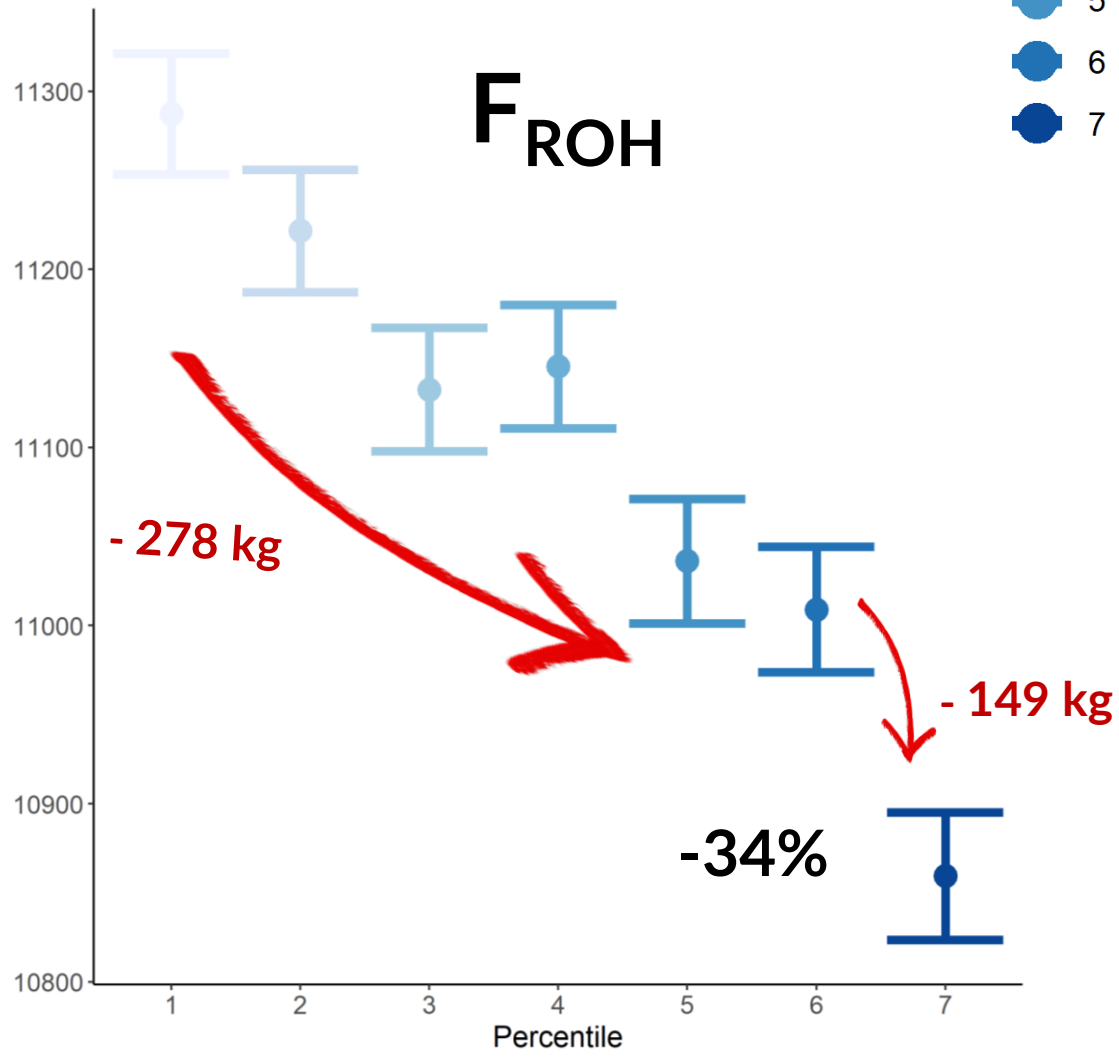


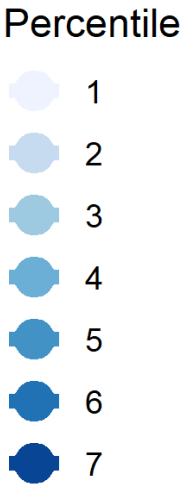
Results and Discussion

2B

F_{ped} and F_{ROH} as percentile classes







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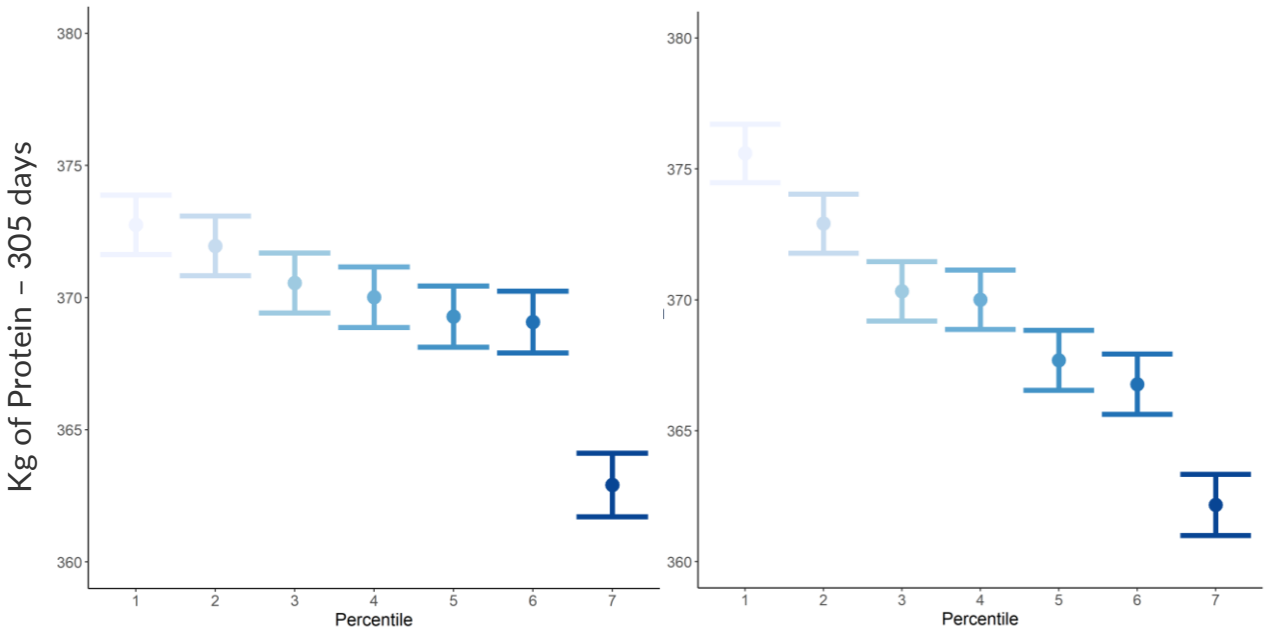
Results and Discussion

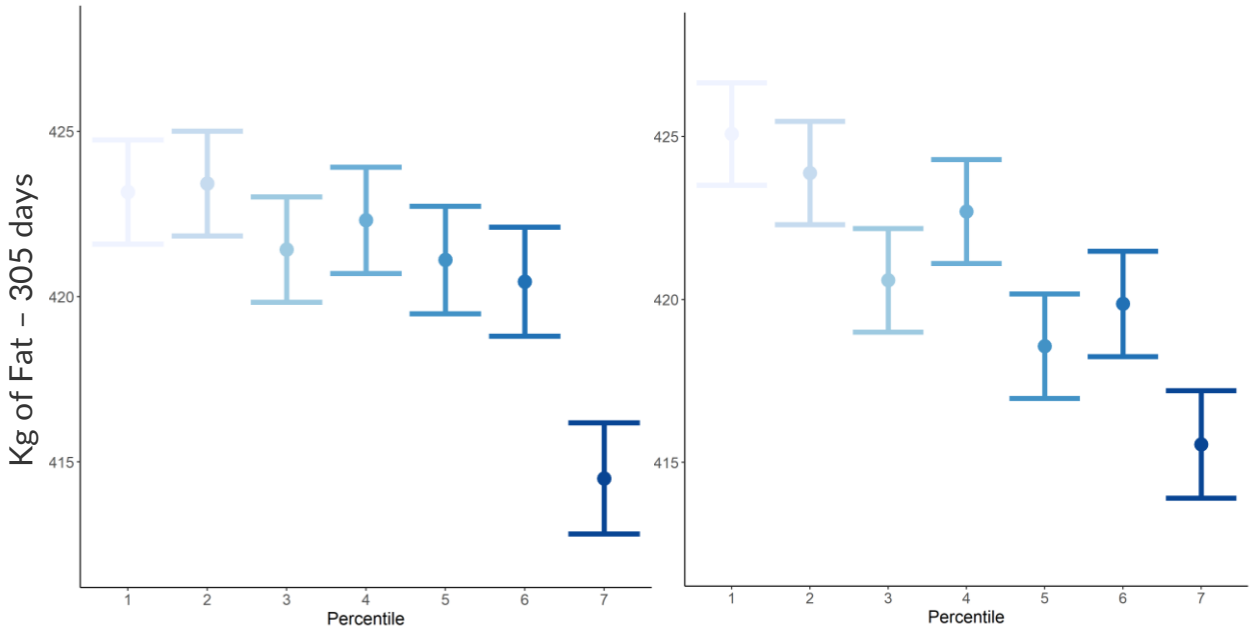
2B F_{ped} and F_{ROH} as percentile classes

Percentile
1
2
3
4
5
6
7

Kg of Protein – 305 days



Kg of Fat – 305 days



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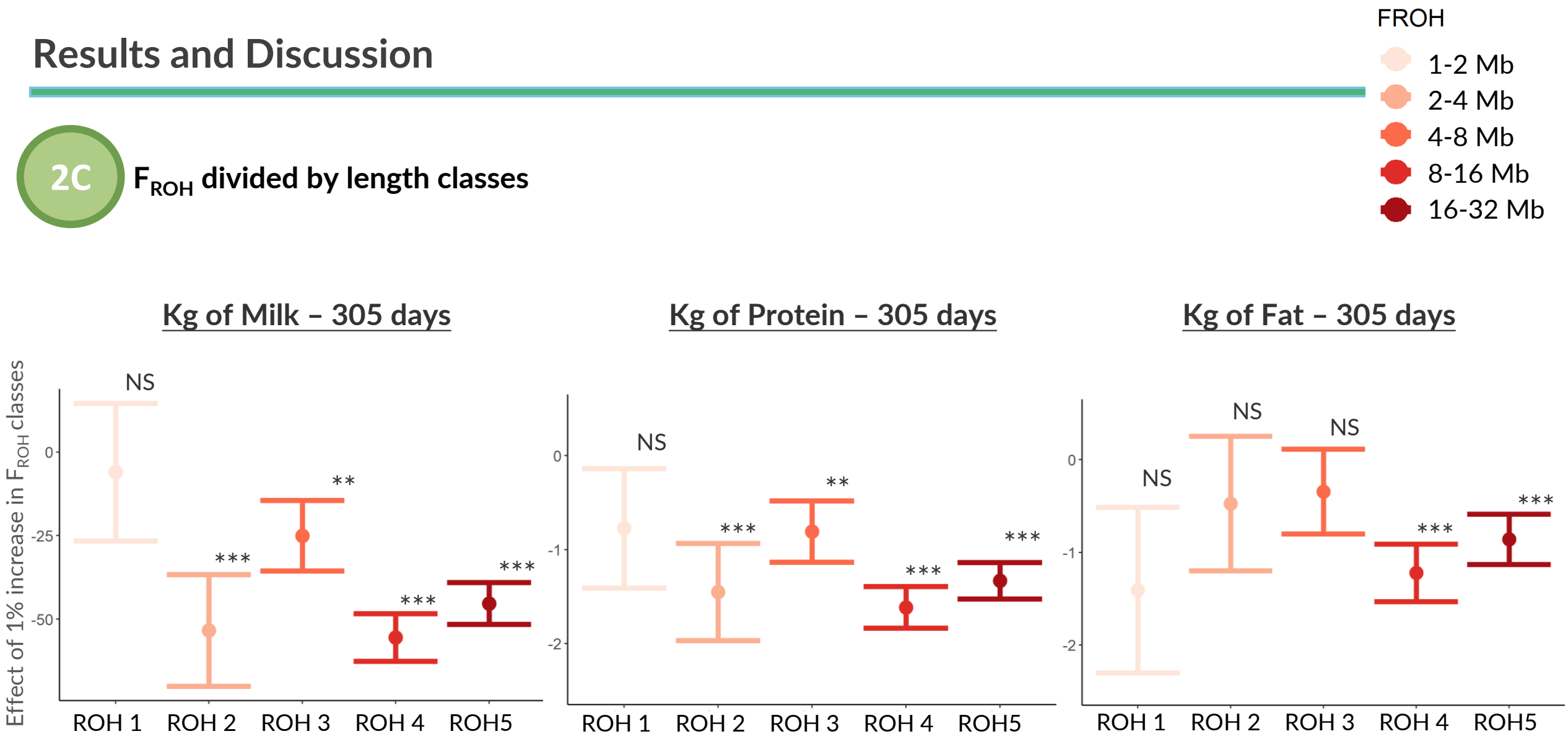
Results and Discussion

2C F_{ROH} divided by length classes



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Conclusion

- Inbreeding depression was observed for **yield traits**
- **Similar results** in terms of inbreeding depression were found based **on F_{ped} and F_{ROH}**
- The effect of inbreeding depression **was more evident in the highest inbreeding percentile class**
- Inbreeding at **recent generations** seemed **more harmful** than inbreeding at distant generations

What to do next?

- Inbreeding depression for **fertility and functional traits**
  - Further evaluation of **old and recent inbreeding**
    - Development of **practical tools** for breeders

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Thank you for listening!

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