

# **Stayability and other tools to select for efficient cows**

# Introduction

## Efficient cows are fertile cows

- tools to select for cow fertility are tools to select for efficient cows
- reproduction more important than calf growth or carcass characteristics in production system indexes to improve biological or economic efficiency

MacNeil et al, 1994; Melton, 1995; Tang et al, 2011; ...

- variation in fertility explains more variation in biological efficiency than cow weight, intake or calf weight

Jenkins & Ferrell, 2002

# Introduction

## simple impacts of increasing fertility on herd efficiency

- more calves
- fewer cull cows → fewer replacements needed
  - less heifer development feed, more cow feed
  - more mature cows → heavier calves
- fewer heifers calving → less dystocia, higher calf survival
  - even more calves

# Selection tools – national cattle evaluation EPD

## Traditional EPD

birth, weaning, yearling weights

calving ease

scrotal circumference

## Indirect selection for fertility using traditional EPD

BW, CE – avoid dystocia, effects on calf survival and re-breeding

BW,  $WW_m$  (milk), YW – avoid large, high milk cows unable to maintain body condition with available feed

low BCS → low fertility

SC – select for earlier puberty, heifer pregnancy, lifetime production

# Selection tools – national cattle evaluation EPD

## Stayability EPD

- direct selection for percent of daughters remaining in production as 6-year-old and older cows
  - -11 to +14% range in RAAA bulls
  - ~50% of beef cows culled before 6 years
  - ~breakeven age to pay development and maintenance costs  
(Dalstead & Guitierrez, 1989; Patterson, 2014)
- useful predictor of fertility if reproductive failure is primary culling criteria
- useless if many cows culled for other reasons
  - stayability related to coat color in “blackened” breeds

# Selection tools – national cattle evaluation EPD

## Problems with stayability

- original S(6|5) definition allows success with two reported calves
  - cannot distinguish between reproductive failure and failure to report
  - holes filled by requiring annual record on breeding females
    - calf record, reason for no calf, reason for culling
    - improved stayability definition – require calf every year
- S(6|5) not observed until cow is 6 years old
  - sire at least 8 years old
    - young sires' EPD are low accuracy parent averages
  - stayability to younger ages (Brigham et al., 2007; Speidel, 2017)
    - aggregate stayability including observations on younger cows
  - stayability to consecutive calvings (Jamrozik et al., 2013)
    - random regression with observation for each calving opportunity
- Stayability is binary (success/failure)
  - observation same for cows calving early and late

# Selection tools – cumulative productivity

## Weight and cumulative productivity of GPE cows

- Cumulative productivity
  - accumulating production from each breeding season may be more informative than single observation of stayability or other productivity traits
- Weight
  - affects nutrient requirements, cow efficiency
  - cow weight increasing in correlated response to selection for calf growth
  - negative correlations with stayability (Mwansa et al., 2002; Berry & Evans, 2014), calves weaned and weight weaned (Hawkins et al., 1965, Stewart & Martin, 1981; Morris et al., 1987)

# Selection tools – cumulative productivity

## Cumulative productivity traits

Records for production by age at calving (years) created for each breeding season assignment

- age at calving: 2, 3, 4, ... 12
- $\frac{1}{2}$  year increment for slips between spring and fall

### ○ Counts

- pregnancies, calves born, calves weaned

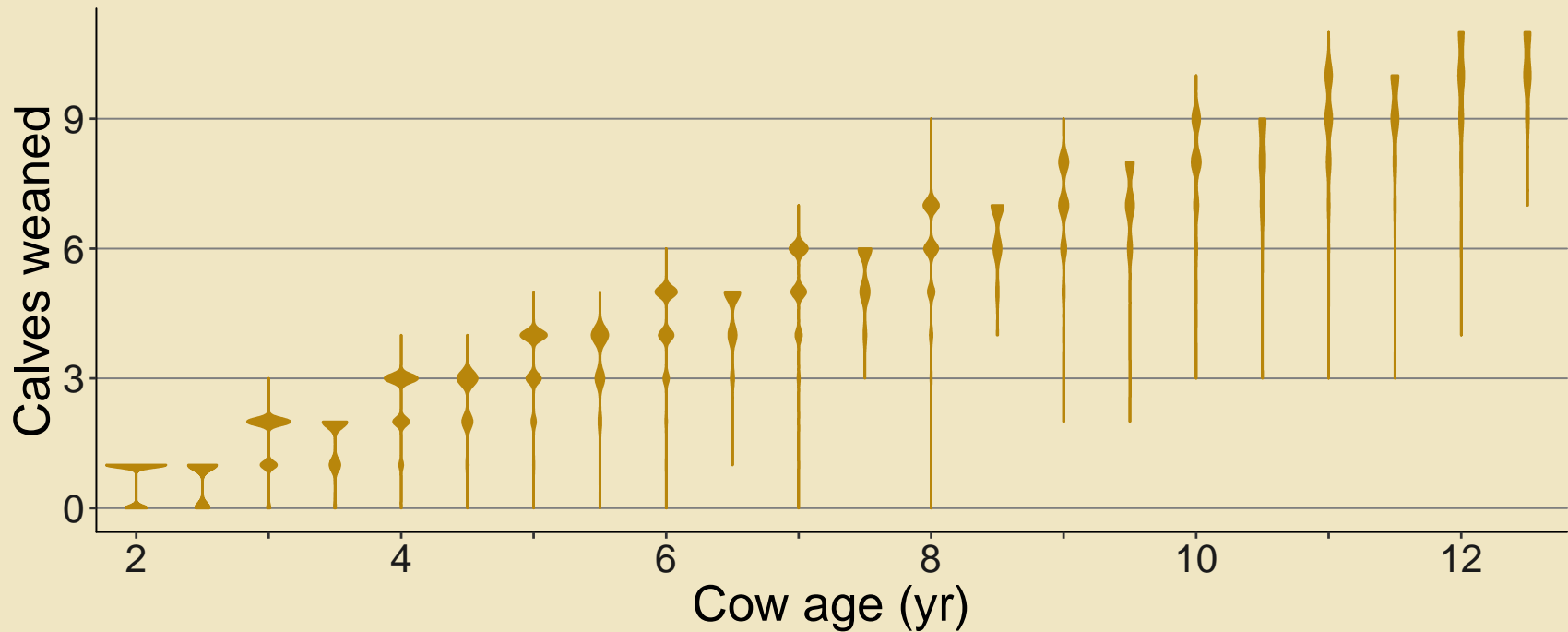
### ○ Continuous observations

- calf age at weaning (days nursing)
  - equivalent to days-to-calving, zero for failure to wean a calf implies penalty
- weight weaned
  - actual calf weight – age adjustment needed to compare calves masks differences between cows due to conception date



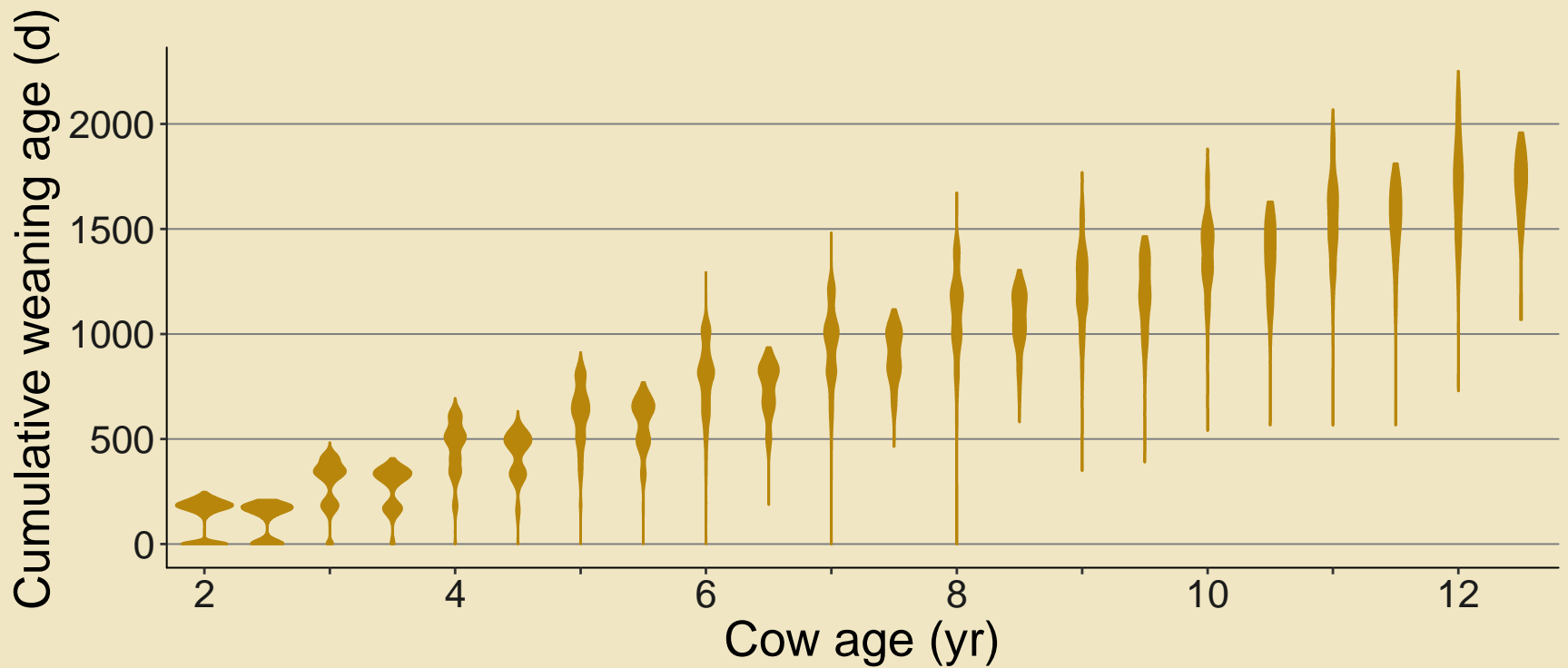
# Selection tools – cumulative productivity

Distribution of calves weaned by cow age at calving



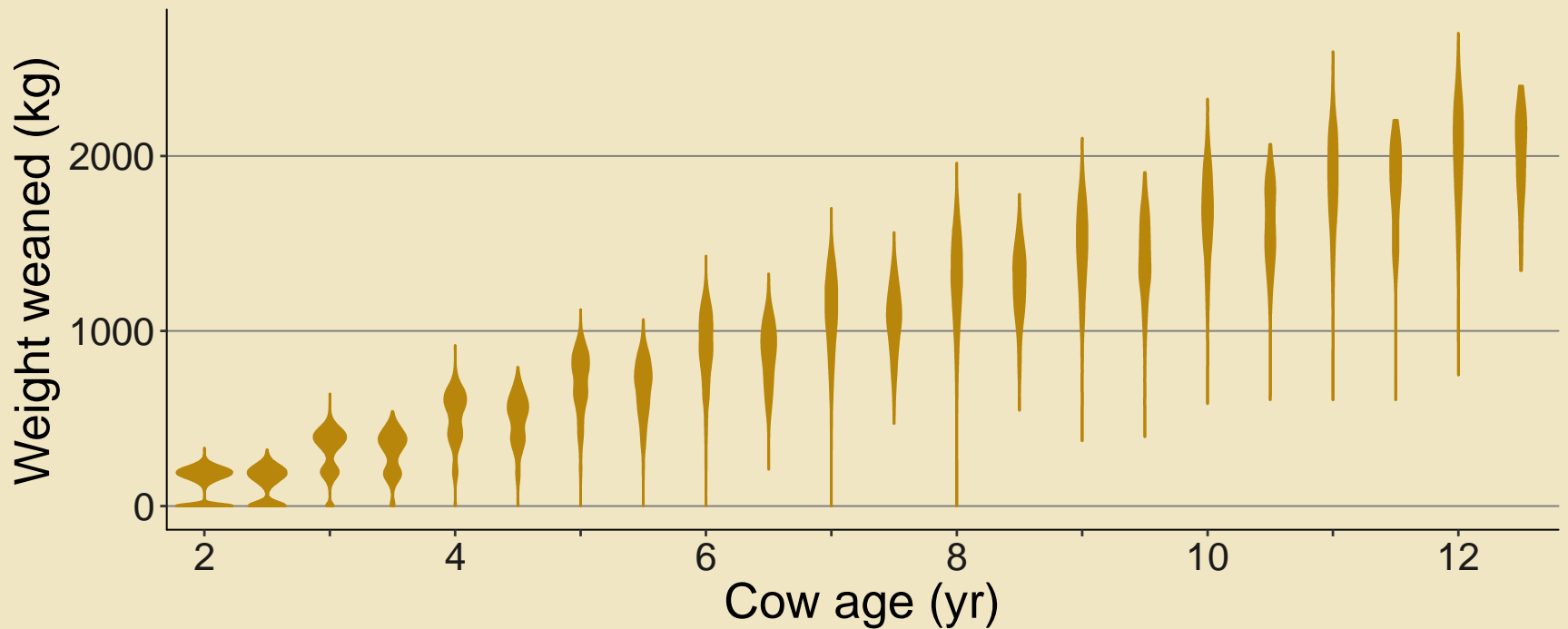
# Selection tools – cumulative productivity

Distribution of days nursing by cow age at calving



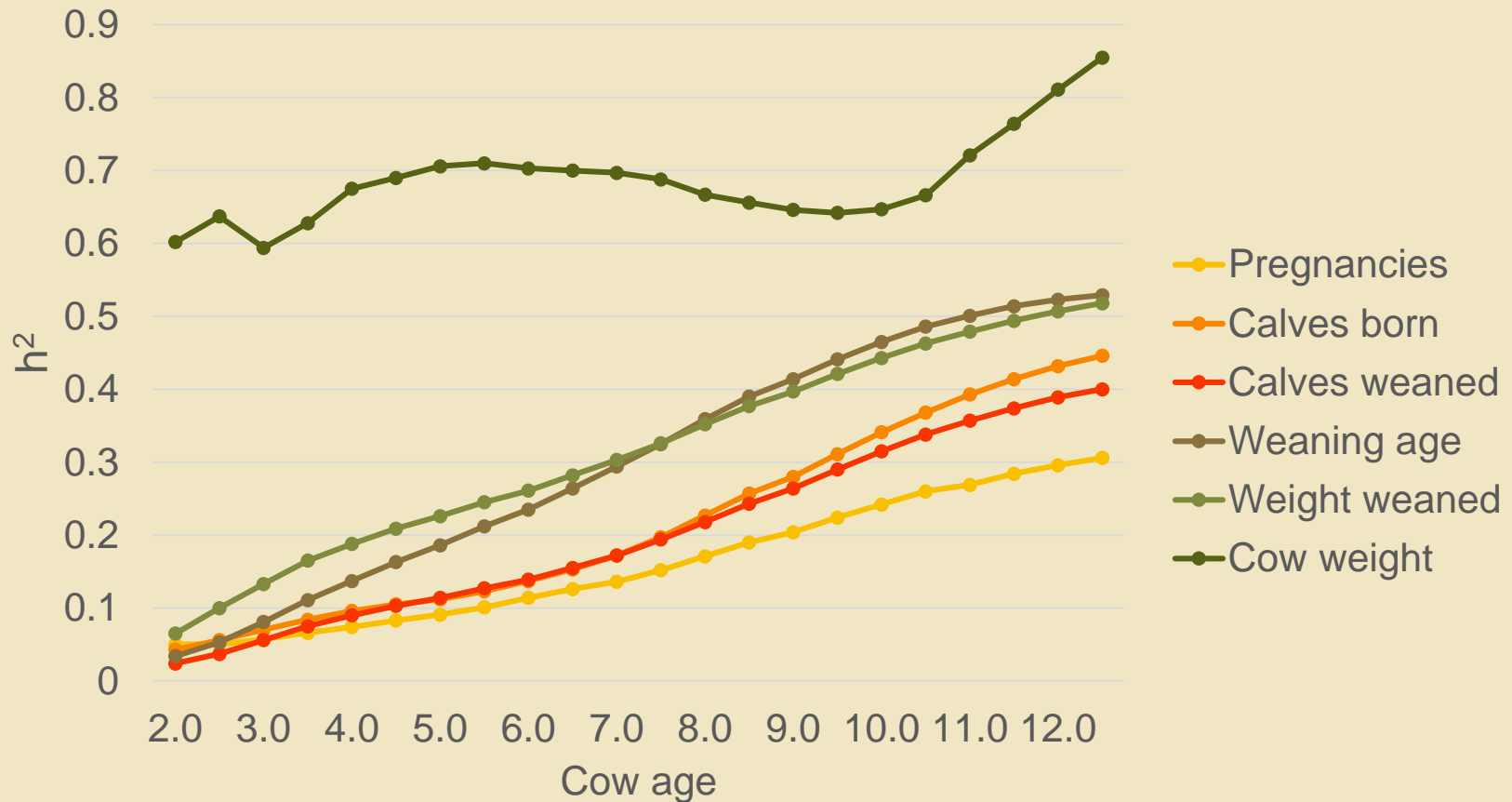
# Selection tools – cumulative productivity

Distribution of weight weaned by cow age at calving



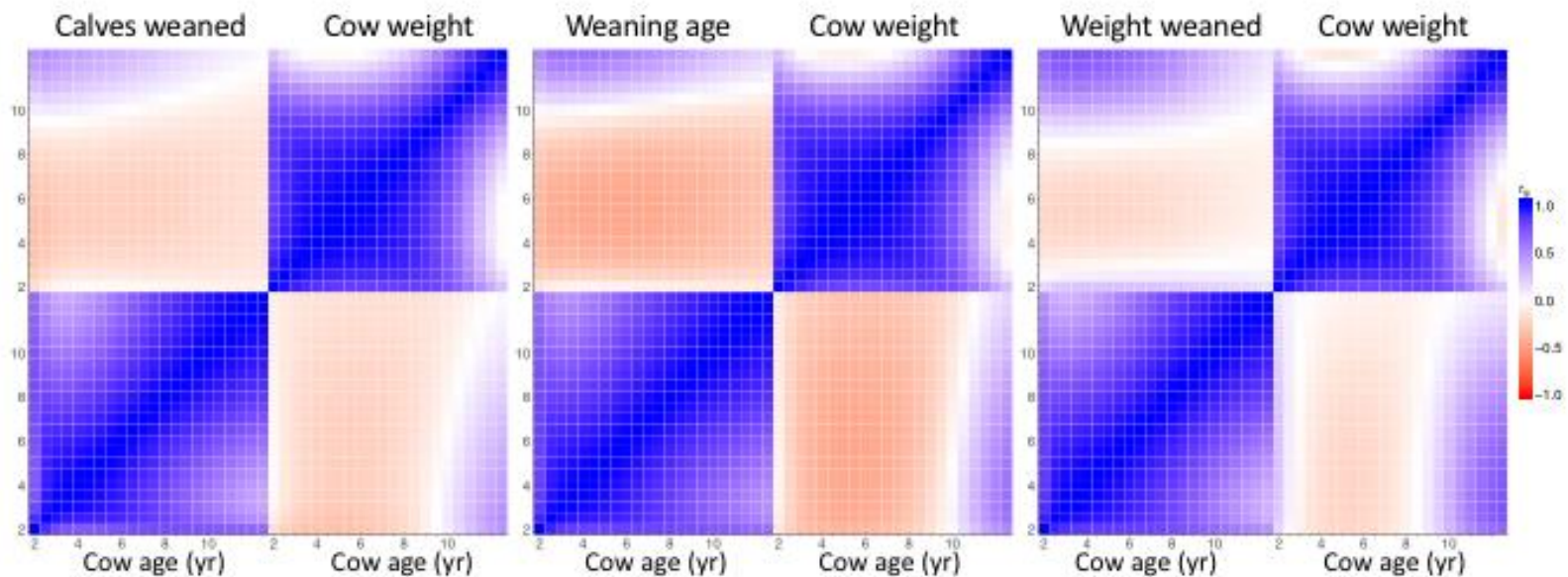
# Selection tools – cumulative productivity

Estimated heritabilities of cow weight and cumulative production



# Selection tools – cumulative productivity

Genetic correlations among cow weight and cumulative productivity



# Selection tools – cumulative productivity

## Correlations among cow weight and cumulative productivity

- strongest between cow weight and days nursing
  - heavier cows tend to have younger calves
  - later conception or longer gestation?
    - Phenotypic relationship
      - 0.92 d gestation/100 kg cow wt (McMorris & Wilton, 1986)
      - 1.00 d gestation/100 kg cow wt – GPE AI records
    - genetic relationship?
      - positive  $r_g$  between birth wt-cow weight, birth wt-gestation length
      - suggest  $r_g$  between cow wt-gestation length should also be positive
- weakest between cow weight and weight weaned
  - younger calves from heavy cows compensate with faster growth

# Selection tools – cumulative productivity

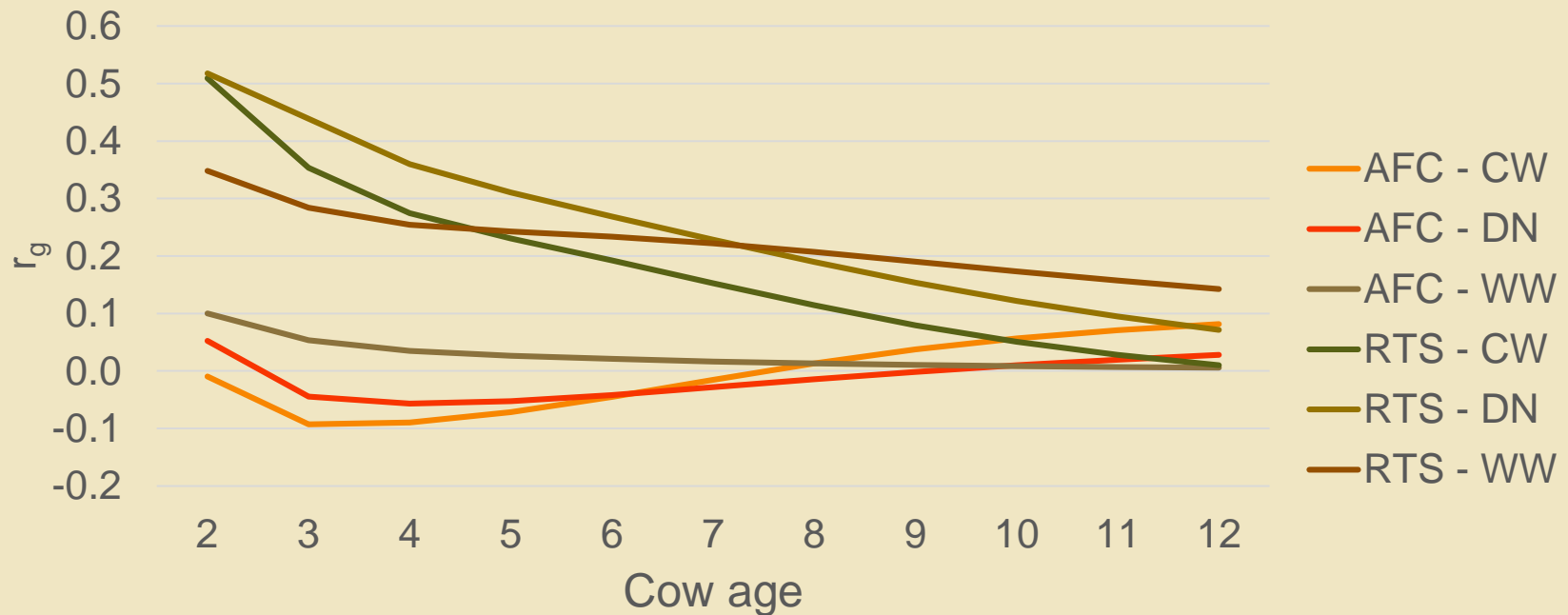
## Cow weight and condition

- Does lower body condition explain tendency for heavier cows to have lower productivity?
  - 6.3 mean BCS of cows within SD of contemporaries' mean weight
    - 8% BCS 8 and 9
  - 6.8 mean BCS of cows greater than contemporaries' mean + SD
    - 24% BCS 8 and 9

# Selection tools – cumulative productivity

Productivity indicators - traits measured on yearling heifers

Genetic correlations between antral follicle count (AFC), reproductive tract score (RTS) and cumulative productivity traits



Jimenez-Krassel et al. (2017) – shorter herd life of dairy heifers with high AFC



# Selection tools – cumulative productivity

## Response to selection for cumulative productivity

<b>Selection strategy</b>	<b>Calves weaned calves/yr</b>	<b>Days nursing days/yr</b>	<b>Weight weaned lb/yr</b>
Industry yearling wt trend (1.5 lb/yr)	-0.002	-0.9	-1.1
Cull open 2- and 3-yr-olds (CF)	0.002	0.7	1.2
CF + Bulls from 6-yr-old and older cows	0.004	1.2	4.0
CF + Top 10% EPD – bull calves	0.007	3.1	8.1
CF + Top 10% EPD – high accuracy sires	0.033	14.2	37.3

# Summary

- Stayability was a start but more complete cow production records collected since then may allow more comprehensive evaluation of female fertility and efficiency
- Records from young cows are informative to project EPD for productivity at later ages
  - increase accuracy of young sires' EPD without waiting for daughters to mature
- Industry trend of increased cow weight correlated to selection for calf growth may have slight effect on cow productivity
  - overcome by culling reproductive failure
  - more noticeable improvement by selecting sires for daughters' productivity
- Further work
  - bioeconomic values of productivity and weight EPD
    - production system selection indexes for biological and economic efficiency
  - genomics of cow productivity
    - "selective" genotyping – genotypes not available for contemporaries of genotyped cows

Questions?

