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Derivation of economic values for German dairy breeds

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Project - REDIVERSE

REDIVERSE – Biodiversity within and between European Red Dairy Breeds



Preservation and promotion of European Red Dairy Breeds

- Population genetic analyses
- Genomic selection strategies
- Optimization of breeding goals and breeding schemes
- Socio-economic analyses

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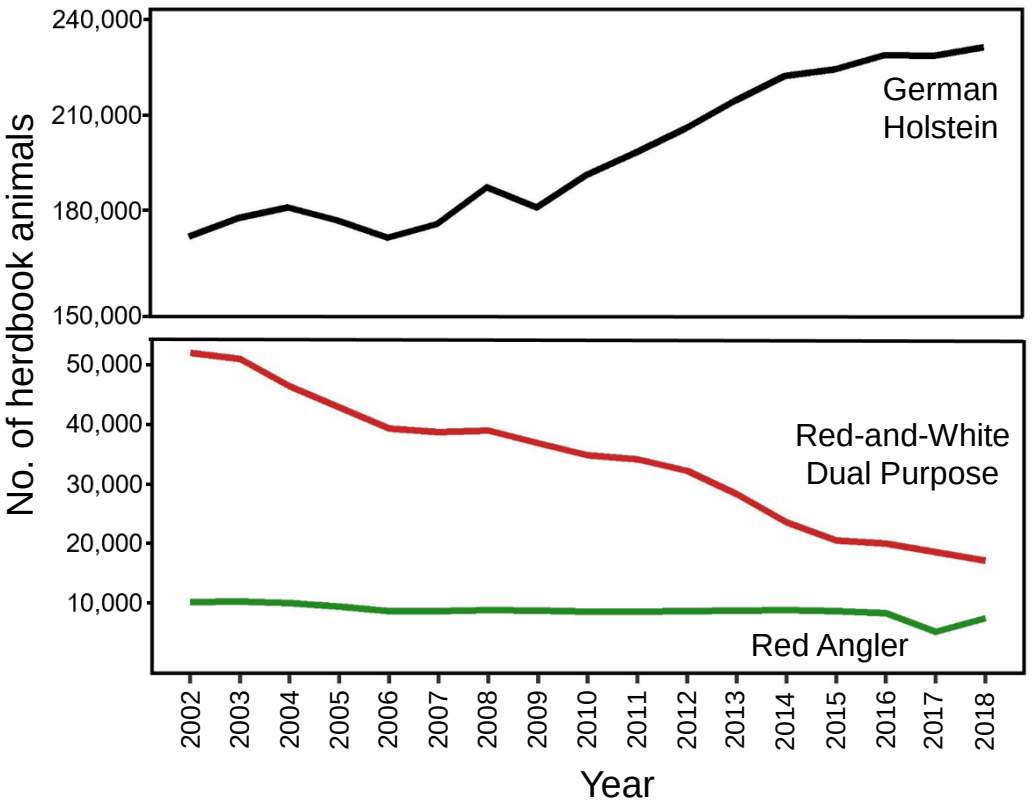
Dairy breeds in Schleswig-Holstein



Average performances

German Holstein
Milk yield: 9,041 kg
Fat: 4.03 %
Protein: 3.40 %

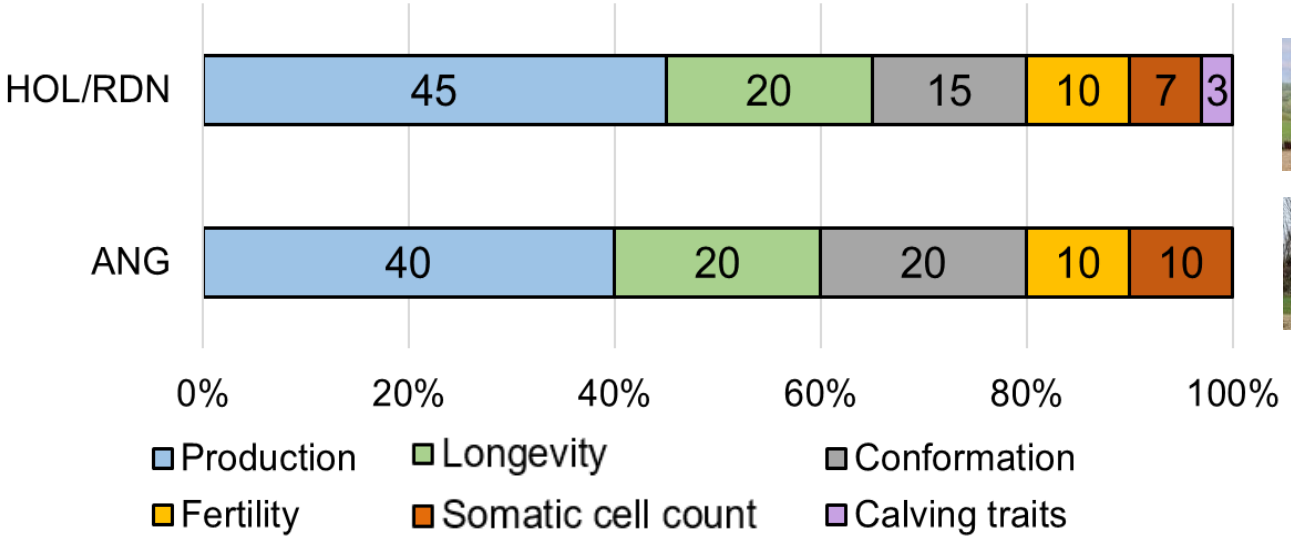
Red-and-White Dual Purpose
Milk yield: 6,895 kg
Fat: 4.31 %
Protein: 3.49 %

Red Angler
Milk yield: 7,950 kg
Fat: 4.54 %
Protein: 3.60 %

(LKV SH, 2018)

Current breeding goals

Current composition of the total merit indices (vit, 2019)



Objectives

- Derivation of economic values for breeding traits
- Determination of the economic optimal selection indices

Material & Methods

1st step: **Bio-economic model SimHerd** (Østergaard et al., 2005)

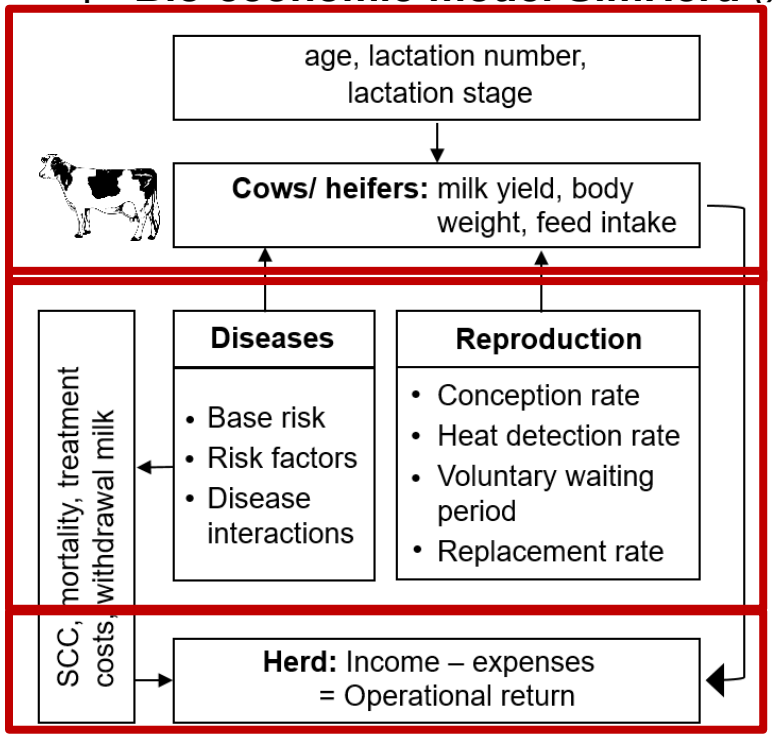


Figure: Schematic representation of the SimHerd model

→ Simulation of different scenarios: varying trait of interest to quantify the economic consequences

→ Derivation of economic values for 23 traits

✓ Structural herd effects

! Correlations between traits

Material & Methods

2nd step: **Multiple regression with mediator variables** (Østergaard et al., 2016)

$$NetReturn_{ijkl} = \mu + \beta_a x_{ij} + \sum_{k=1}^{n} \beta_b m_k + \varepsilon_{ijkl}$$

$NetReturn = average\ annual\ net\ return$
$\mu = mean$
$x = trait\ of\ interest$
$m = mediator\ variables$
$\beta_{a,b} = regression\ coefficients$
$\varepsilon = residuals$

Mediator variable:

1) Correlation to the target trait
2) Part of the breeding goal

Removing effects from the economic value of the trait of interest which are caused by variation in correlated traits

→ Prevention of double counting !

Results & Discussion (I)

Table: Derived economic values (in Euro/marginal change in trait per cow-year)



Complex	Trait	HOL	ANG	RDN
Health	Mastitis	-2.71	-2.69	-2.57
	Lameness	-3.10	-3.05	-2.70
	Ketosis	-1.96	-1.87	-1.67
	Milk fever	-2.23	-2.14	-1.98
	Metritis	-1.82	-1.74	-1.73
Fertility	Conception rate cows	2.21	2.49	1.42
	Conception rate heifers	1.51	1.30	0.84

Health:

→ Highest economic effects in HOL

→ Lowest economic effects in RDN

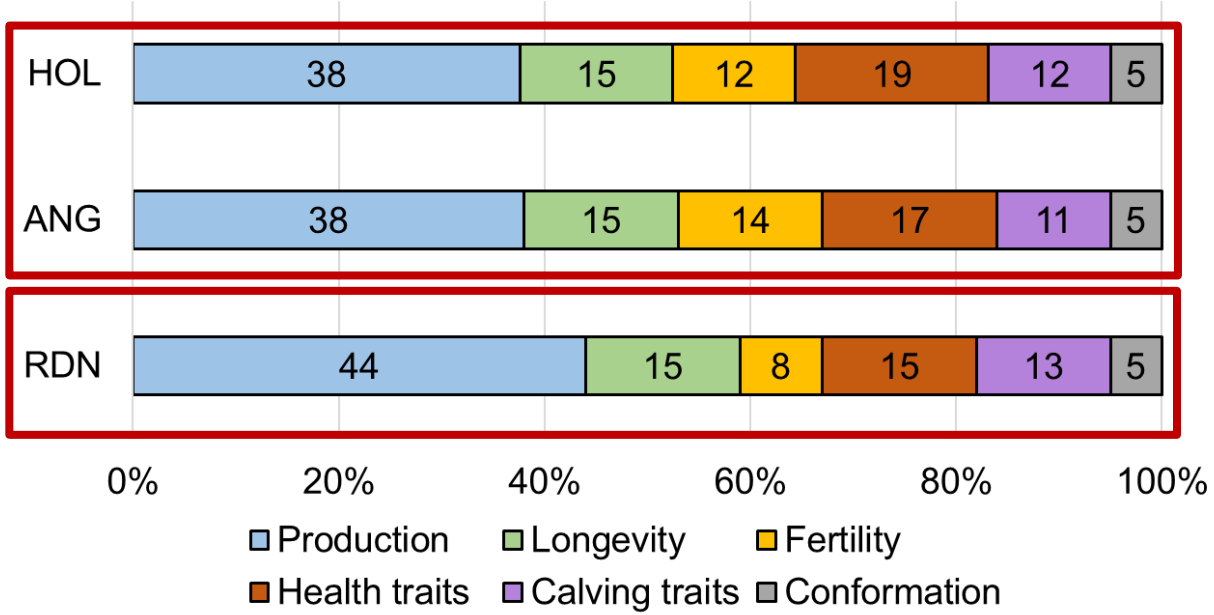
Fertility:

→ Largest differences among breeds

→ „Law of diminishing returns“

Results & Discussion (II)

Relative importance of traits in the selection indices
(Economic optimal selection indices)



→ Selection indices for HOL and ANG differ only slightly

→ Higher emphasis for production (milk+meat)

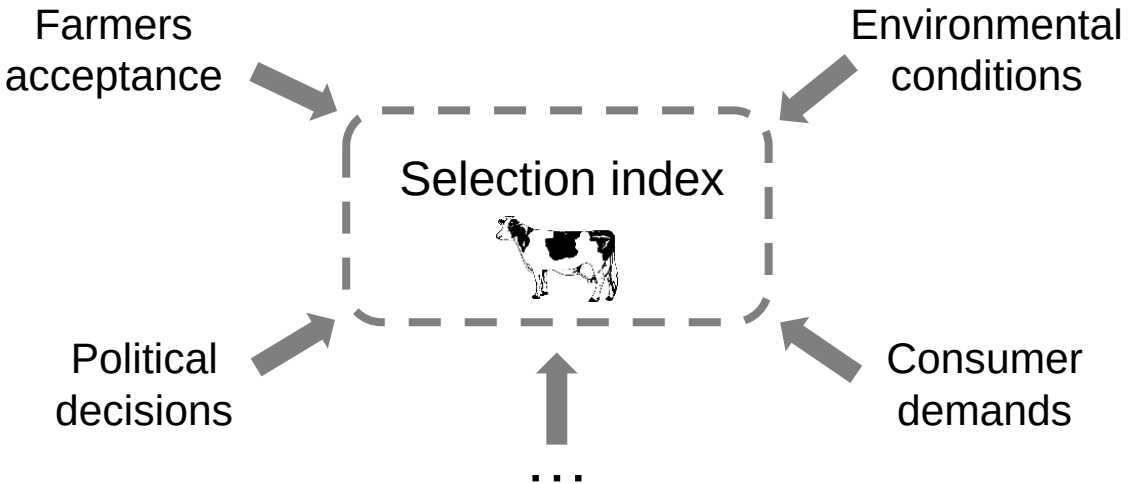
→ Lower relative importance of fertility and health

Conclusions

- In part, **large differences in economic values** have been found (e.g., fertility traits)

→ Even for smaller cattle breeds, **seperate calculations** of economic values and selection indices are important

- In this study, a **strictly economic approach** was applied



Thank you for your attention!

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ERA-NETSUSAN

Results

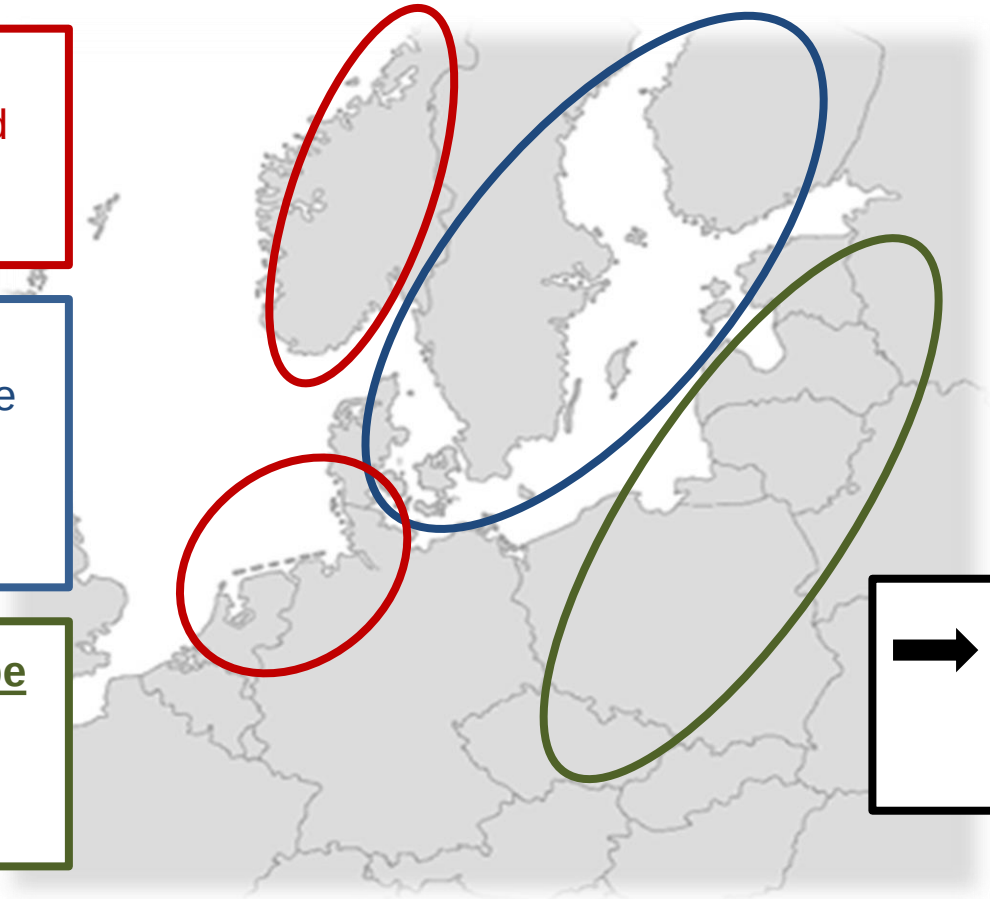
Complex	Trait	Unit	HOL	ANG	RDN
Production	ECM	kg	0.16	0.16	0.17
	Fat	kg	1.16	1.16	1.17
	Protein	kg	3.17	3.17	3.18
	Average daily gain	kg/day	0.31	0.38	0.59
	EUROP form score	point (1-5)	12.88	12.85	12.50
Conformation	Feed and legs	point (1-9)	15.97	15.97	15.97
	Udder	point (1-9)	23.04	23.04	23.04
Workability	Milkability	point (1-9)	15.97	15.97	15.97
	Temperament	point (1-9)	7.10	7.10	7.10
Health	Mastitis	%	-2.71	-2.69	-2.57
	Lameness	%	-3.10	-3.05	-2.70
	Ketosis	%	-1.96	-1.87	-1.67
	Milk fever	%	-2.23	-2.14	-1.98
	Metritis	%	-1.82	-1.74	-1.73
Calving difficulty	Dystocia	%	-3.41	-3.50	-3.97
Calf survival	Stillbirth	%	-2.14	-1.92	-2.59
	Early calf mortality	%	-1.43	-1.76	-1.78
	Late calf mortality	%	-3.78	-3.50	-5.03
Cow survival	Cow mortality	%	-14.39	-14.90	-15.20
Fertility	Conception rate heifers	%	1.51	1.30	0.84
	Conception rate cows	%	2.21	2.49	1.42
	Insemination rate heifers	%	1.15	0.96	0.73
	Insemination rate cows	%	1.70	2.12	1.15

Next steps

Dual purpose
Norwegian Red
MRY
RDN

Dairy type
Finnish Ayrshire
Swedish Red
Danish Red
Angler

Eastern Europe
Lithuanian Red
Latvian Brown
Polish Red



➡ Implications on genetic gain and genetic diversity