Characterization of genomic homo- and heterozygosity in a commercial turkey population

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Introduction

- Runs of homozygosity (ROH) are segments of continuous homozygous genome
- ROH can be useful for characterizing livestock genomes and understanding implications of strong selection
- Livestock genomes are mostly homozygous
  - Alternative: heterozygous clusters, runs of heterozygosity (ROHet)

Objective

- Analyze the turkey genome for runs of homozygosity and runs of heterozygosity
- Compare inbreeding levels using ROH (F_{ROH}) and pedigree information (F_{PED})

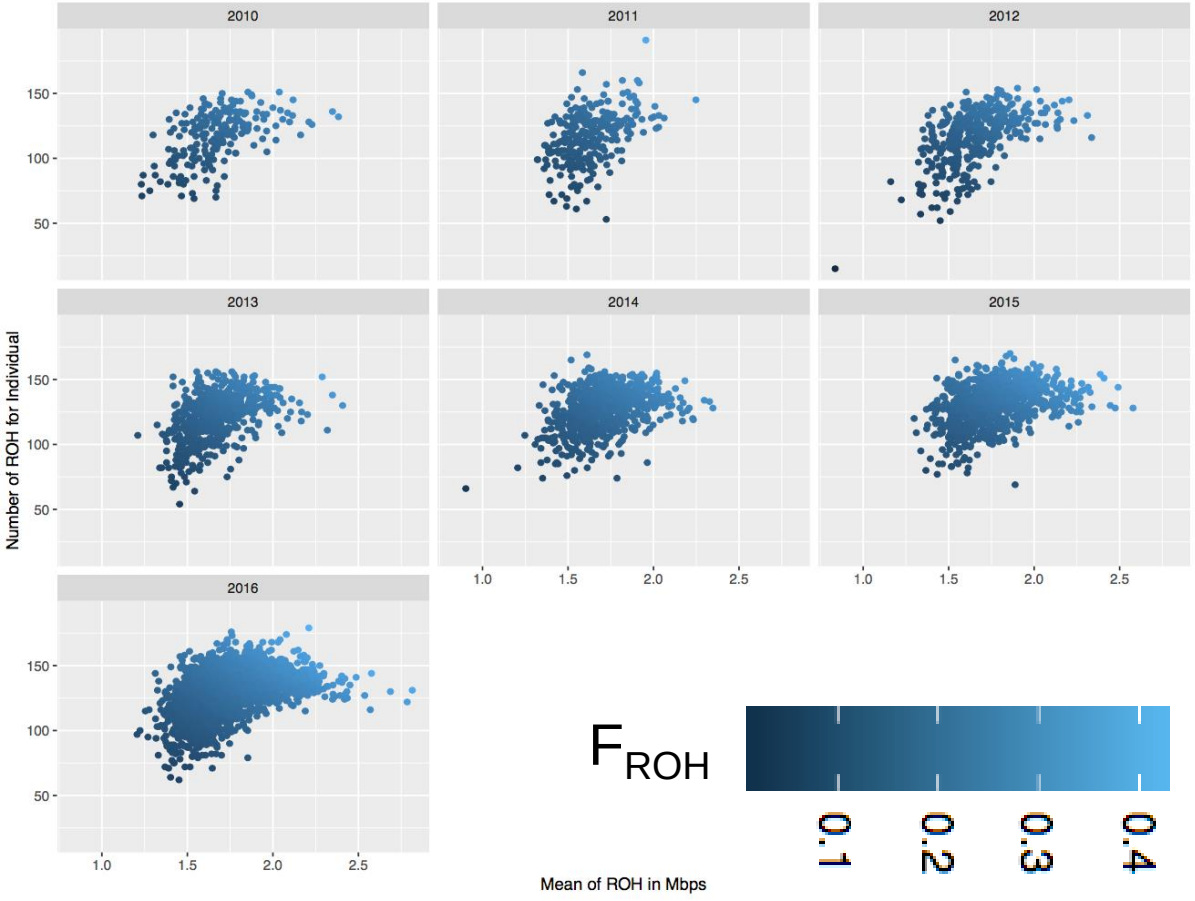
Data

- A commercial line with 5,297 individuals
- Pedigree records for 773,414 individuals
  - Maximum depth of 29 generations
- Markers call-rate threshold: 90%
- After editing: 56,450 SNP

Run parameters

- ROH and ROHet were detected using the R package *“detectRUNS”* v.0.9.5
- Parameters:
  - Minimum length
    - 50 SNP for ROH
    - 20 SNP for ROHet
    - 1Mb for ROH and ROHet
  - No missing or opposite genotypes
  - Maximum gap between consecutive SNP: 106 bp

ROH / Individual



Number vs mean length of ROH (in Mbps). Gradient expresses calculated inbreeding (Froh) for each section of the plot

ROH distribution

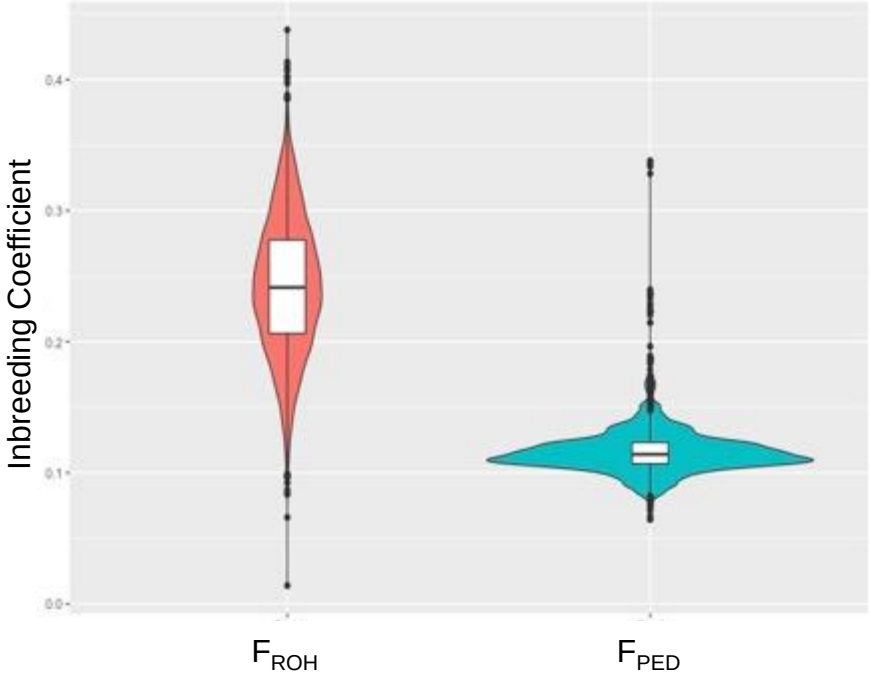
Average number of ROH per bird

Class (Mb)	ROH	
	Average n ROH / bird	Mean length of ROH / bird
1-2	37.52 (± 7.1)	1.49 (± 0.1)
2-4	27.39 (± 6.4)	2.75 (± 0.1)
4-8	8.30 (± 3.6)	5.28 (± 0.4)
8-16	1.88 (± 1.2)	10.08 (± 1.5)
>16	1.10 (± 0.3)	19.06 (± 3.7)
Total	**126.21 (± 17.7)**	**1.73 (± 0.2)**

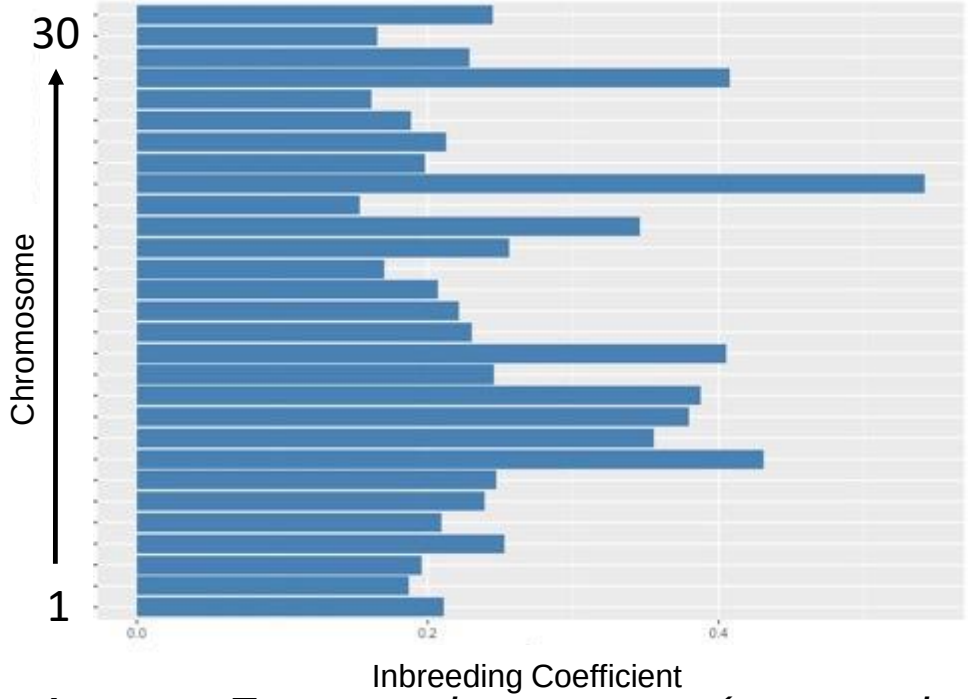
Average number of ROHet per bird

(standard error in brackets)

Inbreeding levels

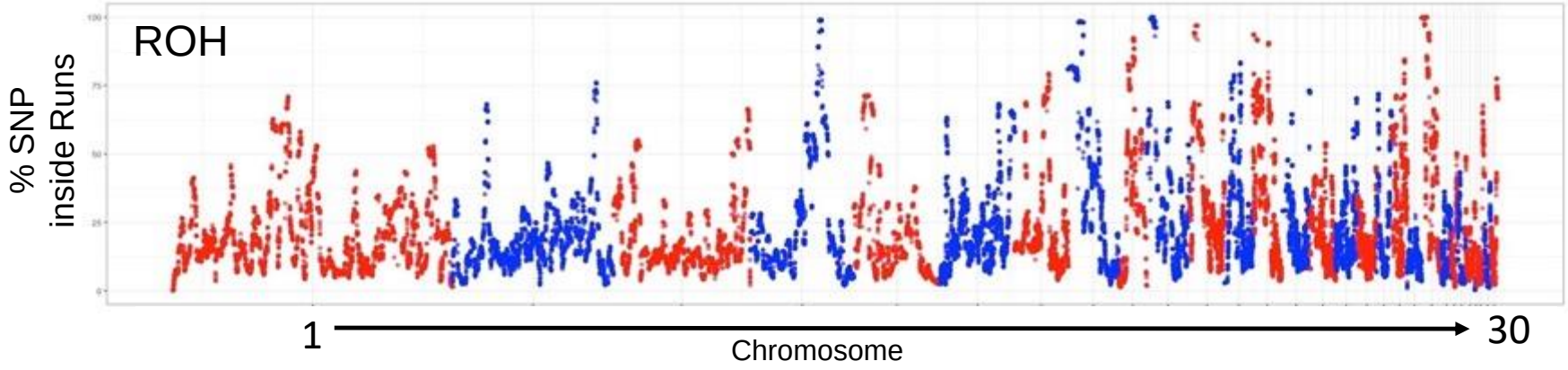


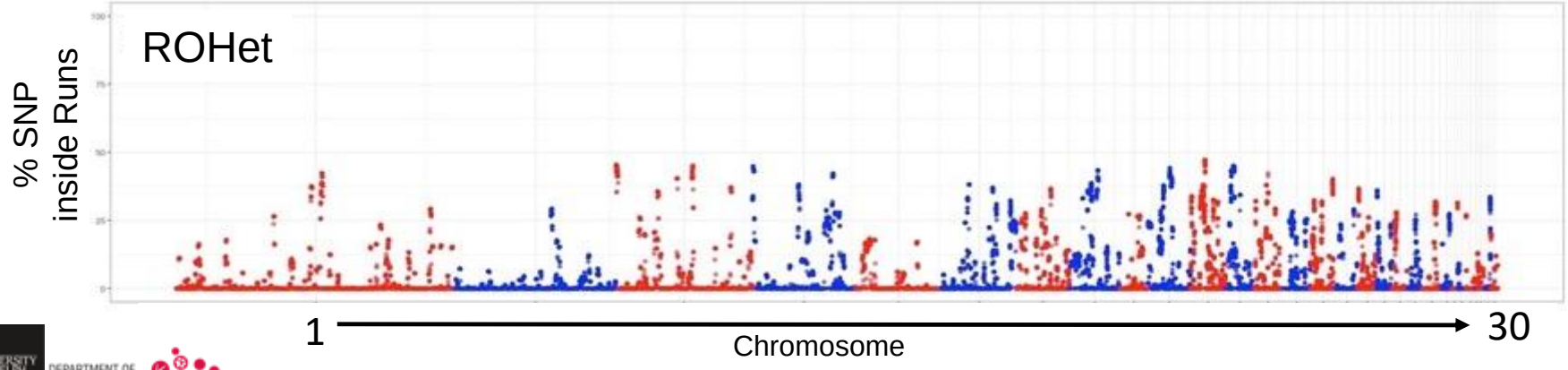
Distribution of F_{ROH} and F_{PED}



Average F_{ROH} per chromosome (corrected for length)

% of SNP inside ROH across genome





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Next Steps: Focus on Phenotypes

Reproduction Traits

- Broodiness & Pause length
- Number of clutches
- Egg production
- Hatchability

Efficiency Traits

- Feed Efficiency
  - Growth rate
  - Feeding traits
- Breeding Efficiency

REPRODUCTION

HEALTH & WELFARE

EFFICIENCY

PRODUCTION

Health and Welfare Traits

- Pecking behaviour / Aggression
- Mortality and livability
- Health
- Environmental Resilience

Production Traits

- Meat Quality
  - pH, drip loss, colour, etc.
  - Technological and sensory properties
- Meat Quantity
  - Carcass composition
  - Whole-body yield

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Conclusions

- Initial report of ROH and ROHet in turkey
- Long and abundant ROH detected
  - Heterozygosity islands
  - Some clusters on specific chromosomes
- ROH inbreeding higher than pedigree inbreeding
- Work underway to determine which phenotypes are affected by homo / heterozygosity

The Guelph Turkey Team

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Hybrid

HENDRIX GENETICS

GenomeCanada

Ontario Genomics

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Hybrid Turkeys receives funding for $6 million genomic selection project

Academia, government, industry partners and funding recipients attended a press conference at the University of Guelph on Friday as Kate Young, Canadian Parliamentary Secretary for Science, announced the recipients of Round 7 of **Genome Canada's Genomic Application Partnership Program (GAPP).** A total of $17 million was award to 5 different projects with Hybrid Turkeys receiving the largest grant for its turkey genomic selection project.

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