



New Cow Fertility Prediction

BIF 2017

B. L. Golden

Theta Solutions, LLC



Objective

- Review previous predictions of cow fertility
- Our modified Jamrosik et al., (2014) approach
- Implementation in a genomic analysis (Hybrid Marker Effects Model)
- AHA Implementation – Sustained Cow Fertility
- IGS Implementation – New Stayability



Why Cow Fertility?

- CF traits tend to be lowly heritable
- Lots of observations – calving records
- ERT with the most impact in maternal selection index
 - Relatively small changes can make a big difference
 - More calves to sell
 - Fewer replacement females – even more calves to sell
 - Heavier weaning weights of sale calves from older cows
 - Less calving difficulty



Predictions of Cow Productivity

- Days to Calving
- Calving Interval
- Cow Longevity – proportional hazard model
- Stayability - MAP
 - Snelling, et al., 1995
 - Brigham, et al., 2007
- Random Regression
 - Jamrozik, et al., 2014



Random Regression Stayability

- The random (e.g., genetic) effects are described as a curve (polynomial) on age of cow at record
- Observations:
 - 0 – Cow did not have calf at a given age
 - 1 cow had a calf at a given age
 - Missing – unknown if the cow had a calf at a given age



Our Marker Effects Model

- Year of birth
- Age at first calving
- Random contemporary group (intercept and slope)
- Random permanent environment due to the dam (intercept and slope)
- Genetic marker random effects (intercept and slope)
 - Genotyped
 - Non-genotyped
- Extra polygenic effects(intercept and slope)

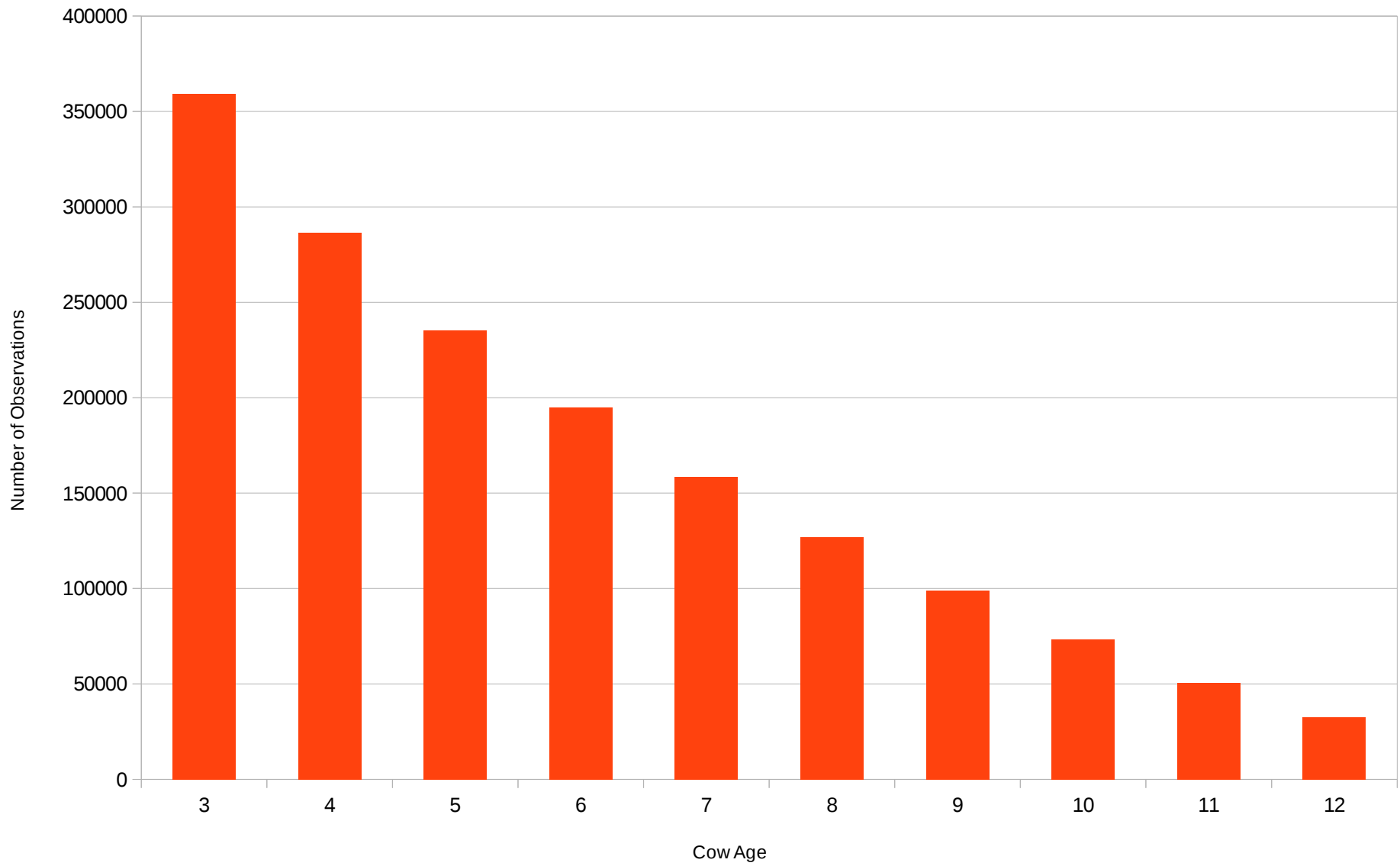


AHA Sustained Cow Fertility

Difference in probability of having a calf every year from age 3 to 12

- 1,158,749 animals in the pedigree
- 896,374 calving observations out of 272,651 cows
- Observations from 3 years of age to 12 years of age
 - Observations at ages >5 yoa set to 5 yoa
- Only observations from the Whole Herd Reporting program were used
- 26,727 genotyped animals
- Additive genetic groups in slope and intercept

Figure 2. Number of Observations at Each Cow Age



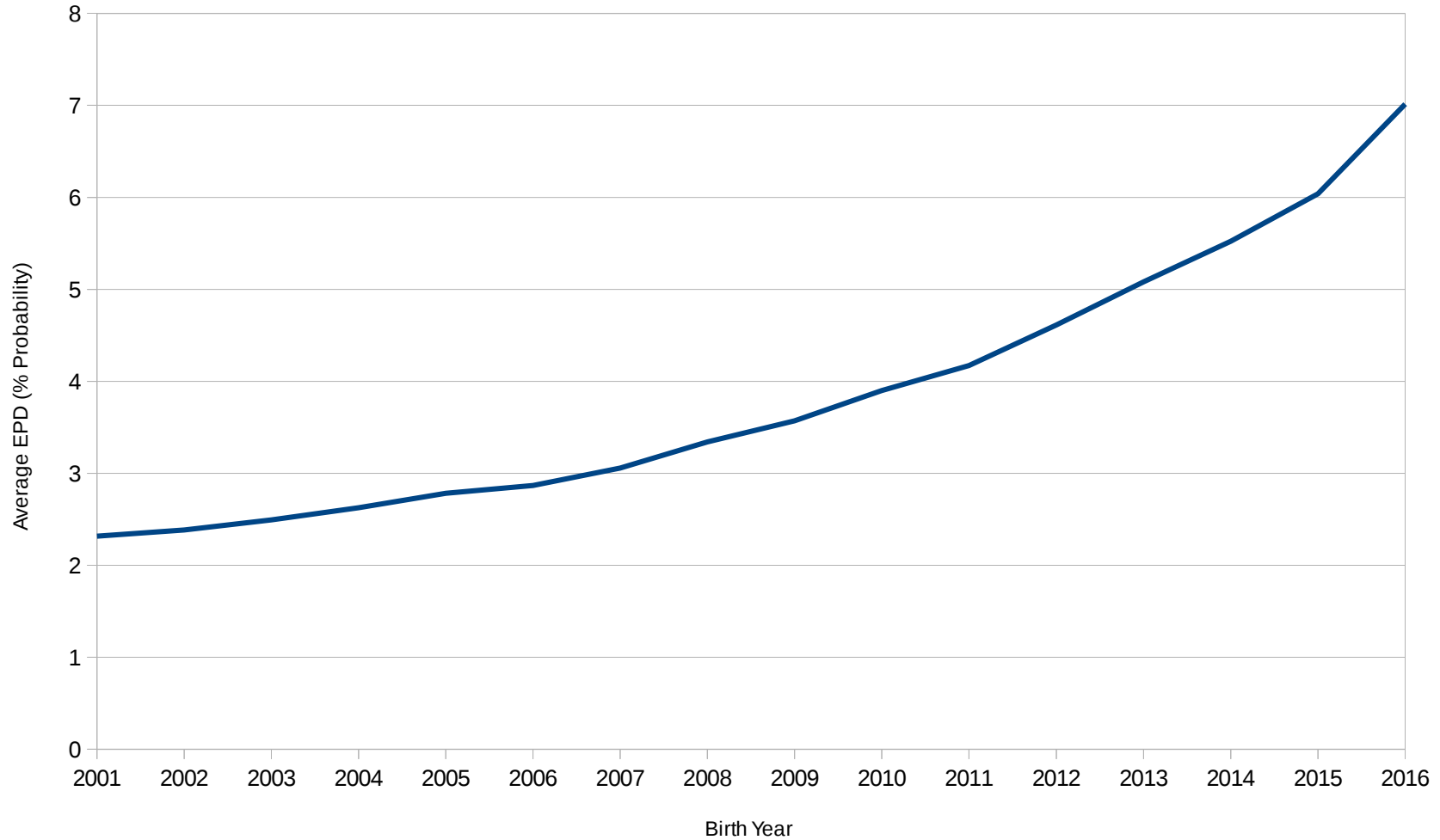
What do Sustained Cow Fertility EPD look like?

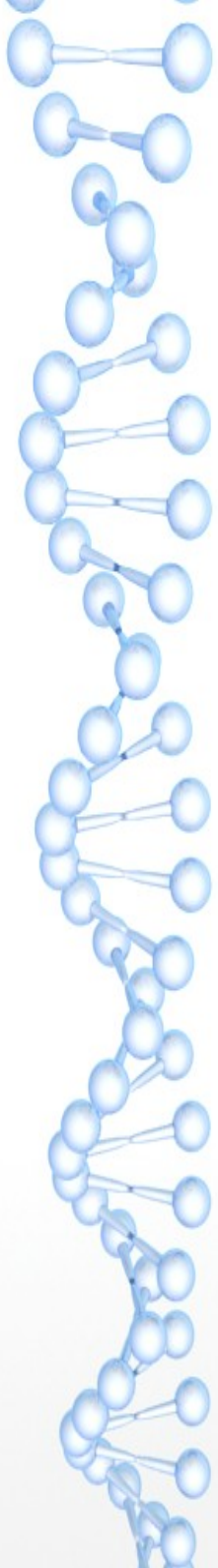
Internal ID	SCF EPD	SCF Accuracy
HERUSAM0000240	14.1	0.80
HERCANM000C02	-3.0	0.79
HERUSAM0000239	2.9	0.76
HERUSAM0000410	-5.4	0.76
HERUSAM0000237	1.8	0.75
HERUSAM0000420	11.0	0.74
HERUSAM0000411	9.8	0.73
HERUSAM0000234	5.6	0.73
HERCANM000C02	0.5	0.72
HERUSAM0000429	7.0	0.71
HERUSAM0000400	7.1	0.71

AHA EPD Trend

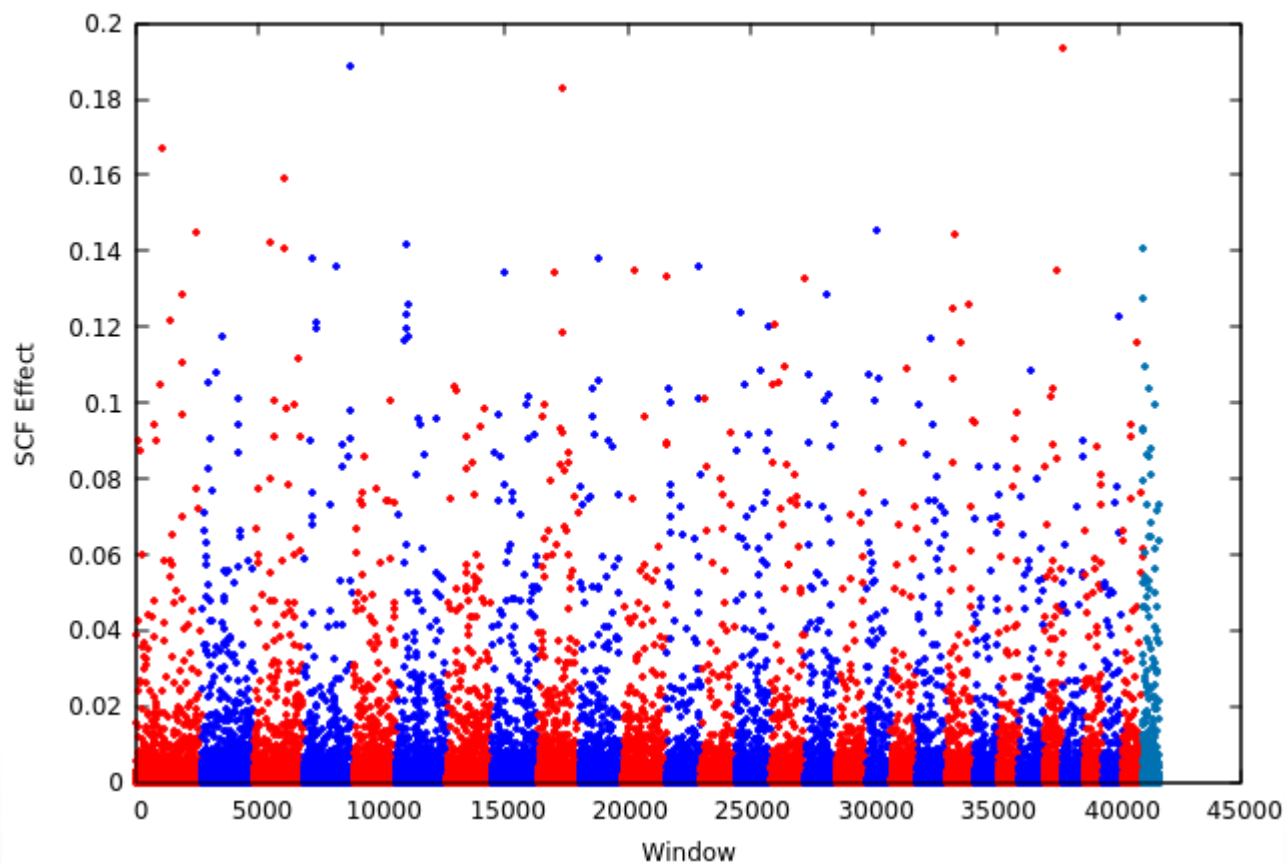
Not base adjusted

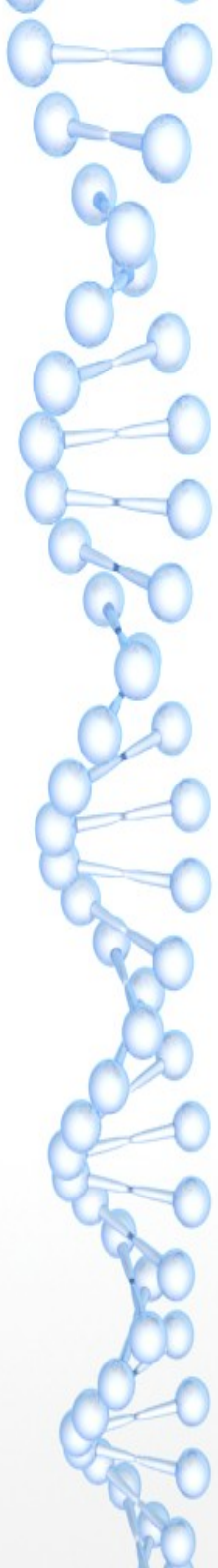
Average AHA Sustained Cow Fertiliy EPD



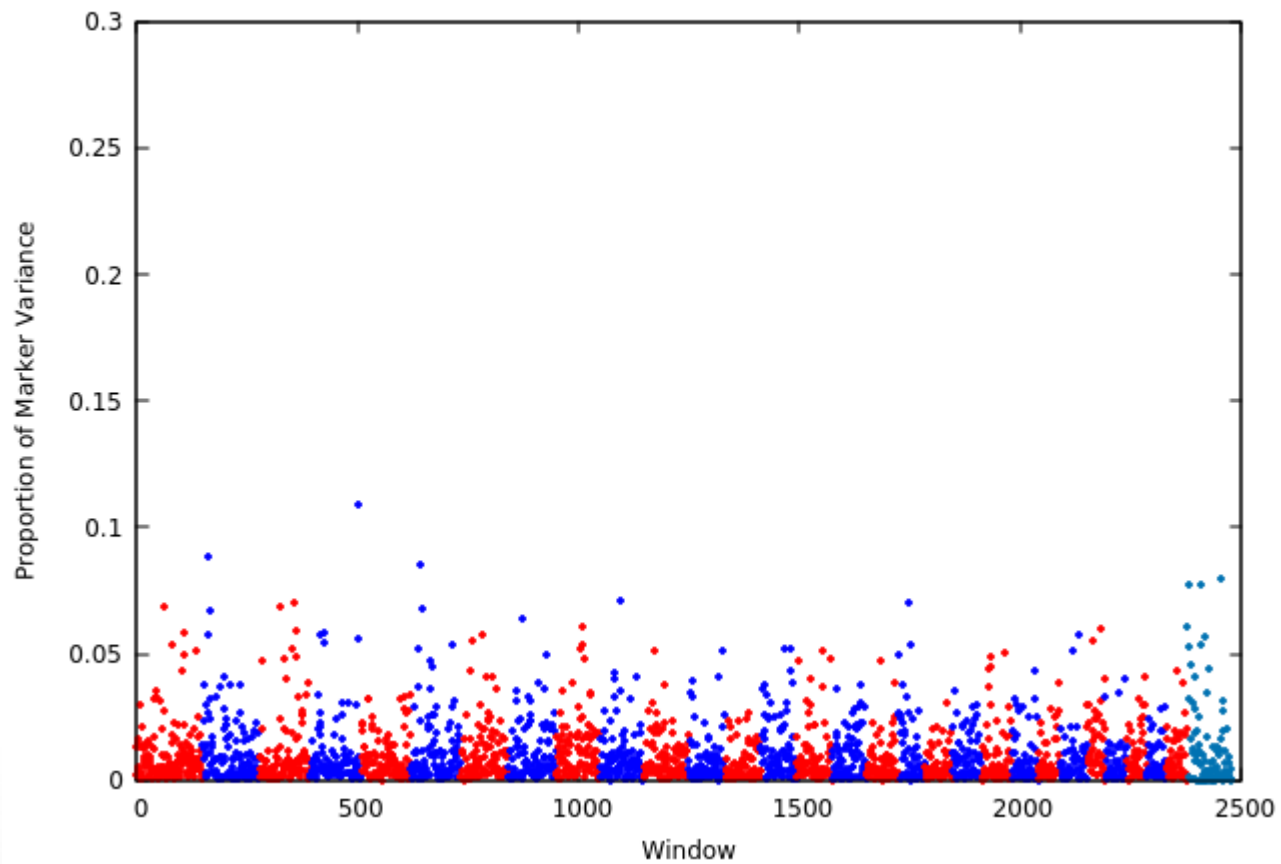


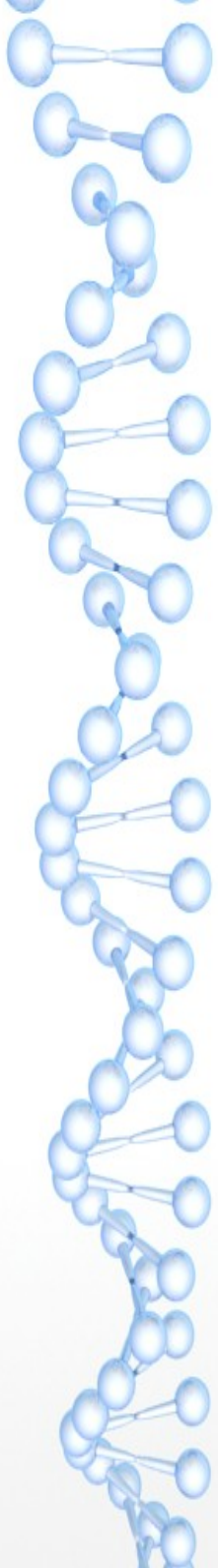
Marker effects - SCF
Hereford Cow Productivity to 12yoa - Genotype file 4/19/17



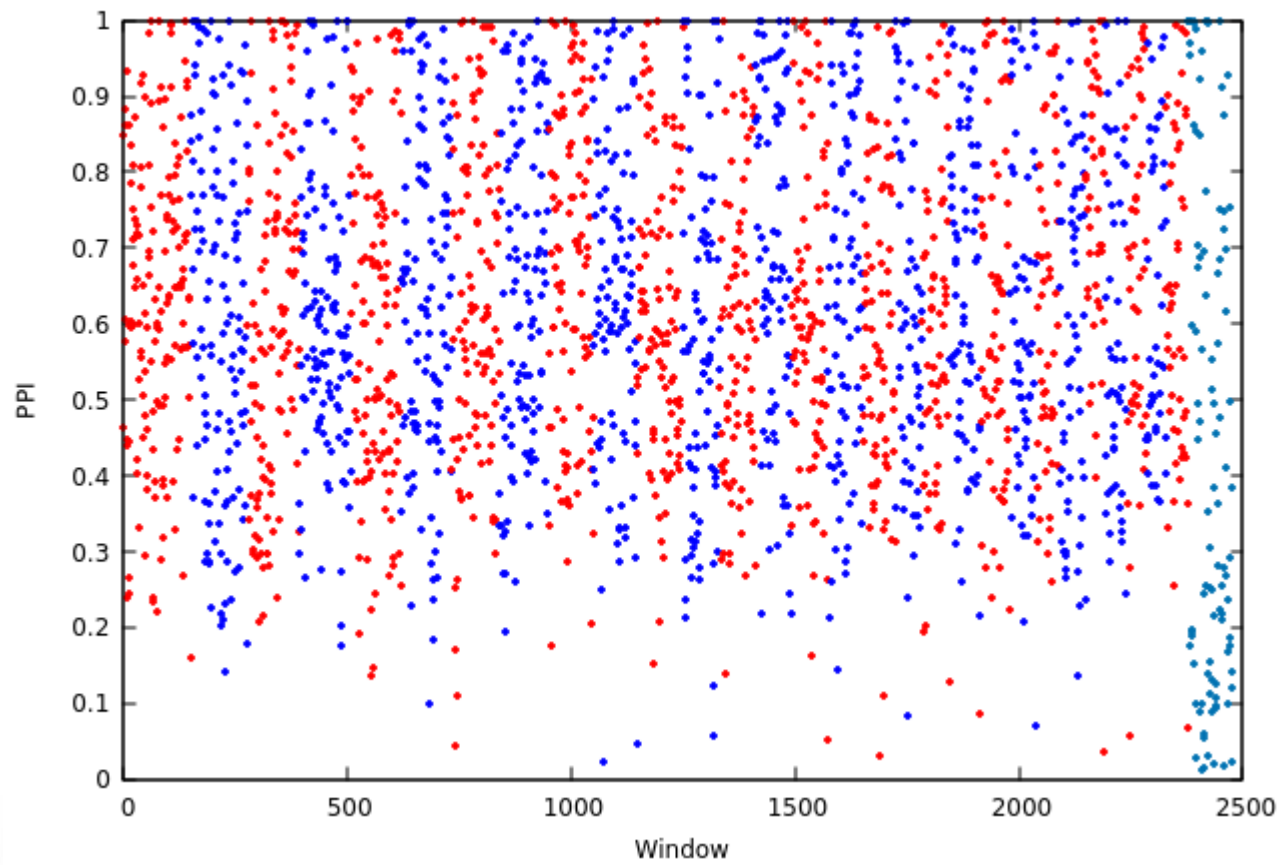


Proportion of variance due to marker effects by 1Mb window - SCF
Hereford Cow Productivity to 12yoa - Genotype file 4/19/17





Posterior probability of inclusion by 1Mb window - SCF
Hereford Cow Productivity to 12yoa - Genotype file 4/19/17





ASA New Stayability

Difference in probability of having a calf every year from age 3 to 6

- 11,158,810 animals in the pedigree
- 3,251,477 calving observations out of 1,298,676 cows
- Observations from 3 years of age to 6 years of age
- 78,854 genotyped animals



Advantages of RR Method

- Uses observations in a more sensible way
 - Simultaneous solution to all ages
 - Censoring from culling is “missing” value
- Handles missing values in a more sensible way
 - e.g., donor cow
- Easy to implement an animal model
- Easy to implement genomic information
 - Marker Effects Model
- Faster to obtain answers
 - PCG solver
 - Gibbs sampler
- Often as good or better than MAP or hazard models
- Can use all data to make a prediction at any age.



Acknowledgements

- AHA

- Stacy Sanders
- Shane Bedwell
- Jack Ward

- ASA

- Lauren Hyde
- Mahdi Saatchi
- Wade Schafer
- Steve McGuire

- ABRI

- Brad Crook
- Shalanee Weerasinghe
- Hugh Nivison

- Theta Solutions

- Dorian Garrick
- Daniel Garrick

- CSU

- Scott Speidel