Inbreeding in the Nordic coldblooded trotter

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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 carpitis 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)

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UNIVERSITETET FOR MILJØ- OG BIOVITENSKAP

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

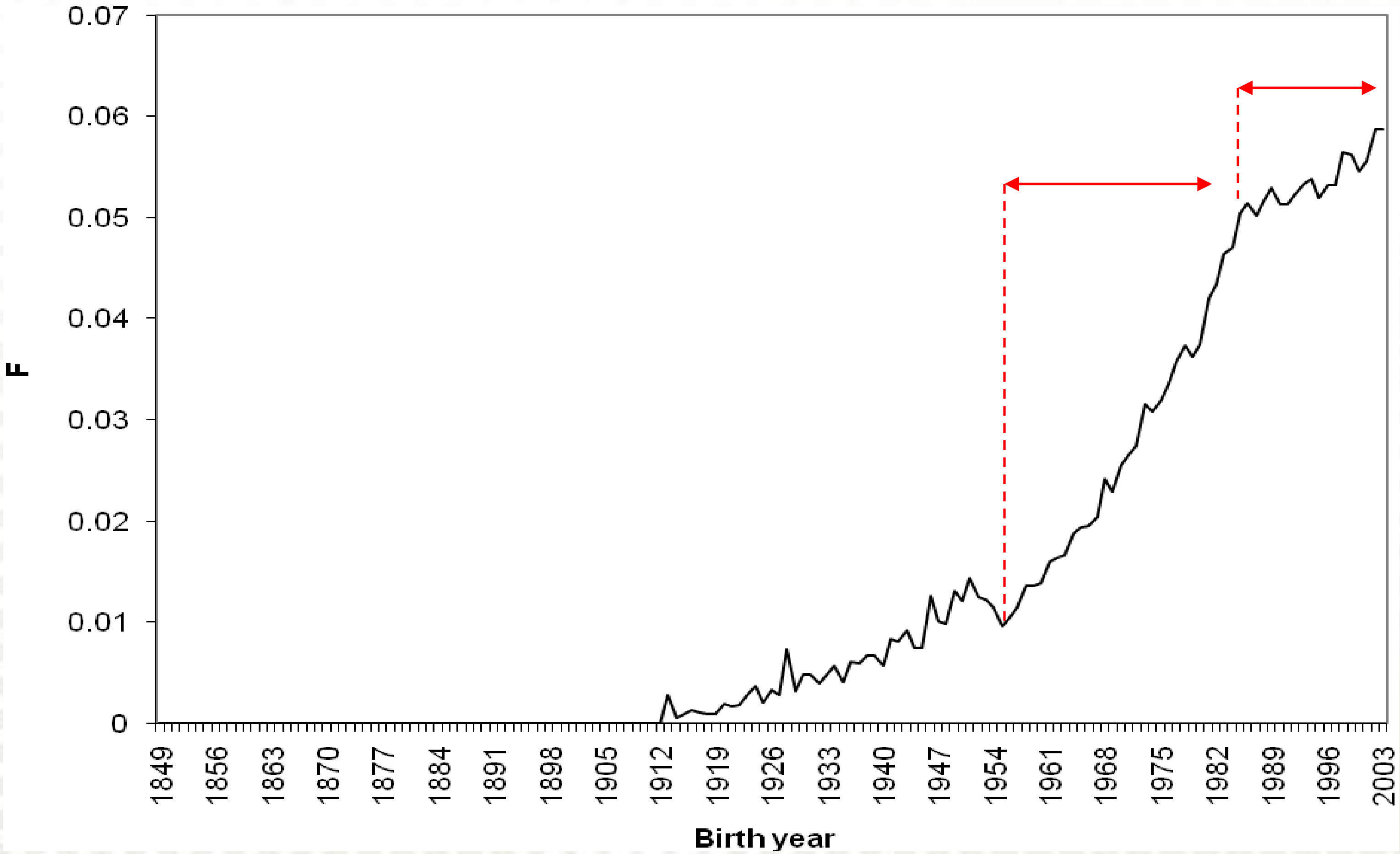
- 98 861 animals born in the period 1849-2003
- Computation of inbreeding was accomplished by the use of Quaas-Hendersons algorithm (Quaas, 1976; Henderson, 1976)
- Effective population size (N_e):

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

(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_{snitt}	0.0470	0.0568
$F_{foreldre}$	0.0304	0.0506
ΔF	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

$\Rightarrow$ 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 capasity of the breeding animals
- This tool is necessary for a long-term breeding strategy and for the sustainable development of the population


Thanks for your attention