

Population analysis and conservation options of the Norwegian Lundehund



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Background

- Highly endangered Norwegian dog breed
- Traditionally was used to retrieve puffins



- WWII: ~50 individuals
- Inbreeding likely:
 - Two severe bottlenecks since WWII
 - Low fertility
 - Intestinal disease widespread

Background

- Cross-breeding project - Norwegian Lundehund Club
 - BUT: Cross-breeds not included in the breeding population

- Our goal was to:
 - Assess genetic variation from pedigree data
 - Evaluate conservation possibilities of the current Lundehund population



Photo: Arild Espelien

Data and methods

- Pedigree data from 1930 to 2015
 - 5433 individuals
 - 1224 individuals alive, of which 50.4 % in Norway
- EVA and ENDOG software



Assessment of genetic variation

- Inbreeding and relatedness
- Effective population size estimated with several methods
 - Regression based
 - Average increase in individual inbreeding (Gutiérrez *et al.* 2008, 2009)
 - Average increase in coancestry (Cervantes *et al.* 2011)
- Probability of gene origin
 - Proportional loss in genetic variation due to different causes

Evaluation of conservation possibilities

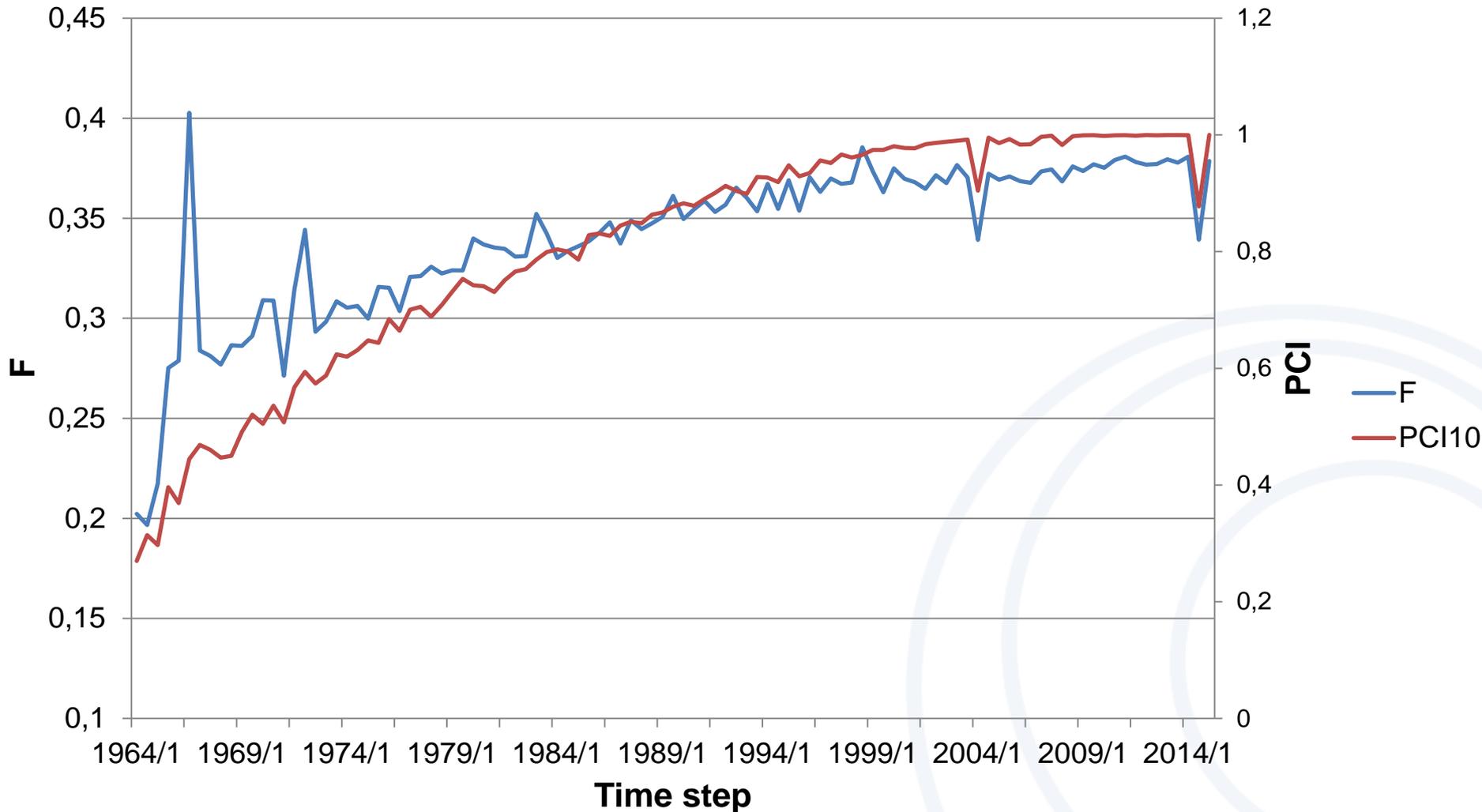
- OCS analyses:
 - dogs born between 2007 and 2014 as breeding candidates
 - Sub-sets of data:
 - Norway
 - Nordic
 - Global

- Effect of cross-breeding with
 - one
 - two
 - three } foreign breeds on average parental relatedness



Assessment of genetic variation

Pedigree completeness and inbreeding



Assessment of genetic variation

Ne and probability of gene origin

- The last fully registered cohort (2014/2):
 - Average coancestry 35.6 %
 - Inbreeding 33.9 %
- The cumulative proportion of genetic variation explained by the two most contributing ancestors is 76 %
- N_e
 - Regression based methods: 34-82
 - Estimates based on individual increase in inbreeding or coancestry: 13
- Probability of gene origin:
 - 38.8 % of the genetic diversity in the base population was lost
 - 78.5 % due to random genetic drift
 - 21.5 % due to unequal founder contributions

Conservation possibilities

Optimal contribution selection (OCS)

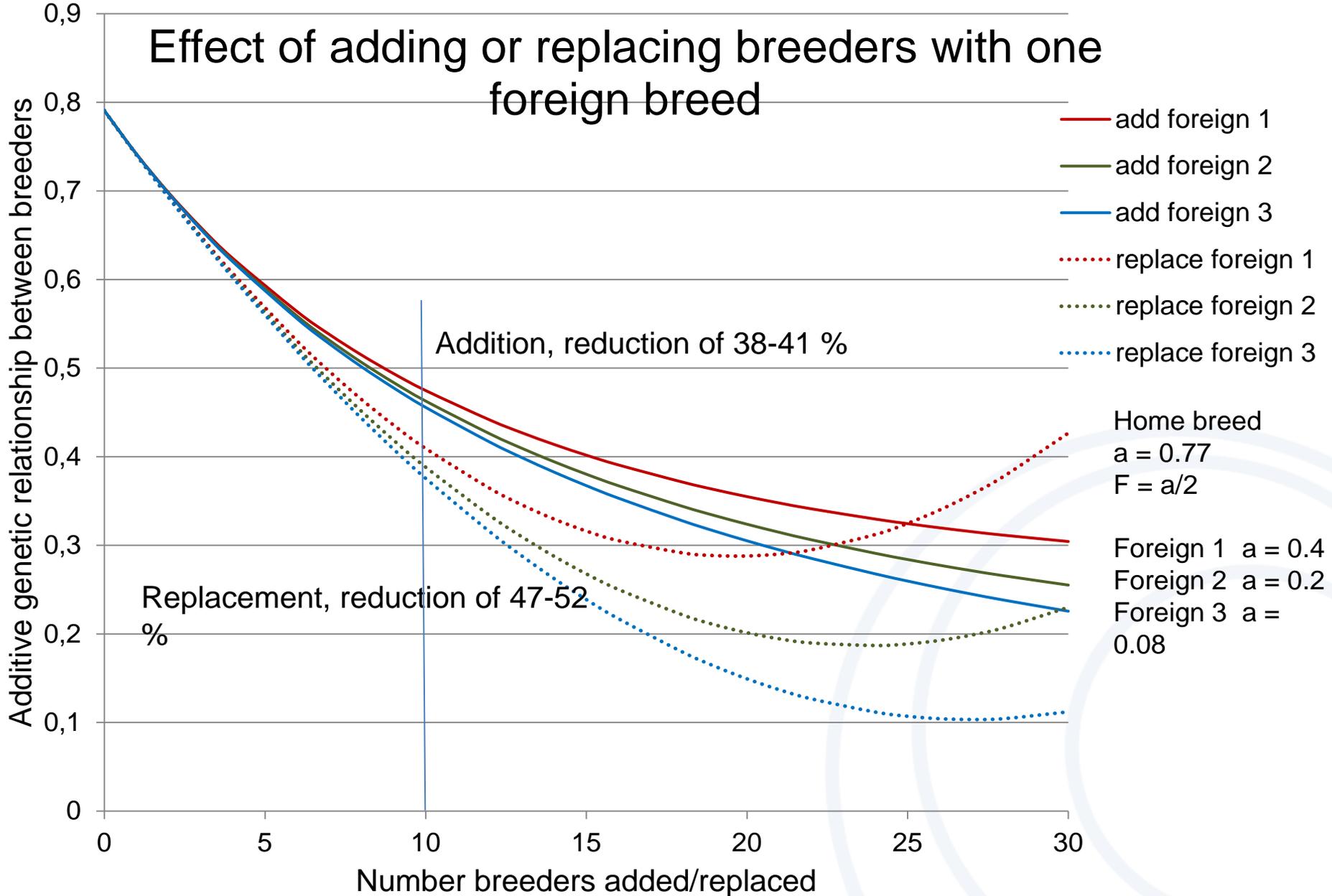
- Allowing several matings/male, exclusive use of cross-bred individuals
 - If cross-breds excluded (as they are) OCS had no effect
- invariant OCS solutions over regions

- OCS alone facilitates no improvement in the current situation
- Cross-breeding inevitable



Conservation possibilities

Effect of adding or replacing breeders with one foreign breed



Conservation possibilities

Cross-breeding

- The number of breeds and different levels of a and F of the foreign populations had a minor effect on the parental a , whereas the number of individuals introduced was decisive
- Effect conditional on the proportional contributions of foreign and purebred parents ← breeding decisions of private dog owners
- The conservation of Lundehund allele variants conditional on the future use of the cross-bred individuals.

Summary

- The Lundehund is an endangered Norwegian dog breed with high recreational and cultural-historical value
 - Current population is showing signs of inbreeding depression, due to extremely high relatedness of the whole population
 - Breeding optimisation, including OCS, offer no remedy unless individuals of foreign breed are introduced to the Lundehund
- crossbred individuals should immediately be accepted as part of the main population and as breeding candidates

Thank you!



Photo: Sorun Lilja Ragnarsdottir