

Pedigree based monitoring of the effective population size through the PopREP web service



Groeneveld, E., C. Kehr-Apelt, R. Fischer and M. Klunker
 Institute of Farm Animal Genetics, Mariensee, FLI, Germany
 eildert.groeneveld@fli.bund.de
 http://poprep.tzv.fal.de

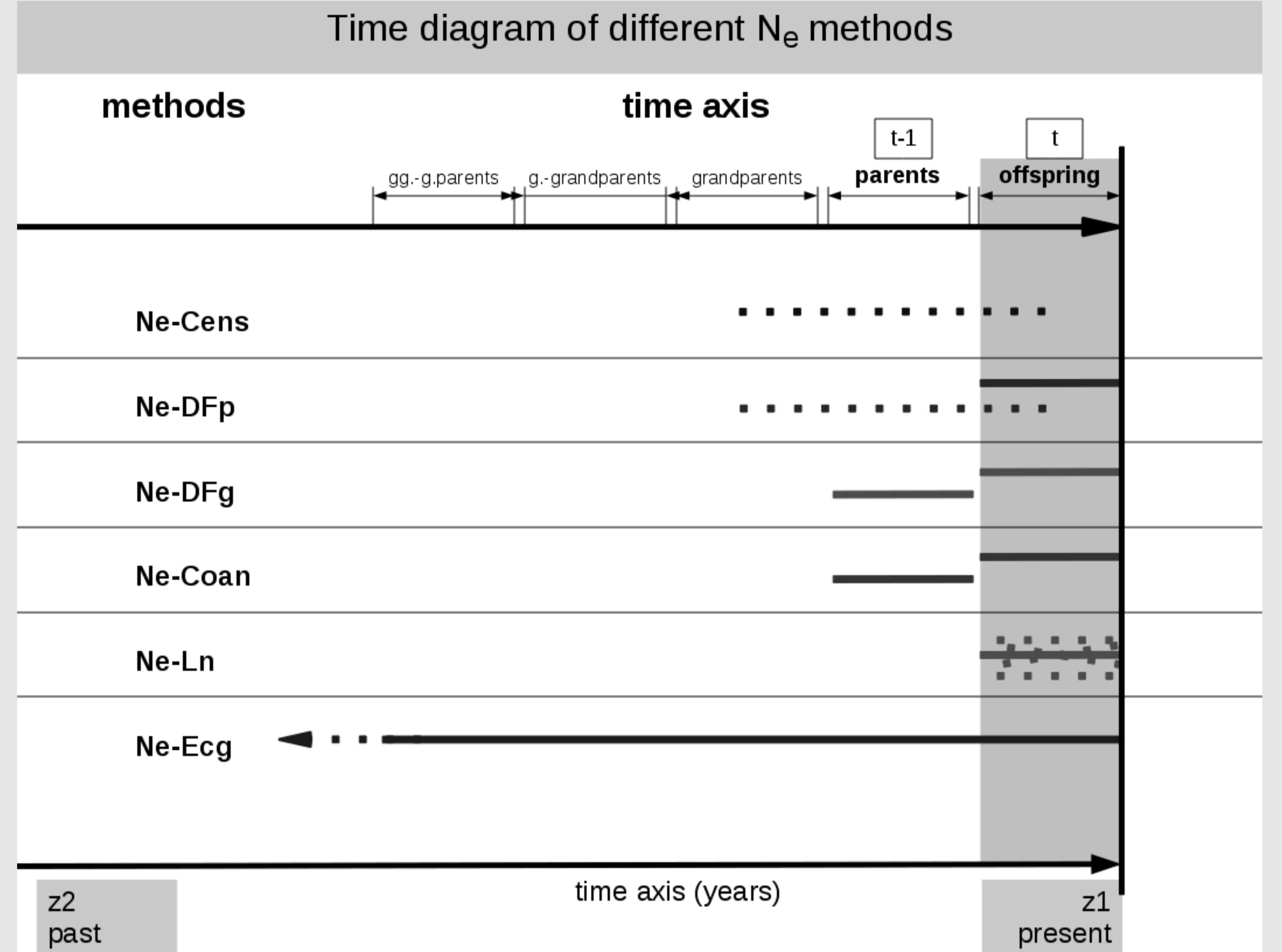


Methods for estimating N_e

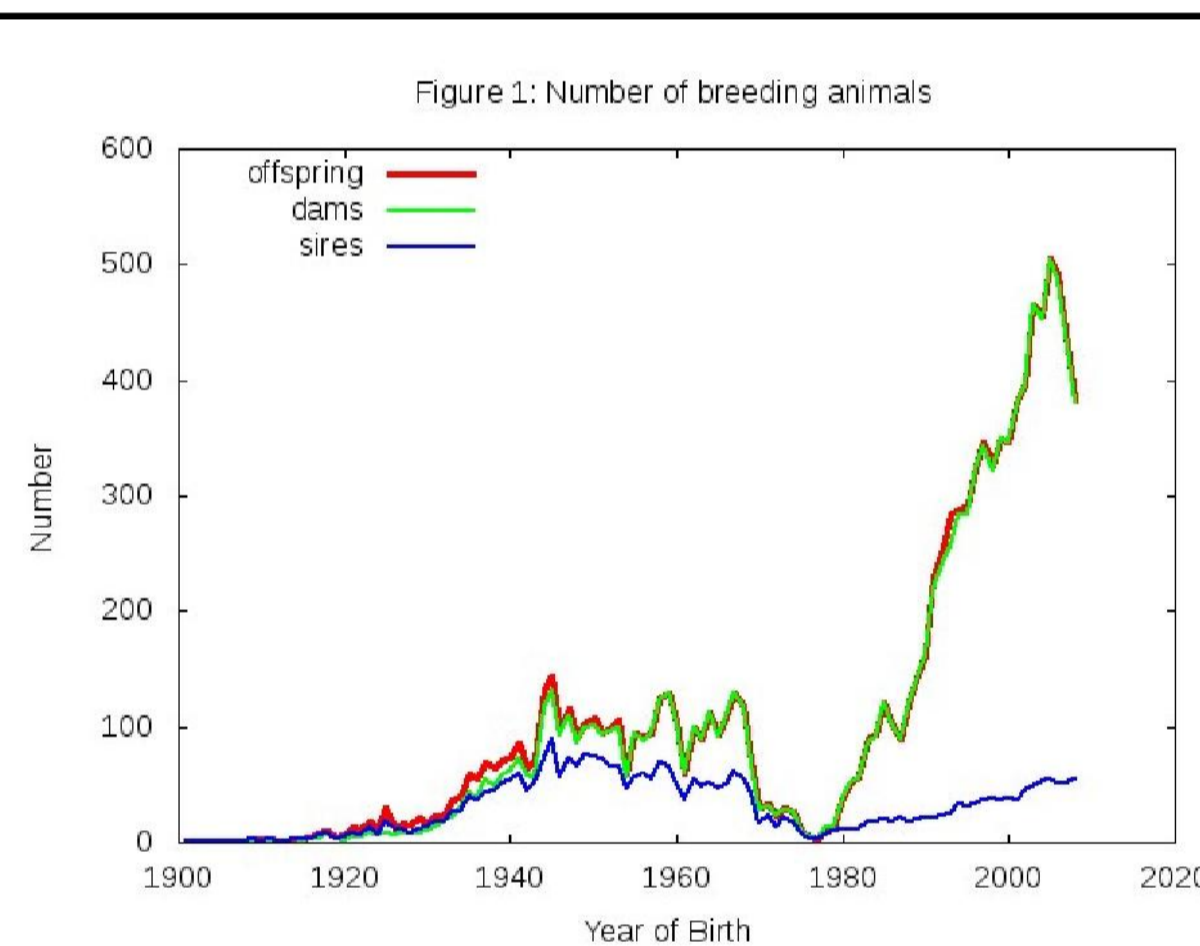
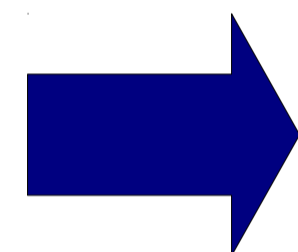
Table 1: Methods for estimating the effective population size N_e

method	source	formula*	description
N_{eCens}	Wright (1923)	$N_e = 4 * \frac{S_n * D_n}{S_n + D_n} * 0.7$	S_n = number of sires per generation D_n = number of dams per generation
$N_{e\Delta F_p}$	Falconer & Mackay (1996)	$\Delta F_p = \frac{F_t - F_{t-1}}{1 - F_{t-1}}$	$F_t = \phi$ inbreeding coefficient of offspring $F_{t-1} = \phi$ inbreeding coefficient of direct parents $1 - F_{t-1}$ = residual heterozygosity of parents
$N_{e\Delta F_g}$	Falconer & Mackay (1996)	$\Delta F_g = \frac{F_t - F_{t-1}}{1 - F_{t-1}}$	$F_{t-1} = \phi$ inbreeding coefficient of the ϕ parents generation
N_{eCoan}	Falconer & Mackay (1996)	$\Delta f_g = \frac{f_t - f_{t-1}}{1 - f_{t-1}}$	$f_t = \phi$ additive genetic relationship (AGR) of offspring $f_{t-1} = \phi$ AGR of parents
N_{eLn}	Pérez-Enciso (1995)	$\Delta F_{ln} = (-1)bL$	$b =$ the slope from the logarithmic regression of $\ln(1 - F)$ on year of birth L = generation interval
N_{eEcg}	Gutierrez et al. (2009)	$\Delta F_i = 1 - \sqrt[ecg]{1 - F_i}$	ecg = sum of all known ancestors with $(\frac{1}{2})^n$ (= equivalent complete generations) F_i = individual inbreeding coefficient

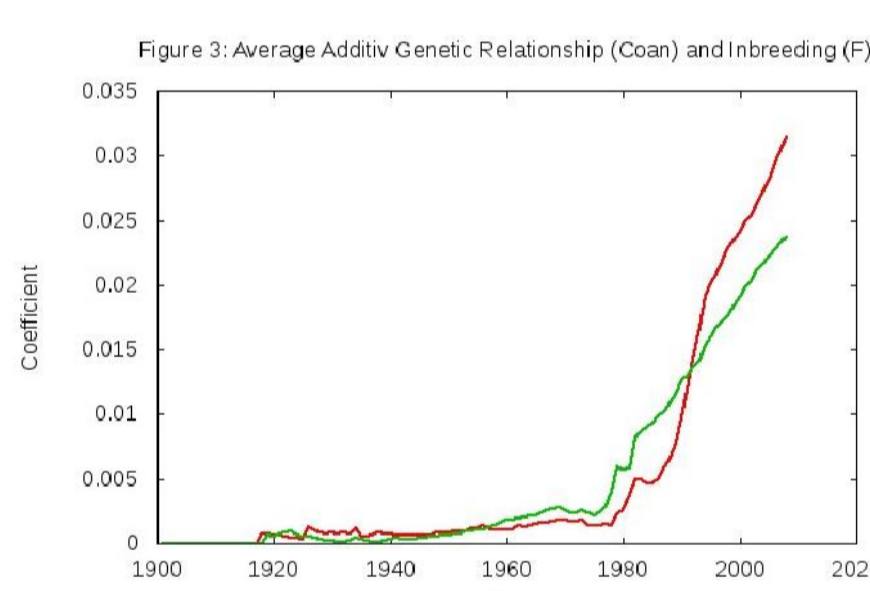
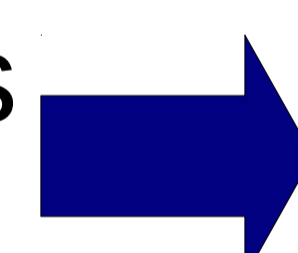
Data window required



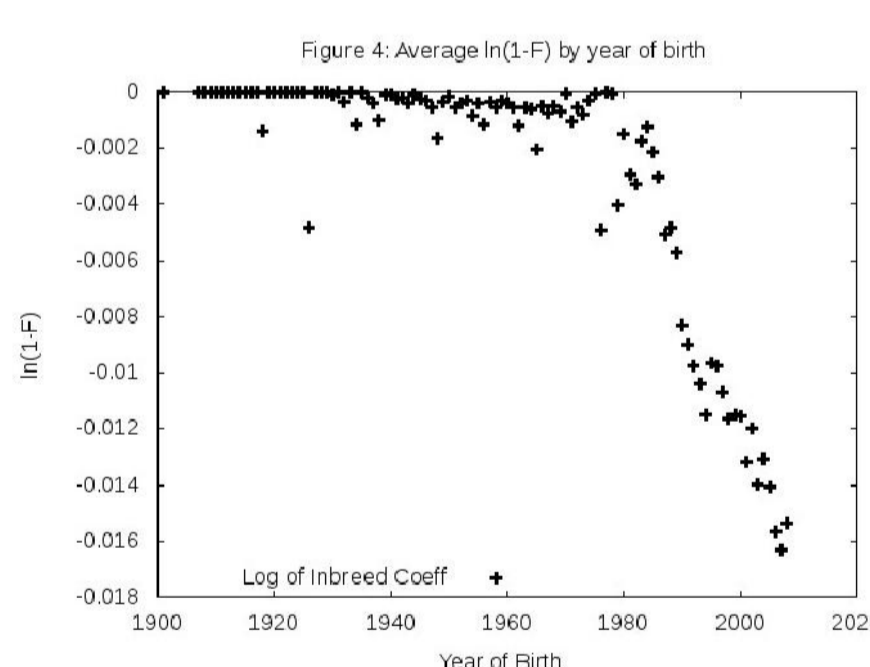
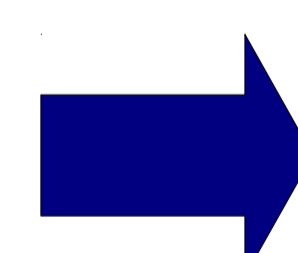
Number of animals (offspring, sires, dams)



Development of inbreeding coefficients and coancestry by reporting year



Scatter diagram of $\ln(1-F)$ for N_e -Ln



Proposed N_e

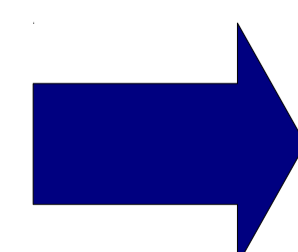
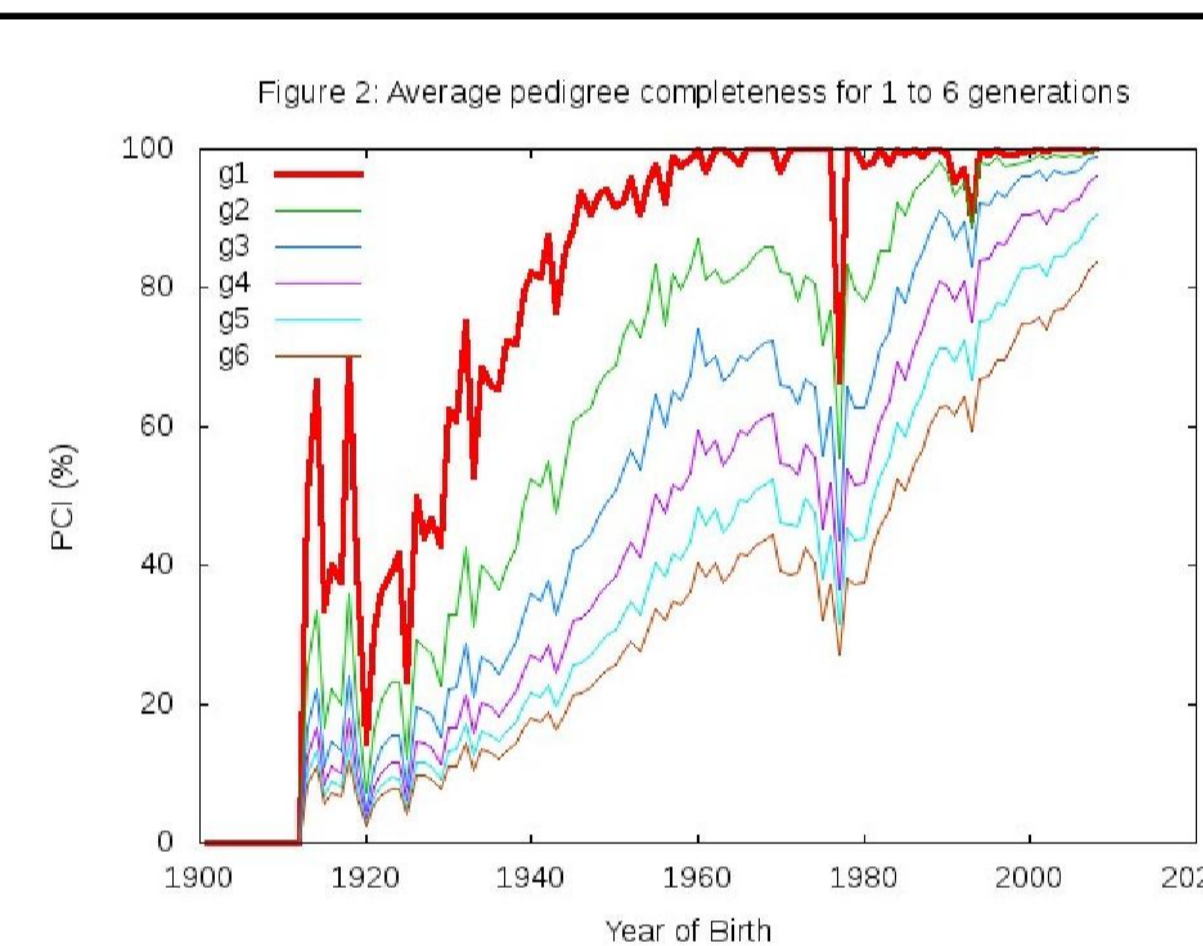
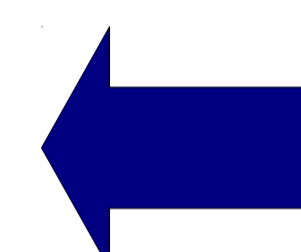


Table 1: Effective Population Size N_e

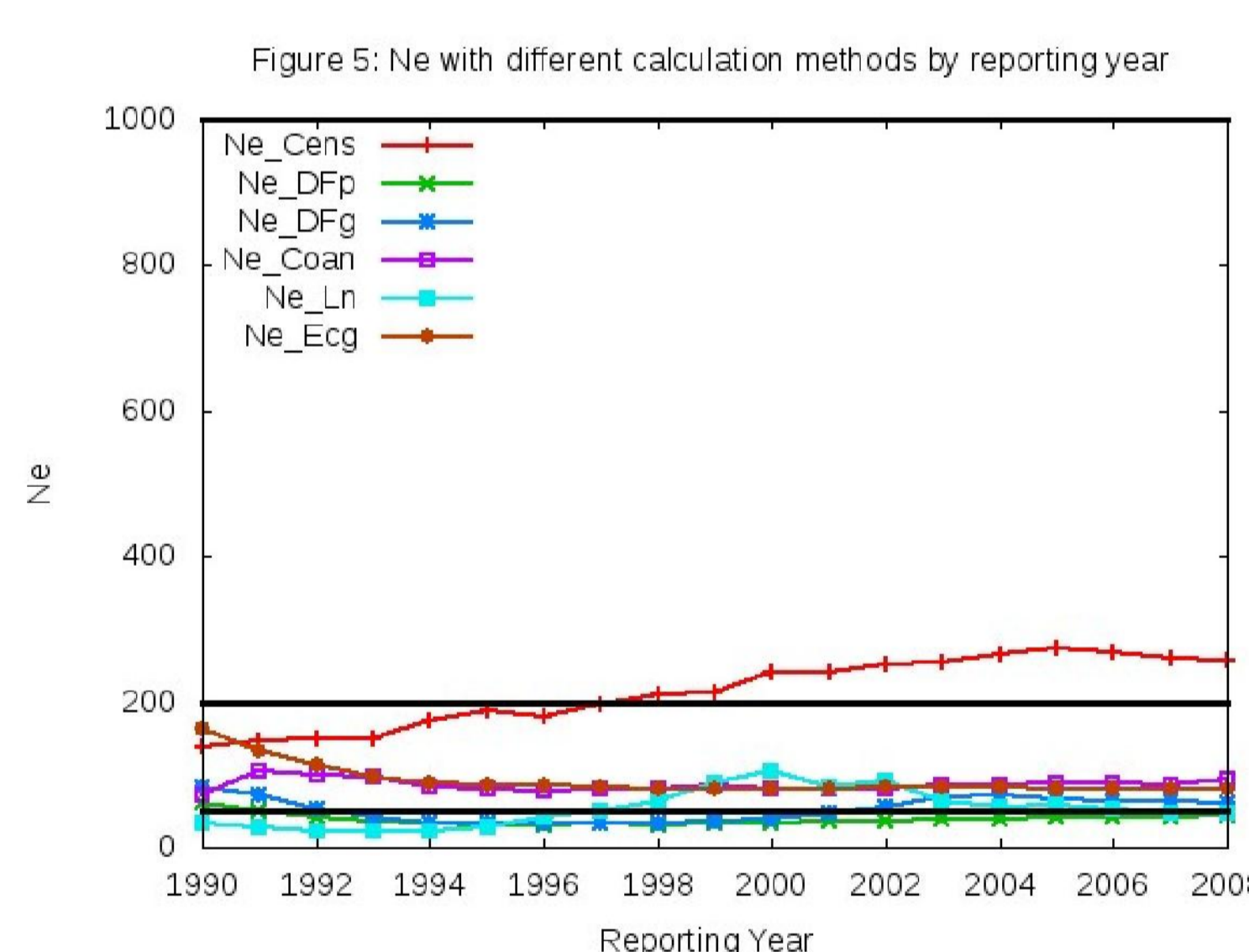
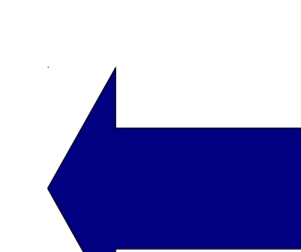
N_e -Method	2008	2007	2006	2005	2004	2003	data history
N_e -Cens	257	260	269	274	265	255	1999 - 1991
N_e - ΔF_p	43	42	42	42	40	38	2008 - 1991
N_e - ΔF_g	62	64	64	67	71	69	2008 - 1991
N_e -Coan	94	87	88	89	87	85	2008 - 1991
N_e -Ln	46	46	52	57	56	64	2008 - 2000
N_e -Ecg	79	79	80	81	82	83	2008 - 1901

Proposed N_e : $N_e - Coan = 87$

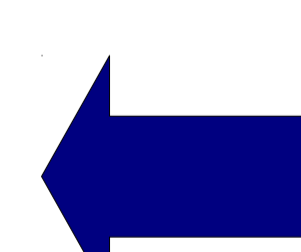
Pedigree completeness (McCluer et al., 1983)



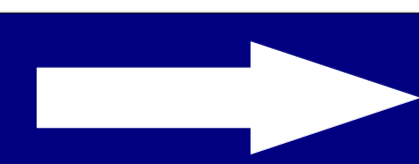
N_e values by reporting year



N_e values of all six methods by reporting year



Decision tree



Proposed N_e -method

Web service

Decision tree:

- (1) Population stratification: Subpopulations?
- (2) Choose method with shortest data history observing constraints

- 1) N_e -Ln
- 2) N_e -DFp
- 3) N_e -DFg
- 4) N_e -Coan
- 5) N_e -Ecg
- 6) N_e -Cens

The service is free and operational around the clock:
<http://poprep.tzv.fal.de>

Acknowledgement

Funding by
 H. Wilhelm Schaumann
 Foundation,
 Germany