# ANALYSIS OF GROUP RECORDED FEED INTAKE AND INDIVIDUAL RECORDS OF BODY WEIGHT AND LITTER SIZE IN MINK

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Schou & Malmkvist, 2017, Early kit mortality and growth in farmed mink are affected by litter size rather than nest climate

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# MINK IN A PIG SESSION?

Housed in groups

→Feed intake is a group record

→2 animals per group

Sexual dimorphism

# AIMS

Modelling

- Group recorded feed intake (FI) yielding sex specific variances
- Body weight in males (BWM) and females (BWF)
- Litter size at day 21 after birth (LS21)

Defining feed efficiency

Examining direct and correlated responses to selection

# DATA

| Traits | FI (kg) | BWM (kg) | BWF (kg) | LS21 (kits) |
|---|---|---|---|---|
| Number of records | **7878** | **16872** | **16890** | **6445** |
| Recording years | 2013-2016 | 2006-2016 | 2006-2016 | 2006-2015 |
| Mean (SD) | 55.41 (6.12) | 3.63 (0.60) | 1.90 (0.34) | 6.17 (2.67) |

# MODEL

random effects

$$\mathbf{y_{FI}} = \mathbf{X_{FI}b_{FI}} + \mathbf{Z_{FIm}a_{FIm}} + \mathbf{Z_{FIf}a_{FIf}} + \mathbf{W_{FIm}c_{FIm}} + \mathbf{W_{FIf}c_{FIf}} + \mathbf{e_{FI}}$$

record | fixed effect year×hal | animal effect male | animal effect female | litter-of-birth effect male | litter-of-birth effect female | residual

$$\mathbf{y_{BWM}} = \mathbf{X_{BWM}b_{BWM}} + \mathbf{Z_{BWM}a_{BWM}} + \mathbf{W_{BWM}c_{BWM}} + \mathbf{e_{BWM}}$$
$$\mathbf{y_{BWF}} = \mathbf{X_{BWF}b_{BWF}} + \mathbf{Z_{BWF}a_{BWF}} + \mathbf{W_{BWF}c_{BWF}} + \mathbf{e_{BWF}}$$
$$\mathbf{y_{LS21}} = \mathbf{X_{LS21}b_{LS21}} + \mathbf{Z_{LS21}a_{LS21}} + \mathbf{W_{LS21}c_{LS21}} + \mathbf{e_{LS21}}$$

Analyzed in RJMC module of DMU (Madsen & Jensen, 2013)

Gibbs sampling: 2.2M rounds, with 200k burn-in and interleave of 500 → 4000 samples

# DEFINING FEED EFFICIENCY

Positive correlation between FI and BW

→ FI increases with BW

Residual feed intake (RFI)

FI corrected for BW

→ genetically independent from BW

RFI calculated post-analysis using R

7 variances and 7 EBVs

| Genetic correlation | FIm | FIf |
|---|---|---|
| BWM | 0.85 (0.02) | 0.68 (0.04) |
| BWF | 0.74 (0.03) | 0.86 (0.02) |

# DIRECT AND CORRELATED SELECTION RESPONSES

Ranking by EBV for trait *j*

Selection of top 10% ($n_s$) for trait *j*

Calculating responses in trait *j'*

If *j*=*j'*: direct response

If *j*≠*j'*: correlated response

Trait *j*

| Animal | RFIm | … | LS21 |
|---|---|---|---|
| 1 | -96 | … | 65 |
| … | … | … | … |
| $n_s$ | -65 | … | -50 |
| … | … | … | … |
| n | 105 | | 25 |

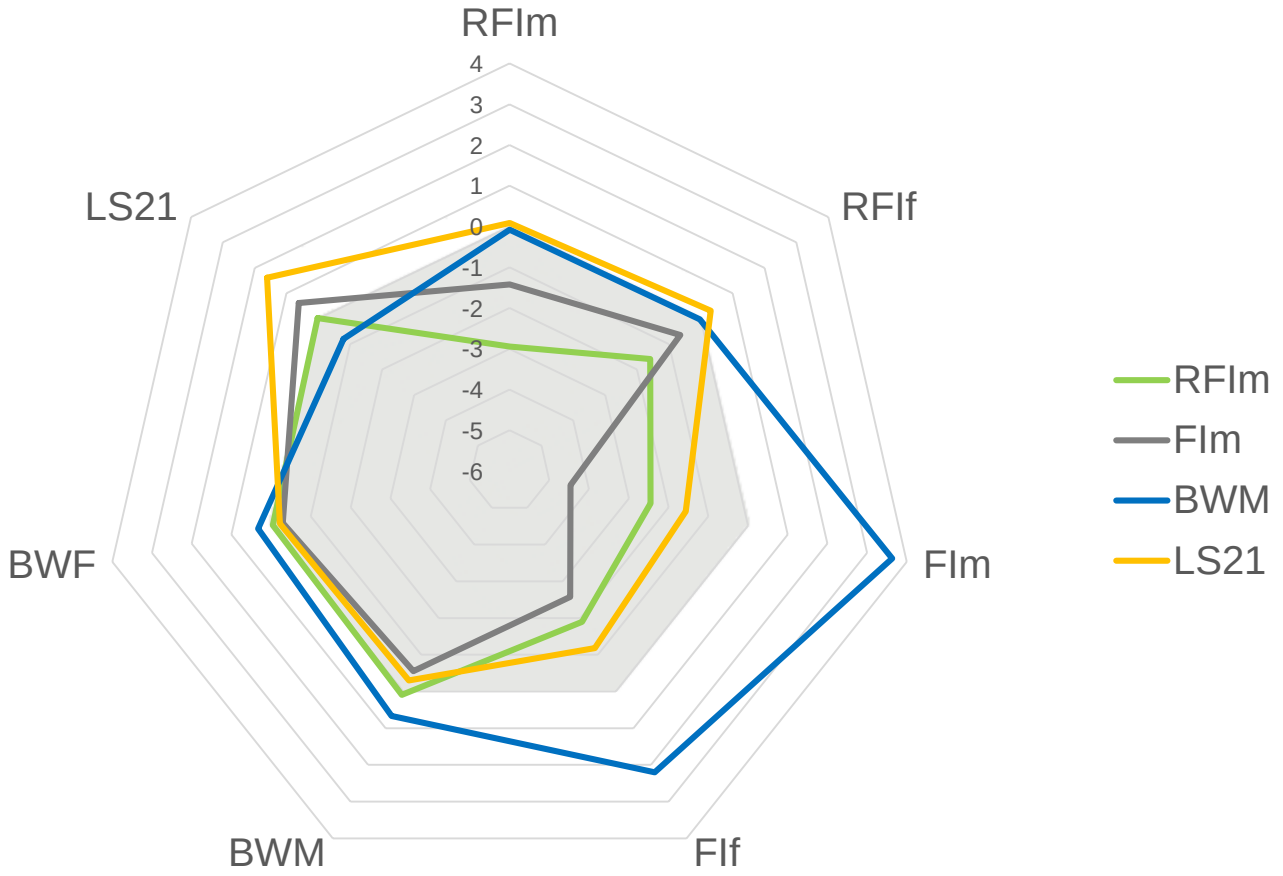
Trait *j'*

# GENETIC PARAMETERS

from the multi-trait model and RFI calculation

| Traits | RFIm | RFIf | FIm | FIf | BWM | BWF | LS21 |
|---|---|---|---|---|---|---|---|
| $h^2$ | 0.22 (0.03) | 0.12 (0.02) | 0.45 (0.03) | 0.35 (0.02) | 0.54 (0.02) | 0.57 (0.02) | 0.13 (0.02) |
| $\sigma_a^2$ | 1.25 (0.19) | 0.67 (0.13) | 5.33 (0.42) | 2.84 (0.24) | 0.13 (0.01) | 0.05 (0.00) | 0.91 (0.17) |
| $\sigma_c^2$ | 0.46 (0.11) | 0.17 (0.07) | 2.02 (0.21) | 0.72 (0.12) | 0.03 (0.00) | 0.01 (0.00) | 0.23 (0.08) |

# DIRECT AND CORRELATED SELECTION RESPONSES



# CONCLUSION

It is possible to model group recorded feed intake and individually recorded bodyweight and litter size in mink

Selection on residual feed intake does not have negative consequences for body weight or litter size

# GENETIC CORRELATIONS

| Traits | RFIm | RFIf | FIm | FIf | BWM | BWF |
|---|---|---|---|---|---|---|
| RFIf | 0.88 (0.06) | | | | | |
| FIm | 0.48 (0.03) | 0.39 (0.07) | | | | |
| FIf | 0.52 (0.06) | 0.48 (0.04) | 0.86 (0.04) | | | |
| BWM | 0.00 (0.00) | -0.04 (0.07) | 0.87 (0.02) | 0.70 (0.04) | | |
| BWF | 0.10 (0.06) | 0.00 (0.00) | 0.77 (0.03) | 0.87 (0.02) | 0.82 (0.02) | |
| LS21 | -0.03 (0.13) | 0.20 (0.13) | -0.47 (0.09) | -0.47 (0.09) | -0.52 (0.08) | -0.65 (0.07) |

# AVERAGE EBV

$$\mu RFI = \frac{EBV_{RFIm}}{\sigma^2_{RFIm}} + \frac{EBV_{RFIf}}{\sigma^2_{RFIf}}$$