Equines in the Nordics

HISTORY, STATUS AND GENETICS

NordGen

Contents

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Foreword

With roots as far as the Bronze age, equines have played an invaluable role in history, both with regards to agriculture and forestry, warfare, transportation and leisure, and therefore hold important cultural significance in the Nordics. The link between horses and the welfare benefits of their caregivers makes the species an important part of society as well. Since the agricultural and industrial revolution, the equine sector has been influenced by a range of challenges due to the dramatic change in the role of horses in society, especially for the Nordic native breeds. However, as society adapts and finds new ways to use and protect them, there is a hope for the future.

Although there has been cooperation between the Nordic countries in the horse sector, a collective report of the status of all the Nordic countries has been missing. This report marks a start for this type of effort by considering both commercial and native breeds. Further, it comprises the horse sector in the Nordics, with a special focus on the native horse breeds and the possibilities they carry for environmental sustainability, their socio-economic importance, their genetics as well as their risk status. The report further evaluates the Domestic Animal Diversity Information System (DAD-IS) maintained and developed by FAO as a tool for gathering information about the development and current status of the native breeds. The goal of this report is to identify knowledge gaps and areas of improvement for the Nordic equine sector and the collected data of the native horse breeds.

One of the biggest challenges has been to find validated information sources for the population numbers of the breeds in each country – there are varying estimates for both commercial and native breeds. The numbers have significant impact for the determination of managing strategies of the populations. Reports for each of the countries (Denmark, Finland, the Faroe Islands, Iceland, Norway and Sweden) are presented, and depict the current role of horses, breeding, population development and economic values of the equine sector are listed in each of the country-reports. The information in the country reports were derived from a questionnaire and by using DAD-IS.

Icelandic horses in their natural landscape in Iceland. Photo: iStock

1. Introduction

1.1 The role of horses in the Nodic society over time

Horses have accompanied the residents of the Nordic countries for thousands of years and have had several purposes during the last centuries. It is uncertain how the first horses came to Denmark, Sweden, Norway, and Finland, but traces of horses have been found as far back as 3000-2000 B.C. The first horses that came to Iceland and the Faroe Islands are believed to have travelled with new settlers during the Viking age (9th and 10th centuries).

The horses have had different purposes depending on the country they resided in and the period in history. For example, in Denmark, horses were primarily used in warfare during the Middle Ages (5th-15th century). More recently, horses were a crucial part of the Finnish army during the WW2. Horses have also been used for transportation of goods, which required sturdy and sure-footed breeds such as the Fjord horse in the Western terrains of Norway or the Icelandic horse in Iceland. In later years, the majority of the Nordic horse breeds became an asset in agriculture and forestry.

Societal interest in horses has also been influenced by the upper class and the royals. For instance, in Denmark, the Frederiksborg horse – considered the first established Danish breed – became popular because of the breeding efforts of the Danish crown during the 16th century. When new royals took over the throne, the interest in horses dropped.

As society changed and modernization of agriculture occurred during the 20th century, the purpose of horses became more associated with leisure and sporting events, such as dressage, jumping and racing. This led to import of breeds from continental Europe of larger and nobler riding types, causing a rapid decline in the populations of the native breeds.

Today, there are approximately 900,000 horses in the Nordic countries. 54% and 21% of them reside in Sweden and Denmark, respectively. Finland, Iceland and Norway's share of the total number of horses varies between 7.7% and 9.4%. The smallest number of horses is found on the Faroese Islands (0.01%). In general, commercial sport horses are dominant in numbers.

1.2 The Nordic native breeds

There are 14 horse breeds that are considered native to the Nordic countries; three in Denmark, one in each of the following countries: Faroese Islands, Finland and Iceland, and four each in Norway and Sweden. The Nordic countries might have different criteria for which breeds are considered as native and worthy of conservation. In Norway, breeds are considered worthy of conservation when they were established in the country before 1950, and has a historical or cultural purpose. In addition, they should not be based on too much imported genetic material. To be applicable for subsidies, they also need to be endangered. Horses that are developed locally in a country in later years (e.g. many warmblood type horses) are thus considered as local breeds, but not native, and some breeds that are not endangered, e.g. Coldblooded trotters, are considered native but not in need of conservation. This report covers breeds that are considered native by their own country's definitions. The native breeds only make up about 4% and 3% of the horses in Sweden and Denmark. For the Faroe Islands, Finland and Norway they make up 18%, 28% and 36% respectively, while 100% of the horses on Iceland are the native Icelandic horse, as they have a prohibition of import of horses to the island. All the Nordic native breeds (except for the Icelandic horse, the trotter line of Finnhorse, and the Norwegian and Swedish Coldblooded trotters) are considered endangered or critically endangered. The Icelandic horse is an exception as it is a popular breed all over the world and it is not at risk. Since most of the breeds are endangered, they need active conservation measures to safeguard them.

1.3 Population statistics

The overall management of the population size and population trends are important parts of conservation work to be able to manage the breed in a sustainable way, and to spot detrimental trends before they become too difficult to turn around. Obtaining accurate numerical data on the Nordic native breeds for this report proved challenging, even with good connections among stakeholders within the Nordic countries. The data is scattered, and the frequency of census data registration varies considerably. Data sources can also provide different estimates, which makes it difficult to assess the correctness of the data. In the worst cases, the information is outdated or completely missing. FAO's maintained livestock diversity database, DAD-IS is used for reporting on the global status and trends of animal genetic resources. Despite its potential impact on decision making, several of the Nordic countries have shortcomings in updating the DAD-IS - database.

1.4 Understanding genetics

The native Nordic horse breeds are adapted to rough environmental conditions because they have been exposed to them for centuries. In addition, genetic variation between and within breeds ensures their capability to adapt to changing environments, which becomes vital in the face of climate change. Genetic diversity enables their use for many different purposes in society, which is also essential for the breed's survival in the future.

In addition to the population data, not all phenotypic characteristics of the native breeds have been mapped yet. Based on our previous study, 30 % of the Nordic horse breeds lack proper phenotypic characterization (Kierkegaard *et al.* 2020). Maintaining the genetic diversity both between and within breeds (both commercial and native) is essential for the survival of the different populations in the future as low genetic diversity and inbreeding not only increases the risk of genetic defects and susceptibility to diseases, but also reduces their ability to reproduce and adapt to environmental changes. Furthermore, understanding the underlying genetics of different traits such as behaviour, tolerance (e.g., against diseases or harsh environments), and performance as well as development of genetic diseases and syndromes, is vital for maintaining a healthy population. Better knowledge on genetics will enable more informed breeding decisions for both commercial and native breeds.

1.5 The equine sectors contribution to economic growth

The equine sector contributes to economic growth in various of the Nordic countries. For example, the sector has contributed to a turnover of 22.5 billion DKK in Denmark. Furthermore, estimates of the horse industry's employment impact vary between 6500 to 15 000 person-years in Finland. In Sweden, the equine sector is a large and growing part of the economy and the interest in owning horses increased during the COVID-19 pandemia (2020-2022).

As interest in and the use of horses has changed, the role of horse owners has also changed from being a producer to being a consumer. The owners and breeders carry most of the financial responsibility. Most of the practical conservation work of the native horse breeds are carried out by voluntary private horse owners. Conservation of native breeds, which may not generate as much income as commercial breeding activities, can therefore be an economical burden for those involved. Most of the Nordic countries provide some subsidies for the native horse breeds, but the requirements for obtaining the subsidies vary between countries and breeds. Economic incentives could lead to positive ripple effects through increased activity in horse enterprises using native breeds, for example in animal assisted therapy or ecosystem services.

Horses of various breeds in North Jutland, Denmark. Photo: Kjetil Løite

2. Methods

2.1 The Domestic Animal Diversity Information System (DAD-IS) database

The Domestic Animal Diversity Information System, (DAD-IS[1]), is a Global Databank of farm animal species and breeds. It is maintained and developed by the Food and Agriculture Organization of the United Nations (FAO). In this report, this database was used in comparison to the various national data sources. In some cases, it served as the only data source for population statistics if national stakeholders could not be reached or could not provide information.

DAD-IS contains information on breed characteristics, uses, population statistics, geographical distribution, and demographics. It also contains the risk of extinction status for each breed. Data from DAD-IS is used for reporting on the global status and trends of animal genetic resources, including the data for indicators of the UN Sustainable Development Goals (SDGs). Under the supervision of the national coordinator for animal genetic resources, each country is responsible for updating their data in the system. DAD-IS allows the calculation of the animal element of SDG indicators 2.5.1 and 2.5.2 for each country, region or globally. These calculations are used in both regional and global decision-making processes.

1. https://www.fao.org/dad-is/data/en/

2.2 Questionnaire

A questionnaire was used to map basic information such as total numbers of horses, breeds, relevant stakeholders, and legislation. It was sent to a network of native Nordic horses maintained by NordGen, national coordinators of animal genetic resources in addition to relevant national authorities and breeding organizations. The academic researchers were also contacted in addition to NordGen's horse network. Some information was acquired through interviews and personal communication. The questions can be found in Appendix A.2.

2.3 Scientific literature and breed stories

NordGen has made comprehensive breed stories of each of the Nordic native breeds based on scientific literature and information gathered from the horse breed associations. These breed stories in addition to additional relevant scientific literature has been used throughout the report. Sources can be found in the bibliography.

3. COUNTRY REPORTS

Jutland horse. Photo: Malene Thyssen / Creative Commons

Knabstrupper. Photo: iStock

Frederiksborg horse. Photo: GettyImages

3.1 Denmark

Background

Historically, the horse has had great importance for the Danish society. For hundreds of years, horses were primarily associated with military use, but the species has also been valuable in agriculture, industry and for transportation. Following the Second World War there were over 600,000 horses in Denmark, but just 30 years later, the number had fallen to approximately 80,000 horses. By virtue of its intelligence and ability to learn, the horse has found new uses. Today the horse has an important role as a sport and leisure animal, which has given the animal a renaissance. Reports show that Denmark has been the country in the EU with the largest number of horses in relation to its surface area (Madsen et al., 2010; Statistics Denmark).

Organization and registration of horse breeding in Denmark

In Denmark, the Ministry of Food, Agriculture and Fisheries (Ministeriet for føde-varer, landbrug og fiskeri) regulates horse keeping and animal welfare[2]. A private research and development organization SEGES is the other legislative body and maintains the national registry for all horses in Denmark. Furthermore, SEGES is certified for giving EU passports, maintains a registry of 24 breeds and grants horse passports to the breeding associations[3]. The Danish law '*lov om Hold af Hest'* provides framework for the keeping, use and welfare issues of horses. The law applies to all horse owners. It was commenced in 2008 and has undergone numerous additions and changes since. The most crucial changes were approved in 2017, and the most recent in 2020[4]. In addition to national law, EU laws are followed.

2. https://fvm.dk/
3. https://www.landbrugsinfo.dk/public/0/c/a/heste_hestepas
4. https://www.landbrugsinfo.dk/-/media/landbrugsinfo/public/9/7/7/guide_lov.pdf

Horses that reside permanently in Denmark must be registered in the Danish national database. In the registration process, a horse must be identified before 12 months of age. Transponders are used in the process, and after that, SEGES issues them a passport[5].

The breed associations organize activities such as annual evaluation of breeding individuals and animal exhibitions. They are also responsible for keeping the studbooks for their own breed. The purpose of studbooks is to maintain data of horses used for breeding and to determine goals and instructions. The main goal is to use stud books to improve horse populations with breeding selection. In general, the selection goals aim at producing animals that are healthy, easily handled and with good performance.

Population statistics

Currently there are approximately 190 000 horses in Denmark (Hestekongres 2023). Detailed statistics are available on Denmark's database for statistics[6], which covers horses permanently residing in Denmark. As the demand for work horses has decreased, the sport and leisure breeds have spread throughout the country in recent decades. The dominating breeds in Denmark are competition or leisure horse breeds such as the Danish warmblood and the Icelandic horse. For example, the Danish Icelandic Horse Association has about 3000 members, and a total of about 38 000 Icelandic horses.

Denmark reported 15 horse breeds in DAD-IS; of which three are considered native to Denmark (Table 1). The information in the database dates back to 1983 and the most recent update is from 2023. The third source of numeric data is obtained from the breed associations (personal communication). Figure 1 illustrates the population trends of the native breeds between the 1980's and 2023. Earlier reported numbers (up until the early 2000's) are significantly lower than what is reported in the later years (Figure 1). The earlier reported numbers appear to correspond to the number of breeding mares for all the breeds, which could suggest that the population size used to be defined as the number of breeding mares in the population (Figure 1). The numbers reported after the early 2000's appear to follow the curve of the breeding mares, but is higher, which could reflect a shift in the criteria used for defining population size. Importantly, registration of the three endangered breeds has improved since 2015.

5. https://www.seges.dk/da-dk/fagomraader/heste/raadgivning/hesteregistreringen.
6. https://www.statistikbanken.dk/HDYR2

Table 1: Population census size in native horse breeds in Denmark (DAD-IS database (2024), FAO, and Nielsen and Kargo, 2020). Number of foals received from the breed associations (2023).

Native breed	2021	2022	2023	Risk status	Trend	Number of foals born per year
Jutland horse	1501	1480	1462	Endangered	Decreasing	65
Frederiksborg horse	1611	1576	1542	Endangered	Decreasing	57
Knabstrupper horse	1736	1729	1736	Endangered	Increasing	116

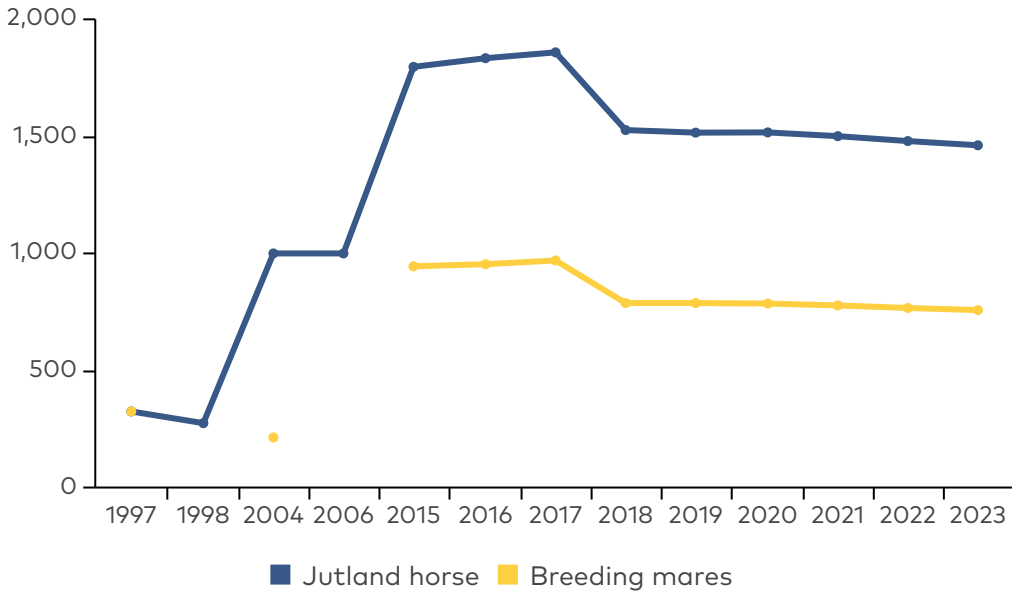


Figure 1.A: Population trends of the three native breeds of Denmark retained from DAD-IS (2024).
The figure shows the population size (blue) and the registered breeding mares (yellow) of the Jutland horse.

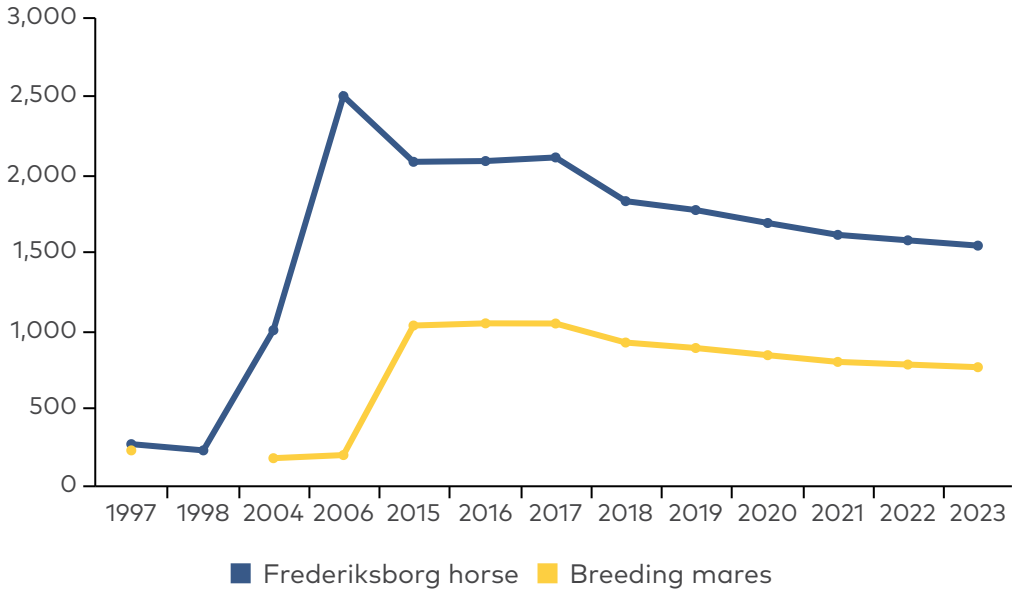


Figure 1.B: Population trends of the three native breeds of Denmark retained from DAD-IS (2024). The figure shows the population size (blue) and the registered breeding mares (yellow) of the Frederiksborg horse.

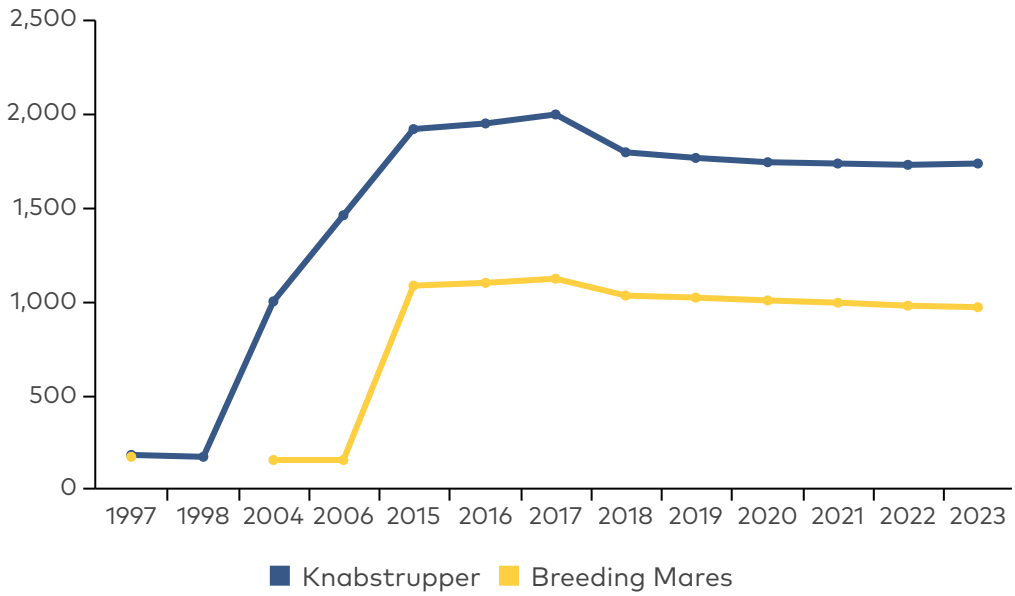


Figure 1.C: Population trends of the three native breeds of Denmark retained from DAD-IS (2024). The figure shows the population size (blue) and the registered breeding mares (yellow) of the Knabstrupper.

Commercial horse and breeding activities

Riding is a very popular hobby in Denmark: According to Statistics Denmark, Denmark is the country in the EU with the largest number of horses in relation to hobby animals. The Danish Equestrian Federation (Dansk Ride Forbund) is the fourth largest association in Denmark. There are almost as many Danish women riding horses (61 954) as there are playing football (63 294).

The Danish warmblood has been bred since the 1950s. It is famous for foaling the highest percentage of offspring with high achieving performance: i.e., most of the foals of the Danish warmblood make it to the international top in dressage sports. This breed is not included in Denmark's national conservation program. Although it is called the "Danish Warmblood", the breed is not considered a native breed to Denmark because it is based on imported warmblood horses from the European continent. Although Danish Warmbloods dominate a large portion of Danish horse breeding today, public interest regarding the Knabstrupper and Frederiksborg horse is also increasing due to their suitability for leisure riding[7].

Economy

The past few years have been turbulent, nevertheless the equine sector has achieved positive growth. Furthermore, breeding contributes to economic growth: the breeding sector accounts for 19% of the profits attained in the equine sector. The horse sector creates 20,000 jobs and contributed to a turnover of 22.5 billion DKK (2023)[8].

Native breeds and conservation programs

There are three native breeds in Denmark – the Jutland horse, the Frederiksborg horse, and the Knabstrupper. These have their own breed associations that are responsible for practical breeding activities and promotion of the breeds. The breed association of the Jutland horse is "Avlsforeningen Den Jydske Hest"[9] which has seven local branches. The breeders for the Frederiksborg horse are organised in the Frederiksborg Horse Breeder Association, which has about 150 members. Knabstrupperforeningen for Danmark is the EU approved mother organization for the Knabstrupper breed, and the Frederiksborg Horse Breeder Association is the EU approved mother organization for the Frederiksborg horse.

7. https://www.spogahorse.com/
8. https://www.ridehesten.com/nyheder/hestekongres-2023-er-i-gang-video/101034
9. https://denjydskehest.dk/

All three native horse breeds are classified as endangered (Table 1). The conservation committee "The advisory Conservation Committee for Danish Farm Animal Genetic Resources for native Danish livestock breeds" advises the ministry in the conservation of farm animal genetic resources. The conservation activities are carried out in collaboration with breed associations. Laws and regulations specific for native horse breeds are issued by Landbrugsstyrelsen. Population statistics about the three national horse breeds are presented in figure 1. The data is collected from DAD-IS and show relative stable population trends since 2018.

Gene banking activities

The national program includes cryo-conservation activities. For the horses, this includes only collecting and freezing doses of semen. Summary statistics of horse gene banking is presented in Table 2.

Table 2: Stocks of stallion semen in "Statens Genbank" between 1988-2014 (updated 03/03/2022).

Breed	Number of stallions	Number of doses
Jutland horse	6	193
Knabstrupper horse	2	82
Frederiksborg horse	10	566
Other breeds	2	63

Subsidies

The Danish native horse breeds are eligible for subsidies. The subsidies provided for Frederiksborg and Knabstrupper are 2000 DKK for mares and 3000 DKK for stallions, while the subsidies issued for the Jutland horse are 1000 DKK (mares) and 3000 DKK (stallions)[10] (i.e., when applying for subsidies in 2023, the horse you are applying subsidies for need to be a parent of a purebred offspring born in 2022).

10. Tilskud til bevaring af husdyrracer (lbst.dk)

Faroe Horse Photo: Cécile Zahorka / The Pixel Nomad & Vor-die-Linse Fotografie

Faroese horse. Photo: Cécile Zahorka / The Pixel Nomad & Vor-die-Linse Fotografie

Icelandic horse. Photo: iStock

3.2 The Faroe Islands

Background

Norse settlers brought horses to the Faroe Islands in the 9th and 10th centuries. Over the centuries, these horses adapted to the rough climate on the islands, and the Faroe Islands became home to a horse breed that was small, strong, hardy, and agile. It is the size of a pony, but is known as the Faroese horse. The horse is most closely related to the Icelandic horse, but also some of the British native breeds. The small horses were mostly used for transport between villages as there were no roads. The horses were semi-wild and roamed the mountains all year and no targeted breeding took place, but their temperament was still mild. The oldest record available of horses on the Faroe Islands is from 1857, which counted 844 horses with 396 mares, and 476 foals and stallions. The horses were then exported massively to Great Britain to be used in the coal mines. The modernization of agriculture on the Faroe Islands made them less needed there, which resulted in a breed that nearly went extinct. By the 1960s, there were less than ten horses of the breed left alive. A rescue operation was initiated, and suitable horses for breeding were used, however many of them were already related. All Faroese horses alive today, are descendants of only four individual horses.

The largest issue for the Faroese equine sector today is that any horse born on the islands cannot be transported internationally as there is no legislative body that can issue horses an EU passport. Subsequently, breeders of the Faroese horse are prevented from selling foals abroad. Further, there are only few local buyers interested in owning this horse on the Faroe Islands. The most popular breed on the Faroe Islands today is the Icelandic horse, which is used for competition and sporting. The lack of opportunity for breeders to sell their foals abroad severely limits conservation work, increasing the risk of extinction due to either infectious diseases or other unforeseen events (Kjetså *et al.*, 2024).

Organization and registration of horse breeding in the Faroe Islands

Until the 1988 legislation for horse breeding activities were strict according to "horse breeding advancement and promotion" (act no. 51, March 14, 1931). The act was abolished by parliament in 1988 without foundation of any new legislation, which is why it can be assumed that breeding standards and overall assessment of stallions and breeding mares in general has been unregulated since 1988. The lack of legislation and possibility of obtaining EU passports for horses born on the Faroese Islands is a probable factor in why there is no breeding activity for other breeds on the islands other than the Faroese horse. Most people who want to buy a horse will buy horses from abroad that are already in possession of an EU passport and thus can be transported in and out of the country freely.

There is no national registration of horses in the Faroe Islands, but breed associations register the breeds in their own breed associations. At present there are two breed associations on the Faroe Islands, one that focuses on the Faroese horse, and one that focuses on the Icelandic horse:

Felagið Føroysk Ross (Faroese Horse Association[11], is a breeding association for Faroese horses. The organization only has a few members, and mainly focuses on breeding and registration (Føroya Fongur) of horses, but also conducts marketing, lectures, and small activities.

Føroyskt Íslandsrossafelag (Faroese Icelandic Horse Association[12]) is a breeding and sporting association only for Icelandic horses. The association has a lot of members and resides within the community of FEIF and international cooperation regarding Icelandic horses. Føroyskt Íslandsrossafelag focuses on everything regarding horsemanship, such as breeding, registration (WorldFengur), lectures, riding teaching, and competitions.

11. www.ffr.fo
12. www.isross.com

Population Statistics

The DAD-IS database only has two entries for the Faroese horse, in 2016 and 2017. However, all Faroese horses are registered in the database FøroyaFongur and the breed is well documented from 1960 until today (Figure 2).

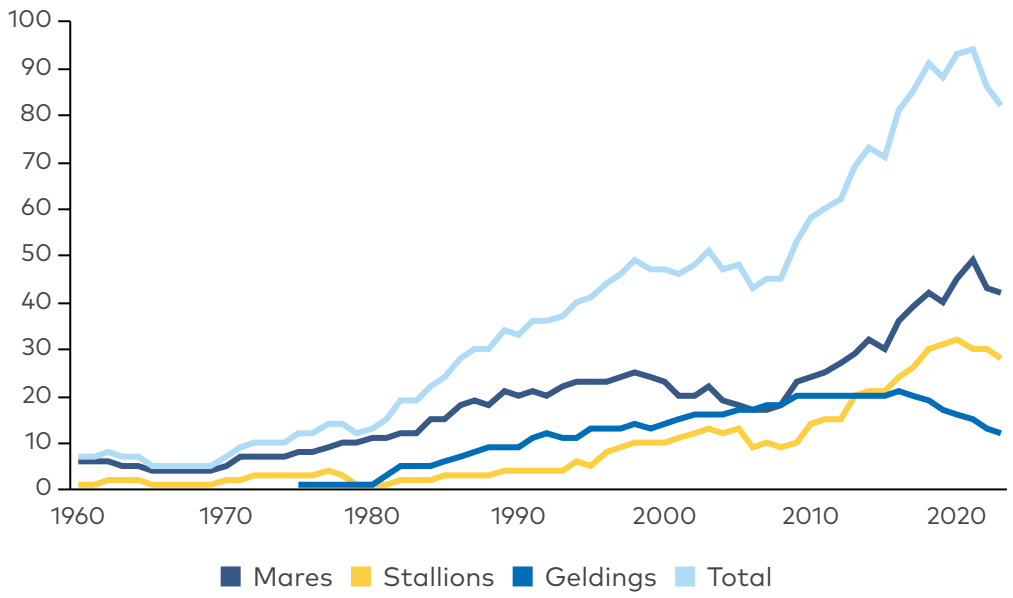


Figure 2: The Faroese horse population from 1960-2023.
Source: numbers from FøroyaFongur. Graph by NordGen.

When it comes to the other breeds on the Faroe Islands, there is no central register of horses residing on the islands. In 2022, the number of horses of each breed on the islands were estimated from contacts in the Faroese horse sector. With such a small horse sector, it is likely these numbers are not too far off, however, but the numbers could be deviating from the actual number. The number for Faroese horse at the time is extracted from FøroyaFongur. It is also important to consider that the number of Faroese horses depicted here do not represent the current population in 2024, which is 82.

Table 3: The number of horses of each breed on the Faroe Islands, estimated in April 2022. Source: Personal communication with contacts in the Faroese horse sector.

Name of Breed	N total 2022	Number of foals born 2022
Faroese horse	92	2
Icelandic horse	388	
Shetland Pony	8	
Norwegian Fjord horse	5	
Other breeds/mixes	16	
Total number of horses	509	2

The situation for the Faroese horse is critical. After many years of increased population size for the Faroese horse, the population reached a peak in 2021 with 94 live horses. However, the number of foals born each year has been stagnating since 2019, and the loss of many older horses and unforeseen events have led to a drastic population decline in the last two years (Figure 2). The main reason for the lack of foals born is because that the breeders have not been able to sell their foals, and thus stopped breeding their mares in fear of not being able to sell them. This is reflected in Figure 3, that shows how only a small percentage of the available breeding mares have been utilised since 2019. As long as there is no possibility to sell the foals abroad, this will probably be a continued trend for the Faroese horse and the outlook for the breed is not good.

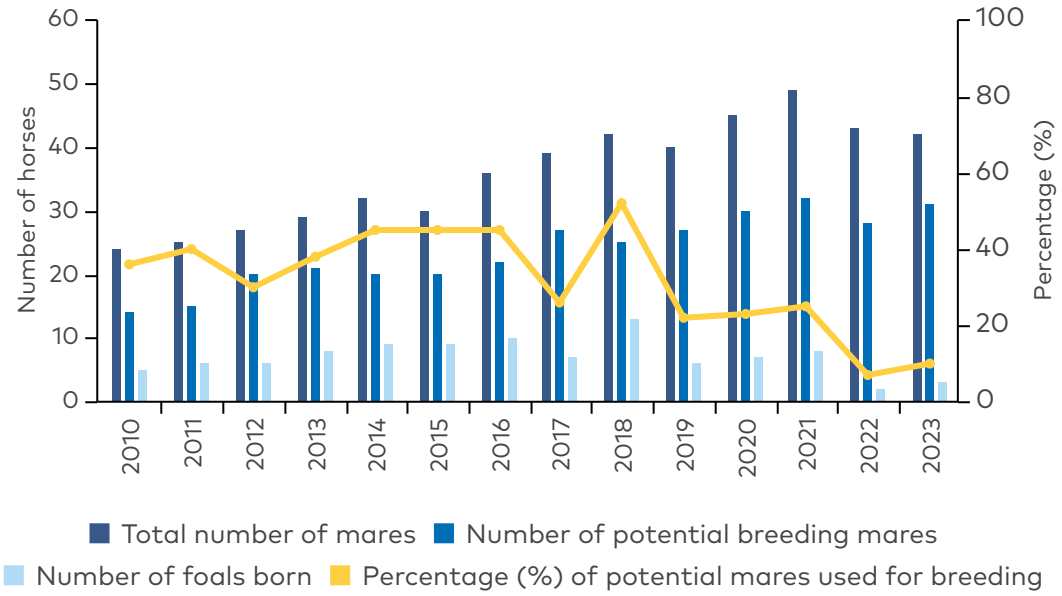


Figure 3: Breeding mares, and number of foals born from 2010 to 2023.
Source: The Faroese horse Action Plan, Kjetså et al. 2023. The figure illustrates the total number of mares (dark blue), the number of potential breeding mares (blue), the number of foals born (light blue), and the percentage of potential breeding mares used in breeding (yellow line).

Commercial horse and breeding activities

There are five riding/sporting associations on the islands. These associations focus on creating activities such as competitions and education. The sport associations are under the umbrella organization Ríðisambandið, which is also part of the Faroese Sport Association (Ítróttasamband Føroya). Some description of the associations is provided below:

Ríðisambandið[13] is the umbrella organization for the riding- and sporting associations. The association promotes riding as a sport on Faroe Islands and supports the riding and sport associations (Føroya Ríðingarfelag, Føroyskt Íslandsrossafelag, Vága Ríðingarfelag, Sleipnir, Suðurross). Ríðisambandið is a part of Ítróttasamband Føroya (ISF[14]) which is the head of all sports on Faroe Islands.

Føroya Ríðingarfelag (Faroe Islands Riding Association[15]) is the biggest sport association on the Faroe Islands. It includes all breeds and focuses mainly on activities such as competitions, lectures, and riding lessons. They have their own registration system, but breeding and registration is not practiced anymore, since most of the horses are Icelandic and included in WorldFengur.

13. www.ridisamband.fo
14. www.isf.fo
15. http://www.ross.fo

Vága Ríðingarfelag is a small sporting association for the island of Vágar. The association focuses on two annual competitions in cooperation with Føroya Ríðingarfelag. They are building a stable area with a riding hall that will soon be ready for use. Most horses are included in WorldFengur.

Suðurross - Suðuroyar Hestafelag[16] is a small association for the island of Suðuroy (South of the island). The association mainly focuses on activities and providing riding lessons and lectures. Most horses are included in WorldFengur.

Sleipnir is a new and small sporting association for the island of Eysturoy. They are in the process of building everything up, and their current focus is carrying out different activities. Most of the horses are included in WorldFengur.

Dalaross is a small sporting association in Kollafjørður, 20 min from Tórshavn. Their current focus is carrying.

Economy

There are no official numbers on the economic impact of the Horse sector on the Faroe Islands. However, it is likely that the horse sector positively impacts the economy by providing work for citizens through e.g. riding tours for tourists, riding instructors, veterinarians and others servicing the horse owners.

The vegetation on the Faroe Islands mostly consists of grassland vegetation and is heavily grazed by sheep. This causes limitation for horse grazing, and winter hay and feed for the horses is mostly imported from other countries.

Native breeds and conservation programs

The Faroese Agricultural Agency is the governmental branch responsible for the conservation of the Faroese horse breed. However, most of the conservation work is conducted on a volunteer basis through the collaboration between the Faroese Horse Association and the Faroese Agricultural Agency. It is mandatory to register the Faroese horse in the "Føroyafongur" database. The database is managed by the breed association and based on collaboration with the international Icelandic breed database "WorldFengur".

The critical status of Faroese horse and necessary actions to preserve them are thoroughly described in a newly published Action Plan for the conservation of the Faroese horse (Kjetså *et al.*, 2024). One of the actions described in the Action plan was to export Faroese horse embryos abroad, due to the issue of not being able to export live horses abroad, and the critical need to increase the population of the

16. www.sudurross.fo

Faroese horse. The Faroese Horse Association has been granted some funding and have taken action by initiating a project to export embryos to Denmark through Icelandic horse surrogate mares. The first embryo foals will hopefully be born in 2025. However, this is a costly method of getting the horse breed exported abroad and there is a limit to how many foals can be born this way. Other actions would be to work towards being able to obtain EU passports for horses born on the Faroe Islands so that they can be exported, and to make an official breeding program for the breed that conserves genetic diversity.

Gene banking activities

There is currently no gene banking program for the Faroese horse, but 9 stallions have their semen stored at the agricultural agency. Furthermore, efforts to establish a gene bank conservation program for the Faroese horse are ongoing.

Subsidies

The Faroese government provides approximately 40 000 euros yearly for the conservation of the Faroese horse. The money is distributed by the Agricultural Agency for the owners and keepers of breeding mares and stallions, projects involving the preservation of the breed, and to support the work of the Faroese Horse Association.

Finnhorses. Photo: Kirsti Hassinen

Finnhorse. Photo: Own Work / Wikimedia Commons

Finnhorse: Photo: Teesusi / Wikimedia Commons

3.3 Finland

Background

A new impact analysis of the equine sector in Finland carried out by Gaia Consulting (completed in February 2023) showed that the horse has positive impact in many areas in Finland. The analysis considers several impact factors, including conservation and biodiversity, carbon sequestration, economy, and social influences, and therefore provides a deeper understanding of the social, economic, and environmental benefits of the equine sector to society than has been demonstrated previously. With a growing concern regarding maintaining biodiversity and reducing global emissions, the equine sector could prove important for mitigating species decline and reducing greenhouse gases in the atmosphere. In Finland, horses help preserve a variety of threatened biotypes and their species by grazing. Further, sporting events, like harness racing has played a key role in preserving the Finnhorse as a unique indigenous breed. With regards to global emission of greenhouse gases, the equine sector can impact carbon sequestration by cultivating horse feed and enhancing the capacity of soil and vegetation to bind carbon through grazing.

Organization and registration of horse breeding in Finland

The Finnish Ministry of Agriculture and Forestry is responsible for preparing laws and regulations related to the equine sector in Finland. Laws and regulations focus mainly on prevention of disease transmission, but also include laws regarding animal welfare. The latest Animal Welfare Act (693/2023) was introduced recently (2024). In addition, new amendments to that are currently in preparation. General animal welfare requirements are laid down in the Animal Welfare Act, the Animal Transport Act, the Council Regulation (EC) No 1/2005 on the protection of animals

during transport and related operations, and the Act on the Protection of Animals Used for Scientific or Educational Purposes. The Finnish Food Authority is responsible for following and executing the laws and regulations. The Finnish Food Authority does not provide a central database for horses. The Finnish Food Authority has forwarded most of these responsibilities to Suomen Hippos ry who has a registry of all equine species other than Estonian Draft Horse and Irish Cobs and issues EU passports for these horse breeds in Finland. *Suomen Irlannincobyhdistys-FSIC ry and Eestin Raskaat Vetohevoset ry issue* passports for the breeds Irish cob and Estonian heavy draft horse.

Population Statistics

There are total of 72 000 horses in Finland. 14 of the breeds are studbook breeds. There is inconsistency in classification of horse breeds compared between DAD-IS and Suomen Hippos' register.

There is only one native horse breed in Finland, the Finnhorse, with four sub-types within the breed: trotter, riding, draft horse and pony type. Its overall population size is 19 704 (2024), and ~1000 foals are born each year: where 70-75% of the foals are trotters, 15% are riding horses, and 3% are draft horses and pony type horses. In the light of these numbers, the Finnhorse with its four subtypes is endangered.

Based on the DAD-IS database, which was last updated in 2019, the overall population size has fluctuated between 24 730 and 16 800 individuals over the registration period 1986-2019 (Figure 4A). The number of breeding Finnhorse females has decreased dramatically from 2745 to 1000 since the registration began in 1983 (Figure 4B). The number of breeding stallions, on the other hand, has increased from 196 to 280.

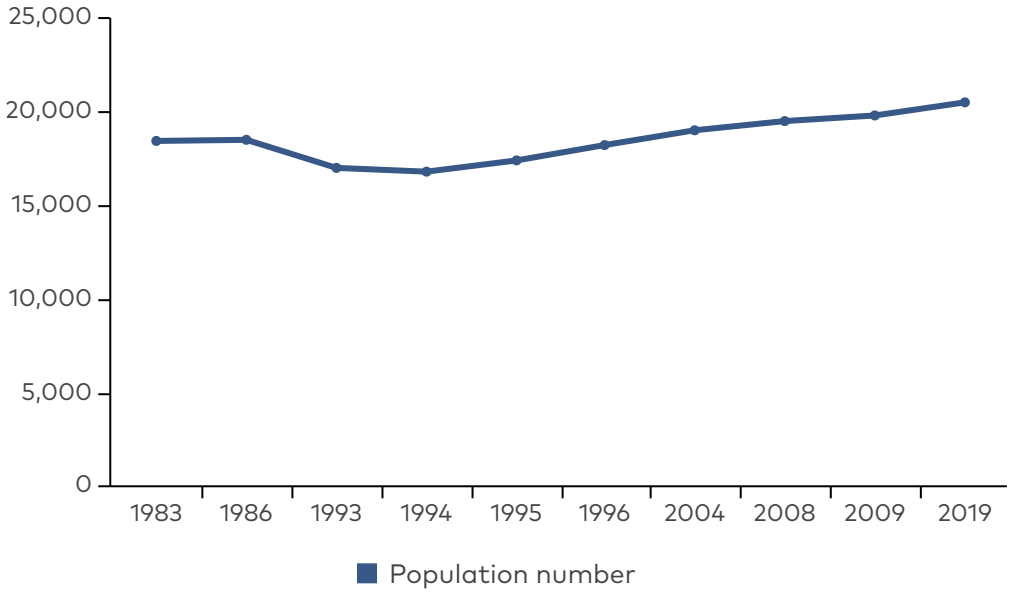


Figure 4.A: Population statistics of the Finnhorse, based on DAD-IS (2023). The figure illustrates the population number between 1983 to 2019.

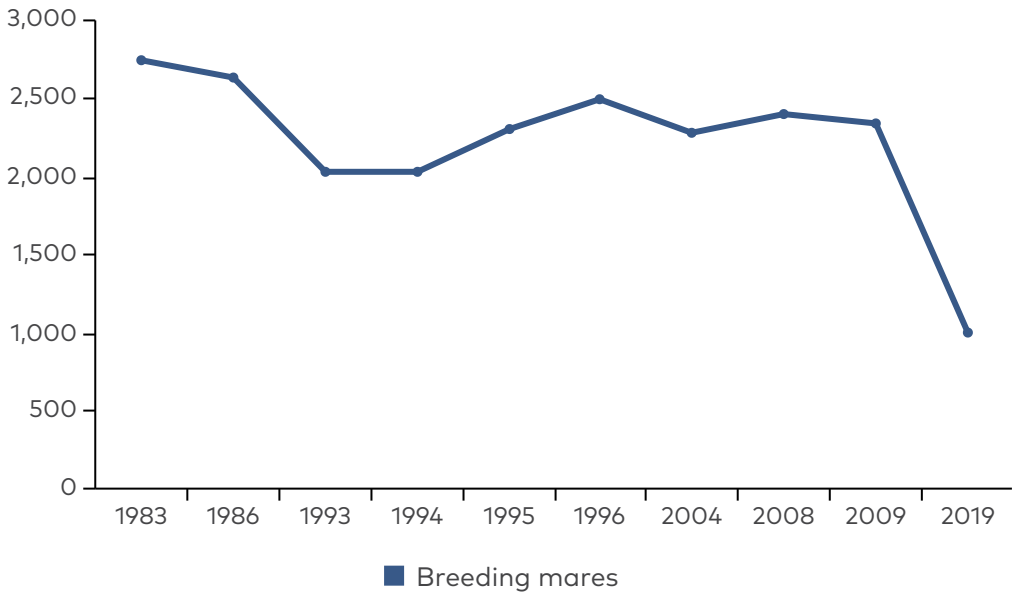


Figure 4.B: Population statistics of the Finnhorse, based on DAD-IS (2023). The figure illustrates the number of mares available for breeding between 1983 to 2019.

Commercial horse and breeding activities

Suomen Hippos maintains a studbook of Finnhorses, warm-blooded trotters, and the following riding and pony breeds: Arabian and English thoroughbred horse, Anglo-Arabian thoroughbred horse, Finnish Warmblood riding horse (FWB), Connemara, Icelandic horse, New Forest, Finnish riding pony, Gotlandsruss, Shetland pony, Welsh (sections A, B, C, and D) and Norwegian Fjord horse.

Economy

The equine industry contributes to a substantial amount of income and employment possibilities. In Finland, estimates of the horse industry's employment impact vary, according to different sources, ranging from 6500 to 15 000 person-years of work (Gaia Consulting, 2023; Hevostalous lukuina, 2022). In particular, the costs related to housing of horses (incl. veterinarian, food, shoeing, equipment) create indirect regional economic impacts that generate a minimum of EUR 274 million to Finland per year. Events in the horse industry can also positively influence the economy in communities and provide employment possibilities. For instance, the annual trotting event in 2022 generated approximately EUR 10 million to the region.

Socially, equestrian activities promote inclusion and improved well-being. Handling horses and practicing riding can positively influence people both psychologically and socially. Social exclusion, especially among young people, has been described as one of the biggest problems in Finland. The impact analysis showed that horseback riding alone has reduced the risk of social exclusion and saved the state EUR 1.6 billion (Gaia Consulting, 2023). This positive social impact is further increased when those involved in harness racing or other equestrian sports and socio-pedagogical equine activities as a form of social rehabilitation and prevention of social exclusion. This demonstrates that equestrian hobbies can reduce the risk of social exclusion and increase the overall well-being of people.

In addition to decreasing social exclusion, equestrian hobbies generate value by reducing the costs of immobility. Calculated from the number of horseback riding enthusiasts of the Finnish Equestrian Federation alone, the number of people who practice the sport for more than 2.5 hours a week brings cost savings to society of more than EUR 30.8 million per year. Riding is not limited to age and is therefore suitable for a wide range of age groups. Horse riding therapy also plays a significant role in the well-being of people by offering rehabilitation both physically and psychologically.

Native breeds and conservation programs

The Finnhorse (Suomenhevonen) is the only native horse breed in Finland, and there are four different breeding lines: trotters, riding horses, draft horses, and pony-type horses. Because of matador breeding, all Finnhorses can be traced back to only four founding stallions, born between 1879 and 1929. According to Suomen Hippos ry, Finnhorse trotters keep the Finnhorse breed alive, which may also be considered as a threat to the diversity of the breed in the long term. Several different efforts to improve interest in the breed are in place. For instance, Hevosopisto Oy in Ypäjä organizes the Finnhorse Royalty event every autumn. During this event Finnhorses compete in dressage and show jumping. Furthermore, finals of the Quality Reviews for the 3-5-year-old Finnhorses and the Breeder's Competition for the 6-year-olds are also included. Traditionally, the Stallion cavalcade is also held in connection with the royals, where Finnhorse stallions and their descendants are presented. Also, draft horses have their own annual national competition, that aims to promote horse culture, traditional horsemanship, the versatility of the Finnhorse and its genetic variation. The Finnhorse has also had its own national day (September 6th) since 2007 (National Finnhorse Day), where Suomen Hippos ry recommends flying the flag on the day in honour of the Finnhorse and Finnish equine expertise.

Recommendations concerning e.g., breeding are given only upon request; there are no specific regulations or laws related to Finnhorse breeding. The Welfare Act of 1996 includes some rules regarding animal breeding in general. The act states that utilizing breeding methods that cause poorer health and welfare for the animals is prohibited. Analysis of breeding of dogs in Finland has been conducted on the basis to improve welfare of the animals, conducting a similar analysis of horses in Finland could prove beneficial as it would improve breeding strategies.

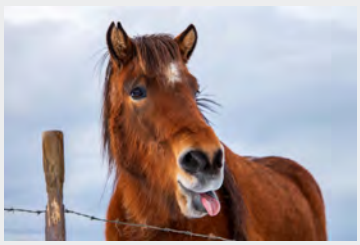
Gene banking activities

The Finnhorse is included in the Finland's National Genetic Resources Program for Agriculture, Forestry and Fisheries (2018). Subsequently, a gene bank for Finnhorse has been established by Natural Resources Institute Finland (Luke) where semen and epididymal sperm samples are cryopreserved from the different Finnhorse breeding lines. The future aim is also to cryopreserve preimplantation stage embryos produced in laboratories for the gene bank. Since horses are owned by private people/organizations, gene bank collections are made only upon approval from the owners. Selection of donors is made in collaboration by the Finnish national coordinator of animal genetic resources at Luke and Suomen Hippos ry. All collection costs are covered by funding from the Ministry of Agriculture and Forestry. The owner also receives five artificial insemination (AI) doses for their own use.

Subsidies

Finnhorse owners are eligible to apply for subsidies (350 euros per horse per year, 2023-27) from the Ministry of Agriculture and Forestry. About 40 million €/year comes to horse husbandry from betting in trotting competitions by Veikkaus. In the future (2024), funding will be directed (the same amount) through the Ministry of Finances, not as Veikkaus' financial contribution, because Veikkaus' money will be credited to the state budget in the future. Of this amount, another €168 000 is allocated to the horse research conducted by the Natural Research Institute Finland. In other respects, the Ministry of Agriculture and Agriculture directs funding to statutory targets in horse husbandry.

Guðmundur Arnarson rides Icelandic horse in tølt. Photo: Dagur Brynjólfsson / Creative Commons



Icelandic horse. Photo: Unsplash

Icelandic horses. Photo: Unsplash

3.4 Iceland

Background

There is only one horse breed in Iceland – the Icelandic horse (íslenski hesturinn). It is believed that the breed was established based on horses brought to Iceland during the settlement 1.100 years ago. For centuries the horse was the primary means of transportation in Iceland. The harsh weather conditions have without a doubt shaped the stock significantly.

The Icelandic horse has served well as a draft horse since the 1800 and was bred as such until the mid-1900s. The invention and use of tractors led to a considerable decline in the horse population. Organized breeding programmes were established in Iceland in the early 1900s when coordinated horse shows were initiated. Today, the breed has become a highly popular riding and gait competition horse, and selection is based on defined breeding goals. The smooth gait, tölt, has become a well-known quality symbol of the Icelandic horse and greatly contributes to its popularity worldwide.

Organization and registration of horse breeding in the Nordic countries

The Ministry of Food, Agriculture and Fisheries, Icelandic Food and Veterinary Authority has supervision of horse welfare according to Laws and Regulations. The Agricultural Advisory Center and Council in horse breeding advise on breeding. The Icelandic Equestrian Association (Landsamband hestamannafélaga) organize sporting competitions and supports the local horse clubs. Horse breeding is

regulated by Act on animal welfare no. 55/2013, Regulation on horse welfare no. 910/2014 and Regulation on Origin and breeding of Icelandic horses no. 442/2011. EU passports are issued by the Agricultural Advisory Center.

WorldFengur is the studbook of Origin of the Icelandic horse since 2001. The WorldFengur is a web database program that was established by the Icelandic Farmer Association in cooperation with FEIF (International Federation of Icelandic Horse Association). It provides information on individual horses, pedigree, assessment on conformation and rideability at Breeding Field Tests, genetic evaluation (BLUP), colours, photos, videos and more. Icelandic horses are bred in many countries around the world and WorldFengur is available in ten different languages.

Population statistics

Records show that the population of the Icelandic horse has fluctuated quite dramatically. The most dramatic decline in the population size was during the Laki volcanic eruption in 1783-84, when the number of horses reduced from 33 000 to 8500. Fifty years later, in 1835, the population had grown to 36,000 individuals.

According to WorldFengur, the number of horses in Iceland was 92 000 in 2024, and the number of registered horses globally was 215 000. The countries with the highest number of registered Icelandic horses outside of Iceland is Germany (73 000), Denmark (46 000) and Sweden (37 000). However, there might be more horses worldwide of full Icelandic descent, that are not registered in the database.

Based on the DAD-IS database, which was last updated in 2023, the overall population size in Iceland has fluctuated between 24 730 and 96 000 individuals over the registration period 1986-2023 (Figure 5A). There are some discrepancies between the numbers from WorldFengur and DAD-IS in terms of the total population of horses in Iceland. There are also some high fluctuations in the numbers between 2015-2020, which looks more like data entry errors than actual population fluctuations. The reason for this is unknown. According to DAD-IS The number of Icelandic mares has increased from 25 000 to 27 822 since the registration began in 1986 (Figure 5B). The number of breeding stallions has also increased from 400 to 1481. The highest number of breeding stallions (7000 individuals) was, however, registered between 2015-16.

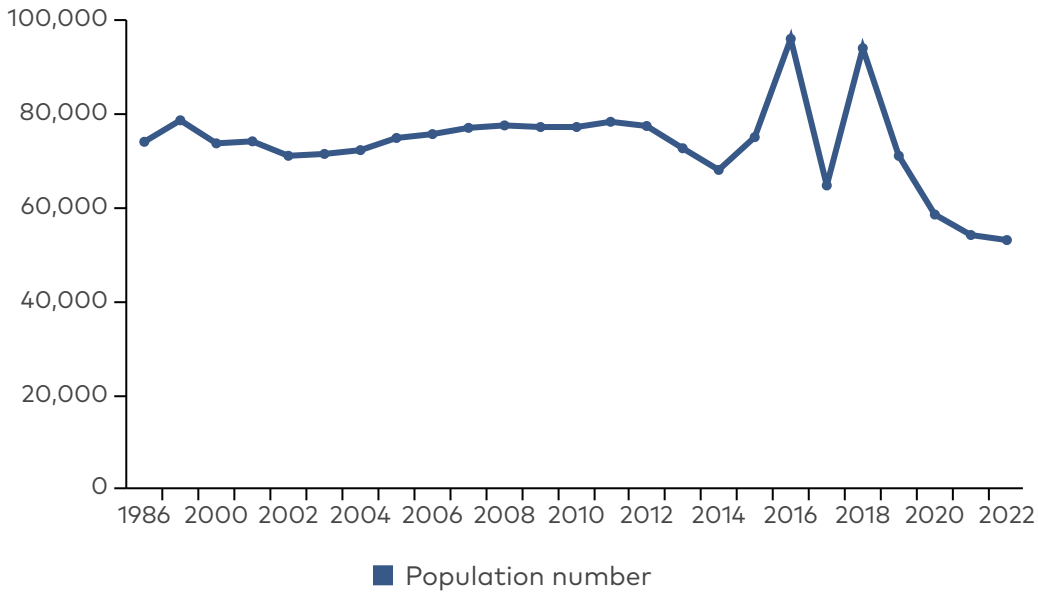


Figure 5.A: Population statistics of the Icelandic horse based on DAD-IS (2023).
The figure illustrates the population number from 1986 to 2019.

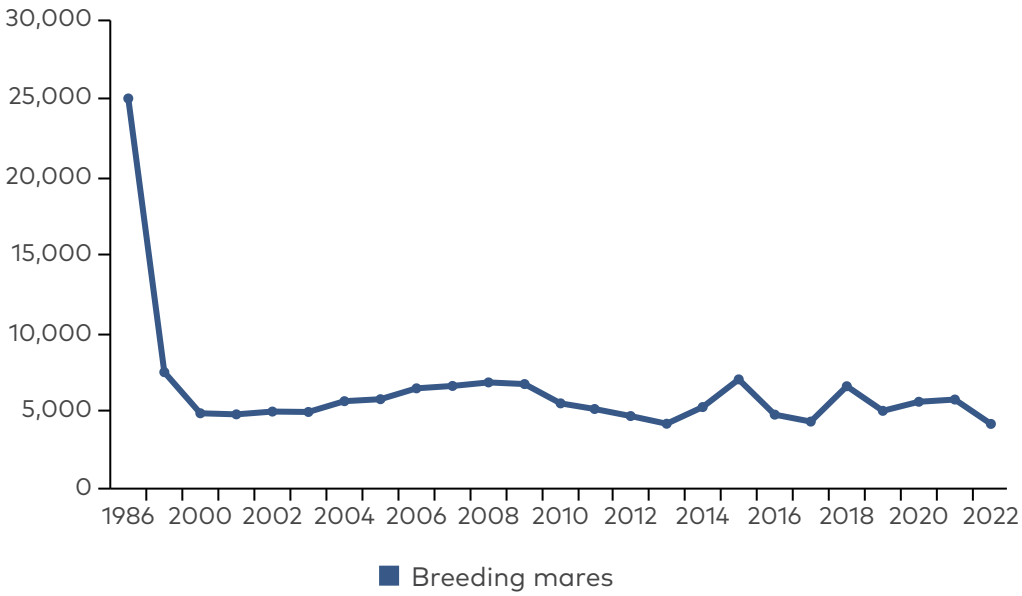


Figure 5.B: Population statistics of the Icelandic horse based on DAD-IS (2023).
The figure illustrates the the number of available breeding mares from 1986 to 2019.

Commercial horse and breeding activities

The Icelandic horse is the only horse breed in Iceland, and legislation prohibits the import of other breeds onto the island. It is both the native breed and a commercial breed in Iceland. In recent decades the popularity of the Icelandic horse has increased steadily, and export of riding horses has become an industry. The Icelandic horse can be found in most parts of the world and the International Federation of Icelandic Horse Associations (FEIF) has 26 countries as members.

There are commercial activities with tourism riding, personal riding and owning, breeding and education with Icelandic horses.

Economy

The export of riding horses provides and income for breeders of Icelandic horses, in addition to tourism riding and other Icelandic horse related activities, the horse sector is providing a positive effect on the Icelandic economy. The Icelandic horse is a good example of how to commercialize a native breed with unique traits: i.e., the initiation of competitions using the unique gaits of the Icelandic horse, has promoted the interest for this native horse globally

Native breeds and conservation programs

The Farmers Association of Iceland (FAIC) and The Horse Breeding Association of Iceland (FHB) are responsible for the breeding work and set the official breeding goals covering health, fertility, colour variability, character, conformation, and riding ability. The BLUP method with animal model has been used for genetic evaluation of the Icelandic horse since 1986. The most important aspects of the implementation of the breeding programme using the BLUP system is field tests and coordinated judgement of horses.

Gene banking activities

Artificial insemination and embryo transfers have been used to a small extent in the most recent past. There are, however, no national conservation program or cryo/gene bank for the Icelandic horse.

Subsidies

There are no subsidies for horse breeding in Iceland.

Norwegian Nordland/ Lyngen horse. Photo: Nasjonalt Senter for Nordlandshest-Lyngshest

Norwegian Fjord horse foal. Photo: Ingvild Rydjord Hansen

Norwegian Dole horse. Photo: NIBIO

3.5 Norway

Background

Like in other countries, horses in Norway were traditionally used for farming, but at present most horses are used for leisure and sporting activities. The Norwegian Fjord horse is probably the most well-known horse breed from Norway, and is found in many countries all over the world. The Dole horse, the Nordland/ Lyngen horse and the Norwegian Coldblooded trotter are the other native horse breeds in Norway. Except for the Coldblooded trotter, the other native breeds are considered endangered. Several of the native horse breeds have also been subjected to transboundary breeding. For example, Norwegian and Swedish trotters share breeding material/ stallions since the 1990's. Furthermore, the Nordland/ Lyngen horse has been bred with an imported Finnhorse stallion in 1979, and traces of the Finnhorse can be found in most pedigrees of this breed today.

Organization and registration of horse breeding in Norway

The main legislative body for horses in Norway is the Norwegian Food Safety Authority (Mattilsynet). This authority is responsible for regulating breeding, registration and keeping of horses. Norway follows the EU laws with some adaptions. In 2017, it was made mandatory for information registered with passport-giving organizations to be reported to the National Horse Registry. There are currently eight organizations that have been given the authority to issue EU passports in Norway. These have all been given this authority by the Norwegian Food Safety Authority (Mattilsynet), and some of them have their own agreement with different gene banks for gene banking activities such as semen collection and storage.

The Norwegian Food Safety Authority (Mattilsynet) have given the authority to issue EU passports in Norway to the following organizations:

- Norsk Hestesenter
- Norsk Varmblod
- Norsk Ponniavlsforening
- Det Norske Travselskap
- Norsk Araberhestforening
- Norsk Galopp
- Norsk Lipizzanerforening
- Dansk Varmblod Norge

Population statistics

According to the National horse registry in Norway, a total of 85 291 live horses and 2026 foals born were registered in Norway in 2022 (Table 4).

Table 4: Number of living horses and number of foals born in Norway in 2022. Data from the National Horse Registry. Some imported horses may not be registered in the National Horse Registry, and the real number of horses might be higher.

Breed Name	N total	N foals born
Coldblooded trotter	17,053	435
Warmblooded trotter	14,515	380
Icelandic horse	11,560	230
Warmblooded Riding horse	7,293	218
Norwegian Fjord horse	6,172	182
Shetland Pony	4,972	96
Norwegian Dole horse	4,270	164
Norwegian Nordland/ Lyngen horse	3,159	115
English Thoroughbred	1,982	41
Other breeds	5,750	75
Crossbreed/Unknown breed	8,565	90
Total	**85,291**	**2,026**

Breed statistics for the native breeds – data discrepancies between DAD-IS and national reports

Data collected from both DAD-IS and national reports are presented below for all the native breeds. They show similar discrepancies in the reporting in DAD-IS compared to reports from the Norwegian Horse Association (NHS) and the Norwegian genetic resource centre (NIBIO) with regards to population development and available breeding mares. For instance, DAD-IS indicates that the Fjord horse population has been declining at a steady pace since 1988, except for a large jump and then drop in the early and late 1990s (Figure 6A). This jump in number could be a technical error. The reported numbers corresponds to the population of breeding mares which also appear to have been steadily declining until 2021, which is a similarity for all of the breeds (Figure 6 and 7) Since 2021 the population and number of breeding mares in each of this breeds appear to have increased, according to DAD-IS. However, when comparing these numbers to national reports from both NIBIO and the NHS, the numbers differs for both number of breeding mares and population size (Figure 6, 7 and 8). Key figures presented from Norway show that the number of mares available for breeding presented in 2019-2022 is higher than those presented in DAD-IS (Figure 6 and 7). The number of mares presented in DAD-IS up to 2022 appear to correspond better to the number of mares used for breeding presented in NHS. The number of breeding mares presented in DAD-IS in the year 2022 corresponds to the number of mares **available** for breeding, and not the number of mares **actually used** for breeding (i.e., mares used for breeding was determined by counting number of foals born – e.g. not counting those who did not carry to term), suggesting an alteration for defining "breeding females" in DAD-IS in 2022.

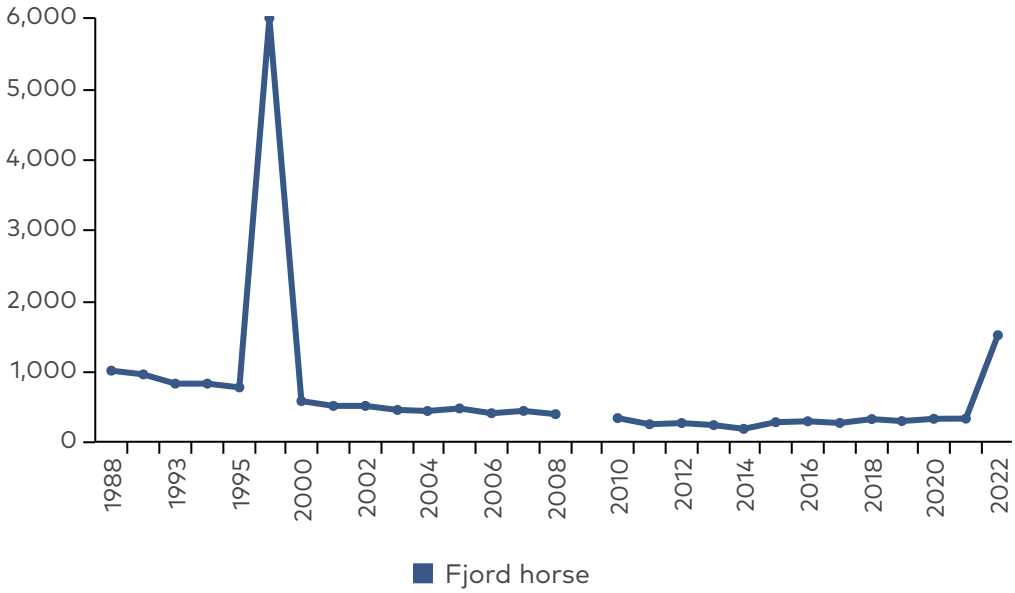


Figure 6A.1: The population number of the Fjord horse. The figure illustrated the population of the Fjord horse reported into DAD-IS between the late 1900's and 2022.

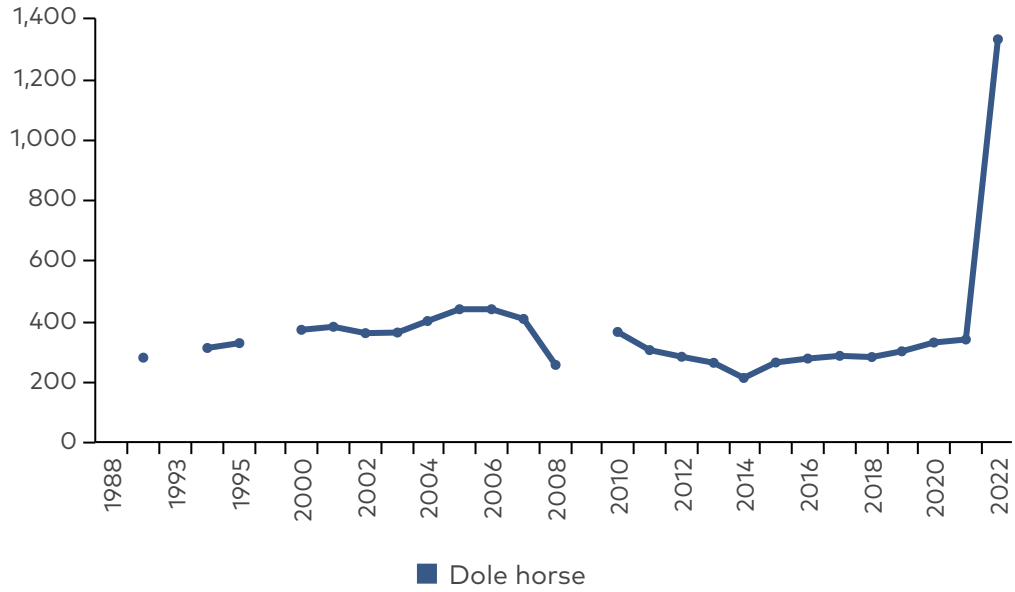


Figure 6B.1: The population number of the Dole horse. The figure illustrated the population of the Dole horse reported into DAD-IS between the late 1900's and 2022.

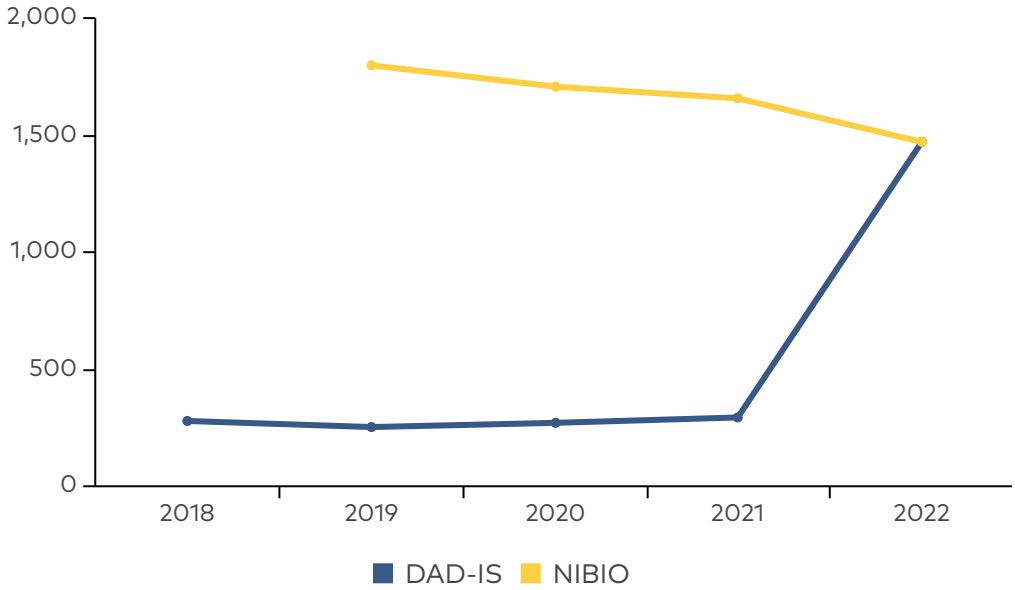


Figure 6A.2: The number of mares available for breeding in the Fjord horse population. The figure illustrates the number of Fjord horse mares available for breeding reported by NIBIO (yellow) compared to DAD-IS (blue).

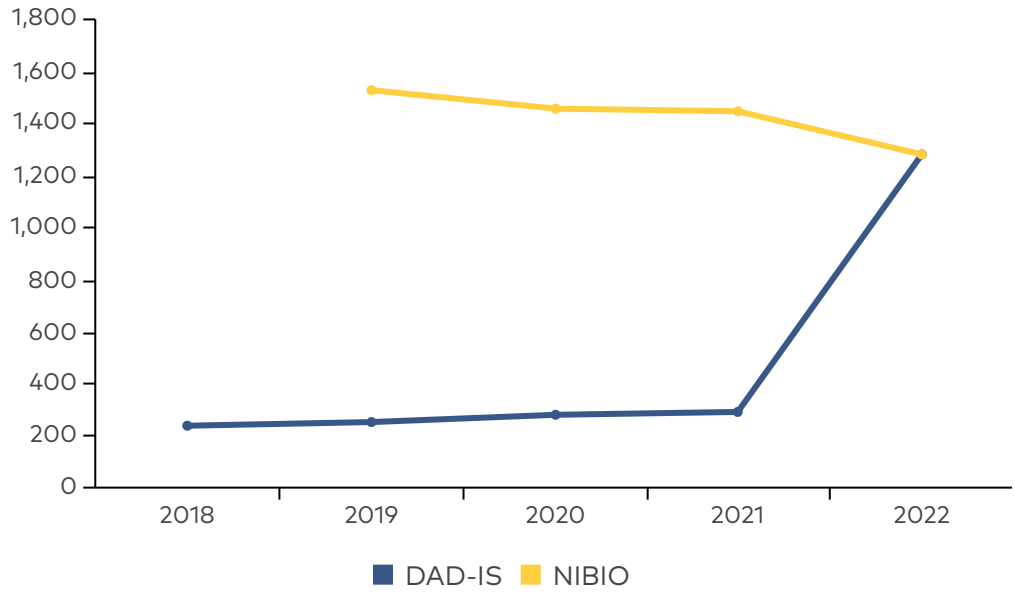


Figure 6B.2: **The number of mares available for breeding in the Dole horse population.** The figure illustrates the number of Dole horse mares available for breeding reported by NIBIO (yellow) compared to DAD-IS (blue).

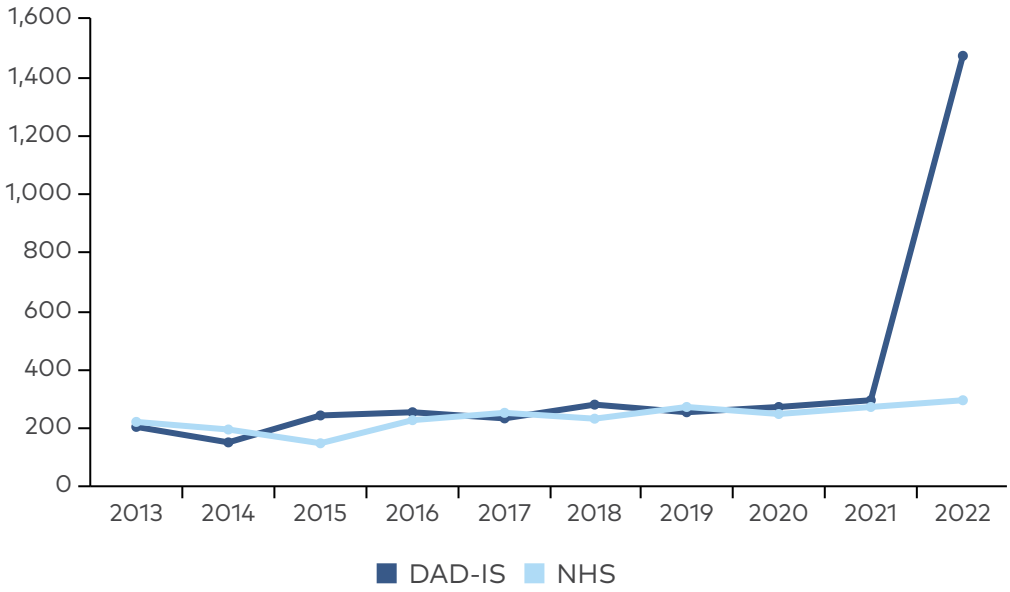


Figure 6A.3: The number of Fjord horse mares used in breeding. The figure illustrates the number of breeding Fjord horse mares reported by NHS (light blue) and DAD-IS (blue) between 2013 and 2022.

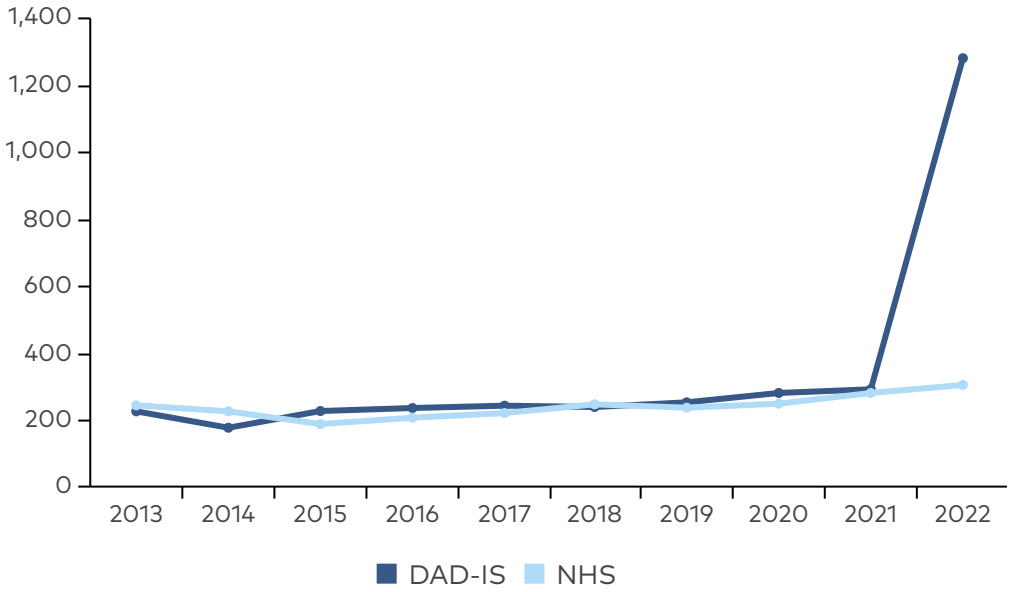


Figure 6B.3: **The number of Dole horse mares used in breeding**. The figure illustrates the number of breeding Dole horse mares reported by NHS (light blue) and DAD-IS (blue) between 2013 and 2022.

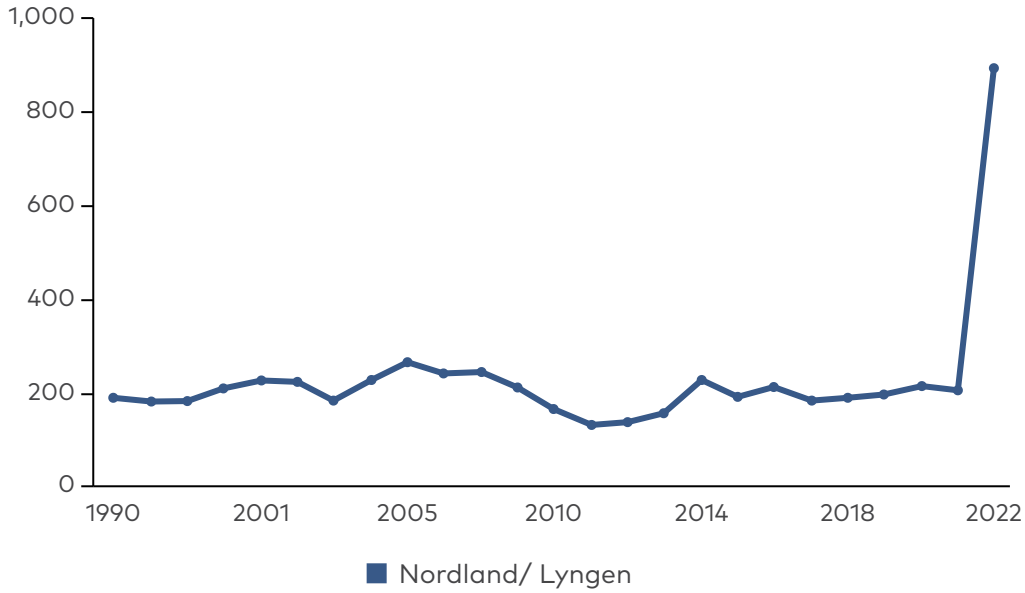


Figure 7A.1: The population number of the Nordland/ Lyngen horse. The figure illustrated the population of the Nordland/Lyngen horse reported into DAD-IS between the late 1900's and 2022.

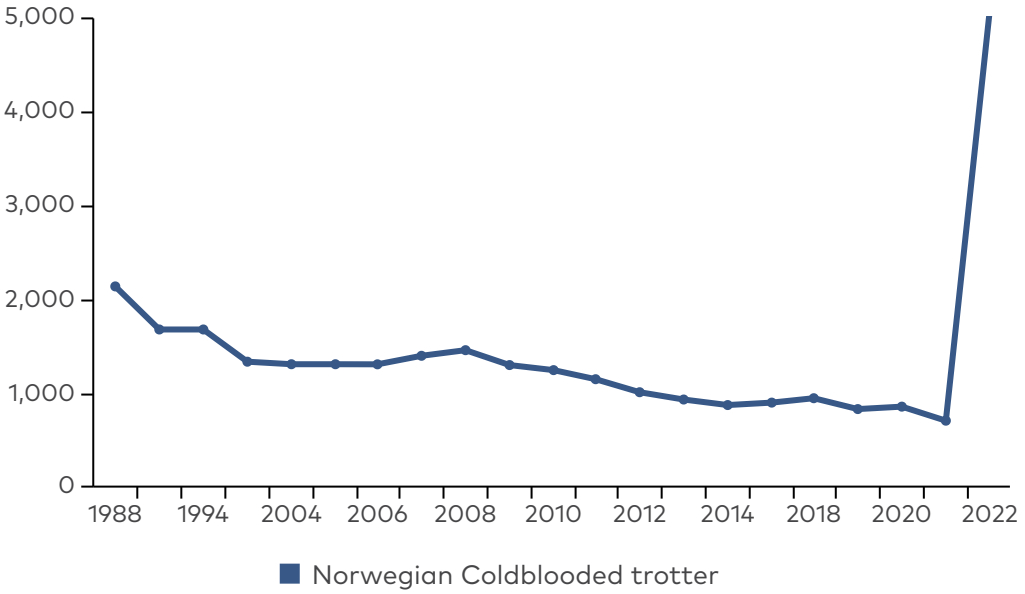


Figure 7B.1: The population number of the Norwegian Coldblooded trotter. The figure illustrated the population of the Norwegian Coldblooded trotter reported into DAD-IS between the late 1900's and 2022.

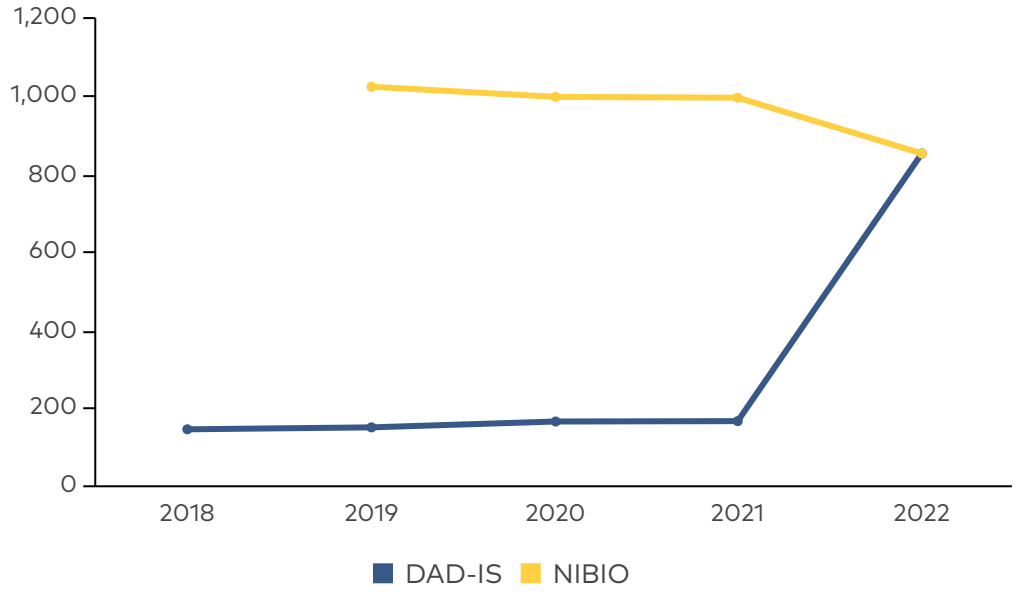


Figure 7A.2: The number of mares available for breeding in the Nordland/ Lyngen horse population. The figure illustrates the number of Nordland/ Lyngen horse mares available for breeding reported by NIBIO (yellow) compared to DAD-IS (blue).

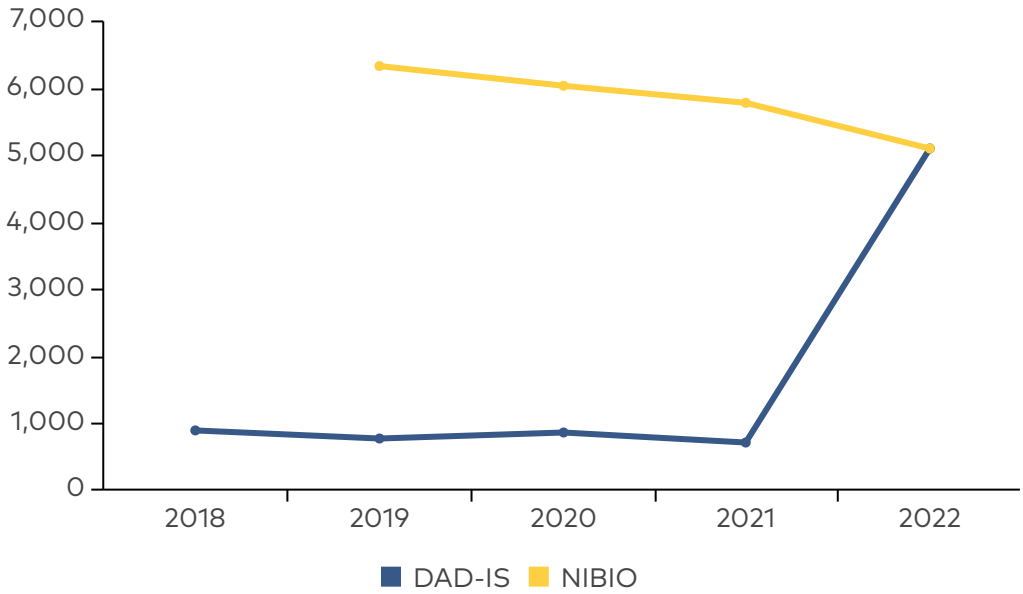


Figure 7B.2: The number of mares available for breeding in the Norwegian Coldblooded trotter population. The figure illustrates the number of Norwegian Coldblooded trotter mares available for breeding reported by NIBIO (yellow) compared to DAD-IS (blue).

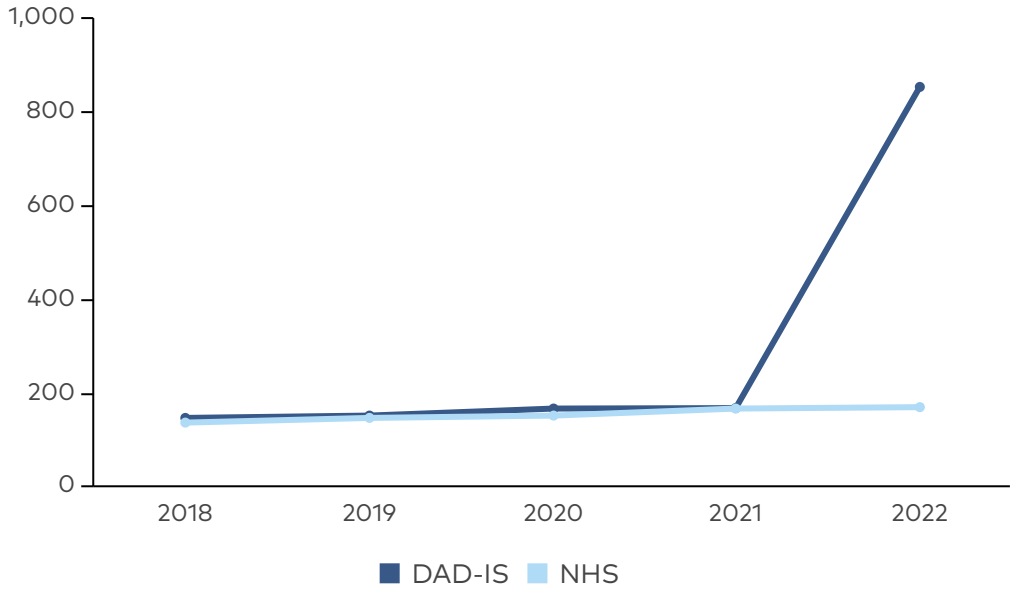


Figure 7A.3: The number of Nordland/ Lyngen horse mares used in breeding. The figure illustrates the number of breeding Nordland/ Lyngen horse mares reported by NHS (light blue) and DAD-IS (blue) between 2013 and 2022.

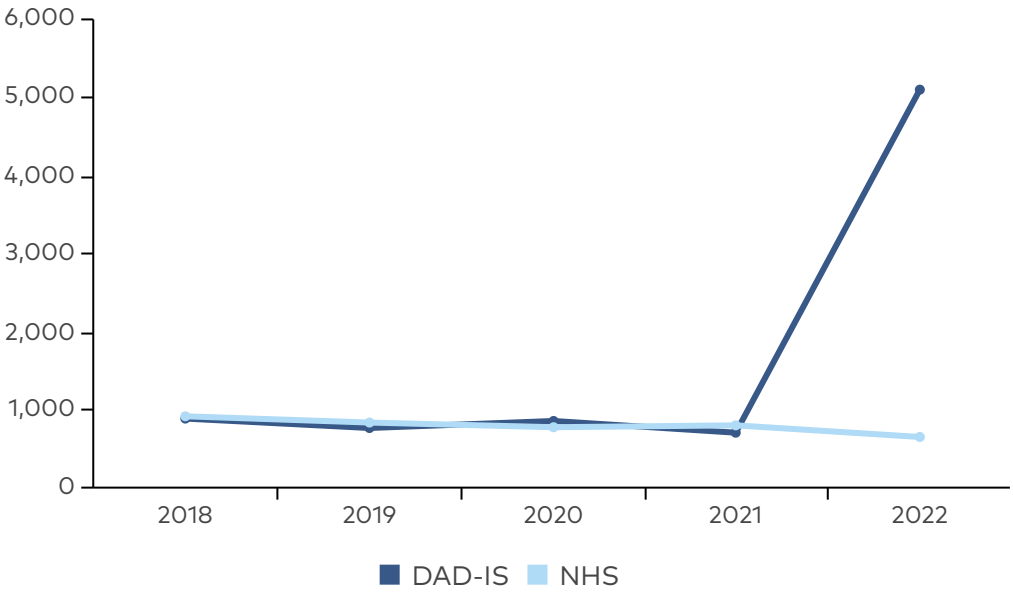


Figure 7 B.3: The number of Norwegian Coldblooded trotter mares used in breeding. The figure illustrates the number of breeding Norwegian Coldblooded trotter mares reported by NHS (light blue) and DAD-IS (blue) between 2013 and 2022.

When comparing the population number that has been reported in DAD-IS with the number of total reported population and total available breeding population that has been reported by the NHS, these numbers are completely different in all the breeds (Figure 6). These findings suggests that different definitions have been used for reporting population number and number of breeding mares have been used. It is important to highlight the significance of consistent reporting because it influences the historical perspective of development for the breeds. For example, following solely data entries into DAD-IS, the breeding mares for all of the native breeds appear to be experiencing an increase, when in reality, the mares available for breeding are slightly decreasing and the number mares used in breeding appear stable (Figure 6 and 7). The same trend is seen for the population number. In DAD-IS it appears to be increasing drastically from 2021 to 2022, while the total number of animals and the total number of animals available for breeding appears to either be stable of decreasing (Figure 8) Additionally, when viewing the population data compared to population numbers presented. These findings highlights the importance of clear definitions and consistency of reporting into DAD-IS so that interested parties (e.g., scientists or policy markers) can obtain the correct desired information from one place. Reviewing the number of mares available for breeding presented by NIBIO, the trend is showing a slight decrease from 2019 to 2022.

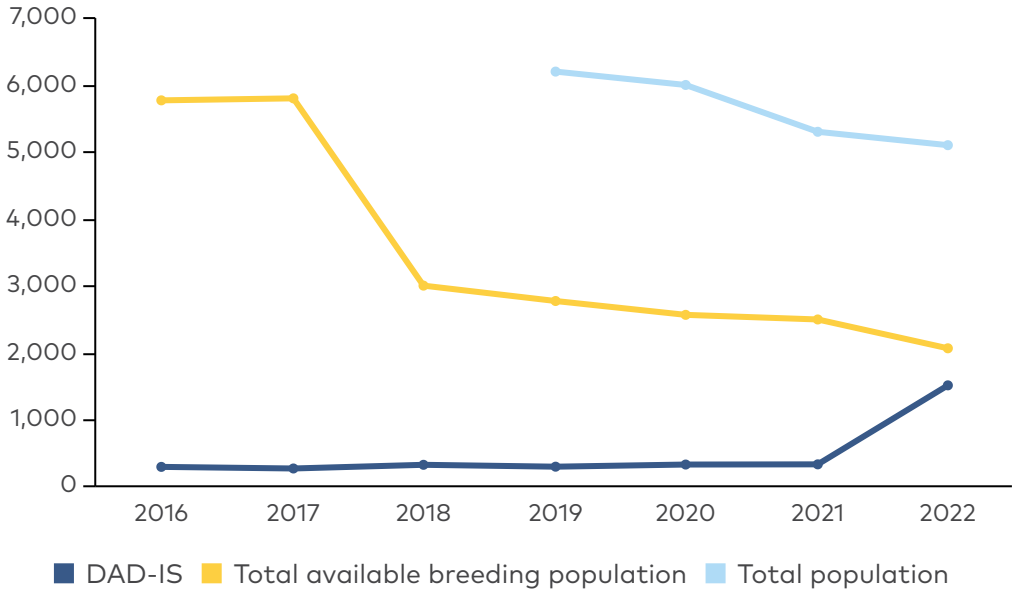


Figure 8A: The population number of the Fjord horse. (Norsk Hestesenter, 2023, 2022, 2021, 2020, 2019, 2017, 2016). The figure illustrates the total population of the Fjord horse from 2016 to 2022 according to DAD-IS (dark blue) and NHS (yellow and light blue). The definition of total population derived from NHS is divided in two (total population available for breeding (yellow) and all individuals within the population (light blue)).

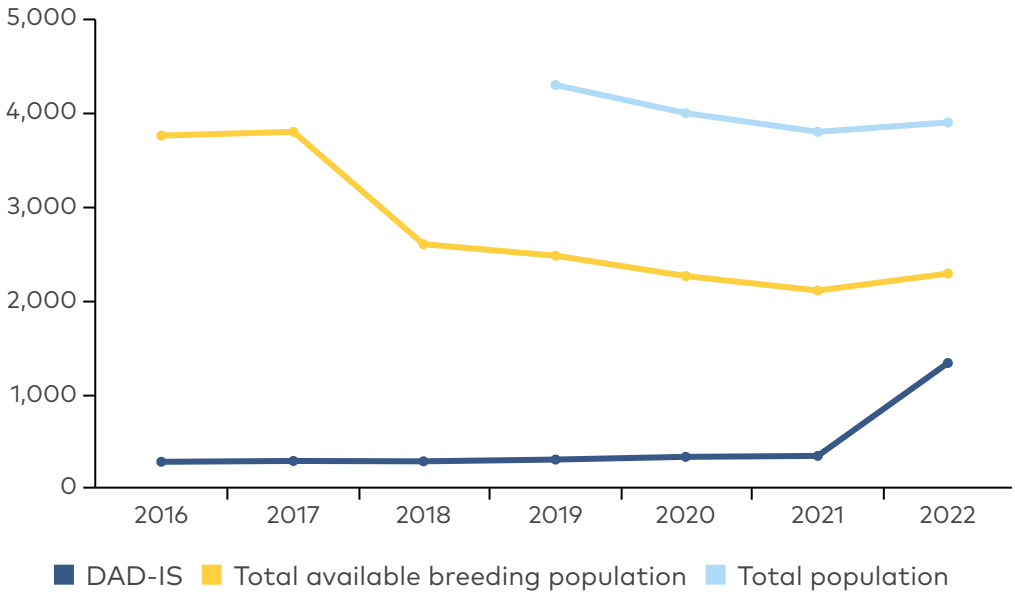


Figure 8B: The population number of the Dole horse. (Norsk Hestesenter, 2023, 2022, 2021, 2020, 2019, 2017, 2016). The figure illustrates the total population of the Dole horse from 2016 to 2022 according to DAD-IS (dark blue) and NHS (yellow and light blue). The definition of total population derived from NHS is divided in two (total population available for breeding (yellow) and all individuals within the population (light blue)).

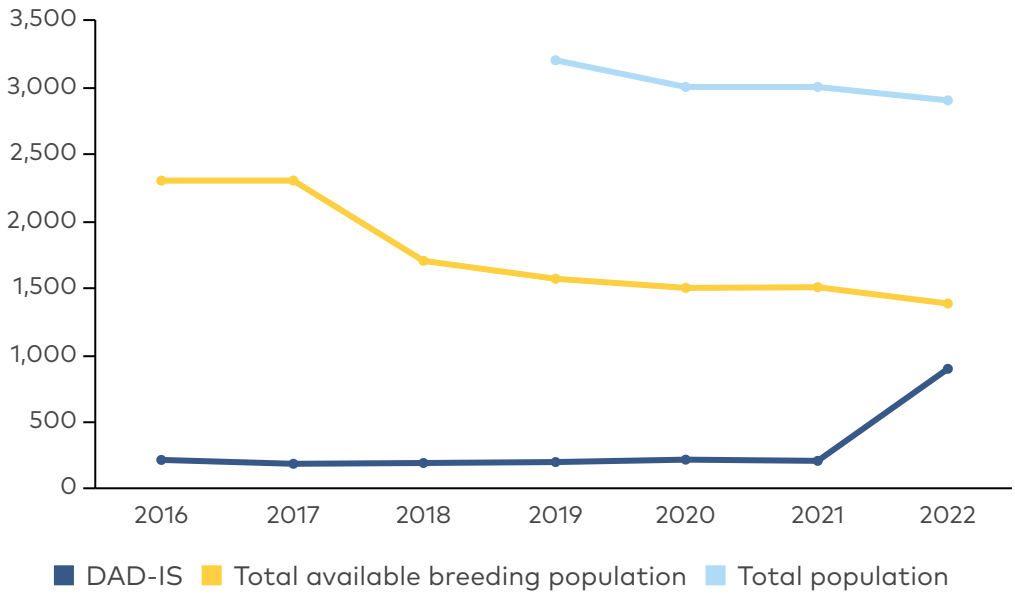


Figure 8C: The population number of the Nordland/ Lyngen horse. (Norsk Hestesenter, 2023, 2022, 2021, 2020, 2019, 2017, 2016). The figure illustrates the total population of the Nordland/ Lyngen horse from 2016 to 2022 according to DAD-IS (dark blue) and NHS (yellow and light blue). The definition of total population derived from NHS is divided in two (total population available for breeding (yellow) and all individuals within the population (light blue)).

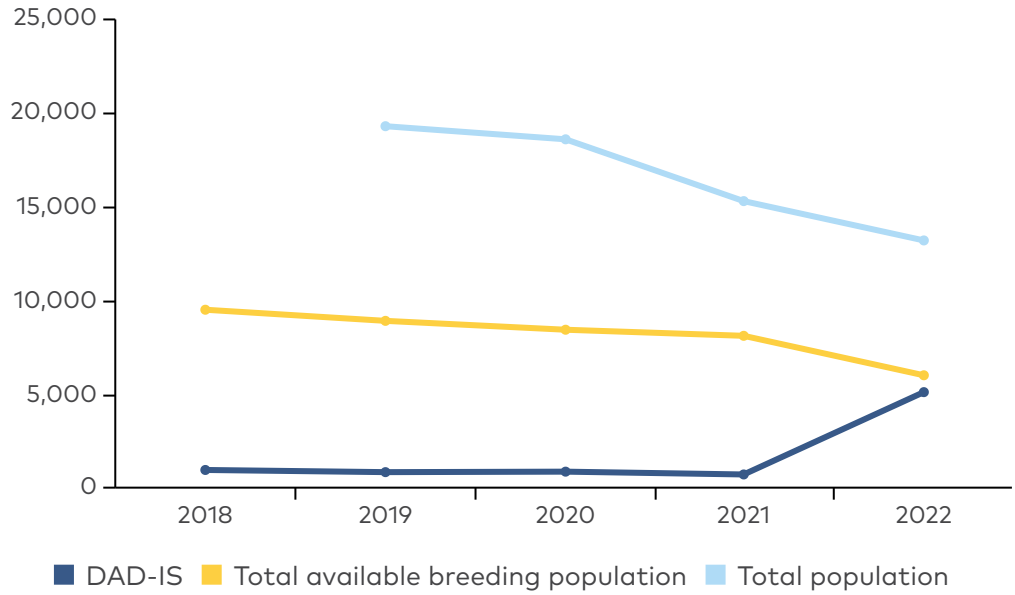


Figure 8D: The population number of the Norwegian Coldblooded trotter. (Norsk Hestesenter, 2023, 2022, 2021, 2020, 2019, 2017, 2016). The figure illustrates the total population of the Norwegian Coldblooded trotter from 2016 to 2022 according to DAD-IS (dark blue) and NHS (yellow and light blue). The definition of total population derived from NHS is divided in two (total population available for breeding (yellow) and all individuals within the population (light blue)).

Commercial horse and breeding activities

The Standardbreds and Coldblooded trotters are the most common breeds in Norway. Trotting is a popular sport in Norway. Breeding and training of the competing horses are part of commercial activities and can generate income for the most winning trotter horses and breeding stallions.

The Norwegian Coldblooded trotter was developed from lighter/faster types of Dole horses and has a lot in common with the Swedish Coldblooded trotter. The Norwegian and Swedish Coldblooded trotters share horses/stallions and collaborate breeding efforts across the borders. Although the population is large, inbreeding remains a concern because of the extended use of "Matador" stallions (i.e., few stallions that produce most of the offspring).

Economy

The equine industry in Norway includes popular trotting races, dressage, jump and other horse sports, riding schools and private leisure and some tourism riding. Most of the economy in the horse sector is driven by servicing the horse owners such as providing horse feed, hoof care, and veterinarian care, but there are also some commercial activities (e.g., within trotting and sporting communities or for riding schools.

Native breeds and conservation programs

There are four native breeds in Norway: Norwegian Fjord horse (Fjordhest), Norwegian Dole horse (Dølahest), Norwegian Nordland/Lyngen horse (Nordlandshest/ Lyngshest) and Norwegian Coldblooded trotter (Norsk Kaldblodstraver). The Fjord, Nordland/Lyngen and Dole horse breeds are considered endangered, while the Coldblooded trotter is considered as vulnerable. The three endangered native breeds are managed by NHS, and their individual breed associations. The Norwegian Coldblooded trotter is managed by the Norwegian Trotting Association (Det Norske Travselskap).

The Fjord, Nordland/Lyngen and Dole horse breeds are small-sized working horses and were traditionally used for farming. They are small compared to other international working horses, which make them ideal for the Norwegian mountain and fjord terrain. The Fjord horse was developed in the west, the Dole horse in the east and the Nordland/ Lyngen horse in the north of Norway. Today the native horses are mostly used for leisure. They are popular with children and for therapy due to their gentle nature. The horses can also be used for sports. There are National Championships for Fjord, Dole, and Nordland/ Lyngen horses, where they compete in different horse sports like jumping, dressage and driving.

Each breed has their own conservation plan. There are also regional horse centres; the Norwegian Fjord Horse Centre (Norsk Fjordhestsenter) on the west coast of Norway, the National Center for Nordland/ Lyngen Horse (Nasjonalt senter for Nordlandshest/Lyngshest) in Northern Norway, and NHS that is also the National Center for Dole Horse in Eastern Norway. NHS publish annual statistics regarding the population development and inbreeding of the breeds. The association also acts as an advisory concerning both inbreeding management and conservation. The responsibility of breeding and registering horses lies within the breed associations themselves.

Gene banking activities

There are no organised national gene bank activities for the native Norwegian horses, but the passport-giving organisations have individually organized agreements with gene banks.

Subsidies

Because native breeds are endangered, there is a need to support breeding of foals and conservation activities for the horses. The three native breeds that are endangered: Nordland/ Lyngen horse, Dole horse and Fjord horse can receive subsidies for young horses less than 3 years of age. Nevertheless, statistics show that only 60% of the young horses that were eligible for subsidies in 2023 received them. The reason for why the remaining horses did not receive them is unknown The Norwegian Horse Center (NHS) is responsible for the conservation of the native breeds, and are provided with subsidies from "Landbruks- og matdepartementet" to preserve the breeds.

Swedish Coldblooded trotter. Photo: Maria Holmén

Gotland pony. Photo: Liselotte Erixon

Swedish Ardennes. Photo: iStock

3.6. Sweden

Background

Horses have had important roles socially, culturally, and economically in Sweden. A changing society has shaped their use: they were first used for meat production, transportation and agriculture, competition and as a resource in the armed forces, and are now used for leisure and sporting events.

During the 20th century, the number of horses in Sweden drastically declined from 700,000 to 70,000. Fortunately, since the 1970, the number of horses in Sweden has grown vigorously. The growing horse sector has become an important part of the economy, and its positive development has made Sweden one of the most horse-dense countries in Europe, and even highest horse density in the Nordic countries with 488 893 horses reported in 2023.

The growth is also reflected by the number of breeders: presently more than 3500 breeders. The biggest increase has occurred in Swedish Warmblood (SWB) breeders with more than 300 new breeders, raising their share to over 37% (HNS Key figure report). Approximately 80% of Swedish horses are kept for hobby purposes and are generally not used for breeding activities. Besides this, most horse breeders have engaged in extensive horse breeding. Of all the breeds in Sweden, more intensive breeding is common in Standardbred trotter, SWB, Icelandic and Shetland pony breeds.

The human-animal relationship is important part of people's well-being. It was reported in 2013 that about one million Swedes had some sort of regular horse activities. Horse riding is also Sweden's biggest recreation and rehabilitation sport[17]. Based on SLU's survey from 2013, horses has been in third place among young people's sport hobbies, after football and indoor bandy.

Organisation and registration of horse breeding in Sweden

The Swedish Horse Industry Foundation (HNS) forms an umbrella for the equine sector and is financed by the Swedish Trotting Association and the Swedish Horseracing Authority through an agreement with the Swedish government. Horse keeping is regulated by the Swedish Board of Agriculture (Jordbruksverket). There are regulations for horses within branches such as animal health and welfare, training, competition, and prevention of doping. Legislation can also regulate the conditions under which horse keeping is practiced – indoors and outdoors.

Identification and registration of horses is regulated by law (Hästpassförordningen (EU) 2021/963). All horses must be registered and get a passport the year they are born (6 months at the latest). The passport must follow the horse throughout its life. HNS reported 19 official organizations and 15 breeding associations responsible for registering and issuing passports in 2020 (in report "Hästar och uppfödare in Sverige åren 2016-2020"). Breeding organizations are also responsible for pedigree recording for the studbook and breeding evaluation of their breeds. Further, transporting horses to Sweden requires registration, as do activities related to semen, ova, and embryos. The semen must come from semen collection stations approved for intra-EU trade.

Horses residing in Sweden for longer than 90 days must be registered in the central horse database. Furthermore, information from breeding associations and organizations that keep records is kept in a database that accessible for the Swedish Board of Agriculture. The database can be searched based on the horse's universal equine life number (UELN) or chip number to see where the horse is registered.

Population statistics

After a dramatic decline, the number of horses in Sweden have increased significantly in the last 30 years. Jordbruksverket reported 355 000 horses in 2019 and 488 893 horses in Sweden in 2023. The Swedish University of Agricultural Sciences (SLU) reported that Sweden is now the second most horse-dense country in Europe (39 horses per 1000 inhabitant). The area with the highest horse-density within Sweden is Gotland, where there are 180 horses per 1000 inhabitants (SLU report 2013:29). Horse companies have an average of 4.7 horses. The total number of all four native breeds is 20 804 horses (HNS Nyckeltal för svensk hästuppfödning under åren 2016-2020). The conservation status of the native breeds can be found in the table (Table 5).

Sweden has reported only 9 horse breeds in the DAD-IS database. The international breeds are the Dartmoor pony, the English Thoroughbred, the Exmoor pony, the Norwegian Fjord horse, and the Shetland pony. The Gotland pony is classified as a regional breed, when in turn the Swedish Coldblooded trotter, North Swedish horse and Swedish Ardennes are classified as national breeds.

Table 5: Status of the four native breeds according to DAD-IS (2023).

Breed	Type	Status	Trend
Swedish Coldblooded trotter (Kallblodstravaren)	Coldblooded trotter	Endangered (breeding females 1380)	Decreasing
North Swedish horse (Nordsvensk brukhäst)	Medium sized, coldblooded working horse	Endangered (breeding females 2500)	Stable
Gotland pony (Gotlandsruss)	Pony	Endangered (2500 females, 250-300 foals annually)	Stable
Swedish Ardennes (Svensk Ardenner)	Medium sized working horse	Endangered (breeding females 700)	Stable

Hästnärings Nationella stiftelsen (HNS) has reported key figures of horses and breeders for more than 10 years. There has been fluctuation in the statistics, but breeding has remained stable. Warm-blooded sport horses dominate numerically. These are used in trotting, galloping, equestrian dressage, jumping, eventing, endurance, driving, working equitation and vaulting. The Icelandic horse is Sweden's fourth most popular horse breed. It is worth noting that the crossbred individuals were the third biggest group between 2001 and 2020.

The magnitude of horse breeding has remained quantitatively at the same level, with approximately 13 000 bred mares per year. The decline caused by the previous economic recession 2009-2013 is still visible, as buyers demand 6-10-year-old horses.

Breed statistics for the native breeds – data discrepancies DAD-IS reporting

The data derived from DAD-IS concerning the Swedish native breeds demonstrated peculiar patterns of population development (Figure 9). For example, for the Gotland pony, the data from DAD-IS suggest that the population has experienced fluctuations with two large declines (late 1990s and early 2000s) and three large jumps (early 1990s, late 1990s and around 2010) in their population (Figure 9A). The number of breeding mares also appear to have some large fluctuations between the early and late 1990s, showing a large jump from approximately 500 to 3000 breeding mares and then a drop from 3000 to approximately 500 breeding mares (Figure 10A). For the Swedish Coldblooded trotter, the numbers have been entered at only three different years for the population and two for the number of breeding mares, which makes it difficult to determine a sensible perspective of the population development. For both the North Swedish horse and the Swedish Ardennes, the population trend appears to follow the trend for number of breeding mares (Figure 9C,D and 10C,D), indicating that similar definitions for population number have been used for these breeds. Nevertheless, the reported data appear to be influenced by discrepancies for all the breeds. This could indicate registration errors for the native breeds and highlights the importance of collecting and reporting correct numbers using the same definitions for population data both within and between the horse breeds.

The overall trends demonstrated from the DAD-IS data do not correspond with the trends that have been expressed by breed associations. For instance, while the data for the breeding mares of the Gotland pony population is depicted as a stable since the 1980's, except for one peculiar jump in number during the 1990's, the breeding association for the Gotland pony reported that the number of foals born was declining in the 1900's, and stable during the 1990's. Similar discrepancies can be noted for both the North Swedish horse and the Swedish Coldblooded trotter. The number of foals born registered for the Swedish Coldblooded trotter is currently in decline, suggesting fewer breeding mares in the population, while the number of breeding North Swedish horse mares is currently stable. This is not illustrated by the data in DAD-IS, as the data indicated increasing trends for both of the breeds (Figure 10).

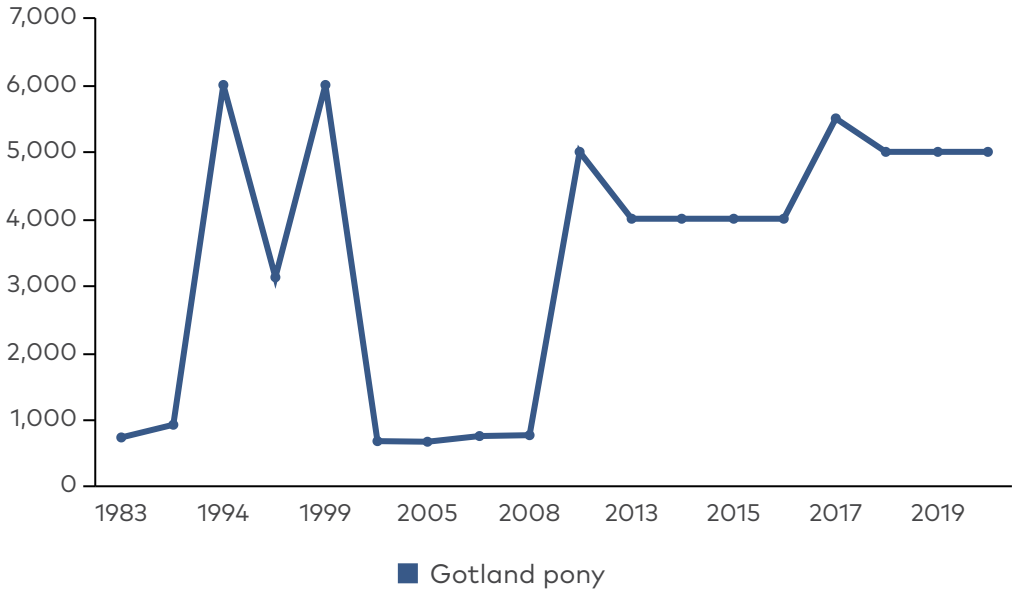


Figure 9A: The population number of the Gotland pony according to DAD-IS reporting between the late 1900's and 2021.

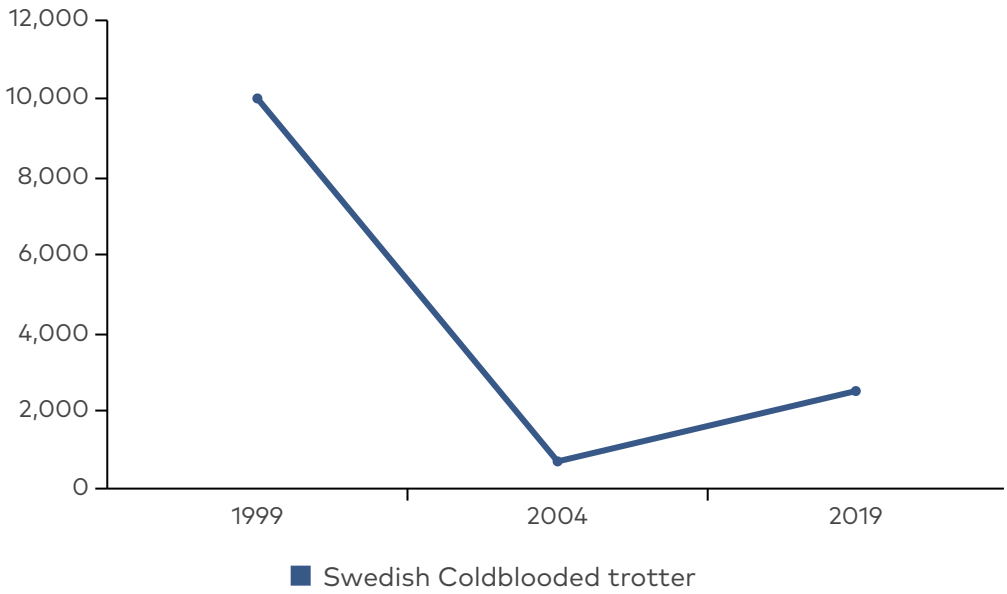


Figure 9B: The population number of the Swedish Coldblooded trotter according to DAD-IS reporting between the late 1900's and 2021.

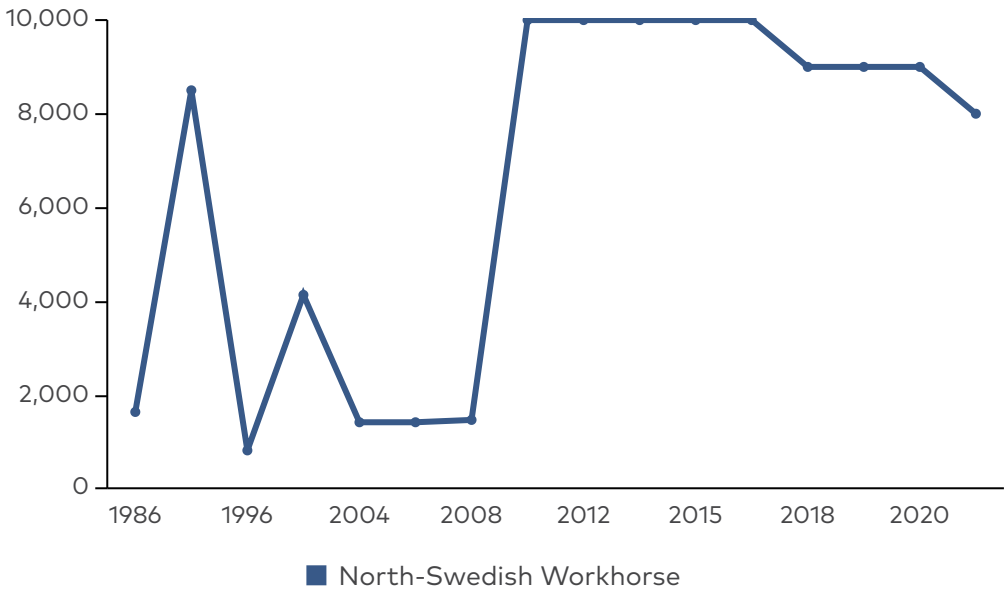


Figure 9C: The population number of the North-Swedish horse to DAD-IS reporting between the late 1900's and 2021.

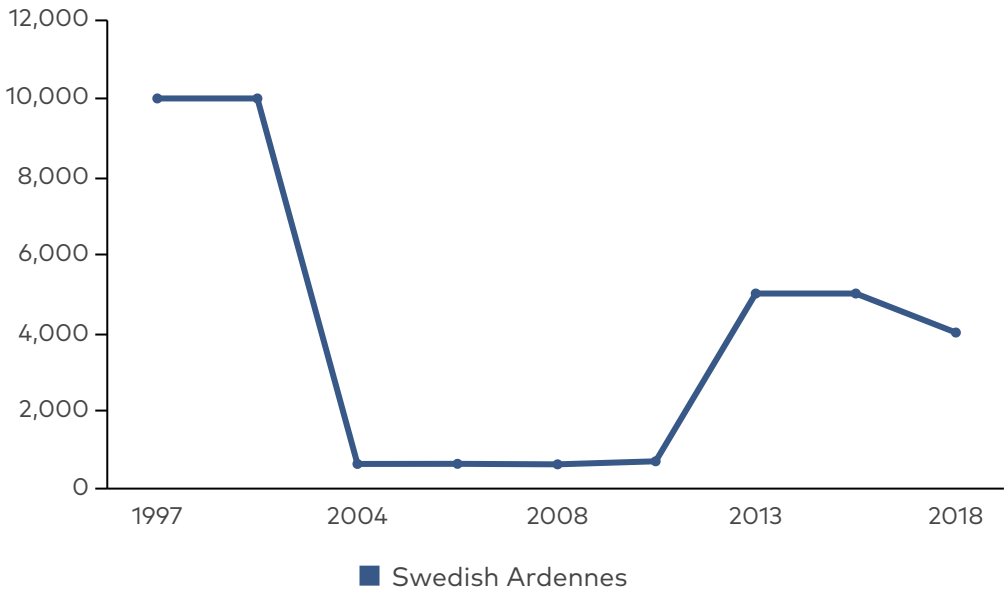


Figure 9D: The population number of the Swedish Ardennes according to DAD-IS reporting between the late 1900's and 2021.

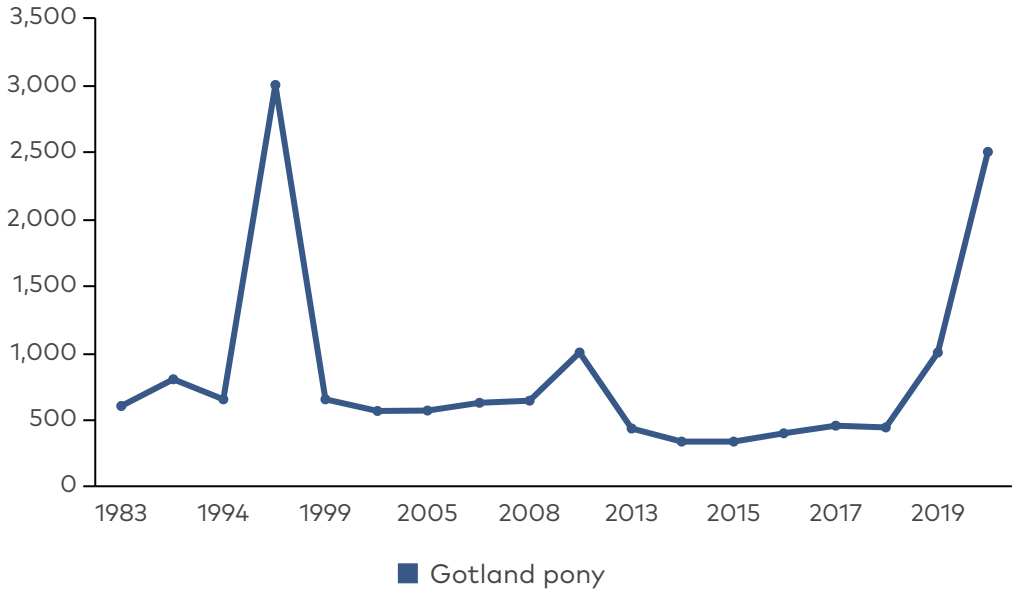


Figure 10A: The number of breeding mares in the Gotland pony population according to DAD-IS reporting between the late 1900's and 2021.

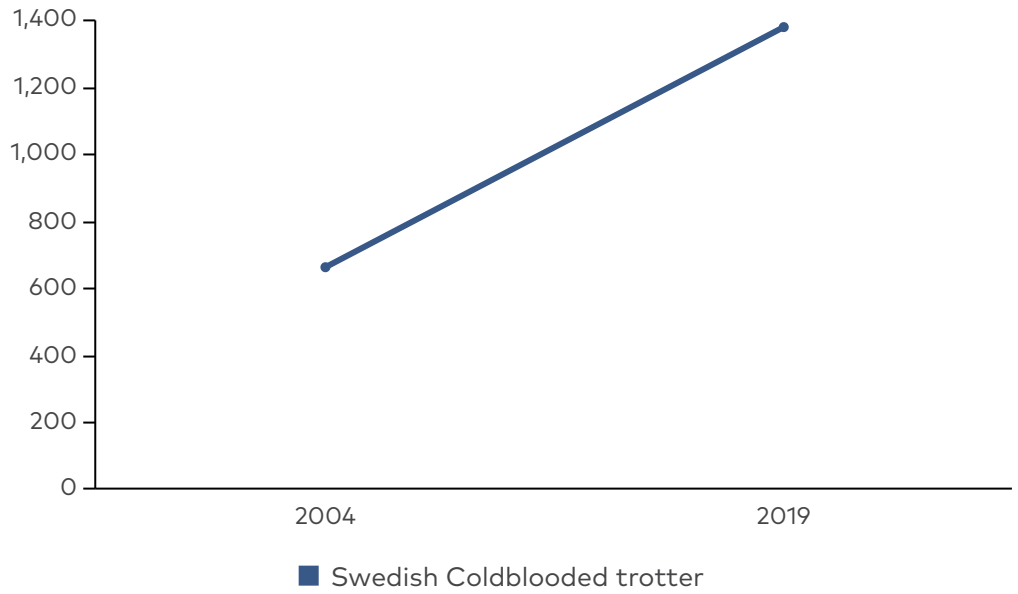


Figure 10B: The number of breeding mares in the Swedish Coldblooded trotter population according to DAD-IS reporting between the late 1900's and 2021.

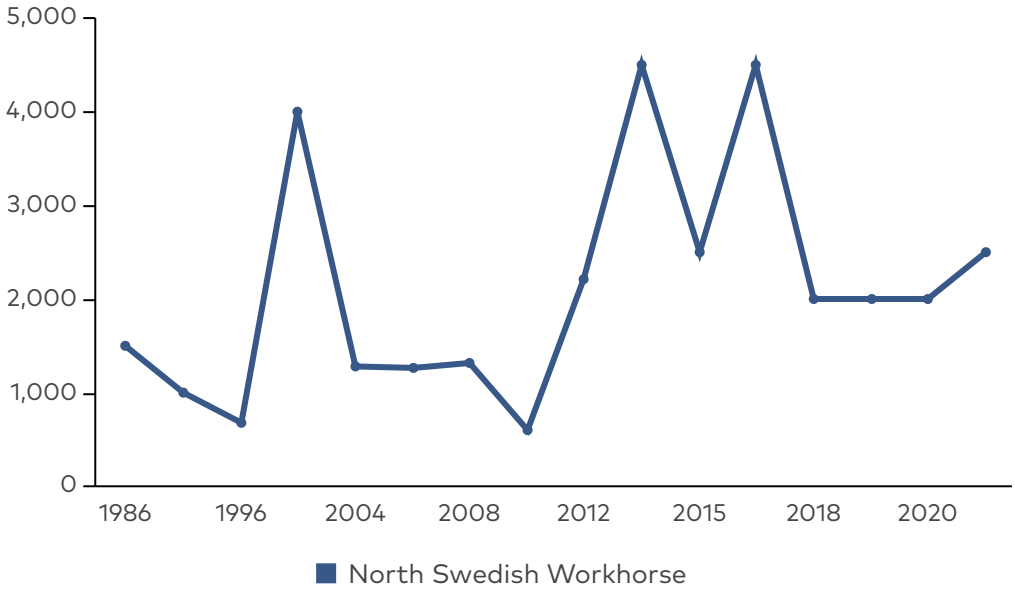


Figure 10C: The number of breeding mares in the North Swedish horse population according to DAD-IS reporting between the late 1900's and 2021.

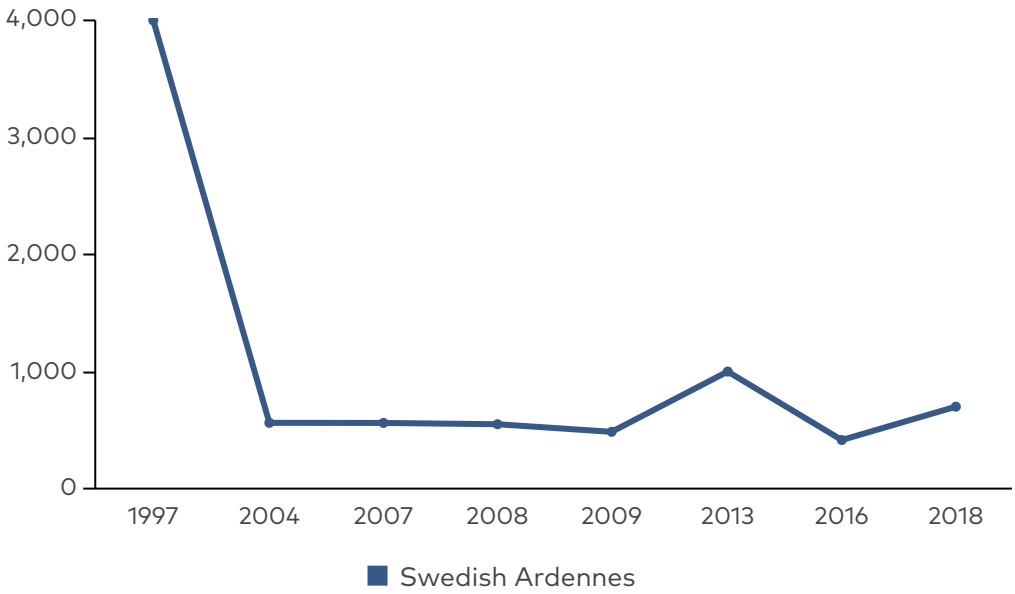


Figure 10D: The number of breeding mares in the Swedish Ardennes population according to DAD-IS reporting between the late 1900's and 2021.

Commercial horse and breeding activities

During the last decades, the number of horses in Sweden has grown exponentially since the 1970s. The growth is also reflected by the number of breeders - presently more than 3500 breeders. The biggest increase has occurred in Swedish Warmblood (SWB) breeders with more than 300 new breeders, raising their share to over 37% (HNS Key Figure Report. 80% of Swedish horses are kept for hobby purposes. More extensive breeding is common in Standardbred trotter, Swedish Warmblood, Icelandic horse and Shetland pony breeds. The most popular breeds are commercial Warmblood, but the third largest category of foals born is classified as crossbreeds.

The use of artificial insemination or natural mating within a breed varies greatly, but AI is common with Swedish Warmblood and Standardbred trotters. Breeds such as the English Thoroughbred and certain pony and coldblooded breeds only use natural mating. In the breeding of Standardbred trotters, semen doses imported from abroad is commonly used in AI.

Among the Swedish Warmbloods, the use of stallions is divided into opposite extremes: ~33.3% of the stallions are used for 10 or more mares, whereas another 30% of stallions are only used for one mare annually. In most native breeds, though, use of stallions is more evenly distributed due to natural mating, but the stallion distribution is variable in the Coldblooded trotters.

Economy

The Swedish horse sector is a large and growing part of the economy. As previously stated, Sweden is one of the most horse-dense countries in Europe. Horses bring an additional source of income to agriculture and have served as one of the reasons why people move to the countryside. The COVID-19 pandemia increased interest in owning horses. Some horses are still used in agriculture and forestry, but most horses are owned for leisure. 20% of horses are used for commercial purposes (e.g., trotting and horseracing, riding schools, and boarding activities). The commercial horse sector has been regarded as a possible contributor to rural development by the Board of Agriculture in Sweden (Jordbruksverket).

Native breeds and conservation programs

There are four native breeds in Sweden: the Gotland pony (Gotlansdruss), the Swedish Coldblooded trotter (Kallblodstravare), North Swedish horse (Nordsvensk brukhäst) and Swedish Ardennes (Svensk Ardenner). Conservation of traditional landrace breeds in Sweden began in the 1970s. The Swedish Board of Agriculture (Jordbrukverket) has the overall responsibility for conserving the native horse breeds. In addition, Jordbrukverket has a Reference Group for animal genetic

resources where representatives of all animal breeds that are listed as endangered are included. The conservation work is conducted in collaboration with breed associations, including the Swedish Russ Breeding Association (Svenska Russavelsföreningen), the Swedish Trotting Association (Svensk Travsport, ST), the Swedish Ardennes Horse Breeding Association, and the North Swedish horse Breeding Association (Föreningen Nordsvenska Brukshästen).

Based on the HNS key figure report for Swedish horse breeding (Nyckeltal för svensk hästuppfödning) there are 559 breeders responsible for the native horse breeds (217 for the Swedish Coldblooded trotter, 135 for the North Swedish horse; 111 for the Gotland pony; 96 for the Swedish Ardennes). In addition to four live native breeds, Sweden has reported two extinct horse breeds in DAD-IS database.

Gene banking activities

According to the DAD-IS database, freezing of semen has been done from the Gotland pony in the early 2010s from 6 stallions. Correspondingly, 127 doses were collected from North Swedish horse and 135 doses from five Ardennes stallions in 2019.

Subsidies

Subsidies for the endangered native horse breeds are provided per foal that is born.

Norwegian Fjord horse. Photo: Ingvild Rydjord Hansen

4. Nordic native horse breed genetics

4.1 Origin and relatives

The available information regarding known origin and the kinship of the different Nordic native breeds is variable, but it appears that several breeds have similar descent (Table 6). For instance, genomic research found that the Finnhorse is closely related to Scandinavian horses (e.g. North Swedish horse, Icelandic horse), the Estonian horse, Mezen horse, Yakutian horse and Mongolian horse. Evidence of genetic relationships between all the native Norwegian horse breeds and Mongolian horses have also been presented. It has also been shown that the Fjord horse is more closely related to the European wild horse (Tarpan) than the Asiatic wild horse (Przewalski) by looking at the number of chromosomes; the Przewalski horse has 66, while the Fjord and Tarpan horse have 64 chromosomes. Similarly, it appears that the Gotland pony is a descendant of the European wild horse Tarpan as well. Further, it is thought that the Icelandic horse is most closely related to the Nordland/ Lyngen horse across all breeds. The Icelandic horse is also related to the Fjord horse, the Faroese horse, and the Shetland pony. Studies have further revealed links between the Icelandic horse and Mongolian horse, which could reflect its relation to the Norwegian horse breeds. A recent whole-genome investigation of the Faroese horse found that they are closely related to other North Atlantic breeds, such as the Shetland pony and the Icelandic horse. Information regarding

descent of the Danish and Swedish horse breeds is more limited. However, the North Swedish horse is believed to have similar descent to the Norwegian Dole breed, while the Swedish Coldblooded trotter descends from the North Swedish horse, suggesting that these breeds also could be related to Mongolian horses. Further, the Swedish Ardennes descends from the Ardennes in Belgium which are thought to descended from the Solutré horse. The Jutland horse share relatives with the Shire and Suffolk breeds, as the stallion Oppenheim (a mix of the breeds) is the ancestor of an important family that sired most of the Jutland population today. Furthermore, the Frederiksborg horse is a founder of the Knabstrupper.

Table 6: The native breeds and their relatives

Breed	Ancestor	Relatives
Icelandic horse	Not confirmed	Most closely related to the Nordland Lyngen horse. Also related to the Fjord horse, Faroese horse, and the Shetland pony. Genetic links with Mongolian horse
Faroese horse	Not confirmed	Closely related to the North Atlantic breeds, the Icelandic horse and the Shetland pony
Finnhorse	Not confirmed	Most closely related to the Estonian horse, Mezen horse, Yakutian horse and Mongolian horse
Jutland horse	The stallion Oppenheim (mix between Shire and Suffolk breeds) – ancestor of Aldrup Mendekal, Prince of Jylland and Høvding (i.e., important founders of current population).	Shire and Suffolk
Frederiksborg horse	Not confirmed	
Knabstrupper	One female (responsible for coat patterns) and one male	Descends from the Frederiksborg horse
Dole horse	Not confirmed	Likely related to Mongolian horses
Nordland/ Lyngen	Not confirmed	Likely related to Mongolian horses
Fjord horse	Not confirmed	Likely related to Mongolian horses and the European wild horse (Tarpan)

Norwegian Coldblooded trotter	The stallion Veikle Balder	Descend from Dole horse, and is therefore also likely related to Mongolian horses
Swedish Ardennes	Not confirmed	Descend from the Ardennes in Belgium which are thought to descended from the Solutré horse
North Swedish horse	Not confirmed	Same origin as the Dole horse, descended from the ancient Scandinavian native horse
Gotland pony	Not confirmed	Believed to be descending from the European wild Tarpan
Swedish Coldblooded trotter	Not confirmed	Descendant of the North Swedish horse

4.2 Transboundary breeding

Several of these breeds are spread out globally and kept in different countries. For example, the Fjord horse and the Icelandic horse are very popular outside of their country of origin. Transboundary breeding could lead to changes in the expression or proliferation of genes to adapt to their environments long term (e.g., heat or sparse vegetation). In theory, this could contribute to spatial genetic diversity within the breed, but it also poses the question to whether environmental factors should be considered during decision-making regarding breeding and conservation plans. Registration and breeding legislation for the different breeds that reside in other countries would be useful to allow deeper knowledge about the breed populations and their spread. The Icelandic horse has the database and studbook of origin, WorldFengur, that registers the pedigree and information about Icelandic horses worldwide. This is a good example of a good solution for a transboundary breed.

4.3 Genetic diversity

Maintaining a high genetic diversity both within and between breeds, is important to ensure sustainable livelihoods of all species, including the horse. Genetic diversity is important for the overall adaptability of an organism. It is important in various sectors, including conservation biology, as high genetic diversity within a population provides individuals with a better predisposition for tolerating stressors such as diseases (e.g., due to the presence of one or more alleles providing resistance

against the disease). In turn, the lack of genetic diversity in a population provides individuals with a poorer predisposition for resilience e.g., if the population is infected by a disease, all the individuals within the population may get infected and die because of poor proliferation of resistant genes. Subsequently, low genetic diversity in a population can lead to extinction. Maintaining a high genetic diversity is also important to avoid problems due to inbreeding.

It is well known that inbreeding has deleterious effects, because it allows recessive genes or alleles to become homozygous (i.e., carry two identical alleles because of common descent from an ancestor). It has been demonstrated that the genome of typical inbred mammals contains four or more loci that are homozygous for deleterious alleles. High rates of inbreeding can cause problems relating to fertility, immune response, birth defects, proliferation of unwanted gene mutations and unwanted heritable diseases.

Maintaining the genetic diversity of a species is not only important between breeds, but also within breeds. The focus in commercial breeding is mainly on performance traits such as speed, endurance, and conformation, which may have negative effects on fertility traits such as reproductive endocrinology and subsequently establishment of pregnancy. Furthermore, commercial breeding, focusing on only a few breeds, contributes to the neglect of older native breeds, leading to the risk of loss of diversity and subsequently risk of extinction.

Older native breeds carry various important features that could become vital in the face of climate change. These include traits such as disease tolerance, adaptability, rate of metabolism, calm temperament, and hardiness. For instance, the Fjord horse has adapted slow metabolism suitable for areas with poor vegetation. Traits relating to commercial/leisure use are also present in the native breeds. For instance, the Icelandic horse is known for its ability to tölt and pace, which is a result mainly from a mutation of the DMRT3 known to be involved in locomotion and gait. This subject is still being investigated, and recent findings suggest that there are other variants that may modify or perhaps even compensate for the «wrong» DMRT3-genotype. Subsequently, neglecting these breeds in favour of modern commercial breeds could contribute to loss of important genetic information.

The Nordic native breeds descend from a few ancestors, and some only have one recognized ancestor (e.g., the Danish Knabstrupper and the Jutland horse). Several of the native horse breeds, including the Icelandic horse, Faroese horse, Gotland pony, Fjord horse, and Nordland/ Lyngen have suffered bottleneck events which have affected the rates of inbreeding in their populations. For instance, the Faroese horse suffered a severe bottleneck event in the 1960s, when only five individuals were alive. This led to a substantial increase of inbreeding in the 1970s that was still high in 1990 and 2004 when 48.2% of the population had an inbreeding coefficient

corresponding to half-sib to full-sib mating and 11.3% had inbreeding coefficient above 30%. The average inbreeding rate in the Faroese horse population is substantially higher than what is reported in other breeds where the average inbreeding is usually lower than 10%. Monitoring for inbreeding provides important information regarding the breeding strategies that are used, and aids in gaining a better perspective of whether the population is stable or not. In Norwegian horse breeds, efforts to reduce increasing inbreeding coefficient have resulted in stabilisation in Nordland/ Lyngen, the Dole horse, and the Fjord horse. The trend is unfortunately still increasing for the Norwegian Coldblooded trotter, which could reflect the necessity to implement new breeding strategies.

Further, modernization of agriculture and the second World War led to decline in the population of the different native horse breeds. Consequently, the current populations of the breeds are small and most of them are categorized as endangered. It is therefore vital to monitor and control the rate of inbreeding to avoid the risks and maintain as much genetic diversity as possible to conserve the breeds.

4.4 Genetic makeup and consequences of domestication

Horses have been subjected to artificial selection for centuries for various purposes including transportation, agriculture, and warfare. At present breeding has mainly focused on breeding horses suitable for leisure and sport activities. Domestication and artificial selection have led to various alterations of in the equine genome. 125 genomic regions that are potentially affected by domestication have been identified. These regions can be classified into two groups: genes involved in physiological adaptations (i.e., genes affecting muscular and limb development, articular junctions, and the cardiac system), and tameness (i.e., genes affecting cognitive functions).

Various of the genomic changes that have accompanied domestication are related to forelimb robustness, gaits, performance, behaviour, and cognitive skills. Coat colour has also been subjected to alterations due to domestication. Several of these traits are linked to neural crest cells, supporting the "neural crest hypothesis for domestication". Mutations in genes affecting the tissues that originate from the neural crest cells have been found to cause several diseases, including lethal white syndrome and stationary night blindness. Genes causing the aforementioned diseases also affect coat colour. In general, modern breeding practices has increased the genetic load in horses and decreased diversity.

4.5 Genetics of the Nordic native breeds

Proliferation of detrimental genes linked to coat colour or other desired traits are not only present in commercial horses, but also occurs in the native breeds. For instance, breeding for the white colour in the Danish Frederiksborg horse allowed proliferation of the autosome recessive lethal white syndrome. Evidence also suggests that the leopard spotting allele in the Knabstrupper leads to stronger predisposition of developing insidious uveitis – consistent low grade inflammation causing damage to the eye. In the Swedish Ardennes horse type 1 Polysaccharide Storage Myopathy (PSSM) is the most common genetic disease. The disease is caused by a mutation of the glycogen synthase 1 gene (GYS1), and manifests as muscle pain, cell damage and muscle weakness, which leads to poorer well-being and performance. This mutation has been identified in up to 87% of draft horse breeds (not present in Fjord horse). Attributes such as slow metabolism allowing the Fjord horse to survive in sparse vegetation can elevate the risk of metabolic syndrome in this breed. Further, they are also susceptible to congenital disorders such as equine degenerative myeloencephalopathy (EDM) which affects the neurological system.

Ossification of ungular cartilages is common in various breeds including Swedish Ardennes, North Swedish horse, Coldblooded trotters and Finnhorses, but the Icelandic horse is thought to have a genetic predisposition for this condition as well. They are also thought to be predisposed to osteoarthritis in the tarsal joints (bone spavin). Both conditions can be associated with injury, pain, and lameness (reduced welfare). Furthermore, studies have concluded that multiple congenital ocular anomalies (MCOA) syndrome is present in the Icelandic horse population, and that MCOA is segregating with the PMEL17 mutation. The PMEL missense mutation is also associated with the silver coat colour, which is a trait that is sought after in breeding. Identifying carriers of this mutation and breeding them with non-carriers would substantially reduce the risk of producing horses with vision threatening abnormalities caused by MCOA.

Equine summer eczema (or insect hypersensitivity) affects various native Nordic horse breeds and has become an important issue in populations of both Icelandic horse and Finnhorse. Summer eczema impairs the welfare of horses and causes substantial financial loss to the owners. It appears to be a multifactorial disease, and occurrence and severity depends on both environment and individual genetic predisposition. Evidence suggests that susceptibility to summer eczema is hereditary and that improved breeding strategies can decrease the risk of developing summer eczema. Nevertheless, since the disease is multifactorial, the influence of genetic predisposition combined with different environmental factors need to be further studied to gain a more comprehensive information. This will prompt improved strategies for prevention and treatment of summer eczema.

In the population of the commercial Norwegian-Swedish Coldblooded Trotter (NSCT), dynamic laryngeal collapse is the most common disorder of the upper respiratory tract. The condition also occurs in other trotter breeds and appears to correlate with anatomic phenotypes, and only occurs when the horse is exercised. A recent study detected a candidate genomic region as potentially important for the expression of dynamic laryngeal collapse, and further investigation within this region would improve our understanding of the underlying biological mechanisms of this disorder in horses.

The Gotland pony, or russ, is the only breed of pony native to Sweden. Photo: iStock

5. Conclusions

The role of horses in the Nordic society has changed over time

Traces of horses in the Nordic countries have been found as far back as 3000-2000 B.C. The horses have had different purposes depending on the country they resided in and the period in history. They have been used for warfare, transport of goods and people, and especially farming and forestry, until the invention of cars and tractors made the need for their work obsolete. Today horses are often considered a hobby animal, but for many people in the Nordic countries they are their livelihood. Some Nordic horses are a commercial success through popularity in gait competitions or trotter racing. However, most of the native horses were agricultural work horses that are now rebranded to therapy assistant animals and leisure horses because of their gentle nature. Use of horses in ecosystem services, such as grazing, and especially in maintaining traditional biotopes important for biodiversity and culture, is increasing.

The Nordic native breeds are in need of conservation efforts

There are 14 horse breeds native to the Nordic countries, of which 10 are considered endangered or critically endangered. These breeds need active conservation measures to safeguard them, but there is hope for the future. Most of the countries provide some subsidies for conservation of the endangered native horse breeds, but not to native breeds that are commercially successful. Some subsidies are provided per foal born, while others are for keeping young horses. The only country that is not providing

subsidies is Iceland. However, as the Icelandic horse is far from endangered, and prosperous worldwide, it is also not needed.

Statistical information concerning the equine sector is insufficient

The commonality between most of the countries is that there is a branch of the government that provide advice regarding breeding, while the breed associations are responsible for carrying out the actual breeding efforts. However, obtaining accurate numerical data on the Nordic native breeds for this report proved challenging. The data is scattered, and the frequency of census data registration varies considerably. Data sources can also provide different estimates, which makes it difficult to assess the correctness of the data. DAD-IS has great potential for impact on decision making, however, several of the Nordic countries have shortcomings in updating the DAD-IS -database.

There is a lack of systematic gene banking of native horse breeds

Overall, there is lack of established gene banking activities for the native Nordic horses. While there is some use of artificial insemination that might lead to storage of semen, there is no regular and methodological sampling of semen or embryos for gene banking storage for most Nordic native breeds. Finland is one of the few countries who have a proper gene bank for their native Finnhorse. Fortunately, establishment of gene banking for the Icelandic horse and Faroese horse have begun. This is especially important for the Faroese horse that is considered critically endangered.

We need to understand genetics to make informed breeding decisions

In addition to the population data, not all phenotypic characteristics of the native breeds have been mapped yet, especially in a cultural and socioeconomic context. Maintaining the genetic diversity both between and within breeds (both commercial and native) is essential for the survival of the different populations in the future. Furthermore, understanding of the underlying genetics of disease and performance traits will result in more informed breeding decisions for both commercial and native breeds.

The equine sector positively contributes to economic growth

The equine sector contributes to economic growth in many of the countries. For example, the sector has contributed to a turnover of 22.5 billion DKK in Denmark. In Finland, estimates of the horse industry's employment impact range from 6,500 to 15,000 person-years. In Sweden, the equine sector is a large and growing part of the economy and the interest in owning horses increased during the COVID-19 pandemia (2020-2022).

Conservation of the native breeds is dependent on private owners and voluntary work

Although most Nordic countries contribute with some form of subsidy or governmental branch responsible for conservation of native horse breeds, most of the concrete conservation work of the native horse breeds is carried out by voluntary private horse owners. Conservation of native breeds, which may not generate as much income as commercial breeding activities, can therefore be an economical burden for those involved. Economic incentives for keeping and using native breeds could lead to positive ripple effects through increased activity in horse enterprises using native breeds, for example in tourism, animal assisted therapy or ecosystem services.

There is hope for the future

The versatility of the native horse breeds means they can be used for various activities, and their mild and patient temperament make them suitable for riding lessons, animal assisted therapy and various leisure activities. Use of horses in ecosystem services, such as grazing, and especially in maintaining traditional biotopes important for biodiversity and culture, is increasing. This has increased the societal interest and significance of the native breeds and gives hope for the future.

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Denmark

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Appendix

A.1 Description of the Nordic Native horse breeds

Denmark

The Jutland horse (Den Jydske Hest)

The Jutland horse is Denmark's national draft horse, developed from a heterogeneous stock of horses existing in Jutland around the middle of the 19th century. Its stud book was established in 1881. British breeds such as the Shire and Suffolk are known to have mixed with the breed. The introduction of the tractor in the 1950s led to a considerable decline in the horse population.

The Jutland horse is a muscular draft horse with a gentle temperament. Nowadays the breed is popular in horse shows and festivals. It is especially remembered for pulling the beer wagons at the Carlsberg brewery in Copenhagen.

The Jutland horse was critically endangered in 1998 when its population comprised of less than 300 horses. In 2003, the Genetic Resources Committee made a big effort to stop the decrease in the number of animals of all the old national breeds. The effort also included the registration of the populations of this breed. The last update of the population size is close to 2000 individuals (2016), changing its status from critically endangered to endangered.

The Frederiksborg horse (Frederiksborg hest)

The Frederiksborg horse is classified as a half-blood, riding- and carriage horse, suitable for leisure riding and sport. The Frederiksborg horse has been used both for riding and as a carriage horse. Despite there being three native breeds in Denmark, the Frederiksborg is described as the national horse of the country.

The Frederiksborg horse was founded in the 16th century, by the Danish kings, Frederik II and Christian IV, who collected the best horse material from the European royal stables of that time. Their specific aim to create the best horse led to the foundation of the Frederiksborg horse. The studbook of this breed was kept very carefully since then, which makes the studbook of the Frederiksborg horse the oldest record of a domestic animal in the world. It is because of these kings' breeding efforts that the Frederiksborg horse is the world oldest pedigree domestic animal breed.

In the 18th century, the horses of the Danish kings were popular throughout Europe for their noble blood and elegant forms. In the 19th century, the breed was left to drift, and a lot of the original material was replaced by imported foreign breeds. The breeding material was sold to local farmers, and the breed became a farmer's horse at the end of the 19th century. Crossbreeding with other breeds, such as the Jutland horse, was used to improve the Frederiksborg farm horse.

Intensive selection for colour phenotypes led to the proliferation of a lethal gene in the population. The gene is responsible for white born horses and is referred to as "Frederiksborger Lethal White". The gene is lethal for embryos that are homozygous for the gene which explains why it previously appeared as low fertility.

The Frederiksborg horse has a purebred conservation programme. However, the breed association accepts controlled crossbreeding to manage the risk of inbreeding. The conservation programme was first initiated in 1997, and in 2003, the Genetic Resources Committee made a big effort to stop the population decline. The effort also includes the registration of the populations of this breed.

The population is conserved by private breeders and controlled by the market. The number of foals born since the financial crisis in 2008 has been between approximately 35 and 60, as opposed to 150-200 in the 1990s. The trend is increasing.

The Knabstrupper horse (Knabstrupperhesten)

The Knabstrupper horse origins at the Knabstrupgaard at the beginning of the 1800s. A single Spanish mare "Flaebe" is considered as the ancestor of the Knabstrupper population today. Flaebe was unusual in colour – deep red with snowflake patterns and a white mane and tail. The breed is described as lively, friendly, sociable, and cooperative in nature, and is known to be hardy and healthy, and tolerable against disease. Furthermore, the Knabstrupper is also known for its appreciable speed and endurance.

Intensive breeding let to regression of the spotted appearance associated with the breed. Further, bad luck combined with inbreeding problems weakened the breed. Since then, crossbreeding has aided in counteracting the rate of inbreeding and population decline. In 1947, the first association promoting the Knabstrupper horse was founded. Later, a country-wide breeding organization was established in 1971. At that time, the only criteria for breeding selection were spotted appearance resulting in crossbreeding with breeds like the appaloosa breed. Other crossbred breeds were Danish warmblood breeds such as Trakehner and Holstein and Frederiksborg horse.

According to the breed association, the number of livings Knabstrupper horses is currently around 2400 animals. The association reports that 90-116 foals are born annually. In addition to Denmark, the breed is also found in Australia, Germany and Italy based on DAD-IS (299 individuals in total). The Danish Agriculture Agency grants support to purebred foals[17].

17. https://lbst.dk/landbrug/genetiske-ressourcer/husdyrgenetiske-ressourcer/genbanken

Faroe Islands

The Faroese horse (Føroysk ross)

The Faroese horse is the only native horse breed from the Faroe Islands. The breed is hardy and adapted to the Faroese climate. It is smaller than the Icelandic horse, but larger than the Shetland pony. Its friendly nature makes it well suited for children and therapy riding, but the horse is also suitable for landscape management. Unfortunately, the breed is classified as critically endangered as there are only 82 Faroese horses left (April 2024). Of these 82 horses, there are 31 potential breeding mares, and only 2-10 foals are born annually. For the status of the breed to improve from “critically endangered” to “endangered”, the number of breeding mares needs to increase to 300.

Finland

The Finnhorse (Suomenhevonen)

To be accepted in the studbook, the horses of each line need to meet certain section-specific criteria that include size, conformation, performance, gaits, health, and behaviour. Suomen Hippos has defined the criteria for different breeding lines. In accordance with the breeding goal, the:

- **trotters** are athletic and muscular. They have a well-proportioned head and an upright positioned neck. Their body is round and has a strong loin and croup hind end. The movements of the trotters are rhythmic and regular. By nature, they are utterly competitive.
- **draft horses** have a strong build. They have a long and deep body, sloping shoulders, and a good wither position. The draft horses are wide from the point of shoulder and croup and have a strong loin and croup. The draft horses' movements are regular and forward going. The draft horses are hardy by nature. The genome of Finnhorse mare (draft horse section) has been annotated as a reference genome as the first coldblooded equine genome in the world (Pokharel *et al.*, 2023).
- **riding horses** are athletic and competent. They have a well-proportioned head and an upright positioned long neck, a good topline, and a strong loin and croup. The strides of riding horses are even and flexible. Under saddle, the riding horses can shorten and lengthen the stride in all gait disciplines. On obstacles, the riding horses have good capacity and jumping technique and are brave, but cautious. Riding horses have a natural ability to carry themselves in good balance and are forward going by nature.
- **pony-type horses** are small in all respects. The height at the withers and croups of pony-type horses are 148 cm or less. They have an expressive head, an upright positioned long neck, a good topline, and a strong loin and croup. The pony-type horses' gait types are flexible and forward going. Under the saddle, the pony-type horses can shorten and lengthen the stride in all gait disciplines. The pony-type horses have an innate ability to carry themselves in good balance. They are versatile and high performing. By nature, they are forward-going, and cooperative.

Iceland

The Icelandic horse (íslenski hesturinn)

The Icelandic horse is believed to be established based on horses brought to Iceland during the settlement 1100 years ago. The closest relatives appear to be the Nordland/ Lyngen, but the breed is also related to the Norwegian Fjord horse, the Faroe Islands horse, the Shetland pony and the Mongolian horse. Considering the value of horses for transportation as well as the long journey across the Atlantic Ocean on small ships, it is likely that the settlers picked strong and sturdy individuals to fund their future herds. For centuries the horse was the primary means of transportation in Iceland. The harsh weather conditions have without a doubt shaped the stock significantly. Records show that the population of the Icelandic horse has fluctuated quite dramatically. The most dramatic decline in the population size was during the Laki volcanic eruption in 1783-84, when the number of horses reduced from 33000 to 8500. Fifty years later, in 1835, the population had grown to 36000 individuals.

The Icelandic horse has served well as a draft horse since the 1800 and was bred as such until the mid-1900s, when materialization took over. The invention and use of tractors led to a considerable decline in the horse population. Organized breeding programmes were established in Iceland in the early 1900s when coordinated horse shows were initiated. Today, the breed has become a highly popular riding and gait competition horse, and selection is based on defined breeding goals. The most unique characteristics of the Icelandic horse are the great colour variation and its versatility with regards to gaiting ability; possessing five gaits; walk, trot, canter, tölt and flying pace. The smooth gait, tölt, has become a well-known quality symbol of the Icelandic horse and greatly contributes to its popularity worldwide.

Norway

Norwegian Fjord horse (Norsk Fjordhest)

The Norwegian Fjord horse, previously referred to as Vestland Fjord horse, originates from the fjord areas in western Norway. The Fjord horse is easy to feed, hardy and sure-footed in the terrain and is therefore well-adapted to variable landscapes. Due to its strength and steadiness, the breed proved highly valuable for transporting important goods through the mountains and along fjords in the early to mid-1800s when the road structure in western Norway was poor. During the 20th century, the Fjord horse was bred purely on the dun colour that is an important breed characteristic even today.

At the initiative of the Royal Society for the Welfare of Norway (Norges Vel), the first stud book for Fjord horses was published in 1910. The Fjord horse is a versatile horse with many uses. Today, the breed is mainly used for riding, leisure, and sports, but its versatility and calm nature has also proved useful in riding school, for therapy riding and working as well. Based on a systematic study conducted by NordGen (Kierkegaard et al., 2020), 23 easily accessible studies were found that included the breed until 2019. This makes the Fjord horse the most characterized horse breed in Norway.

The Fjord horse is the Norwegian national horse breed that has the largest populations outside Norway's borders (in Denmark, Sweden, Belgium, the Netherlands, Germany, and the USA). In Norway, there are about 5800 Fjord horses, with an estimation of 80 000 Fjord horses worldwide. The annual Norwegian Championship (NM) for Fjord horse is a combined competition where the purpose is to promote the versatile use of the Fjord horse. To emphasize the versatility of the team, the competition consists of various riding and driving exercises. In addition, the award of "Best Young Fjord horse (BUF)" was created to promote young horses. The first NM in Fjord horses was held in 1986. At the end of the 90s, the week surrounding the annual NM for Fjord horse evolved to include extra open classes – increasing public interest and prolonging the competition to last between 5-7 days. This week could be referred to as "the NM week" and has now become a horse festival. The NM in Fjord horses is one of the largest horse competitions in Norway and is becoming increasingly popular with up to 150 participating teams.

The Dole horse (Dølahest)

The Dole horse is a healthy, functional, medium-heavy horse with good working abilities, which is known to be strongly built, versatile, reliable, and calm. The breed originated in Gudbrandsdalen and in the east of Norway in general. The breed was established in 1857 and was bred specifically for agriculture and forestry and transportation. Today, the Dole horse is used as a sports and leisure horse, but it is

still used as a workhorse in agriculture and forestry as well.

The Nordland/ Lyngen horse (Nordlandshest/ Lyngenhest)

The Nordland/ Lyngen horse is a highly versatile breed that has not only been used for all kinds of farm work, but also as a carriage and riding horse. It is strong enough to carry an adult rider and is suitable in size and temperament for children and adolescents. The first known and documented exhibition where this breed participated was in 1898 at Lyngseidet in Troms. The organized breeding of Nordland/ Lyngen horses started in the 1930s. At that time, the population was located in the northernmost counties with the main population along the Lyngenfjord in Troms. The breed was recognized by the ministry in 1968, and the first stallion was registered in a studbook in 1969.

The breed has been called Lyngen horse or Nordland horse depending on where in the country it has been, but in 1998 it was decided that the official name is Nordland horse/ Lyngen horse. Nordland/Lyngen horses are well suited for competitions and compete in all riding and driving disciplines. The breed is also suitable for tourist riding and as a pack horse. There are currently about 2300 horses of the breed in Norway.

The Norwegian Coldblooded trotter (Norsk kaldblodstraver)

The Norwegian Coldblooded trotter is a hardy, versatile and strong horse breed that has a common origin with the Norwegian Dole horse. The stallion Veikle Balder, born in 1849 at Korsvoll Dovre, is considered the ancestor of the Norwegian Coldblooded trotter. This stallion left a strong impact on horse breeding and can be found in the pedigree of almost all coldblooded trotters today.

Over time, the Norwegian Coldblooded trotter has been refined into a lighter breed to improve both its speed and agility, and its main area of use is trotting. Trotting is the oldest organized sport in Norway. The first known trotting races were organized in 1832, and in 1875 the Norwegian Trotting Association, Det Norske Travselseskap (DNT) was founded.

Although the breed is bred for a specific area of use, its versatility makes it well suited as a leisure- and competition horse in other riding and driving sports. The Swedish and Norwegian Coldblooded trotters are closely related, and the countries established a cooperation agreement regarding breeding and racing for the Coldblooded trotter in 2000. DNT has 11 federations and 162 local associations spread across Norway. The DNT committee comprises of 6 members, and 3 deputy members chosen by the general assembly of DNT. At present there are approximately 12 000 coldblooded trotters in the country. Veikle Balder, an interest organization that works to safeguard the coldblooded horse is one of DNT's collaborating organisations.

Sweden

The Gotland pony (Gotlandsruss)

The Gotland pony is a robust popular family pony, used for various purposes such as riding, working, and trotting. It is one of the oldest horse breeds in Europe. For over thousands of years, the breed has adapted to life in Gotland, where horses still graze as a seminatural condition. In appearance, it resembles the Polish Hucul and Koni breeds as well as British Exmoor pony.

The breed shows great endurance and is considered highly disease resistant, making them popular for working and competition purposes. High endurance and robustness are favourable traits which will become more significant with the present issues of climate change and the continuous evolution of diseases.

Although the Gotland pony is one of the oldest Swedish horse breeds, few studies exist concerning its socio-cultural significance. Many Gotland ponies are born on Gotland where they are kept in large herds on the Lojsta heath. During the last 5 years, the population has been stable (approximately 5000) – the reported mares in Sweden is about 2500 (2020), and approximately 250-300 foals are born. Responsibility for the practical breeding work lies with the Swedish Russ Breeding Association (Svenska Russavelsföreningen – www.gotlandsruss.se). The association is also invested in spreading knowledge about the breed.

The Swedish Coldblooded trotter (Kallblodstravare)

The Swedish Coldblooded trotter descends from the lighter line of the North-Swedish horse, which, in turn, descend from the Nordic landrace horse 2000-3000 B.C. It is probably the oldest trotting breed in the world. Together with the Norwegian Coldblooded trotter and the Finnhorse, the Swedish Coldblooded trotter forms a group of the world's coldblooded trotters. The native breed history is in many ways the basis for trotting as a sport in the Nordic countries. Its ability to walk and trot became particularly important in the Nordic climate with the invention of the sled. The versatility of the breed has also made it appreciated in equestrian and driving sports.

Phenotypic traits, genetic diversity based on pedigree data, and molecular genetic diversity within and between breeds of Swedish Coldblooded trotter have been characterized in a reasonable extent. Inbreeding has also been calculated within the framework of research at SLU and NMBU with the Swedish Trotting Association (ST). However, there are no studies that have examined the socio-cultural significance of the breed.

The breeding evaluation of stallions considers various factors, including breed type, health status, performance, breeding index, degree of inbreeding, and the relationship between the stallion and the population. Swedish and Norwegian Coldblooded trotters have cooperated in breeding work across borders since 2000 and currently share a common breeding program. The purpose was to improve the situation of the Swedish Coldblooded trotter, but the introduction of the Norwegian Coldblooded trotter into breeding did not yield the desired results as Norwegian stallions now dominate the populations of coldblooded trotters. Further, inbreeding has increased more rapidly in the Swedish part of the population during the recent years.

The Swedish Board of Agriculture has listed the Coldblooded trotter as a breed that Sweden is responsible for, but it is not categorised as endangered. This is different from the risk status it has in DAD-IS, where it is listed as endangered, which reflects upon the necessity to correctly report numbers into DAD-IS. Today, there are about 12 000 Coldblooded trotters in Sweden. Measures have been taken by the Swedish Trotting Association to prevent population decline (about 15% since 2000) through the redistribution of breeding funds, foal subsidies and the design of the competition system.

The North Swedish horse (Nordsvensk brukhäst)

The North Swedish horse is a medium sized, coldblooded working horse. The North Swedish horse derives from the crosses of local horses in the Swedish mainland, and is described as a dependable, calm, and durable breed. The official breeding association was established in 1924. Prior to this, the breed had had a long history as a human companion: The horse has been illustrated both as a riding horse and draft horse in the petroglyphs from the Bronze Age. After the invention of the harness in the 8th century, the horse was used to pull heavier loads, and as the trade between Norway and Sweden increased, it was this breed that was largely used to transport goods both within Sweden and across the border to Norway.

The industrialization led to the utilization of larger machines and therefore required heavier working animals. Subsequently, different European heavier breeds were imported and crossbred with local breeds. The Ardennes breed in the south of Sweden became most suitable for this kind of heavy work. In the northern regions, however, the North Swedish horse became an asset, because its characteristics were more valuable in smaller agricultural sites. The number of mares in Sweden is approximately 2500, and approximately 420 foals are born annually. North-Swedish horse stallions have been used to mate the Norwegian Dole Horse mares.

The Swedish Ardennes (Svensk Ardenner)

The Swedish Ardennes is described as medium sized working horse. The Ardennes horse has a relatively short history as a native breed in Sweden, as the first horses were imported from Belgium (the origin of the Ardennes breed) in the 1870s. The imported horses were small and durable, and thus suitable for war conditions. After being introduced to Sweden, Ardennes horses were used to cross with local horses, which resulted in stronger working horses for pulling heavy machinery, especially in southern and central Sweden. Unfortunately, the Swedish Ardennes population declined due to the modernization of agriculture and is currently classified as endangered. The number of mares in Sweden is 700 (2018).

Five full generations of Ardennes are required for registration in the studbook, in which case all parents are registered in the studbook. In addition, it is also required that the stallion is DNA tested and that previous matings and foals are registered to ensure that no harmful defects are inherited.

A.2 Questionnaire

The following questions were sent to contact persons in the horse sector for each Nordic country.

1. Which organisations/government branches regulate horse keeping and breeding in your country?
2. What laws regulate horse breeding and horse registration in your country?
3. Which organisations are certified for giving out EU horse passports?
4. Is there a national registry for all horses in the country? Or what type of registration exists?
5. Total number of horses in the country
6. Number of imported horses per year?
7. Number of exported horses per year?
8. Number of horses per breed type?
   - Native horses (number of horses per breed)
   - Other breed categories (warmbloods, trotters, ponies etc.) (Number of horses per category)
9. Number of foals born per year in the country?
   - Per breed category if possible
10. Is there a national conservation program for the native breeds? If so: how is it organized
11. Do you have a cryo /gene bank conservation program for the native breeds in your country? If so: how is it organized
12. Does your country have subsidies for the keeping of native breeds? If so, how much and how is it organized?
13. Which laws and regulations are regulating the conservation program and the keeping of native breeds in your country? For example, is there any regulation for protecting native breeds?
14. How many commercial horse breeding organisations are there in your country?
    For example: Stud farms, breed association or similar
15. Which breeds are mainly represented in commercial horse breeding activities?
16. Is breeding of sport horses mainly within country or mainly import?
17. How is breeding and registration of horses financed? Can you give approximate numbers of cost/budgets? (government funding, sponsors, fees etc)
18. Is there any additional information or links that you could provide to complement this information? (reports, etc.)

19. If you are not able to provide the necessary information from this questionnaire, could you please direct us to a contact person that might be able to answer.

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NordGen

The Nordic Genetic Resource Centre (NordGen) is the Nordic countries' gene bank and knowledge center for genetic resources. NordGen is an organisation under the Nordic Council of Minister and works with the mission of conserving and facilitating the sustainable use of genetic resources linked to food, agriculture and forestry.

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