Genetic structure in Croatian Simmental cattle

Špehar M.[1,2],Ivkić Z.[1], Bulić V.[1], Kovač M.[2] ,Malovrh Š.[2]

[1]Croatian Livestock Center, Ilica 101, 10000 Zagreb, Croatia
[2]University of Ljubljana, Biotehnical Faculty, Department of Animal Science, Groblje 3, 1260 Domžale, Slovenia

Importance of genetic diversity

- Genetic diversity = variety of alleles and genotypes present in population
- Basis of evolutionary potential of species for
  - Responding to environmental changes
  - Genetic selection

Description of genetic variability

- Demographic description
  - Generation interval, family size, no. of males and females in population over time
- Probability of identitiy by descent of genes
  - Inbreedig coefficient
  - Effective population size
- Probability of gene origin
  - Effective number of founders, ancestors and founder genomes
  - Equivalent number of known generations

Objective

- To present generation interval
- To estimate genetic variability using pedigree information
- Genetic variability parameters
  - Inbreeding
  - Effective number of founders and ancestors
  - Equivalent number of known generations

Material and method

- Pedigree information

	Male	Female	All
No. of animals	4497	76582	81079
Year	1998-2003	2001-2005	
Reference population	85	35218	35303

- PEDIG program package

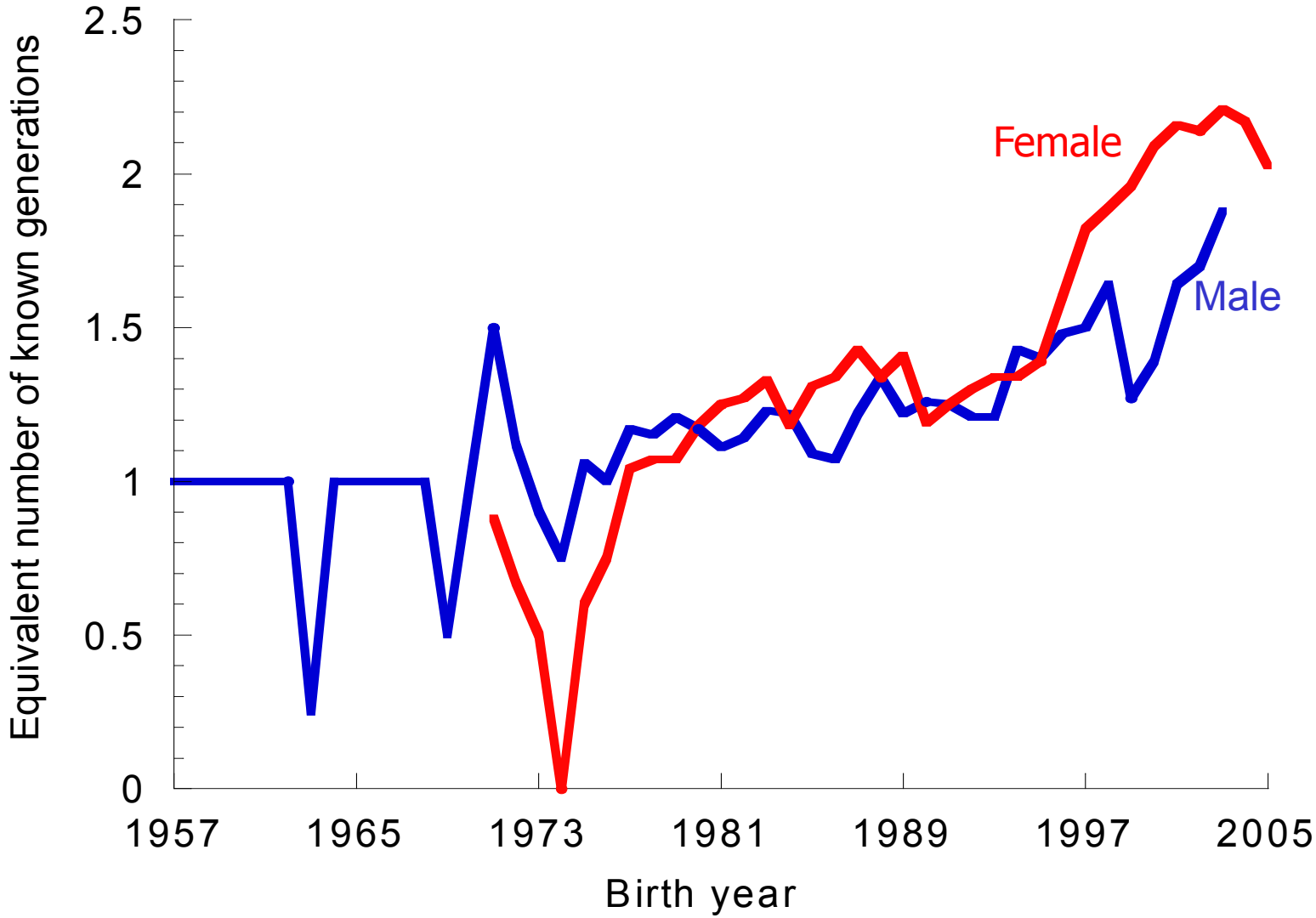
Generation interval for the four pathways parent-offspring

Pathway	Number of		Generation interval
	Parent	Offspring	
Sire-son	175	504	8.44
Sire-daughter	887	45666	7.05
Dam-son	74	81	6.74
Dam-daughter	22527	29140	5.75

Inbreeding

Class	Number of animals	Inbreeding (%)
0	80698	99.5
0 - 5	152	0.002
5 -10	94	0.001
10 -15	17	0.0003
25	118	0.002
		Average
Inbred animals	381	10.39
Total	81079	0.05

Number of generations



Effective number of founders and ancestors

Parameter	Sex	
	Male	Female
Number of founders	157	23420
Effective number of founders	119.5	382.0
Effective number of ancestors	79.4	171.2
N_{50}	34	70
C_{max} (%)	3.1	2.8

N_{50} – number of ancestors contributed 50% genes in gene pool

C_{max} – gene contribution of the most important ancestor

Proportion of genes (%) from the three most important ancestors

Most important ancestors	Birth year	Origin	Contributions	
			Marginal	Cumulated
Male reference population				
Samurai	1992	Germany	3.16	3.16
Horwein	1986	Germany	2.85	6.01
Horfred	1993	Germany	2.53	8.54
Female reference population				
Bel	1995	Croatia	2.82	2.82
Remi	1997	Croatia	2.27	5.09
Piton	1994	Croatia	1.89	6.98

Conclusions

- Low average inbreeding coefficient in whole population
- Equivalent number of known generations was small
- Most important ancestor contribute to reference population (3.1% in males, 2.8% in females)
- 50% genes in gene pool of male and female reference population was contributed by 34 and 70 ancestors
- Quality of pedigree data