Foundational Review of U.S. Female Fertility Trait Evaluations

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Overview

▶ Female fertility traits

▶ Current evaluation

▶ Goals for development

▶ Testing

Female Fertility Traits

Female Fertility Traits

▶ Daughter Pregnancy Rate (DPR)

▶ Cow Conception Rate (CCR)

▶ Heifer Conception Rate (HCR)

▶ Early First Calving (EFC)

▶ First Service to Conception (FSC) *potential new*

Daughter Pregnancy Rate (DPR)

- Implemented in 2004 as single trait

- Non-linear transformation of days open to pregnancy rate

- Predicts percentage of non-pregnant cows that will become pregnant during 21-day period

Days open = Number of days from previous calving to confirmed pregnancy

Cow Conception Rate (CCR)

▶ Implemented in 2009 as single-trait

▶ Predicts **lactating cow's** ability to conceive

▶ Expected percentage to become pregnant at each insemination in comparison to breed base

Insemination No. (cow)	✗	✗	✗	✓	○	○	○
	1	2	3	4	5	6	7
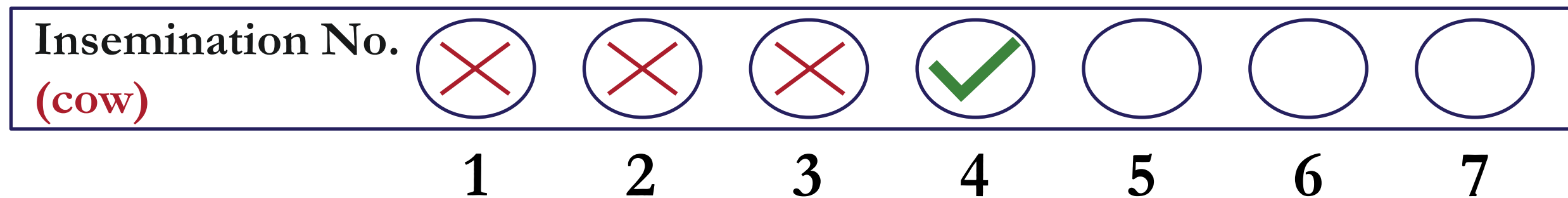
Heifer Conception Rate (HCR)

- Implemented in 2009 as single-trait
- Predicts **maiden heifer's** ability to conceive
- Expected percentage to become pregnant at each insemination in comparison to breed base

Insemination No. (heifer)	✗	✗	✓	◯	◯	◯	◯
	1	2	3	4	5	6	7
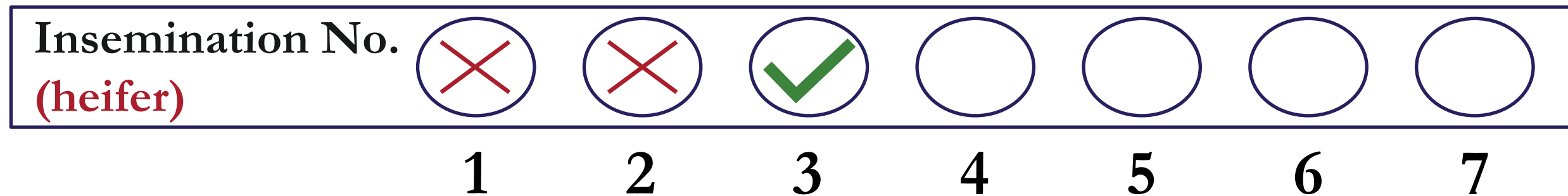
Single- to Multi-trait Evaluation

- ► As of 2015, CCR, DPR, and HCR are evaluated using a multi-trait evaluation

- ► Correlations

DPR-CCR:	+0.86
HCR-CCR:	+0.45
DPR-HCR:	+0.36

- ► Heritabilities

|	
DPR:	0.014
CCR:	0.016
HCR:	0.010

Early First Calving (EFC)

- Implemented in 2019 into multi-trait evaluation
  - Uncorrelated
- Predicts ability to alter female offspring's age at first calving
- Defined in days compared to breed base
- Positive PTA = days earlier

Sun	Mon	Tue	Wed	Tue	Fri	Sat
						1
2	3	4		6		8
9	10	11	+2 early	13	Due date	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

Current evaluation

Number of Records by Trait and Year (with Updated Values)
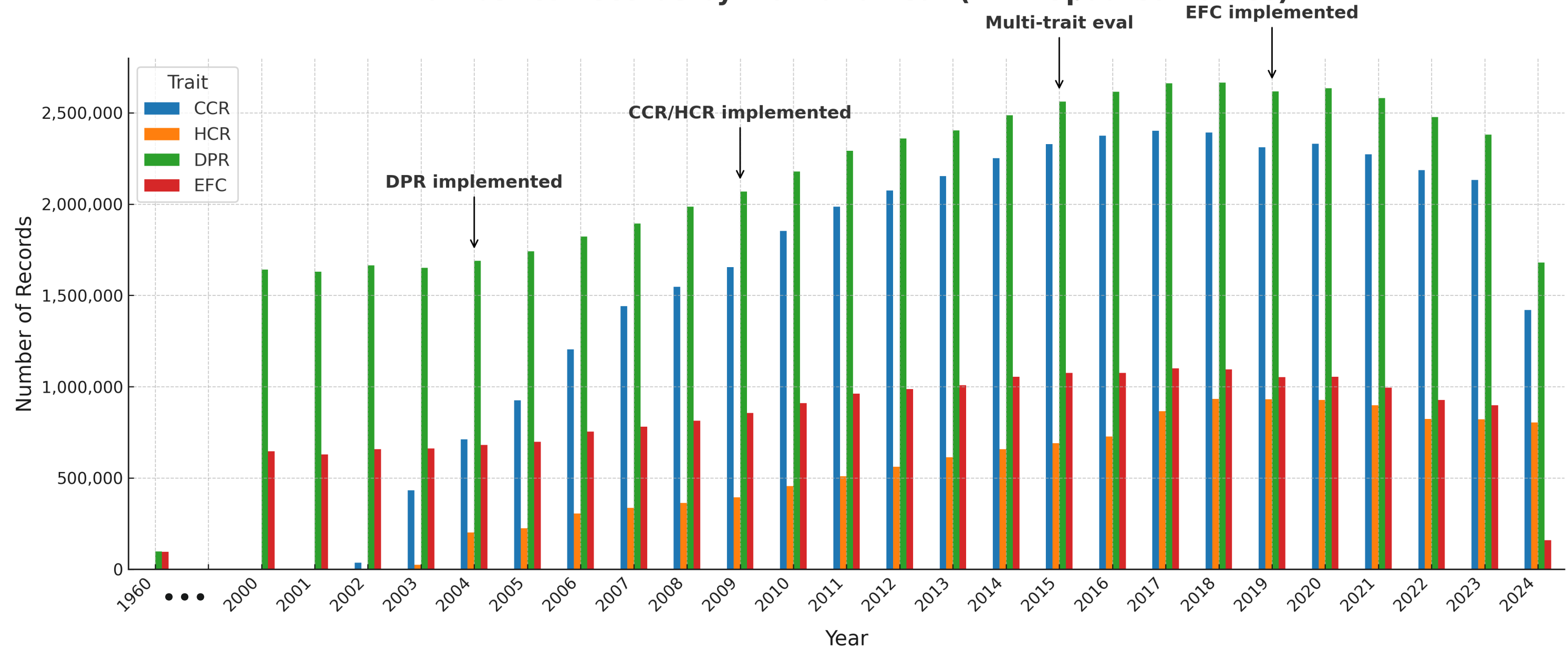
Opportunity

▶ To ensure stability, methodologies should be reviewed

▶ Additionally, in recent years, subtle but consistent seasonal patterns have been observed

▶ Some young bulls gradually, but consistently decline from evaluation to evaluation as more info is accumulated

  ▪ Expect more variety in changes -- upwards and some downwards

Models

▸ DPR, CCR, and FSC have the same model

$$Cow\ Management\ Grp\ +\ Cow\ Age\ Grp\ +\ Parity\ Grp\ +\ Inbreed + Het\ +\ animal\ +\ pe\ +\ e$$

▸ HCR

$$Hef\ Management\ Grp\ + Hef\ Age\ Grp\ +\ Inbreed + Het\ +\ animal\ +\ e$$

▸ EFC

$$EFC\ HYS + Inbreed +\ Het\ +\ animal + e$$

Objective

▶ To understand the source of young bull trends

▶ Test updates to improve consistency

▶ Determine whether any adjustments are needed

Course of Action

▶ Review incoming data
  ▪ Raw data submitted in formats

▶ Review processed data
  ▪ After EDITS to enter National Cooperator Database tables

▶ Review data extraction & editing process
  ▪ Routine extraction for tri-annual and edits by specific traits

▶ Review statistical methods

Testing

Data to test

▶ Evaluate potential changes across multiple tri-annual evaluations

> December 2023 →
>
> April 2024 →
>
> August 2024 →
>
> December 2024

Potential Solutions in Testing

▶ Updating variance component estimates

▶ Modeling cow and heifer traits separately

▶ Updating pre-adjustments for individual inseminations (CCR/HCR)

  ▶ Already includes mating type (i.e., sexed vs. non-sexed semen)

  ▶ To include breed of service sire (includes beef breeds that are reported)

▶ DPR to account for herd-year Voluntary Waiting Period

▶ Potential new trait, First Service to Conception

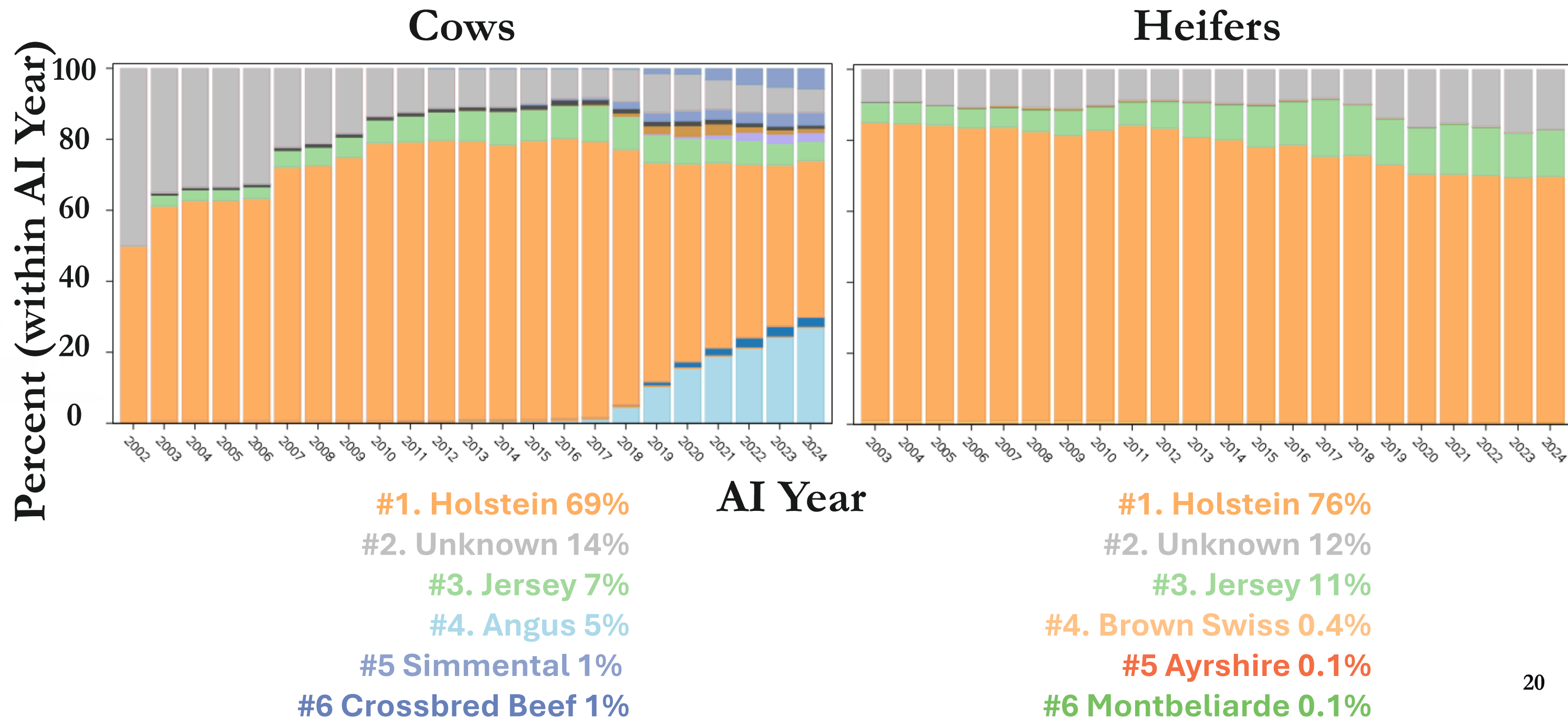▶ Different weights (function of information vs. 0 and 1)

Mating Type by AI Year

Cows

Heifers

AI Year

Percent (within AI Year)
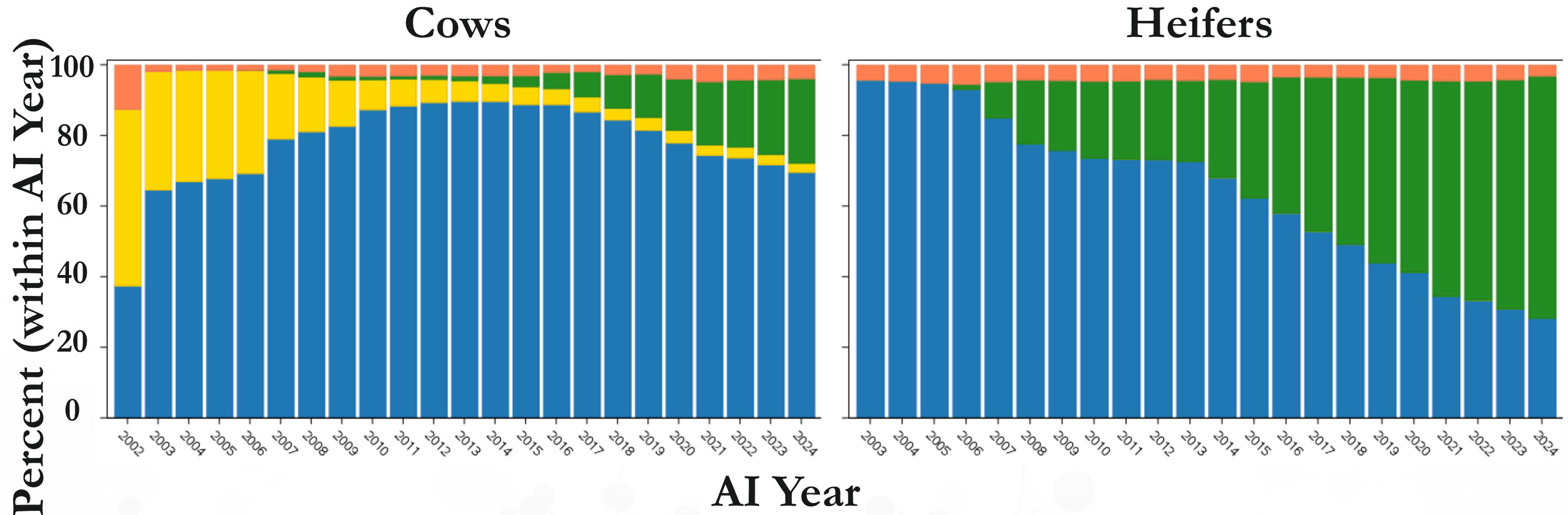
A = Artificial Insemination
B = Unknown Breeding
N = Natural Breeding
G = Gender Selected Semen

Service Sire Breed by AI Year

Cows — *Percent (within AI Year)* vs *AI Year* (2002–2024)

Heifers (2003–2024)

Cows:
- #1. Holstein 69%
- #2. Unknown 14%
- #3. Jersey 7%
- #4. Angus 5%
- #5 Simmental 1%
- #6 Crossbred Beef 1%

Heifers:
- #1. Holstein 76%
- #2. Unknown 12%
- #3. Jersey 11%
- #4. Brown Swiss 0.4%
- #5 Ayrshire 0.1%
- #6 Montbeliarde 0.1%

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Variable Herd-Year VWP and DPR

▶ DPR was developed with Voluntary Waiting Period (VWP) to be 50 days + 20-day grace period

  ▪ **VWP** = intentional number of days between calving and the first insemination

▶ DPR currently does not include to adjust for recent management changes of variable VWP

  ▪ Herd-year VWP by lactation group
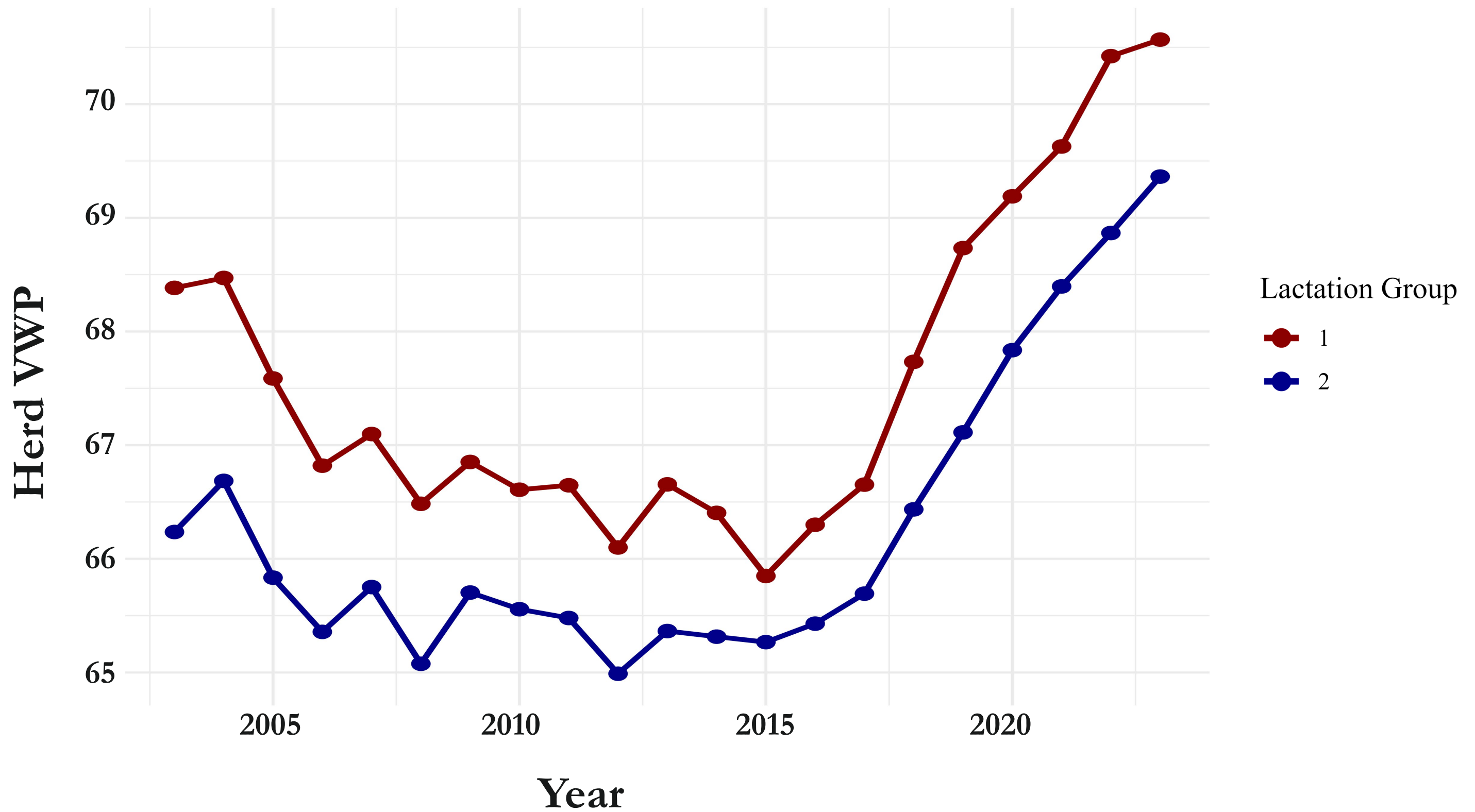
First Service to Conception (FSC)

▶ Predicts lactating cow's ability to conceive, as interval trait

▶ Defined as days from first insemination to last insemination (max: 200d; penalty if no conception: 230d)

Jason Graham's poster #2051
Monday morning:
"*Update on Genetic Parameters and Introduction of New Female Fertility Traits in the U.S. National Evaluation*"

Conclusions

- Review of U.S. female fertility traits is in-progress
  - Team of people devoted to project: internal, collaboration with USDA AGIL and intern from University of Connecticut
  - Eager to share our findings when available
- Review of potential solutions are in testing
  - Includes potential new trait, FSC
  - Updates to data and modeling across 4 tri-annual evaluations

Acknowledgements

▶ U.S. dairy producers

▶ Member sectors and collaborators

▶ USDA AGIL

▶ CDCB staff

Jason Graham's poster, #2051
Monday morning:
"Update on genetic parameters and introduction of new female fertility traits in the U.S. national evaluation"

Gaurav Dutta's poster, #2010
Monday morning:
"Genetic parameter estimation for first service to conception: A potential female fertility trait in US dairy cattle evaluations"

THANK YOU FOR YOUR ATTENTION

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