IMPACT OF SINGLE-STEP ON SELECTION INDICES

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SELECTION INDEX IN A NUTSHELL

- Tool to enable informed multiple-trait selection
- Based on:
  - Breeding objectives
  - Economic parameters
  - Relationships among traits
  - Population (herd) means
- Designed to improve commercial level profitability
- Not to be confused with breed (organization) specified trait goals
- New (~ 10 years) to the beef industry but "old hat" to other industries

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WHAT IMPACTS SELECTION INDICES

- Changes to goal traits
- Changes to traits with EPD (index traits)
- Changes to genetic (co) variances

- Changes to component trait accuracy
- Changes to trait definitions (scaling)
- Changes to economic parameters/assumptions
- Changes to population (assumed) means

GENERAL FORM

- $b = P^{-1}Gv$

GENERAL FORM FOR EPD (OR BREEDING VALUE)

- $b = G^{11}G_{12}v$

EXAMPLE (TERMINAL)

- Hot carcass weight
- Yield grade
- Quality grade
- Feed intake
- Yardage
- Mortality
- Morbidity

- Carcass weight
- REA
- Fat
- Marbling
- DMI
- ?
- ?

This fits breeders who do not retain heifers from these matings and sell all calves on a grid

GENERAL FORM WHEN GOAL=CRITERIA

- $b = v$
- Rarely is this the case
- We make assumptions to force this case
- Some breeds took "single-step" as an "opportunity" to update to this scenario

CHANGE TO ACCURACY

$$r_{HI} = \frac{b'G_{12}v}{\sqrt{(b'G_{11}b)(v'Cv)}}$$

- Upper bound of accuracy (assumes EPD accuracy of 1)
- Replacing G_{11} with P gives the lower bound of accuracy (phenotypic selection)
- As component trait accuracy increases, so does r_{HI}

CHANGES TO ACCURACY

- Assume the simple linear index below:
  - $I = 0.9 \times EPD_1 + 0.1 \times EPD_2$
- If all animals in the population have accuracy of 0 for EPD_1, rank differences in the index will be caused by differences in EPD_2 only (regardless of weighting for EPD_1)
- As accuracy increases, EPD are dispersed allowing the trait to contribute more to ranking based on

CHANGES TO TRAIT DEFINITIONS

- Seemingly the same trait may have vastly different scale and thus inference
- Examples:
  - Marbling
  - Reproductive longevity
- Scale (interpretation) of the EPD trait must match the scaling (interpretation) of v

PRACTICAL EXAMPLE

- Assume the economic value (v) for marbling is $1 when assumed on a 100 point scale
  - Assume b=v
- What happens if that values is used when marbling EPD represents a 10 point scale?
  - Does b = 1?

RE-RANKING BASED ON COMPONENT EPD

- Sensitivity determined by weighting in the index
- Example of rank change due to change in evaluation
- Across all animals in ASA database
- r ~ 0.88 for API
- r ~ 0.796 for TI

SINGLE-STEP'S IMPACT ON INDICES

- Positive
  - Increased accuracy
  - Re-ranking is not a bad thing when you move closer to the truth

- Need to understand when (if) reasonbleness checks needed

CROSSED THE FINISH LINE?

- Releasing a single-step evaluation should allow the opportunity to turn organizational focus to other areas of NCE
  - Obviously additional improvement to be made overtime relative to ss
- Economic indices clearly misunderstood
- Effort now needs to be focused on
  - Phenotypes
  - Enabling (accurate) selection decisions

Data

Knowledge

Data is constantly growing

(more animals, more traits, more genotypes, sequence data)

Requires turning data into tools

Tools

Decisions

Increasing list of EPD

Requires turning tools into impactful decisions