Genetic structure of the French Blonde d'Aquitaine, Charolais and Limousin beef cattle populations

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Three major beef breeds in France

- 77% of beef cows in France in 2007
- Huge changes in beef cattle populations
  - Demography
  - Artificial Insemination (AI) use
  - Breeding programs
- Assessment of genetic diversity by pedigree analyses
  - Inbreeding trends
  - Probability of gene origin approach

Pedigree analyses carried out with Pedig (Boichard, 2002)

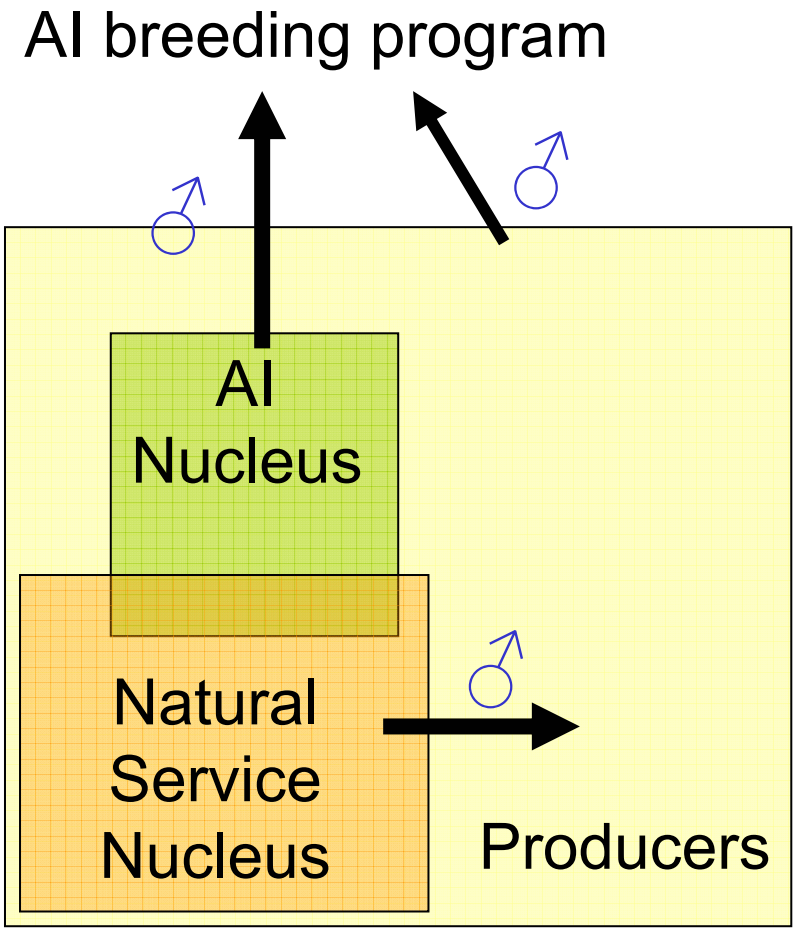
http://www-sgqa.jouy.inra.fr/article.php3?id_article=110

Presentation of populations

	Recorded calves	Pedigree
Blonde d'Aquitaine (BLA)	807 221	7 500 000
Charolais (CHA)	2 992 246	20 700 000
Limousin (LIM)	2 142 788	12 500 000

Recorded population =

~15% of the whole French population



Pedigree knowledge

Complete Generation Equivalents : $CGE = \sum_{\text{Generations}} \%\text{known ancestors}$

	BLA	CHA	LIM
Recorded Pop	6.0	8.7	7.2
Producers	5.9	8.4	7.2
NS Nucleus	6.9	10.2	8.3
AI Nucleus	6.6	9.8	8.3

Inbreeding (F) & effective size (Ne)

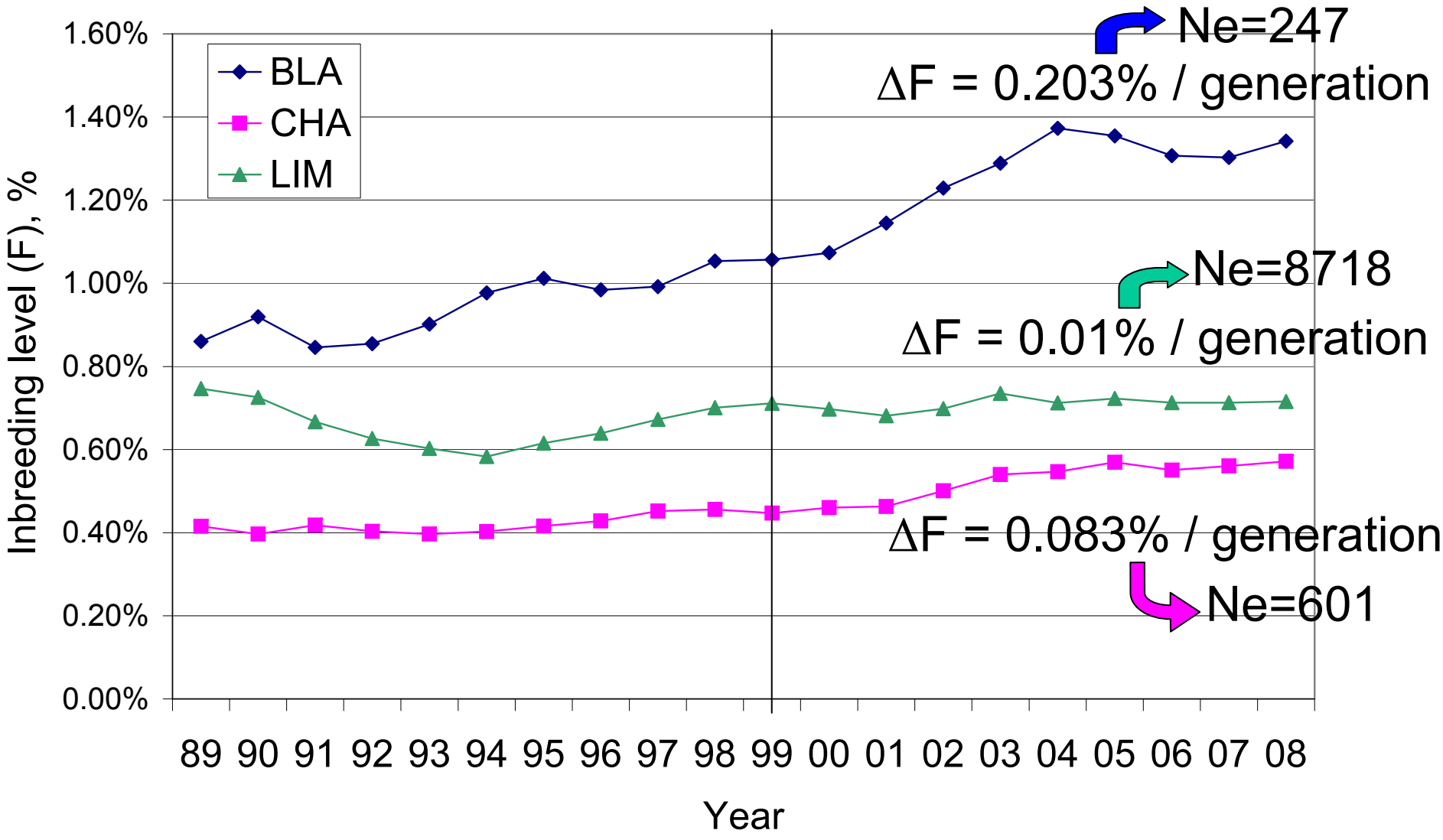
- Inbreeding calculated with Meuwissen & Luo ‘s algorithm

- Annual rate of increase in inbreeding calculated by regression on the birth year of calves (t):

$$\ln(1-F)=t*\ln(1-\Delta F_a) + k \quad \text{(Perez-Enciso, 1995)}$$

- Effective size: $Ne= 1/(2\ L\Delta F_a)$, with L=generation interval

Inbreeding trends (ΔF) and effective size (Ne)



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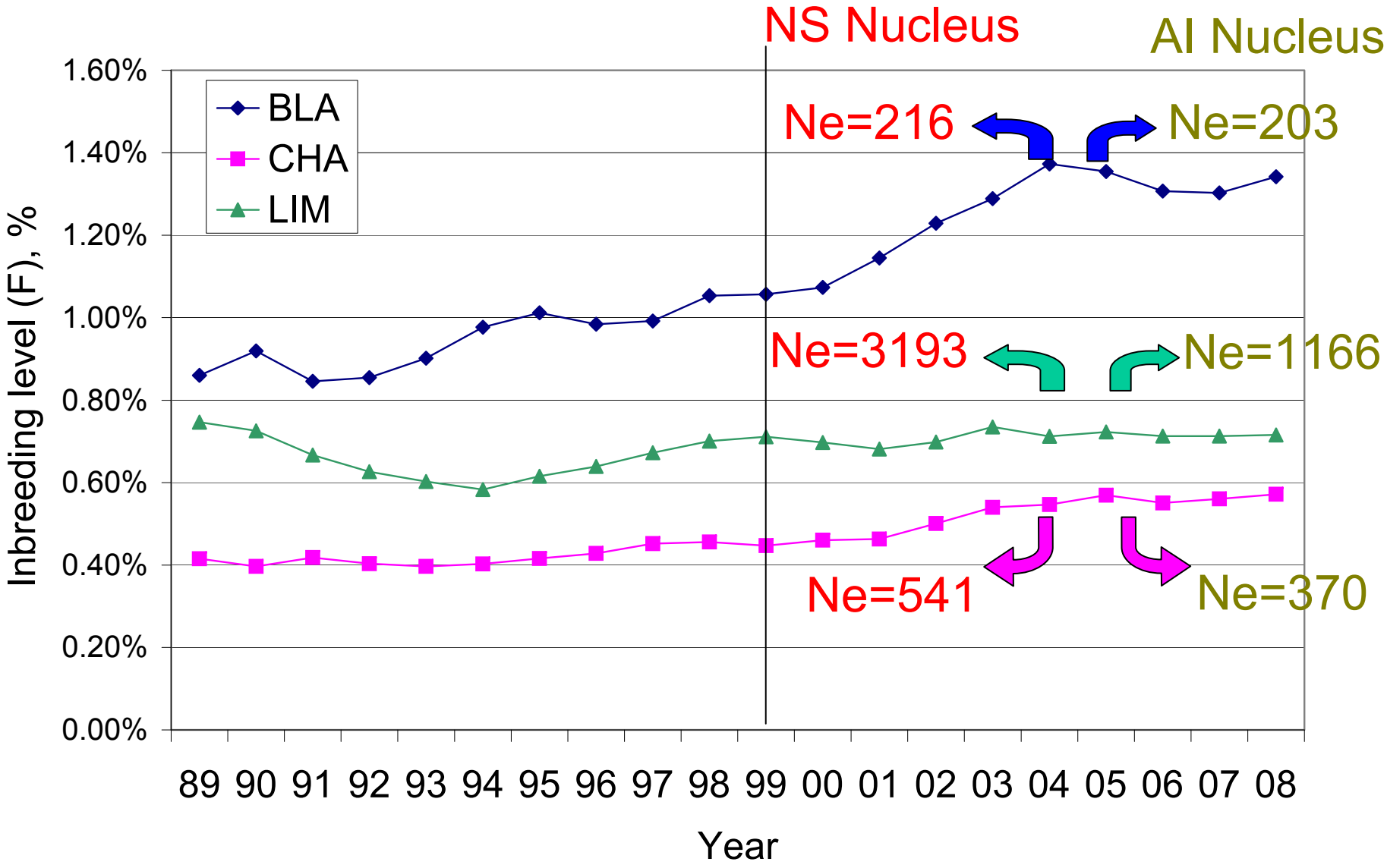
Inbreeding trends (ΔF) and effective size (Ne)



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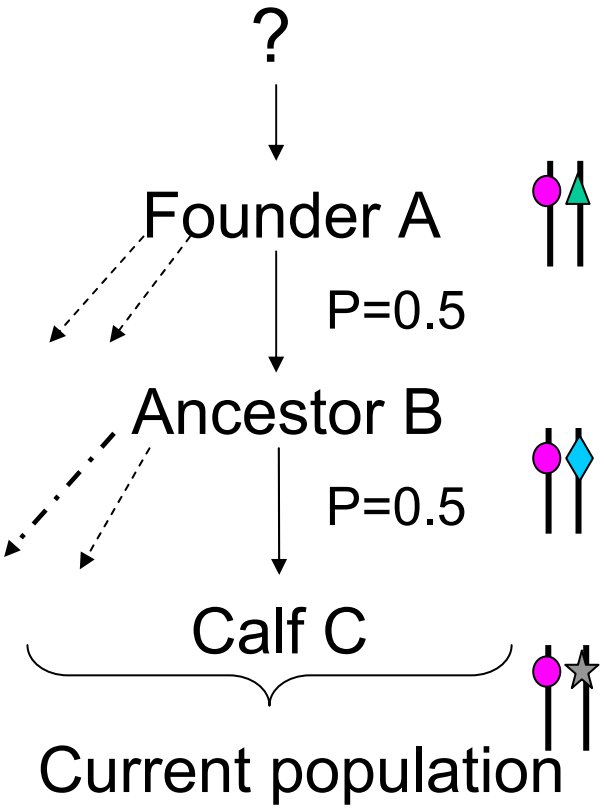
The probability of gene origin approach



- effective number of founders: **Fe**
- effective number of ancestors: **Fa** ≤ Fe

Ratio Fa/Fe => bottleneck effects

Genetic diversity within populations

- Statistics calculated for calves born

  between 1984-1988, 1994-1998 & 2004-2008

- Ratio Fa / Fe:
  - CHA: 79% > 63% > 48%
  - LIM: 47% > 39% > 28%
  - BLA: 41% > 39% > 37%

Conclusions

- Low inbreeding trends & high effective sizes

- Existence of strong bottlenecks
  - BLA: old bottlenecks but stable
  - LIM: old bottlenecks getting worse
  - CHA: recent bottlenecks

- Take care for the future !



Thank you for your attention!

Evolution of the AI rate