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GENETIC TRENDS, PRINCIPAL COMPONENTS AND SIGNATURES OF SELECTION FOR A MERINO RESOURCE FLOCK DIVERGENTLY SELECTED FOR REPRODUCTION

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Introduction - Reproduction

- **Reproductive Performance**
  - Key facet of production
  - Genetic improvement has proven challenging
  - Quantification
  - Distribution
  - Heritability

- **Quantitative Selection for Reproduction**
  - Capable to deliver worthwhile gains
  - Support emphasis of reproductive traits
  - Long term responses in production and reproduction traits

Introduction – Modern Technologies

- **Population Genomics**
  - Characterization of genetic structures
  - Define population groups with much greater definition

- **Current Focus**
- **Elsenburg Merino resource flock**
  - Case-control group that shares an ancestral population
  - Divergently selected for reproductive performance over an extended period
  - Phenotypic and genotypic data
  - Population structure and divergence in context of reproduction

Objectives

- **Evaluate the trends in breeding values of both product and reproductive traits over a 30 year period**

- **Elaborate on quantitative observations through genomic enquiries into population divergence**

Materials and Methods

- **The Elsenburg Merino flock**
  - Divergent selection for reproduction
    - NLW per ewe joined
    - High Line vs Low Line
  - Data recorded over a 30-year period from 1986 to 2016
  - Progeny Records of 5092 individuals

- **Genetic Trends**
- NLW, YW, FD, TFS
  - Individual Breeding Values
  - ASREML
    - GLMM
    - Uni-Trait Analysis
  - Trends over time
    - BVs used to predict mean values for each group within years
    - Separate trends for progeny from outside sires
    - Linear regressions

Materials and Methods

- **Genomic Data Generation**
  - 390 influential animals genotyped between 2012 and 2018
  - Illumina OvineSNP50
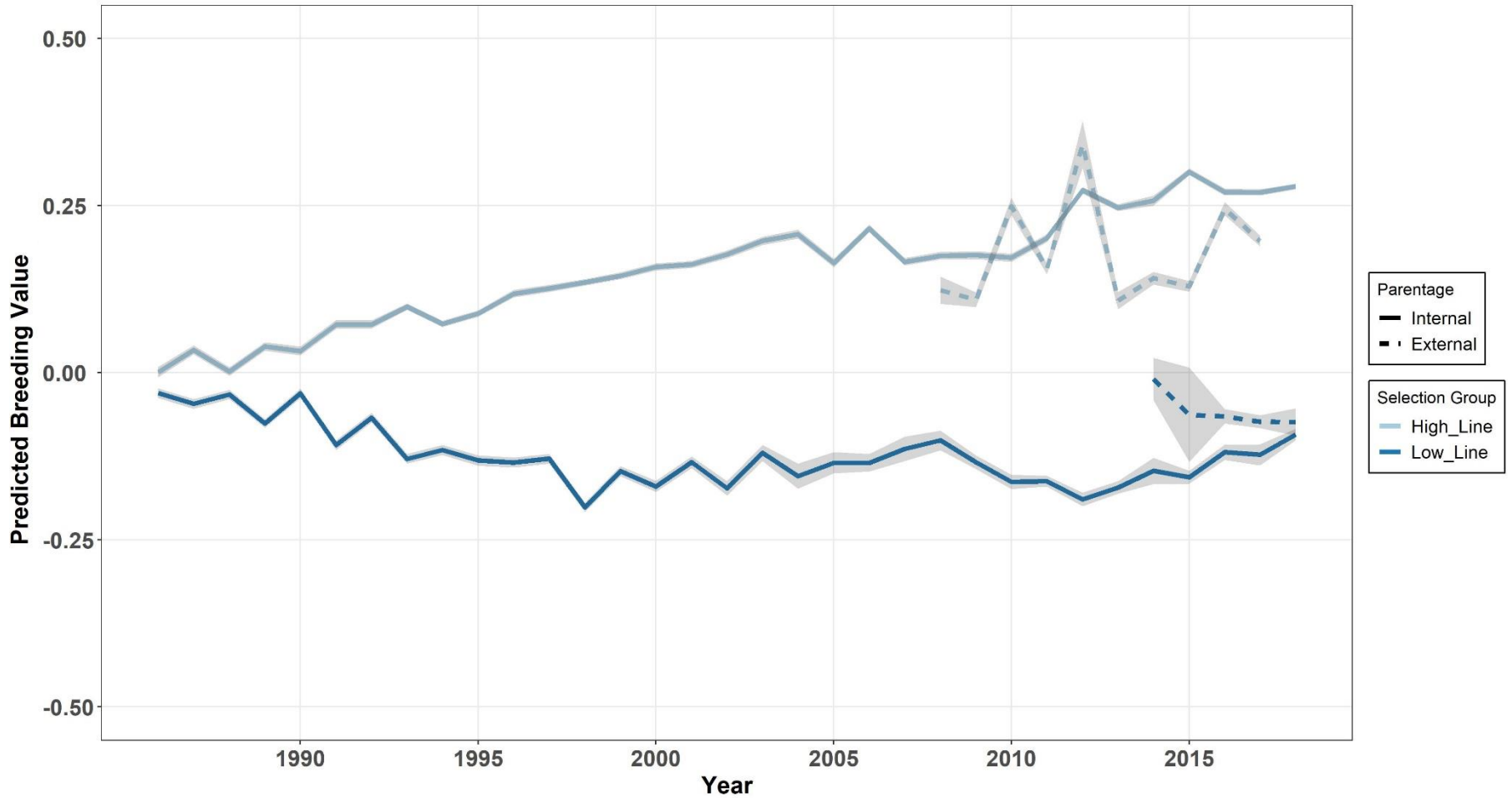 - Quality Control
    - 47725 SNPs left for analysis

- **Genomic Analysis**
  - "R"
  - Open Source Statistical Software
  - PCA
  - Signatures of selection
  - *ggplot2, irlba, lokern*

Results and Discussion - Genetic Trends

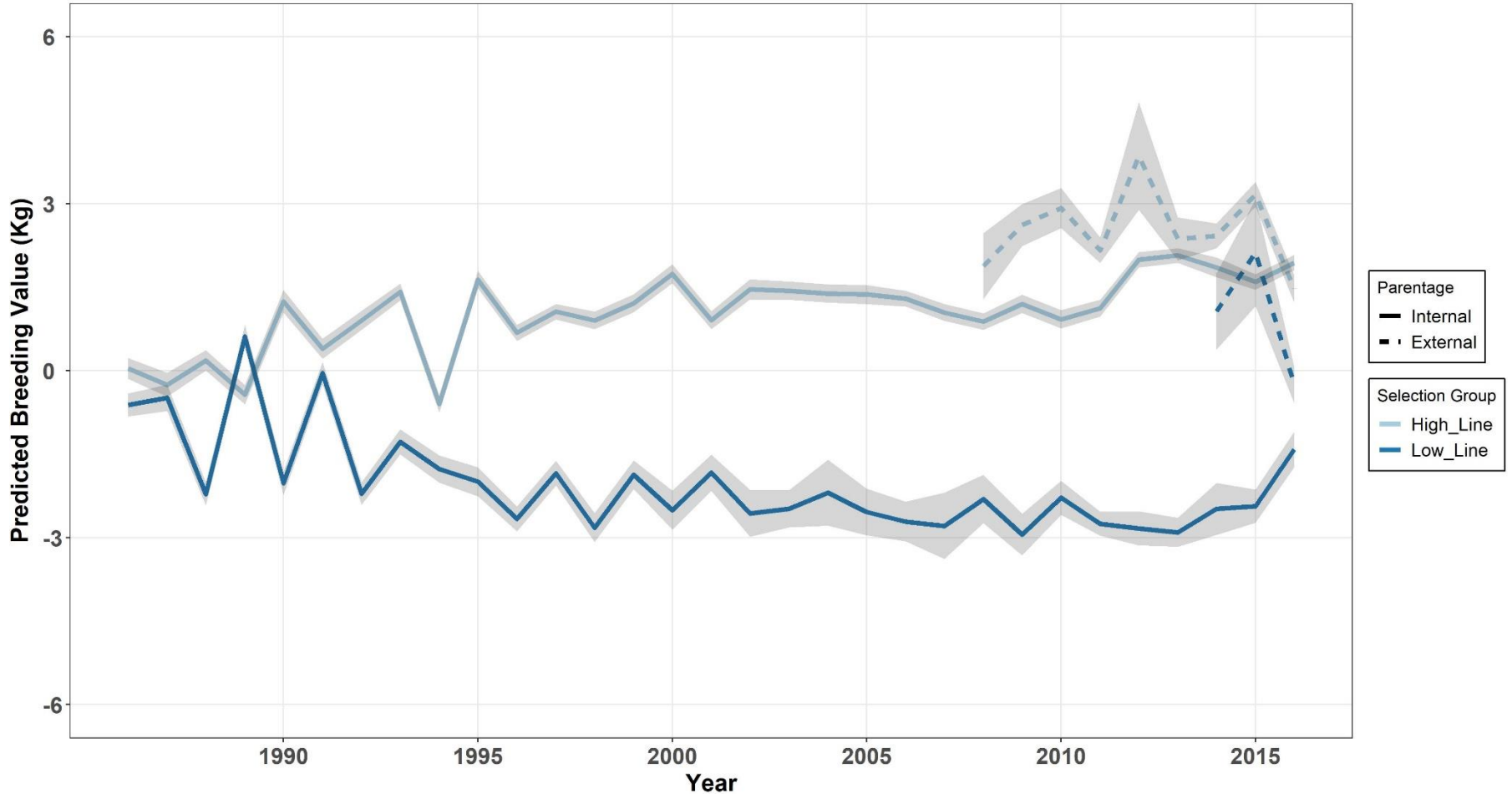Genetic Trends For Number of Lambs Weaned
1986 to 2016

Results and Discussion - Genetic Trends
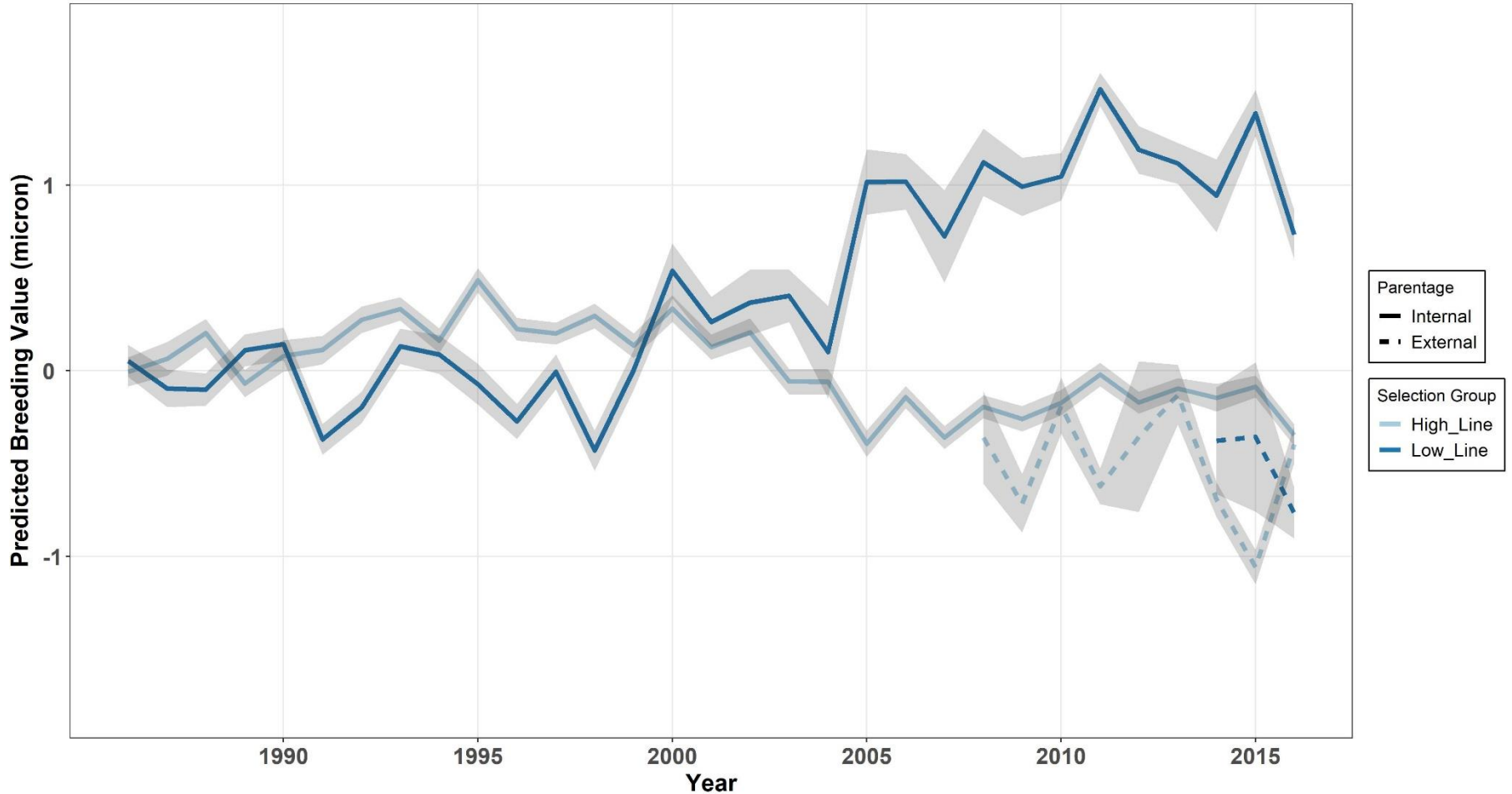

Genetic Trends For Yearling Weight
1986 to 2016

Results and Discussion - Genetic Trends

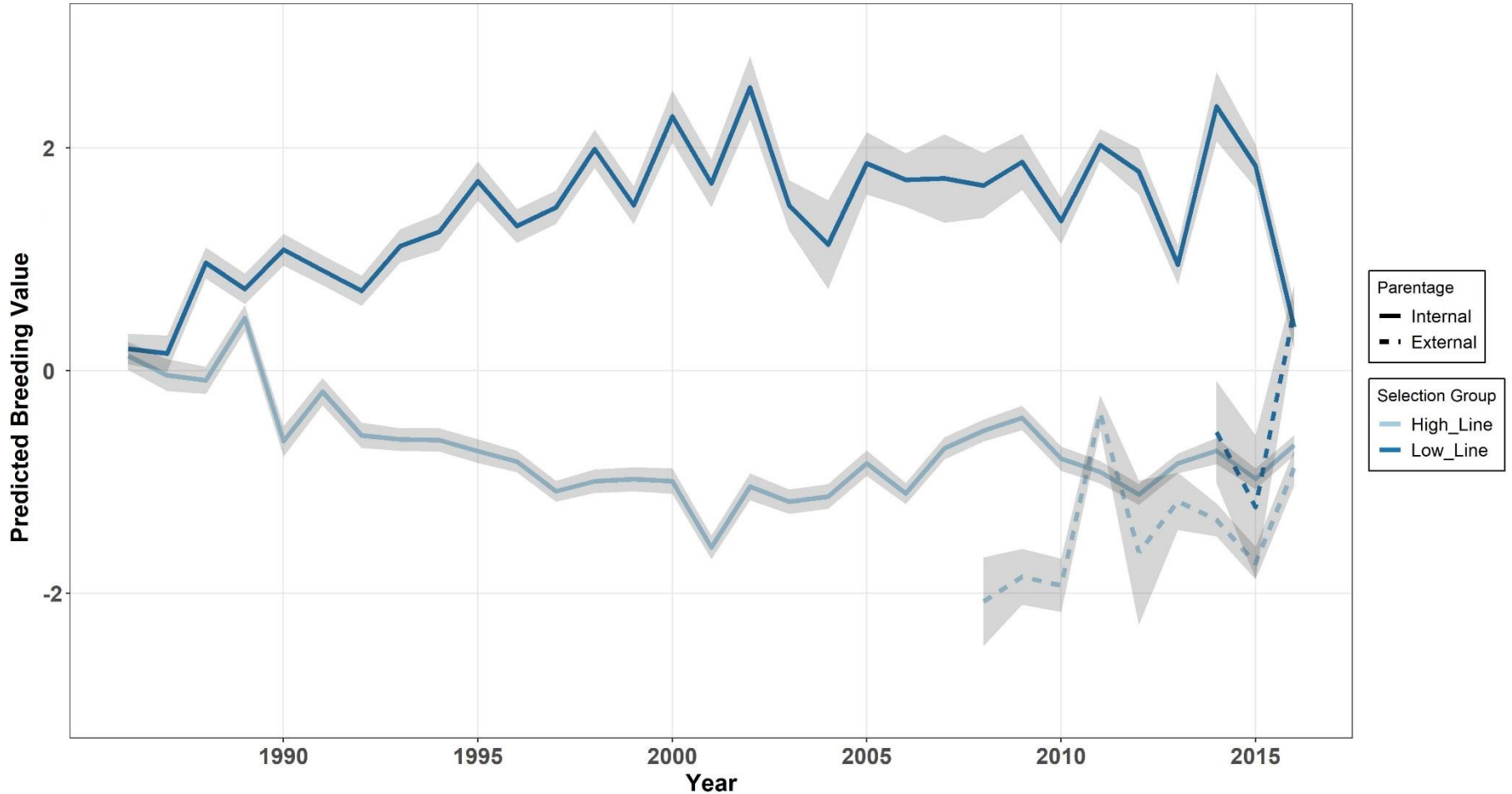**Genetic Trends For Fibre Diameter**

1986 to 2016

Results and Discussion - Genetic Trends

Genetic Trends For Total Fold Score
1986 to 2016

Results and Discussion - Regression Lines

Trait	Coefficients	Risk Statistic	R2	% of mean
NLW/EJ				
H-Line	0.0093 ± 0.0002	p < 0.01	0.98	1.02%
L-Line	-0.006 ± 0.004	p < 0.01	0.82	-0.70%
YW				
H-Line	0.066 ± 0.005	p < 0.01	0.84	0.17%
L-Line	-0.116 ± 0.01	P < 0.01	0.83	-0.44%
FD				
H-Line	-0.003 ± 0.002	p < 0.19	0.056	-0.02%
L-Line	0.035 ± 0.004	p < 0.01	0.754	0.18%
TFS				
H-Line	-0.042 ± 0.004	p < 0.01	0.774	-0.54%
L-Line	0.078 ± 0.004	p < 0.01	0.69	0.99%

Results and Discussion - PCA

Principal Components for High and Low Lines
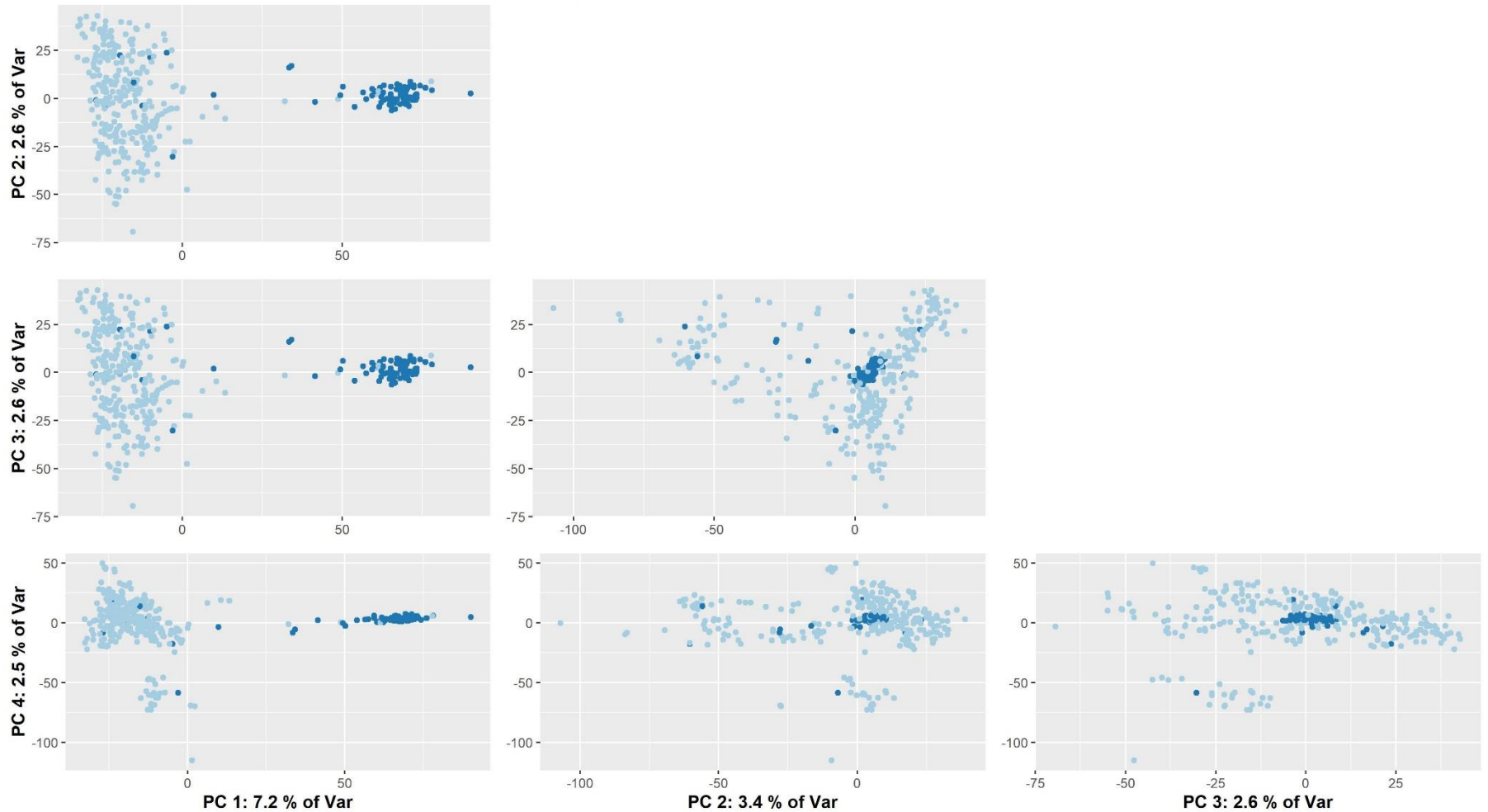
Results and Discussion - Fst Values

Fst Values for High Line Selection Group
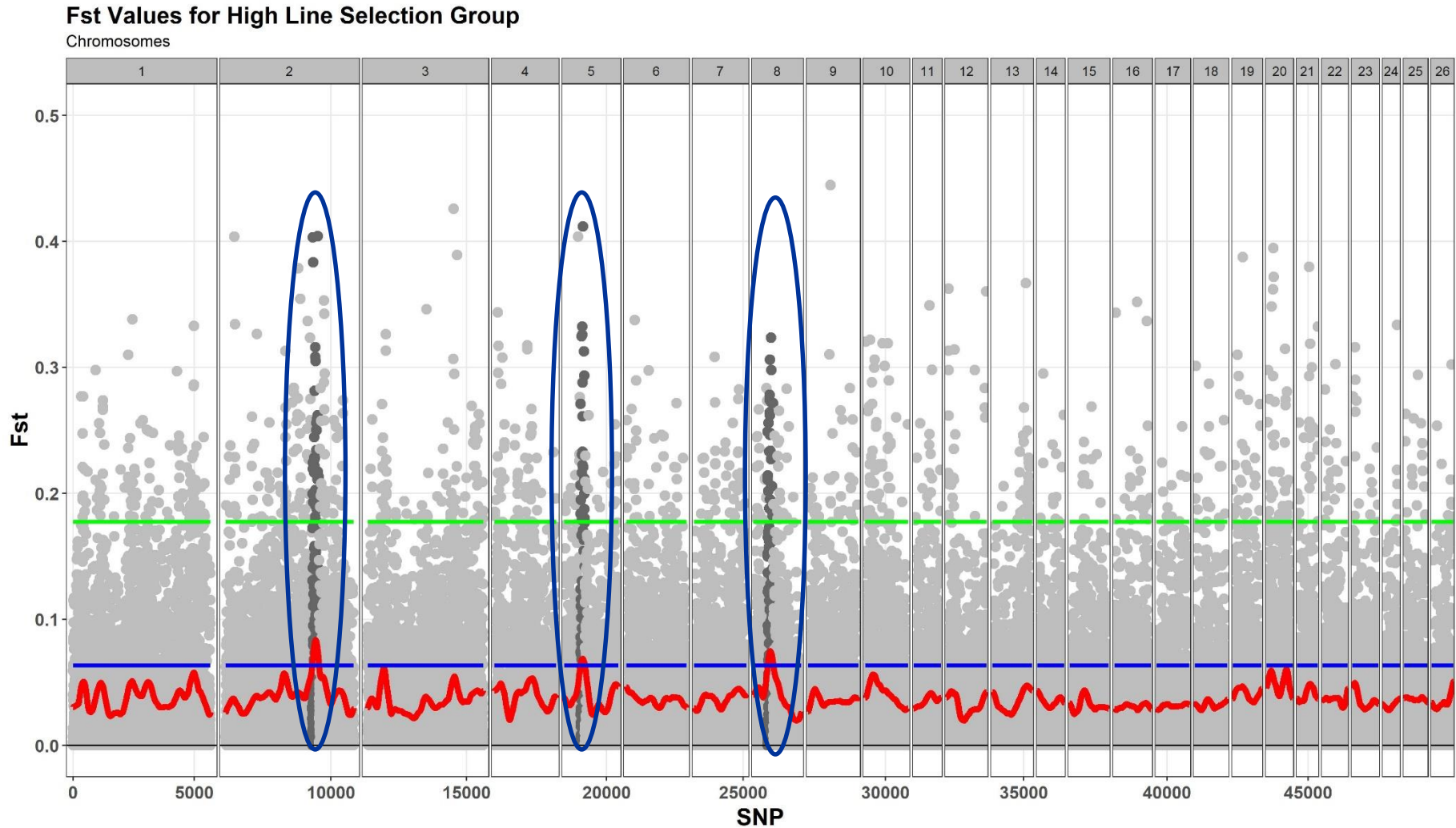
Conclusions and Recommendations

- **Results of the current study contributes to our understanding of the effects of selection for reproductive performance**
  - Relatively few detrimental effects
    - Promotes the inclusion of reproduction in selection indices

- **Observations from a genomic perspective support quantitative observations of divergence**

- **Recommend continued data generation on a genomic basis**
  - GWAS
  - GEBV

Acknowledgements

Thank you