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Extending the genetic diversity in the gene bank for endangered cattle breeds in Norway

Nina Svartedal, NC AnGR, Norwegian Genetic Resource Centre.

ERFP assembly 2024, Florence, August 30.



Photo: Michael Angeloff, NIBIO



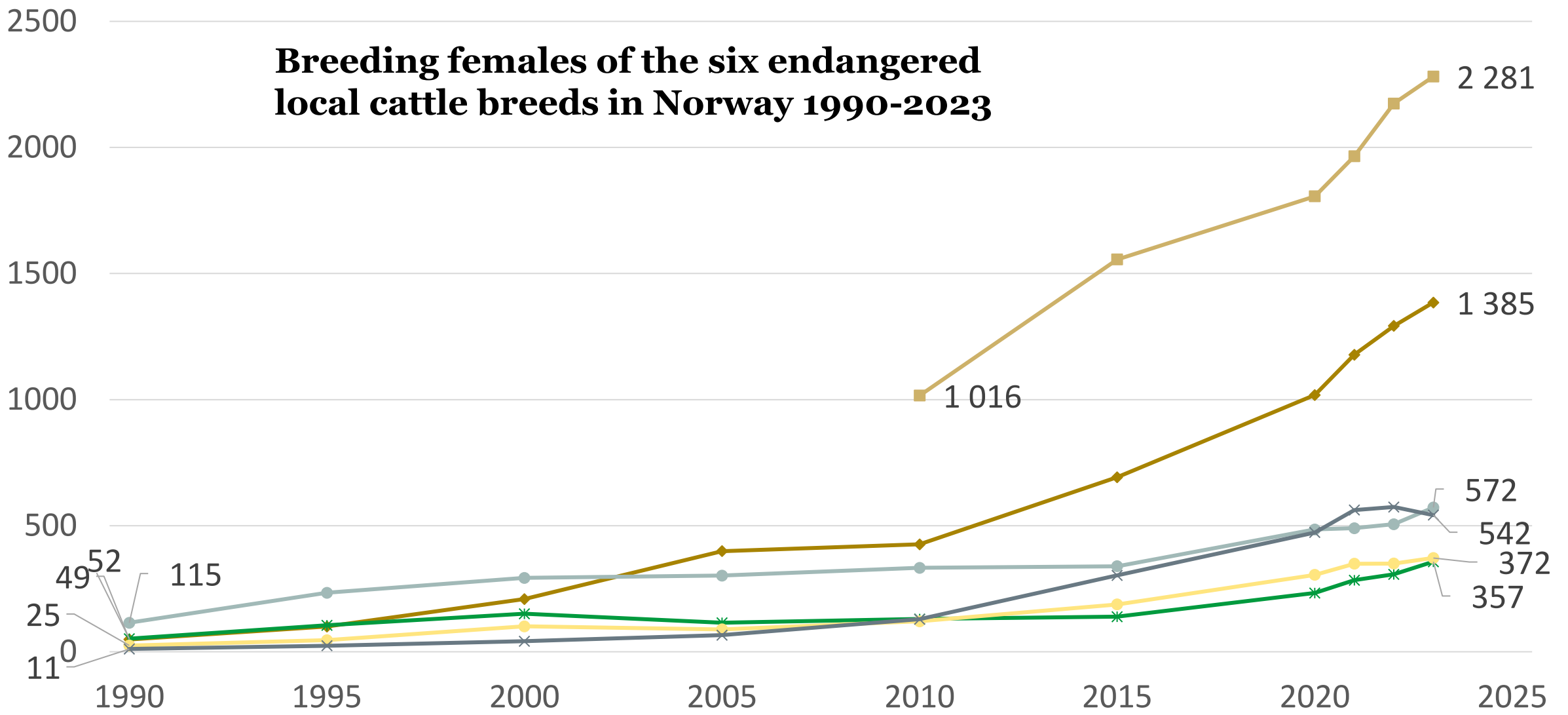
In 2023 Norway celebrated that no native breeds of cattle, horses, sheep or goats are **critically endangered**, they are **only endangered**.



In 1990 four of the six native cattle breeds had less than 50 breeding females.



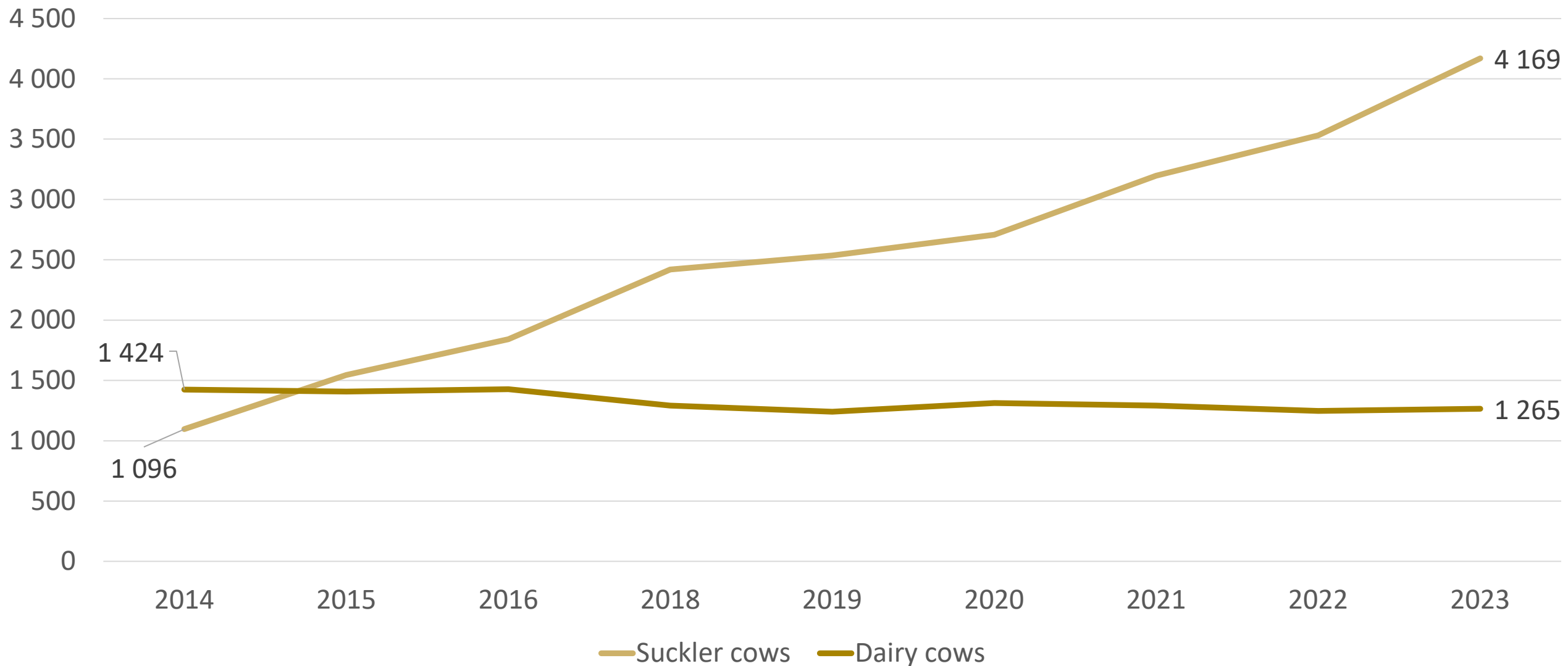
Breeding females of the six endangered local cattle breeds in Norway 1990-2023



Black Sided Trønder and Nordland
Telemark
Døla

Western Fjord
Western Red Polled
Eastern Red Polled

New area of use – the increase in population sizes is in meat production



Eier:	Knut Halvor Aschjem	Prod.nr:	30210001		
Gård:	Aschjem Gård				
Adresse:	Holstadveien 103 1430 Ås				
Individnummer:	0117	Kjønn:	Okse	Rase fra Kuregisteret:	100% ØR
		Født:	31.03.2024	Rase fra Kukontrollen/SFK:	100% ØR
Navn fra Kuregisteret:	Malfang av Asch	Død:			
Navn fra Kukontrollen/SFK:	Malfang av Asch	Innavlskoeffisient:	0.0309		
		Pec-verdi:	0.9243		

Innavlskoeffisient og Pec-verdi (pedigree completeness) er basert på slektskapsinformasjon fra 12 generasjoner bakover.

Far: 0080 Gnau DyrelD: 27295810 0080 Født: 02.09.2020 Rase: 100% ØR Eier: Knut Halvor Aschjem	Farfar: 0056 Romeo DyrelD: 02140001 0056 Rase: 100% ØR	FFF: 5613 Leopold av Søråsen DyrelD: 04021772 5613 Rase: 99% ØR
		FFM: 0028 Rosa DyrelD: 02140001 0028 Rase: 98% ØR
	Farmor: 1700 Gunhild DyrelD: 06230382 1700 Rase: 100% ØR	FMF: 6768 Ullvar DyrelD: 04021772 null Rase: 100% ØR
		FMM: 0167 Granhild DyrelD: 05340096 0167 Rase: 100% ØR
Mor: 0199 Mia DyrelD: 01050709 0199 Født: 10.11.2017 Rase: 100% ØR Eier: Knut Halvor Aschjem	Morfar: 1401 DyrelD: 01350623 1401 Rase: 100% ØR	MFF: 6751 1 Eng (Lund) DyrelD: Rase: 100% ØR
		MMF: 0146 RØDKOLL DyrelD: 05380069 0146 Rase: 97% ØR
	Mormor: 0082 Victoria DyrelD: 01050709 0082 Rase: 97% ØR	MMF: 0072 DyrelD: 01050709 0072 Rase: 99% ØR
		MMM: 0227 Valdresj DyrelD: 05420377 0227 Rase: 94% ØR

The Cow Register

- A pedigree database established in 1990
- Includes all the six endangered local cattle breeds in Norway
- Free of charge for the farmers
- Mandatory to join for subsidy payments
- Independent of production system
- Monitors the population sizes
- Pedigree data used for
 - Breeding advise to farmers
 - Estimation of kinship between ai-bulls
 - Ne estimates

Today: Regular extension (1-3 ai-bulls/year/breed) of the gene bank

The oldest bulls are from 1970's

	Black Sided Trønder and Nordland Cattle	Western Fjord Cattle	Telemark Cattle	Western Red Polled Cattle	Døla Cattle	Eastern Red Polled Cattle
No of gene bank bulls 2023	79	67	62	63	56	43

Selection criteria for gene bank bulls of endangered breeds in three eras:

1. 1978 - 1990 – by chance, no pedigree information available
2. 1990 - 2019 – manual evaluation of the bull's pedigree
3. 2019 - today – evaluation of the bull's genetic contribution to the gene bank

Selection criteria 1990-

- Phenotypic characteristics eg;
 - mother's phenotype, (yield and exterior)
 - Bull calf's phenotype
- Pedigree information
 - Based on manual evaluation
- Number of recorded offsprings and ai-bull brothers

Far: 49576 Petrus DyreID: 15280625 0212 Født: 10.03.2019 Rase: 100% VFF Eier: Hans Gubhage	Farfar: 48945 Kvitebjørn DyreID: 15191077 0470 Rase: 100% VFF	FFF: 0410 OKSE DyreID: 15191077 0410 Rase: 100% VFF
	Farmor: 0897 Stjernøga DyreID: 15280625 0897 Rase: 100% VFF	FFM: 0339 KAREN DyreID: 15191077 0339 Rase: 100% VFF
Mor: 1288 Eva DyreID: 05130078 1288 Født: 20.09.2017 Rase: 100% VFF Eier: Hans Gubhage	Morfar: 48947 Sole DyreID: Rase: 100% VFF	FMF: 6820 Frøy DyreID: 15191077 null Rase: 100% VFF
		FMM: 492 Dalmøy DyreID: Rase: 100% VFF
	Mormor: 1208 eva DyreID: 05130078 1208 Rase: 100% VFF	MFF: 6820 Frøy DyreID: Rase: 100% VFF
		MFM: 1093 Nusse DyreID: 05160611 0340 Rase: 100% VFF
		MMF: 1072 Justin DyreID: 15280625 0160 Rase: 100% VFF
		MMM: 0009 Eva DyreID: 14170066 0070 Rase: 100% VFF



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Since 2019 – one new criterion:

The bull's genetic contribution to the gene bank

The contribution is based on pedigree data from the Cow Register

Possible new ai bulls of Western Fjord Cattle

The kinship between the bulls in the gene bank at the time of assessment is 0.0605 (using EVA-prog)

The candidates' kinship with the ai-bulls:

- a) Lavrans (0.0246)
- b) Halvard (0.0337)
- c) Erik (0.0333)

Conclusion:

All three will add positive genetic variance to the gene bank.



Possible new ai bull of Døla Cattle

The kinship between the bulls in the gene bank at the time of assessment is 0,0941 (using EVA-prog)

This candidate's kinship to the ai-bulls:

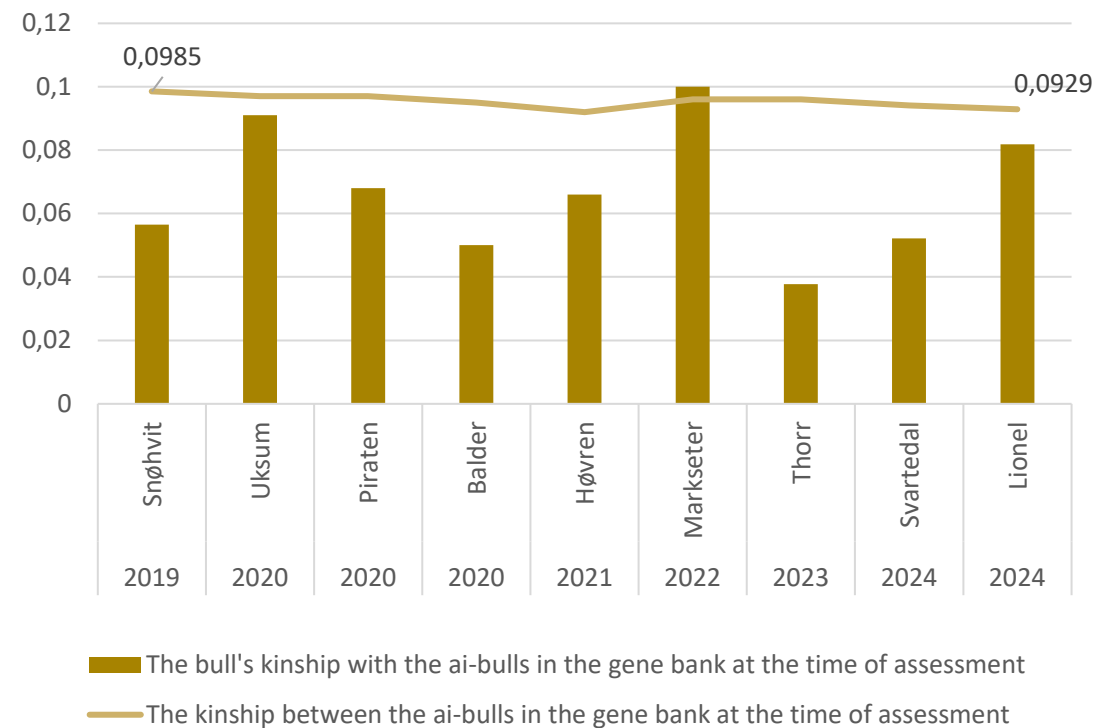
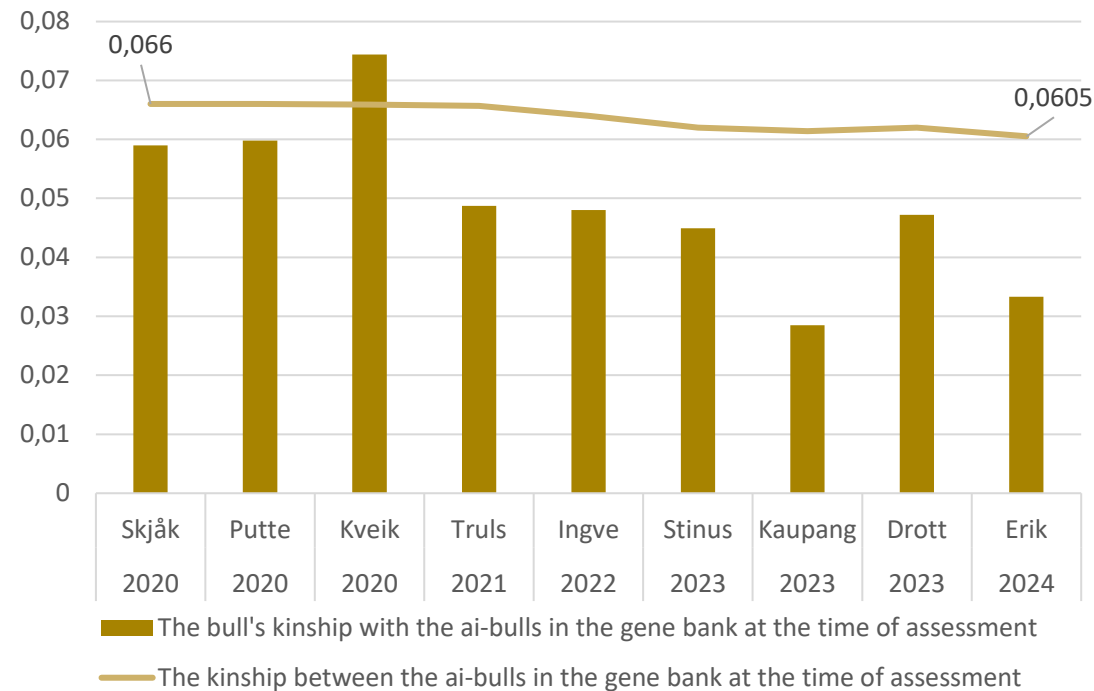
0,0521

Conclusion:

This bull calf will add positive genetic variance to the gene bank.



The kinship between gene bank bulls 2019-2024



Western Fjord Cattle



Døla cattle





Thanks for your attention!



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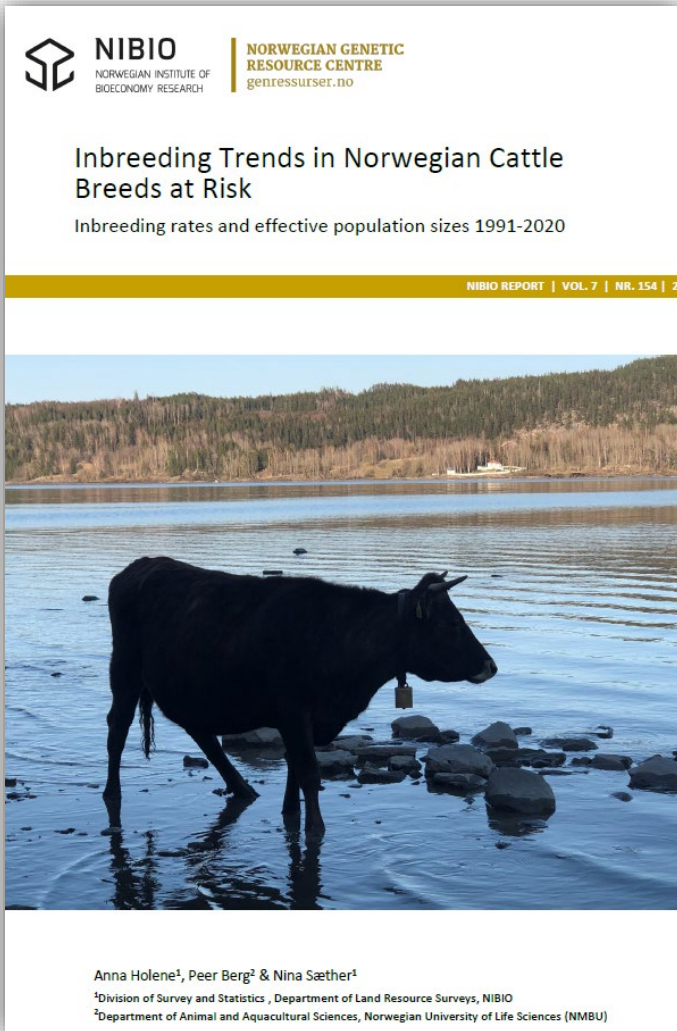
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Documenting the effective population sizes based on pedigree information

Estimating the effective population sizes in 2020 in six native breeds with extremely small population sizes in 1990.

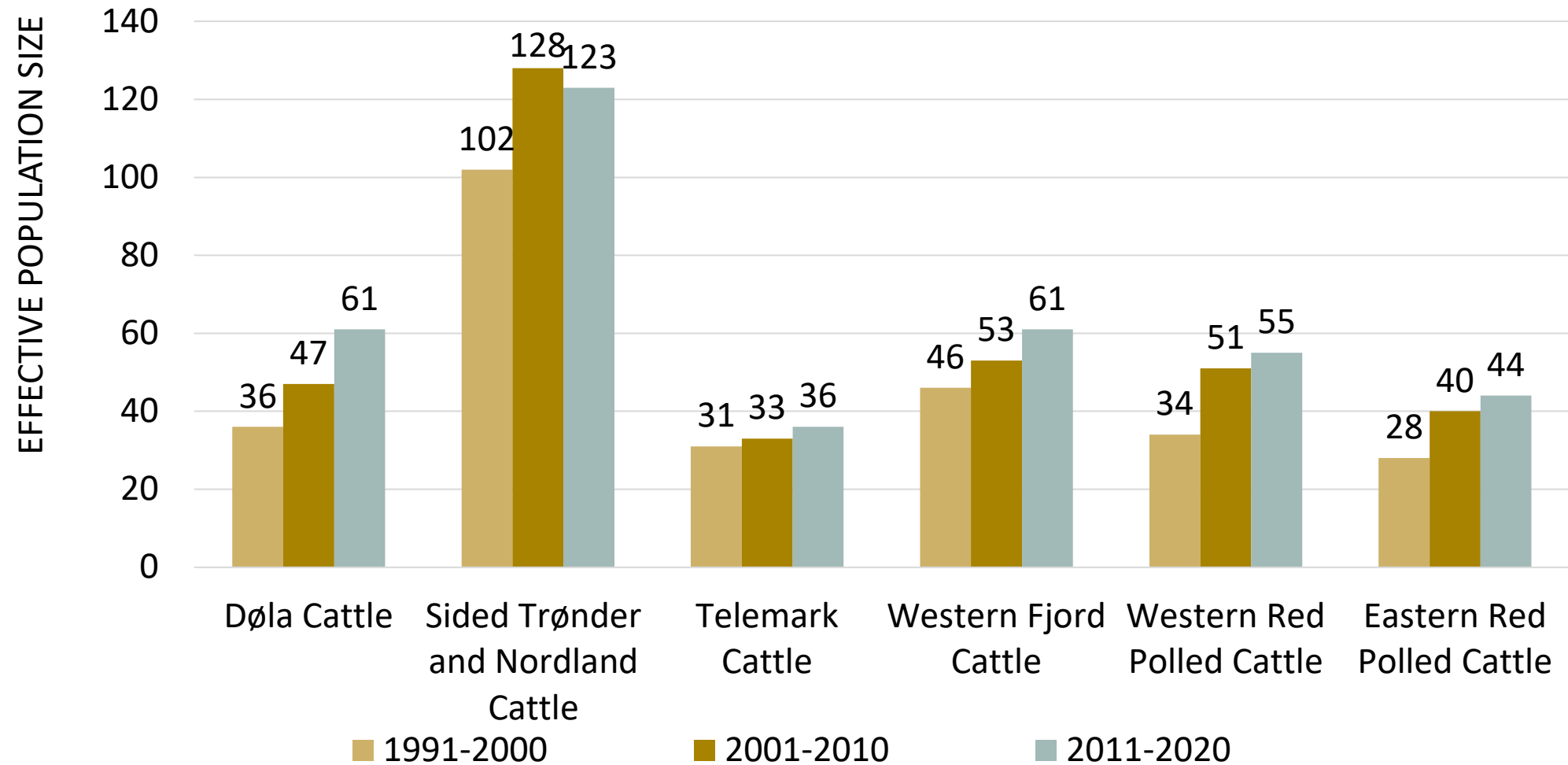
[NIBIO Brage: Inbreeding Trends in Norwegian Cattle Breeds at Risk \(unit.no\)](#)



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Effective population sizes 1990-2020



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Important actions to save the endangered cattle breeds

- Pedigree database “The Cow Register” – free of charge to register
- Breed societies – communicating knowledge and live animals to new owners
- Regular extension of the gene bank – Today: Geno has appr 60 ai bulls of each breed in the gene bank
- Sustainable breeding in small populations – basic knowledge for all stakeholders
- Easy access to breeding advice at farm level – and free of charge
- New areas of use – today 75 % of the cows are in beef production as suckler COWS.
- Production subsidies to breeding cows and breeding bulls