

# Gene-banking of Dutch rare poultry breeds: cryobiology and genetics

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## Dutch rare breeds

Number of Dutch rare domestic animal breeds and their status

(SZH and ID-Lelystad, 2002)

	Cattle	Horse	Goat	Sheep	Poultry	Duck	Rabbit	Goose	Pigeon
Critical, declining								1	2
Critical, stable					1	3	2		2
Critical, growing							1		1
Endangered, declining		1					1		2
Endangered, stable			4		23	1	4		6
Endangered, growing	2	1	1		4				
Vulnerable, declining		1							
Vulnerable, stable	1		1	1	4		3		2
Vulnerable, growing	2		3			1	1		1



## Ex situ conservation of AnGR

Live populations may be threatened by

- Extinction (already many rare breeds are lost)
  - Insufficient use
  - Outbreak of epidemic → mass culling measures
- Genetic erosion

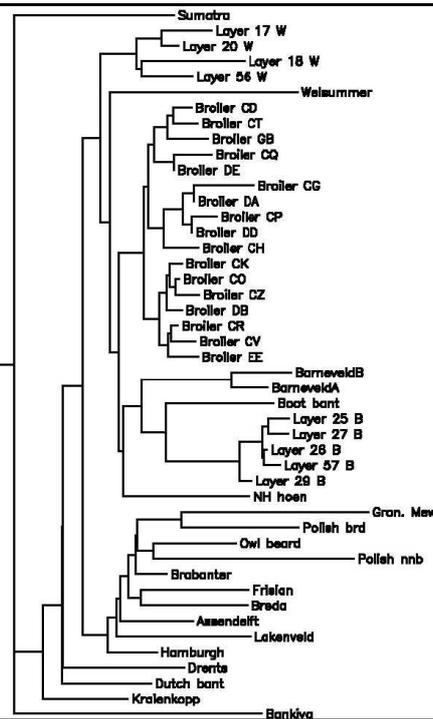
Therefore, Cryobanking of germplasm is the ultimate security against loss of allelic variation and loss of entire breeds

## Ex situ conservation of rare poultry breeds

Genetic considerations:  
Conservation goals and Choice of breeds

## Genetic considerations in choice of breeds

Eding et al. 2002



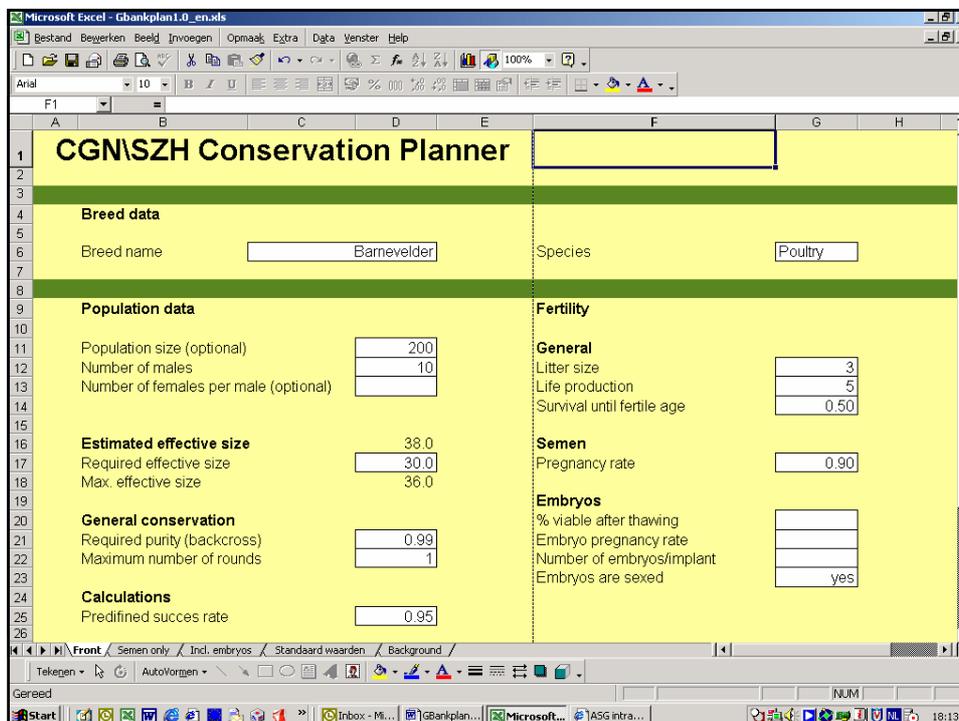
## Genetic considerations in choice of breeds

Eding et al. 2002

Set	es+1	Div(M)	% loss	N <sub>ge</sub>	% loss
Whole		0.935		7.69	
Safe only		0.893	4.49	4.67	39.25
Safe + 1 set :					
Drents fowl	0.247	0.916	2.06	5.93	22.89
Dutch bantam	0.269	0.915	2.12	5.90	23.35
Bankiva	0.180	0.914	2.29	5.79	24.77
Kralenkoppe	0.241	0.911	2.60	5.60	27.21
Dutch Owl-bearded	0.168	0.902	3.49	5.12	33.40
Welssummer	0.157	0.902	3.57	5.08	33.94
Brabanter	0.167	0.900	3.70	5.02	34.74
Frisian fowl	0.132	0.900	3.72	5.01	34.87
Breda fowl	0.138	0.900	3.72	5.01	34.87
Polish bearded	0.115	0.899	3.82	4.97	35.45
Sumatra	0.106	0.899	3.88	4.94	35.83
Polish non-bearded	0.100	0.898	3.91	4.92	36.02
Groninger Mew	0.079	0.897	4.05	4.86	36.83
Lakenvelder	0.109	0.897	4.05	4.86	36.83
Hamburgh	0.121	0.895	4.24	4.78	37.86
Barnevelder A	0.091	0.895	4.24	4.78	37.86
Booted bantam	0.098	0.895	4.26	4.77	37.98
Barnevelder B	0.067	0.894	4.35	4.73	38.51
Noord-Hollands hoen	0.051	0.894	4.44	4.69	38.97
Assendelft	0.000	0.893	4.49	4.67	39.25

## Genetic considerations in choice of breeds

- The ranking of the breeds on the basis of their contribution to the genetic diversity when added to the safe set.
- The place in the phylogenetic tree *vis à vis* the other breeds in the gene bank and the safe set.
- Other considerations: age of the breed; rarity of the breed



The screenshot displays the 'CGN\SZH Conservation Planner' spreadsheet in Microsoft Excel. The spreadsheet is organized into several sections for data entry:

Breed data	
Breed name	Barnveelder
Species	Poultry

Population data	
Population size (optional)	200
Number of males	10
Number of females per male (optional)	

Estimated effective size	
Required effective size	38.0
Required effective size	30.0
Max. effective size	36.0

General conservation	
Required purity (backcross)	0.99
Maximum number of rounds	1

Calculations	
Predifined succes rate	0.95

Fertility	
<b>General</b>	
Litter size	3
Life production	5
Survival until fertile age	0.50
<b>Semen</b>	
Pregnancy rate	0.90
<b>Embryos</b>	
% viable after thawing	
Embryo pregnancy rate	
Number of embryos/implant	
Embryos are sexed	yes

Reconstruction of the breed is done via the insemination of female animals from another population with semen stored in the gene bank.

After inputting the relevant data in the Front tab you will find here all the information needed for a succesful backcross pr

### The backcross program for Barnevelder

<b>Length of program</b>	7 generations	<b>Material stored for</b>	1 reconstruction(s)
<b>Per generation</b>	48 female animals are needed for the required effective size		
<b>Per generation</b>	109 Successful inseminations for the required number of adult female animals		
<b>#Doses semen</b>	770 in total		
	80 Per still availbale male animal (as given in the Front tab)		
<b>Expected inbreeding levels</b>	21.1 % increase after end of program		

## Conservation goals per breed

- In 2003 semen of six breeds was frozen.
  - 10 males per breed
  - Approximately 50 doses per male.
  - These conservation goals were met in all breeds except in Hollanse Kriel (Dutch Bantam) in which we only had 68 doses.
- In 2005 additional 5 breeds were conserved.
  - 80 doses per male
  - 10 males per breed.

## Methodology of cryopreservation of Poultry semen



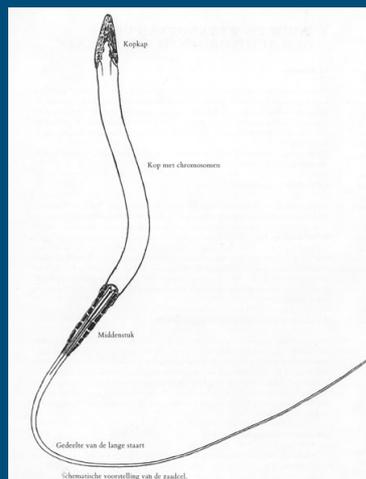
## Collection of semen



## Collection of semen



## Sperm cell



## Freezing methods

- Glycerol seems to be the best cryoprotectant, but in the hen it is contraceptive

Tselutin et al.1999

CPA	Package	% fertilized
glycerol	straws	63.9
DMA	pellets	84.7
DMA	straws	26.7

## Freezing methods

- Our research was aimed at improving the freezing method for poultry semen
  - Freezing in straws, using DMA as cryoprotectant
  - Improvement of the semen diluent
  - Interaction cryoprotectant concentration and cooling rate
- → Large improvement of % live sperm after thawing

## Insemination experiment

	Treatment	% fertilized eggs	% eggs embryos	Mean day of last fertilized egg after last insemination
1	Fresh semen in ASG medium	96.6 <sup>a</sup>	90.5 <sup>a</sup>	16.4 <sup>a</sup>
2	Frozen in straws in ASG medium with DMA	87.6 <sup>b</sup>	80.4 <sup>b</sup>	12.7 <sup>b</sup>
3	Frozen in straws in Lake's medium with DMA	78.1 <sup>b</sup>	68.9 <sup>b</sup>	9.9 <sup>c</sup>
4	Frozen in pellets in Lake's medium with DMA	85.9 <sup>b</sup>	77.8 <sup>b</sup>	12.3 <sup>b</sup>

## Present collection of Dutch gene bank

Poultry breed	Nr. of males	Nr. of ejaculates	Nr. of doses
Barnevelder	10	91	499
Drente Fowl	10	95	454
Dutch Bantam	19	185	342
Twente Fowl	10	96	614
Dutch Uilenbaard (Dutch Owlbeard)	11	113	839
Welsumer	10	93	647
Brabanter	9	151	1059
Fries Hoen (Frisian Fowl)	12	181	722
Kraaikop	11	157	992
Lakenvelder	8	122	742
Dutch Baardkuifhoen (Dutch Bearded Poland)	11	169	852
Total	121	1453	7762

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