

# Inbreeding in the Nordic coldblooded trotter

21<sup>st</sup> World Trotting Conference, Bjerke 20.05.09

Hanne Fjerdingby Olsen



## INBREEDING

- Inbreeding = mating of relatives
- New inbreeding more disturbing than old inbreeding
- Inbreeding reduces the genetic variation
- Reduction of the genetic variation makes a population more vulnerable for changes (environment, politics, economics etc.)
- Inbreeding can lead to reduced fertility, viability and performance (inbreeding depression)
- Inbreeding can increase the frequency of homozygotes (recessives) and so the frequency of hereditary defects and lethal alleles

## SELECTION AND INBREEDING

- Selection of breeding animals is essential to systematically improve the performance
- Selection = choose the best animals for breeding
- Ranking of breeding animals
  - conformation, character of the breed
  - performance (BLUP)
- Selection gives an increase of inbreeding
- Fast genetic gain gives high rate of inbreeding
- High rate of inbreeding over a short time span will reduce the genetic variation and damage the population over time



## INBREEDING DEPRESSION - COLDBLODDED TROTTER

- Effect of inbreeding depression on fertility (Klemetsdal & Johnson, 1989)
  - Foaling rate reduced 4,2% by 10% increase in the inbreeding coefficient
  - Early abortion increased 12% by 10% increase in the inbreeding coefficient
- The probability of bilateral carpalis was 6,7% and 12,3% among horses with lower or higher inbreeding coefficient than average (Dolvik & Klemetsdal, 1994)
- Effect of inbreeding on racing performance (Klemetsdal, 1998)

## BREEDING STALLIONS 2007

- In total 68 approved Norwegian stallions in 2007
- Composition:
  - 50 of 68 stallions members in 18 groups of half siblings (>2)
- **Elding (★1983): 11 sons, 13 grandsons**
- Alm Rigel (★1975): 3 sons, 9 grandsons
- Alm Svarten (★1981): 2 sons, 2 grandsons
- Atom Vinter (★1985): 3 sons, 2 grandsons



## MATERIAL AND METHODS

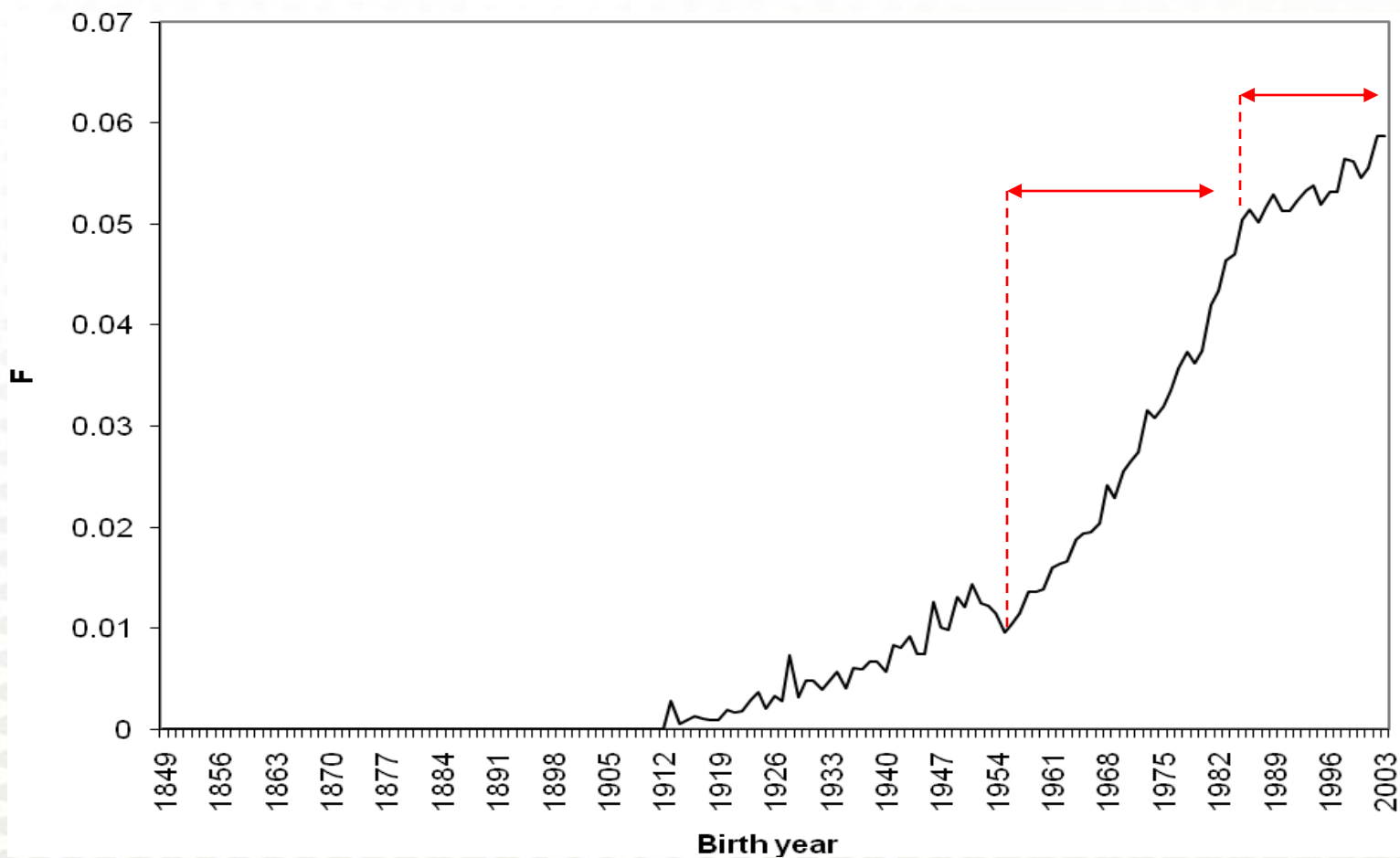
- 98 861 animals born in the period 1849-2003
- Computation of inbreeding was accomplished by the use of Quaas-Hendersons algorithm (Quaas, 1976; Henderson, 1976)
- Effective population size ( $N_e$ ):

$$N_e = \frac{1}{2\Delta F}$$

(Falconer&Mackay, 1996)

**The number of animals that would give rise to the rate of inbreeding, if they bred in the manner of an idealized population**

## THE HISTORY OF INBREEDING



## THE HISTORY OF INBREEDING (continued)

	1982-1985	2000-2003
$F_{\text{snitt}}$	0.0470	0.0568
$F_{\text{foreldre}}$	0.0304	0.0506
$\Delta F$	0.0171	0.0066
$N_e$	29	76



## HOW TO EXPLAIN THE HISTORY?

- Two periods with different rate of inbreeding
- First period (1955-1985) dominated of Steggbest (used in both countries)
- New dominating stallions around 1985
  - popular stallions represent "bottle neck effects"
  - changes in dominance will affect the effective populations size
  - old stallions retire naturally due to inbreeding depression?
- Last period (1986-2003) dominated of Elding
- Elding has >1200 offspring in the period 1990-2008
  - father of the five fastest, Norwegian born ever
  - father of 25 millionaires
  - a lot of approved offspring

⇒ BOTTLE NECK



## HOW TO DEAL WITH THE FUTURE...



- How to avoid these bottle neck situations?
- Optimal contribution – a good tool
  - maximizes genetic gain with a constraint on the rate of inbreeding
  - have seen up to 30% larger genetic gain, compared to selection based on BLUP values alone
  - the method allows for monitoring the over all build-up of the relationship in the population
- Are about to be implemented in the Nordic coldblooded trotter
- Hopefully, this tool will be accepted as a method, although there will be quotas on the mating capacity of the breeding animals
- This tool is necessary for a long-term breeding strategy and for the sustainable development of the population

