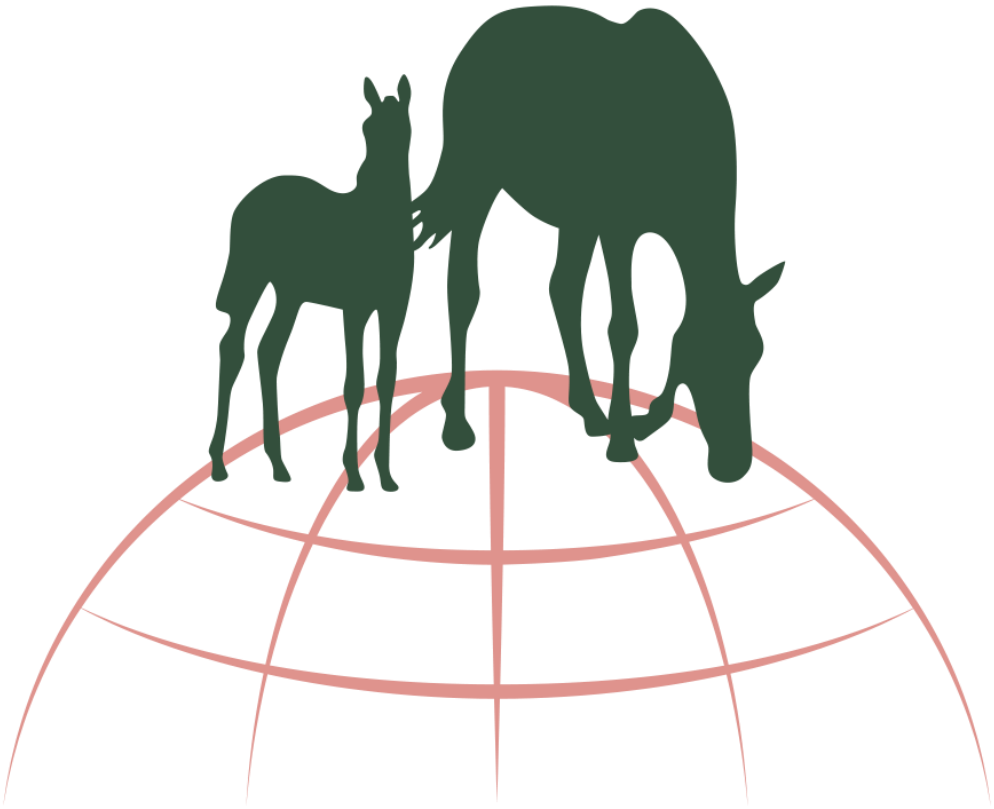
WBFSH



STATE OF THE INDUSTRY 2022-2023

KATY HOLDER-VALE & RENAI HART Development Department

OBJECTIVE

Our objective for the State of the Industry 2023 report is to create constructive and productive engagement between WBFSH, through its member studbooks, their member breeders, the FEI and National Federations, and through to the riders. This starts first and foremost by obtaining and recoding the correct current data that can be used in more meaningful and beneficial analysis. We want this report and those in the future to help to make our industry more of a success for everyone that shares our love of horses.

QUICK LOOK

Statistics
Data from 86 Studbooks members has contributed to a statistical look at WBFSH around the world.

Conditions
A literature review of four conditions breeders need to consider, Shivers, Fragile Foal Syndrome, Polysaccharide Storage Myopathy Type 1 and Type 2.

Animal Welfare – Spotlight on Weaning
An insight into past and current weaning practices and how breeders can manage their weaning techniques to enhance horse welfare.

Social Licence
The importance of having a Social License to Operate (SLO) is at the forefront of WBFSH. Glancing into other industries and their findings can assist in the development of a robust SLO for WBFSH.

Introduction

WBFSH President
Jan Pedersen

The State of the Industry 2023 report not only provides a summary of the activity in sport horse breeding today but also a look into current issues in our industry. This can provide a prompt of how, together as a whole, we can address issues of the future. We hope that this report will be able to provide a starting point to bigger discussions for the longevity of our industry.

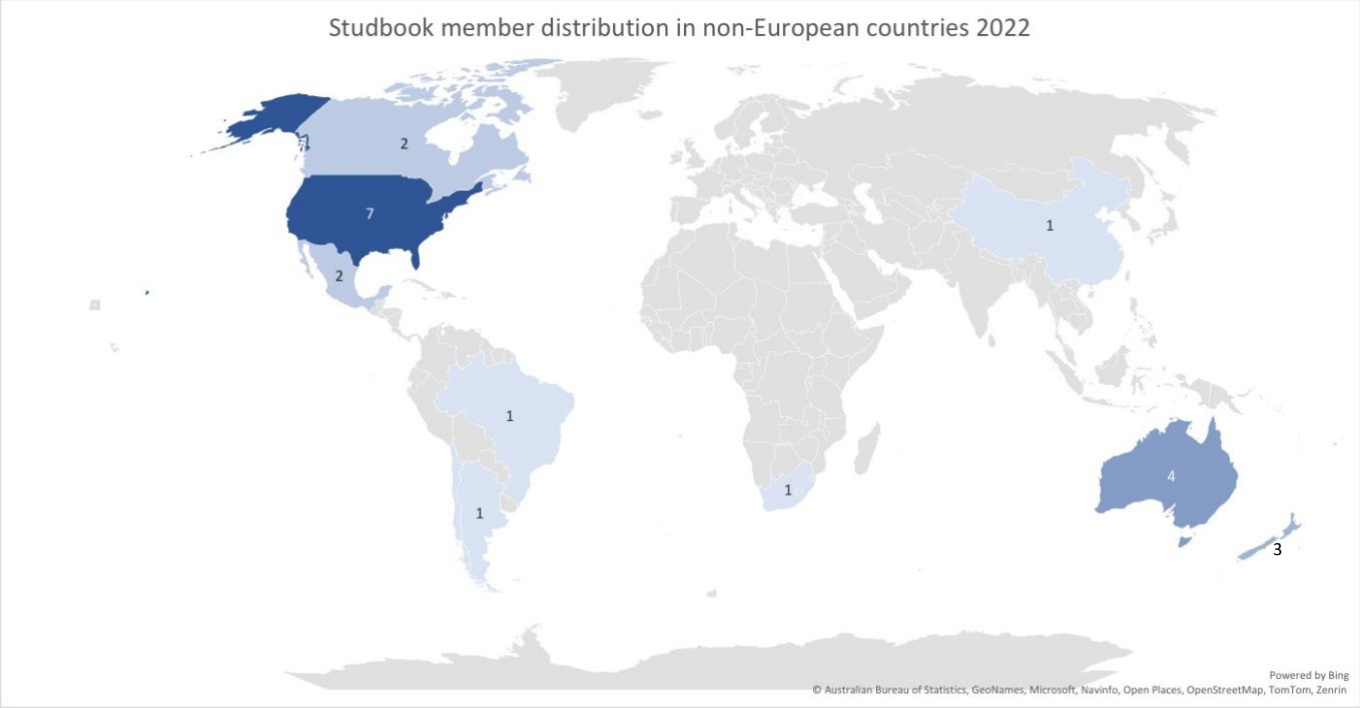
Executive Director and Vice President of the Department of Development
Katy Holder-Vale and Renai Hart

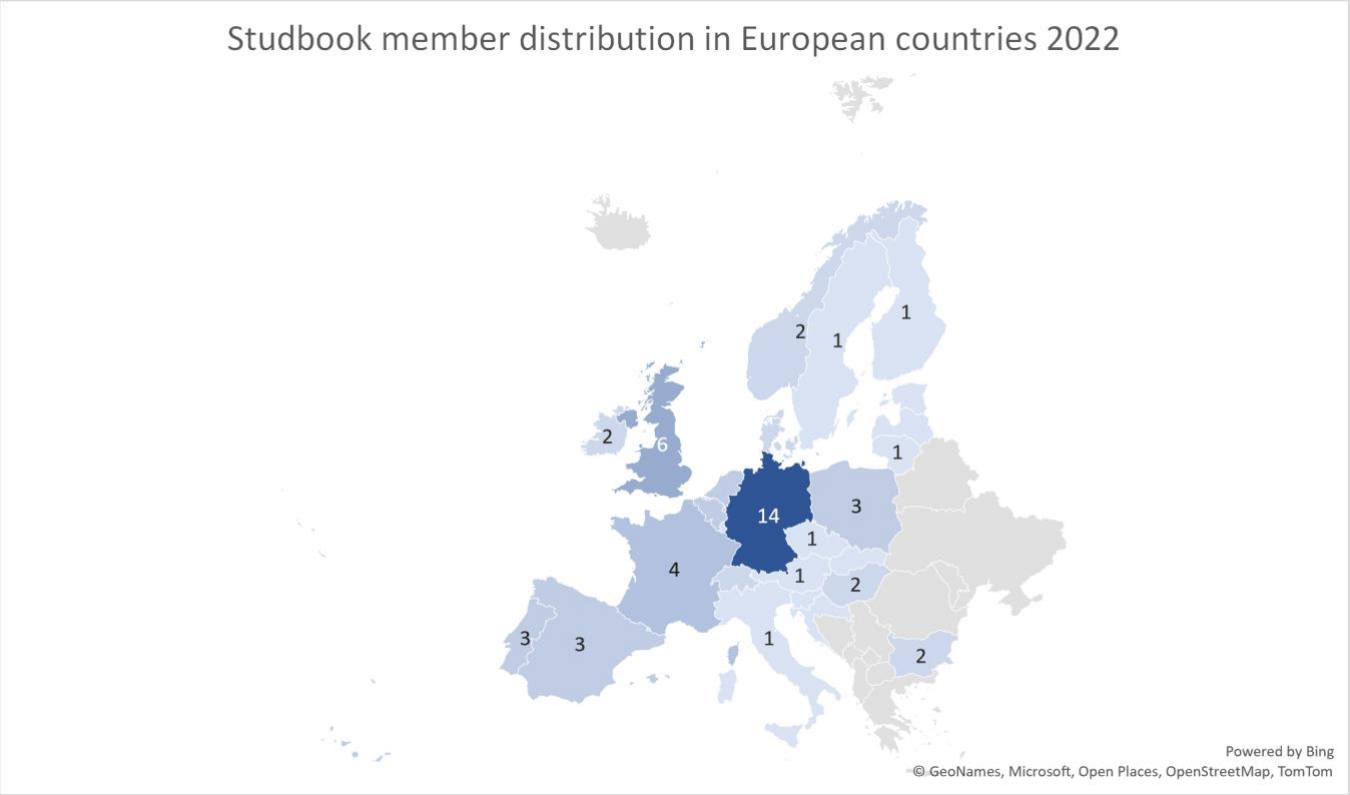
The State of the Industry report looks at where horse breeding is going in the future throughout the world. This 2023 report looks at current scientific studies that we feel may be important to our breeders. We found it reassuring that the collated statistics also show stability in numbers and each year we get more returns from the studbooks, so the numbers give us a realistic picture of the sports horse breeding industry. With the changing climate of social licensing in sport our department has initiated a big project with a scientific department of a UK university to put together a guide on Best Breeding practice that we forecast to be released by the end of 2024. We hope you will find this year's report interesting and next year we plan to be looking at the new developments in breeding techniques.

STATISTICS

Studbook distribution

2022 data was returned from 86 Studbooks, spread across 36 countries. The highest concentration of studbooks is in Germany with 14 Studbook members. Six WBFSH members are associate members. All except 1 studbook utilise the UELN code system (as per data collection of the 2022 Annual Member reports). At the GA-2022 it was agreed that the use of the UELN should be mandatory. This has since been included as an update of the Statutes. Graphs - Studbook member distribution in non-European countries 2022 (n=86), Studbook member distribution in European countries 2022 (n=86).



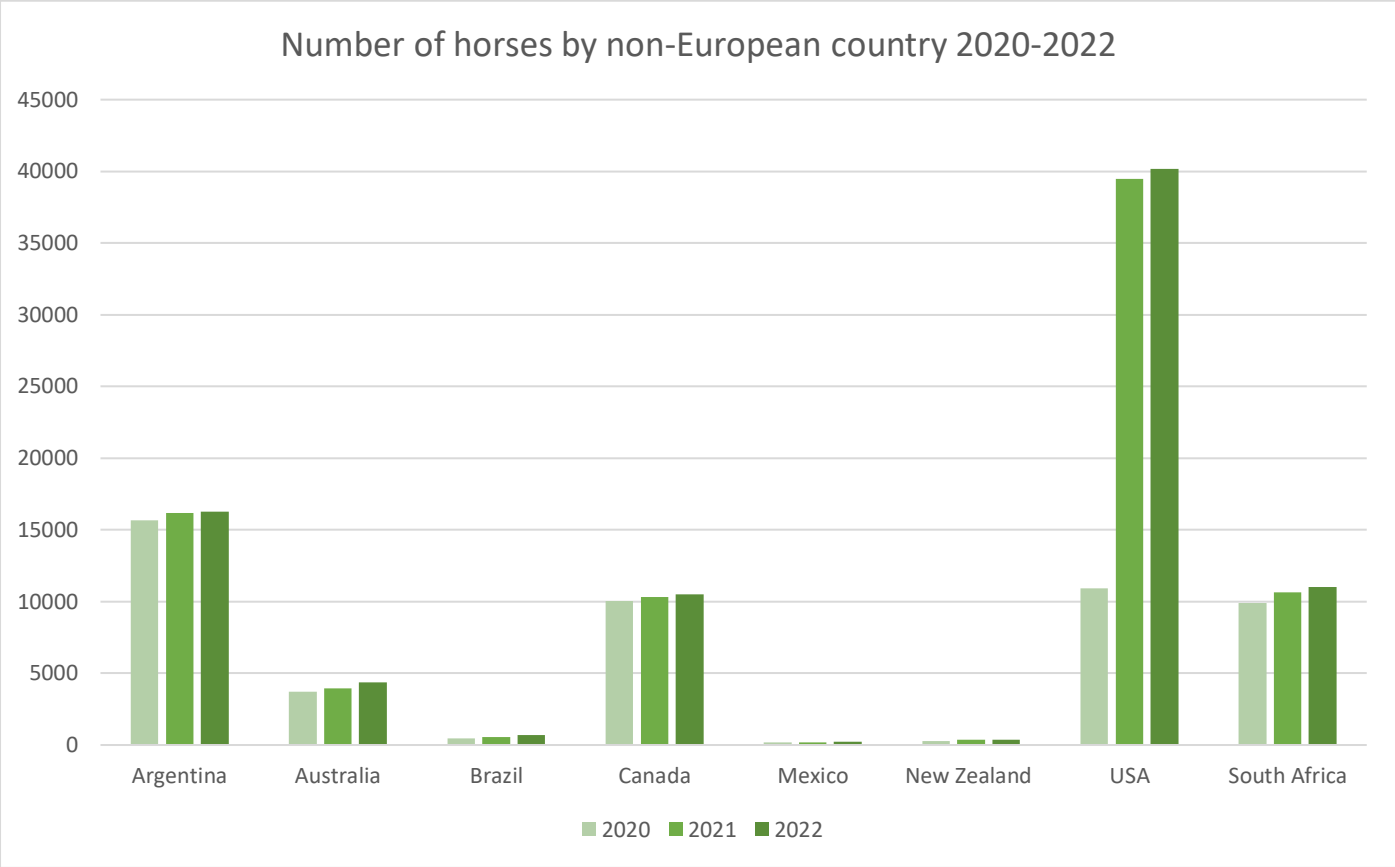


Studbook Members

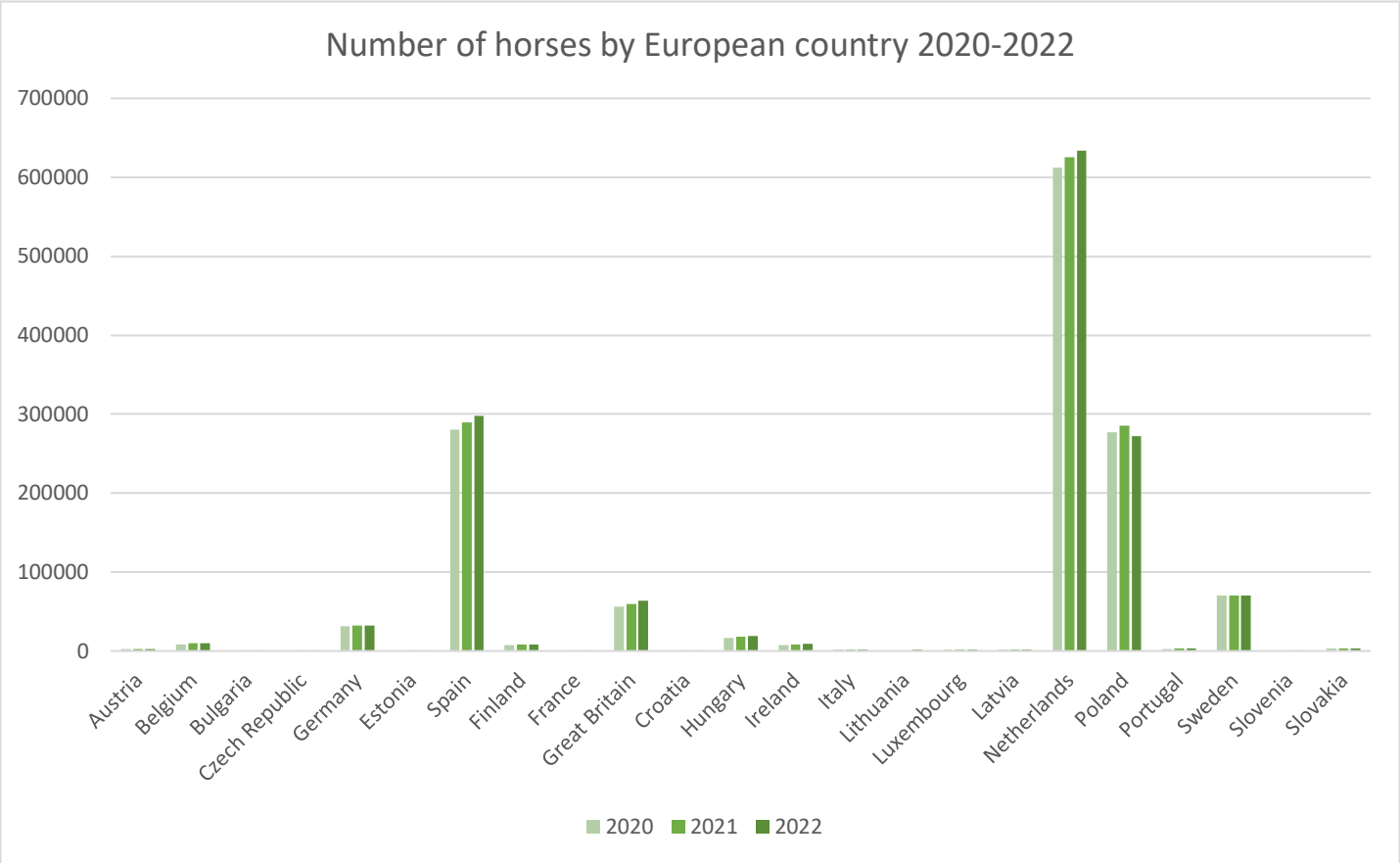
There has been an increase in the number of members of the WBFSH members, from 75 full members and 3 associate members in 2019, to 80 full members and 6 associates in 2023. This reflects also an increased number of members within the WBFSH studbooks. In 2019 there were 194,192 members and this increased by 12.7% in 2020 to 222,340 members. There was a further increase of 4.6% from 2020 to 2021, with returned data reporting 232,939 members. And a further increase of 3.1% to 2022 with 240,270 members. Graph – Number of WBFSH Full and Associate Members (2018-2023).

Total horses

The total number of horses from the data returned grew by 4.6% from 2020 (1,438,153 horses) to 2021 (1,508076 horses) and again increased by 0.9% to 2022 to 1,521,989 horses. Although it would have been interesting to see the aftermath of covid on numbers the data from 2019 was incomplete and left out of this data set. Graphs – Number of horses by non-European countries 2020-2022. n=81. Countries were removed from the data that had zero returns for all three years (n=5), Number of horses by European countries 2020-2022. n=81. Countries were removed from the data that had zero returns for all three years (n=5).

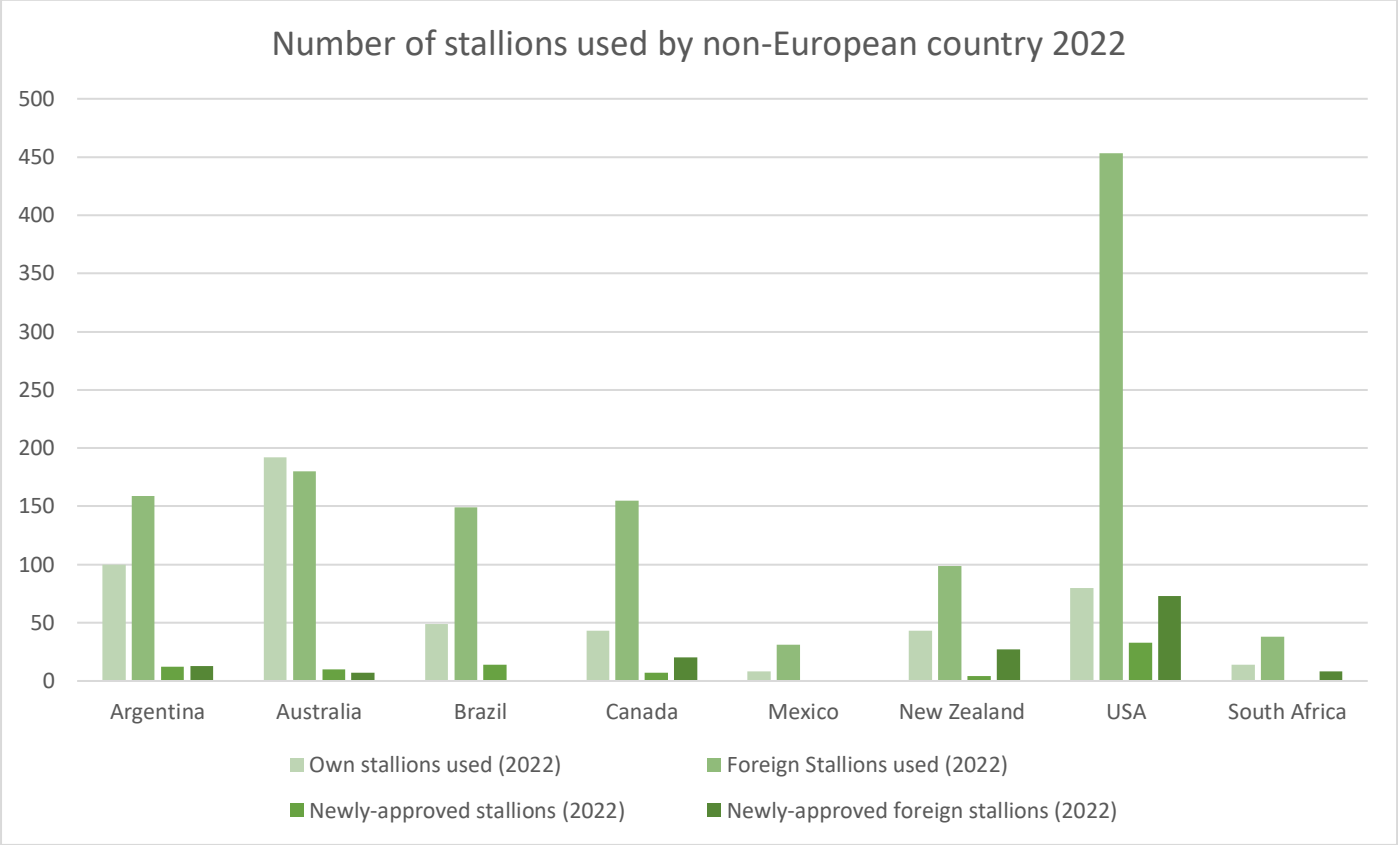


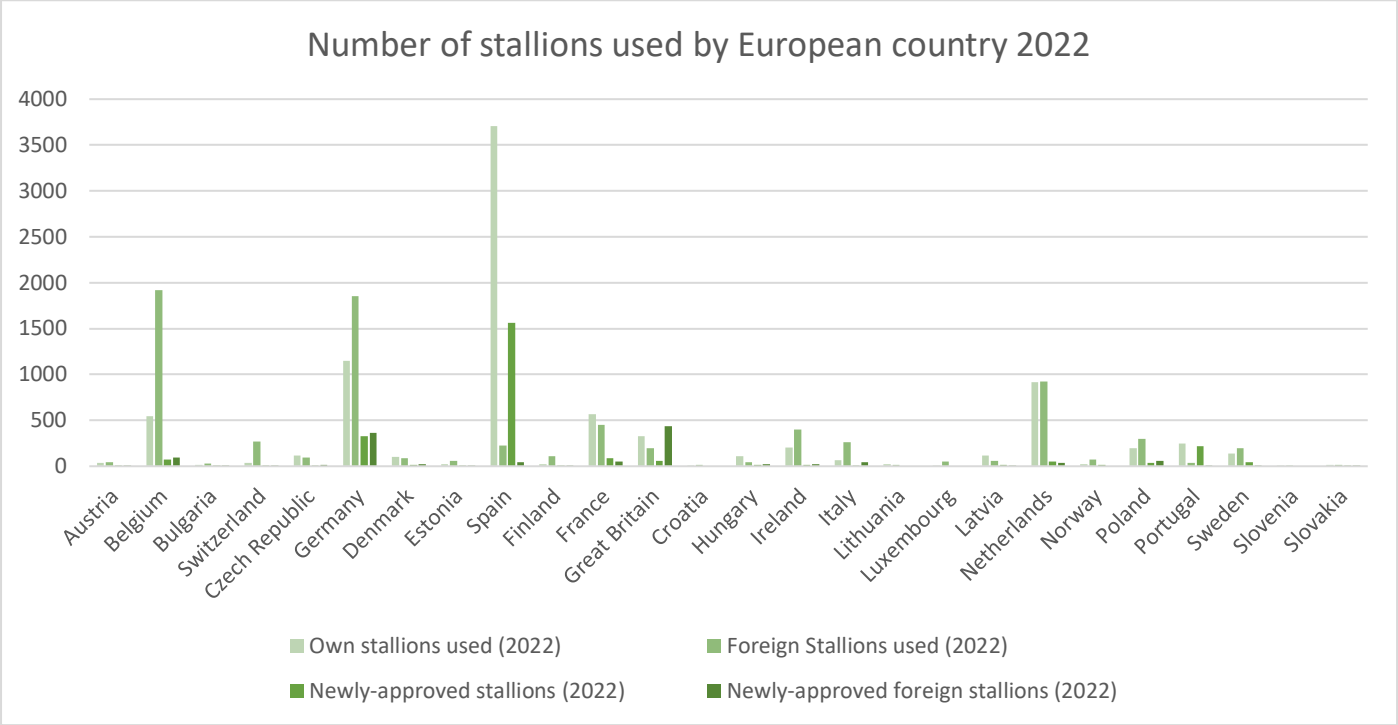
Regarding the number of horses reported, these figures are very difficult to collect, as there are massive differences between studbooks, how total horses are accounted for. Some studbooks report all horses registered, even from foreign studbooks, whereas some report only horses from their own studbook. Some studbooks report all entered horses, including deceased horses. The status of horses is often left unchanged if death is not reported. Furthermore, studbook databases vary greatly with respect to the differential data that can be extracted. Therefore, this is a difficult figure to collect. The same comment replies for the number of horses in European countries.


Number of horses by European country 2020-2022
700000
600000
500000
400000
300000
200000
100000
0
Austria
Belgium
Bulgaria
Czech Republic
Germany
Estonia
Spain
Finland
France
Great Britain
Croatia
Hungary
Ireland
Italy
Lithuania
Luxembourg
Latvia
Netherlands
Poland
Portugal
Sweden
Slovenia
Slovakia
2020
2021
2022

Stallions

Most non-European countries tended to use more foreign stallions for breeding rather than their own stallions, with the exception of Australian Studbooks. This can most likely be attributed to the use of imported frozen semen in countries outside of Europe, showing the trend of using overseas bloodlines. The trend of using foreign stallions is common in most European countries, where semen can easily be shipped chilled or frozen. There are a few exceptions notably Spain, Great Britain, Hungary and France. In Spain it is expected as the PRE, one of the largest WBFSH members, is a closed studbook. Graph – Number of stallions used by non-European country 2022. n=86, Number of stallions used by European country 2022. n=86.



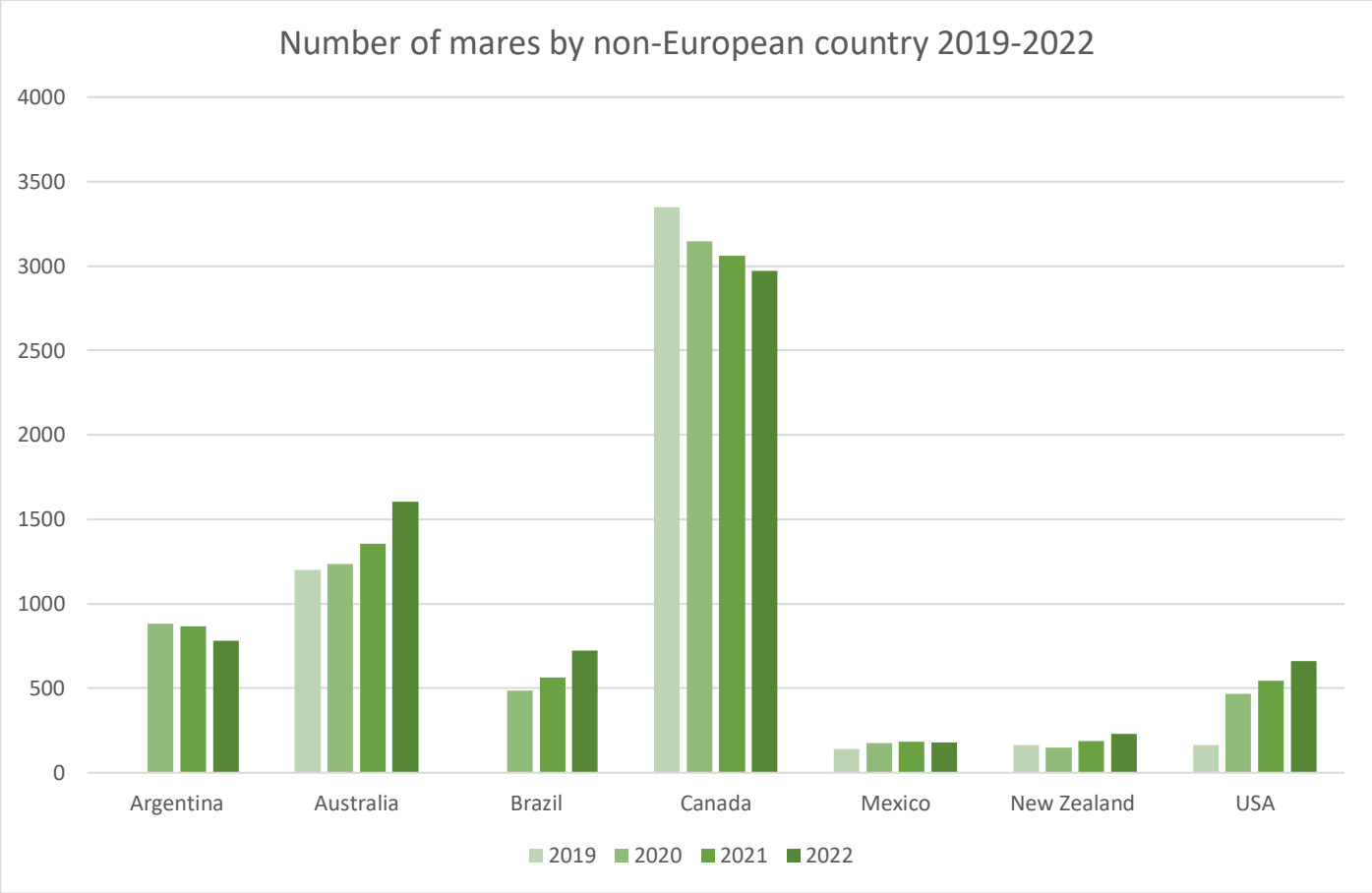

Number of stallions used by European country 2022
4000
3500
3000
2500
2000
1500
1000
500
0
Austria
Belgium
Bulgaria
Switzerland
Czech Republic
Germany
Denmark
Estonia
Spain
Finland
France
Great Britain
Croatia
Hungary
Ireland
Italy
Lithuania
Luxembourg
Latvia
Netherlands
Norway
Poland
Portugal
Sweden
Slovenia
Slovakia
Own stallions used (2022)
Foreign Stallions used (2022)
Newly-approved stallions (2022)
Newly-approved foreign stallions (2022)

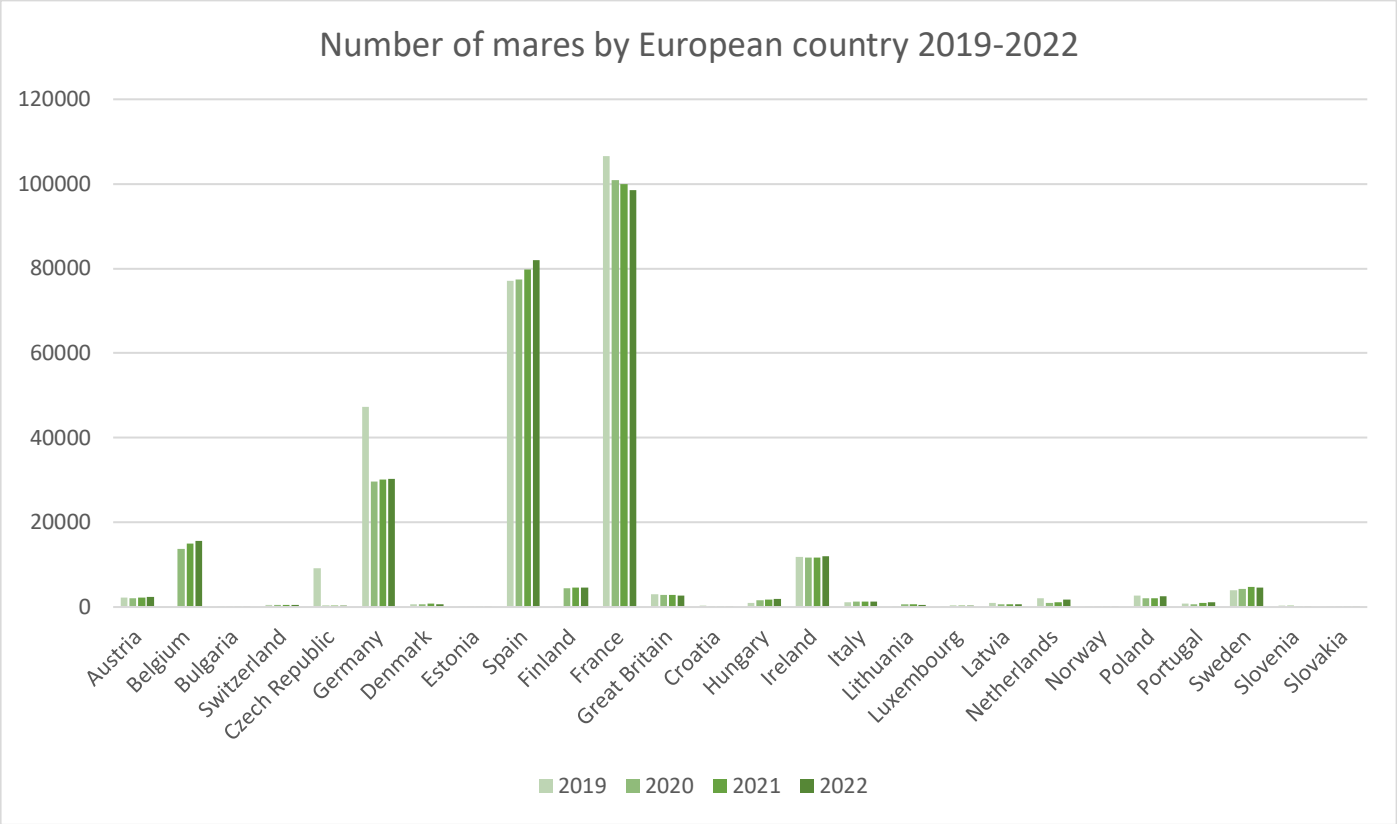
Mares

The total number of mares, from the data returned over 86 Studbooks, was relatively stable over 2019-2022. There was an initial loss of numbers from 2019 to 2020 of -4.8% and then a slight increase from years 2021 and 2022 of 1.8% and 1.2% respectively. Graphs - Number of mares by non-European country 2019-2022.Studbooks that returned zero data over all years were removed from the sample. n= 83, Number of mares by European country 2019-2022. Studbooks that returned zero data over all years were removed from the sample. n= 83.

It needs to be mentioned that the reporting of the number of mares varies greatly between studbooks, and often also relates to the database system that studbooks have, and the ability to extract statistics. Some studbooks can count all mares, or all mares from foal to aged 30 years. In some cases, the numbers also include deceased mares, as death is not often reported. Some studbooks are able to report active breeding mares, i.e. mares that have had a foal in the last breeding season. This depends also on whether a studbook still works with covering certificates, which allows for collection of data on active breeding mares.

Interesting is the figure from Canada, where it is most likely that all mares, regardless of breeding status, are counted. The number reported is large compared to the number of foals reported in Canada. This is similar to the figure reported for France, as the Studbook Selle Francais reported around 100.000 mares, the figure including all mares entered, regardless of age, studbook or breeding status.

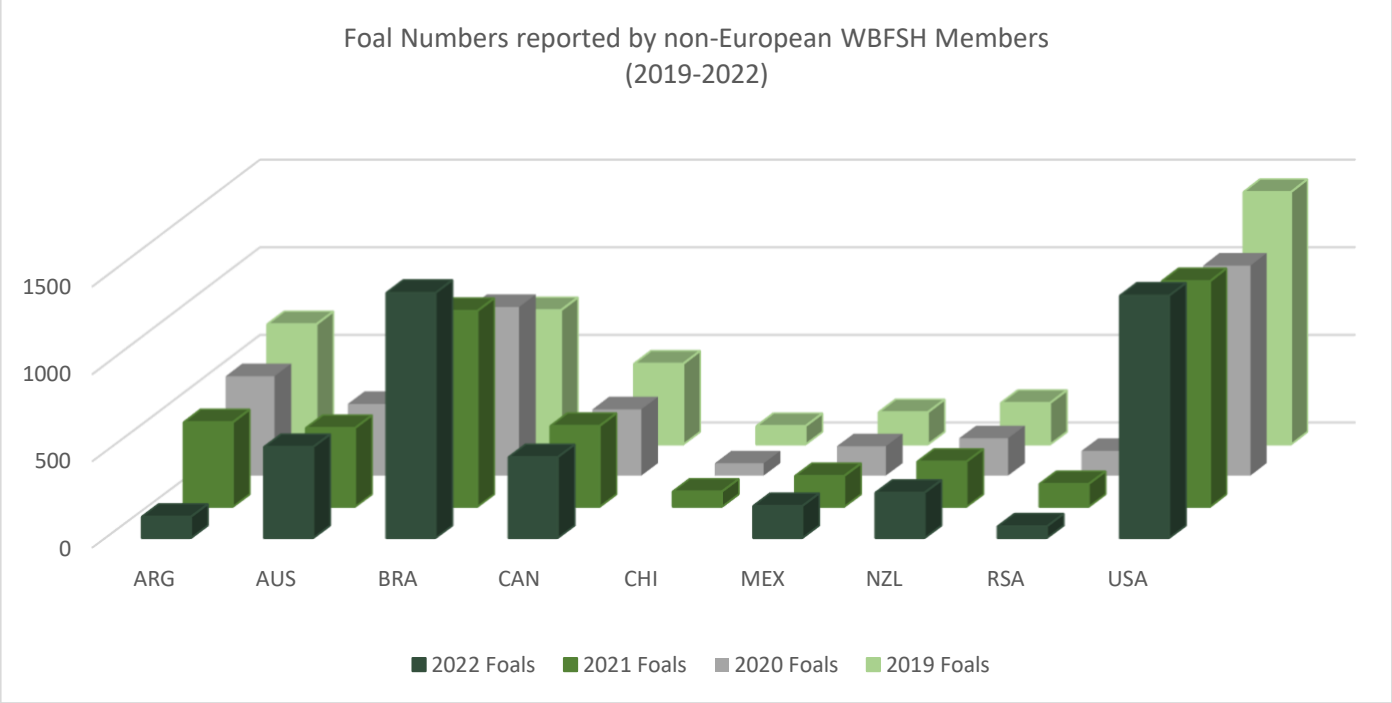


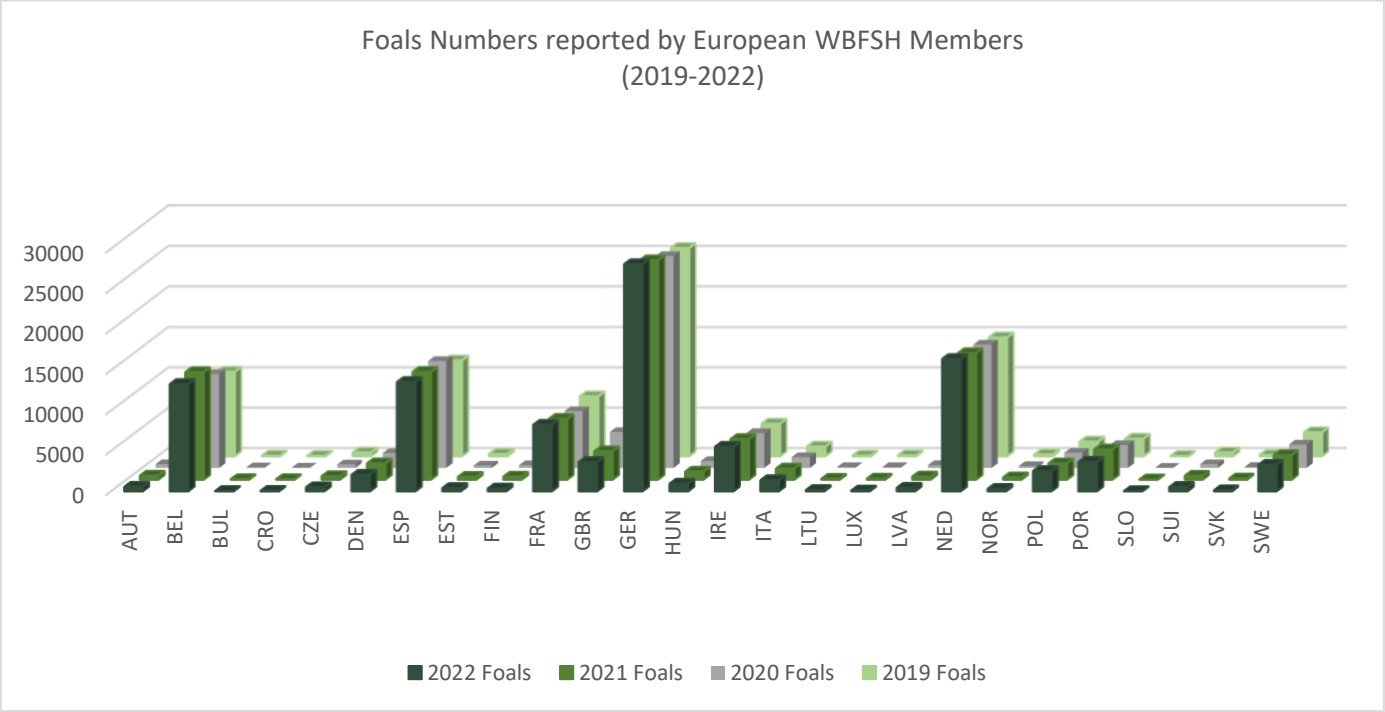

Number of mares by European country 2019-2022
120000
100000
80000
60000
40000
20000
0
Austria
Belgium
Bulgaria
Switzerland
Czech Republic
Germany
Denmark
Estonia
Spain
Finland
France
Great Britain
Croatia
Hungary
Ireland
Italy
Lithuania
Luxembourg
Latvia
Netherlands
Norway
Poland
Portugal
Sweden
Slovenia
Slovakia
2019
2020
2021
2022

Foal numbers

The total number of foals increased from 96.872 in 2019 to 110.597 in 2022 (increase of an astounding 14.17%). On average the yearly increase in the number of foals from 2019-2022 was 4.5%. The highest producer of foals outside Europe are the USA (6 WBFSH full members), followed Brazil (1 WBFSH full member). Graphs – Number of foals by non-European country 2019-2022. n=84 studbooks returning full results over the 4 years. Number of foals by European country 2019-2022. n=84 studbooks returning full results over the 4 years.

In Europe the largest number of foals comes from Germany (28.109 foals in 2022). There are 14 full WBFSH members in Germany. This is followed by the Netherlands, which has 3 full WBFSH members, that produced 16.421 foals in 2022. Spain, with also three WBFSH full members, is the third largest producer of foals, with 13.560 foals in 2022. They are mainly from the ANCCE (PRE) studbook, which breeds exclusively dressage foals. This likely makes Spain the largest producer of dressage foals, as both the German and Dutch studbooks (apart from the KFPS) breed for jumping and dressage.




Foals Numbers reported by European WBFSH Members
(2019-2022)
30000
25000
20000
15000
10000
5000
0
AUT
BEL
BUL
CRO
CZE
DEN
ESP
EST
FIN
FRA
GBR
GER
HUN
IRE
ITA
LTU
LUX
LVA
NED
NOR
POL
POR
SLO
SUI
SVK
SWE
2022 Foals
2021 Foals
2020 Foals
2019 Foals

WBFSH

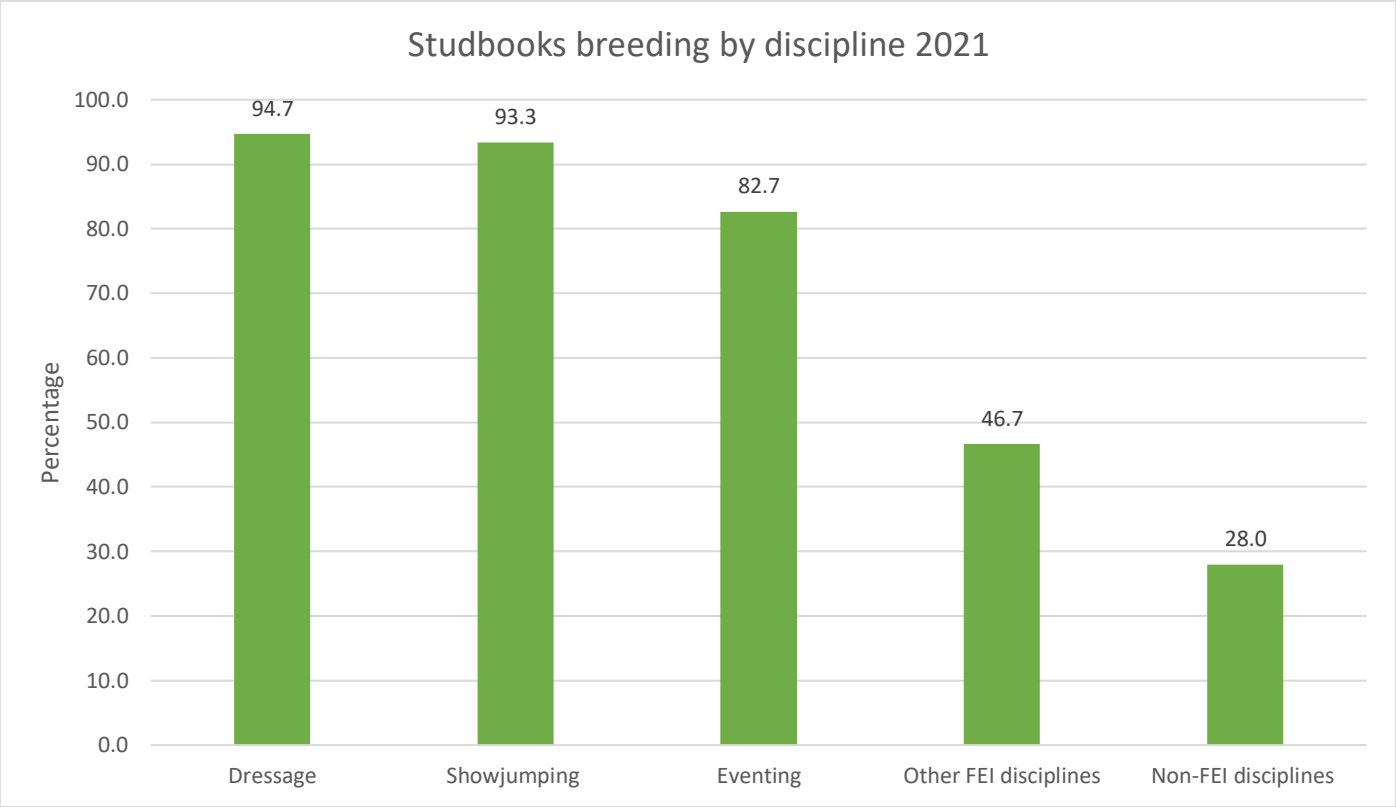
FOALS NUMBERS REPORTED BY WBFSH MEMBERS

(2019-2022)

Country	2022 Foals	2021 Foals	2020 Foals
ARG	123	489	571
AUS	527	456	413
AUT	552	483	460
BEL	13305	13335	11637
BRA	1408	1124	966
BUL	38	56	71
CAN	468	468	382
CHI		88	71
CRO	54	45	41
CZE	502	422	428
DEN	2048	2016	1831
ESP	13560	13366	13259
EST	396	335	290
FIN	343	366	335
FRA	8255	7530	7039
GBR	3631	3513	4453
GER	28109	27132	26204
HUN	939	988	841
IRE	5530	5031	4315
ITA	1375	1366	1332
LTU	154	99	100
LUX	98	117	102
LVA	430	370	350
MEX	185	178	170
NED	16421	15686	15300
NOR	295	264	228
NZL	262	261	216
POL	2510	2008	1872
POR	3654	3743	2840
RSA	67	132	143
SLO	13	20	16
SUI	538	473	461
SVK	130	134	118
SWE	3285	3040	2892
USA	1392	1294	1202
Total	**110597**	**106428**	**100949**

Breeding for discipline

Data from 2021 showed that dressage is the highest percentage discipline that Studbooks include in their breeding program, followed closely by showjumping. 81% of foals are not split into discipline specific breeding programs. Graph – Studbooks breeding by discipline 2021. n=75.



Pedigree verification

From 2021 data verification of pedigrees is completed with DNA analysis by 91% of studbooks (n=75). Of the DNA technologies, Microsatellite technology is most commonly used (65%), followed by SNP chip technology (20%), which is a newer technology, which more Studbooks are likely to utilize in the future. 5% of Studbooks use “other” techniques (n=68): cover and birth certificates, and physical inspection of the foal with its mother.

Breeding Values

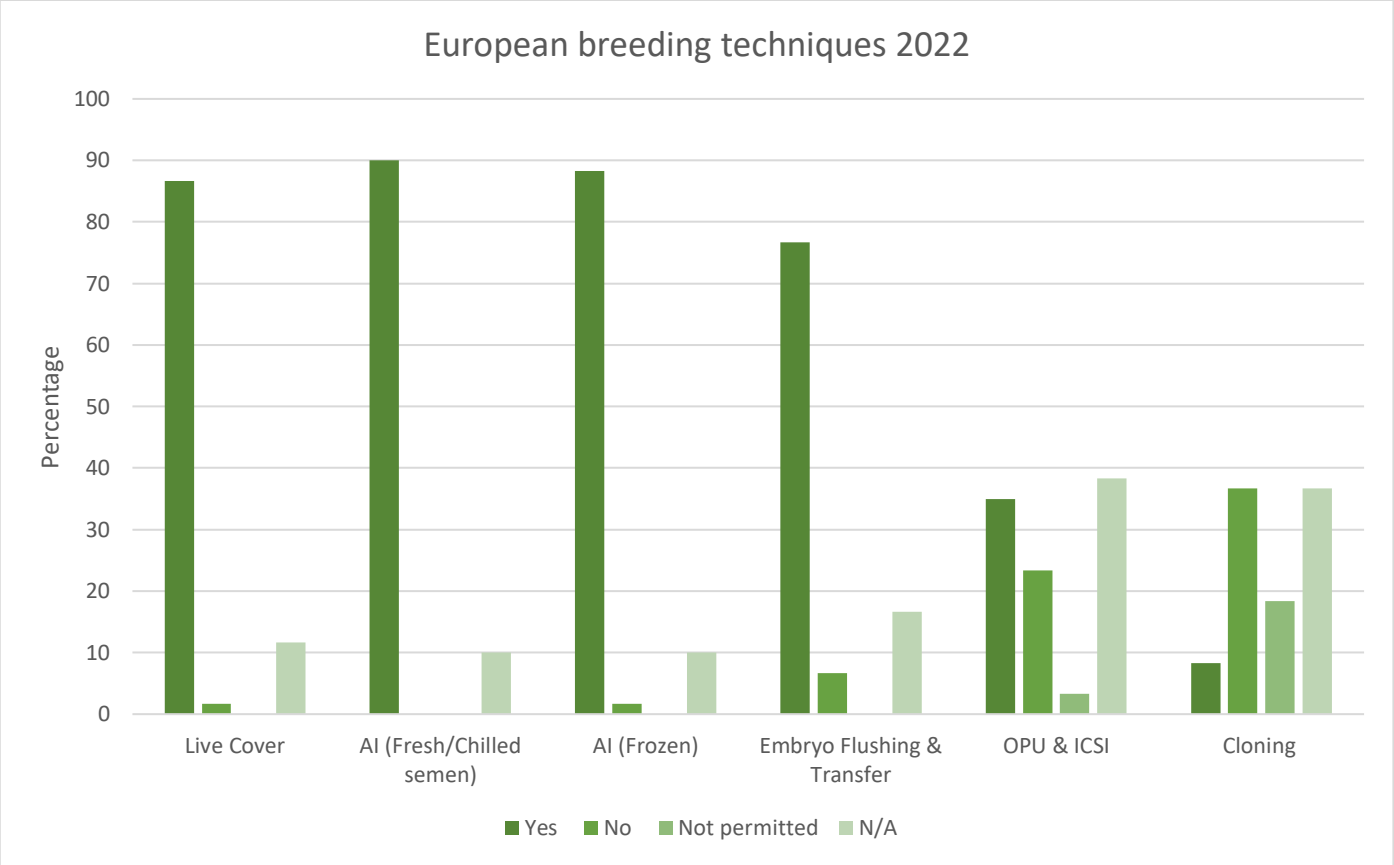
From the 2021 results 46% of Studbooks calculated breeding value (n=70). Of the studbooks that do not calculate breeding values, the reasons were around not being a big breeding base and being statistically small or too low numbers of foals to complete breeding values.

Breeding Techniques

90% of studbooks use AI (fresh & chilled and also frozen semen). Live cover is also used very often at 87%. This is a higher figure than expected. However, 47% of studbooks reported that live cover is used rarely or very rarely. This is expected, as most breeders have adopted more advanced breeding techniques. Graph – European breeding techniques 2022, n=60.

Artificial insemination is the most used breeding technique, with a similar utilisation of chilled/fresh semen, and frozen semen. 52% of European studbooks reported that AI (all typed of semen) is used in more than half of all coverings.

In the Asia Pacific region, 25-50% of coverings are done by AI, both fresh/chilled and frozen, whereby the use of fresh/chilled and frozen is similar. In comparison, in Europe there is still more fresh/chilled semen used, than frozen. This can be attributed to the fact that transport distances between European countries permit use of fresh/chilled semen, whereas areas such as Asia Pacific rely on frozen semen to use European-based stallions.



77% of European studbooks reported that they use Embryo Transfer (ET), compared all studbooks that replied from the Asia-Pacific area. Nothing was reported by the African and South American studbooks.

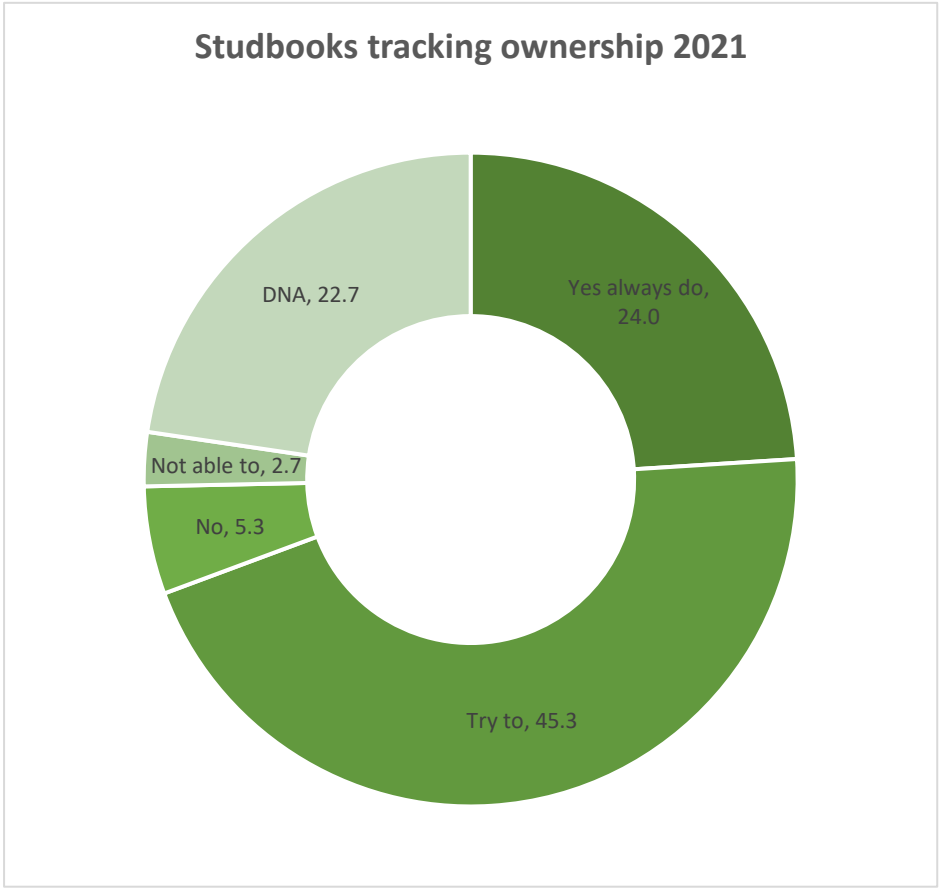
Mostly, the frequency of ET is under 10%, indicating that most mares still carry their own foals. ICSI/OPU is used by 35% of European studbooks, and all reported that the frequency is under 10%. This compared to the Asia-Pacific region, where 75% of studbooks (3 of 4 studbooks) use ICSI/OPU, but also at a frequency of under 10%.

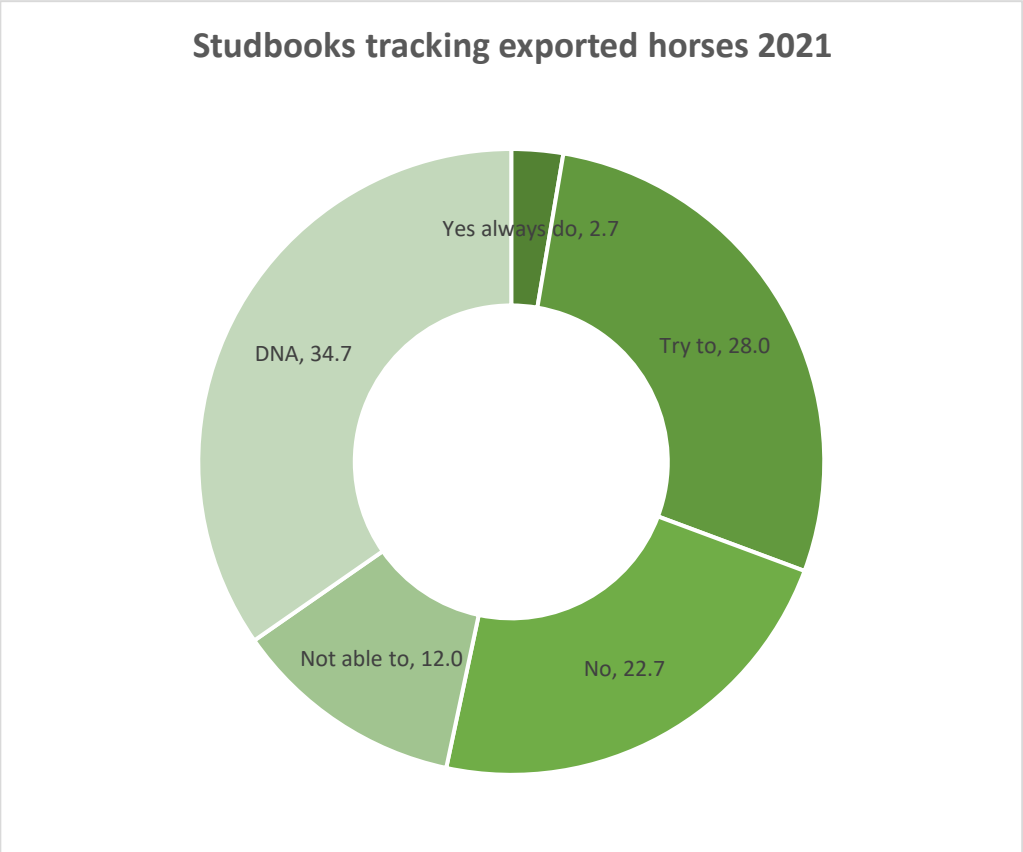
The world over, cloning is hardly used. 60% of all studbooks do not permit cloning. Three studbooks reported that it is used for less than 10% of covering, two of these are European-based, and one is in North America.

There are ethical considerations regarding cloning, as well as welfare considerations, for example what the health implications of cloned animals are. Clones are permitted to compete in FEI sport.

Ownership Tracking

In 2021, 24% of Studbooks always track ownership, and 45% try to track change of ownership (n=58). A lower number of Studbooks always track exported horses at 3% and 28% try to, with 12% not able to track exports (n=49). Some studbook countries have a national compulsory database, some use the horse's passport or rely on members or new owners to report the changes. Tracking of horses' ownership is required to be recorded in 79% of countries in a central database (n=73). There was insufficient data from studbooks about the number of horses exported over 2019-2021. Graphs – Studbooks tracking ownership, Studbooks tracking exported horses.




Studbooks tracking exported horses 2021
Yes always do, 2.7
Try to, 28.0
No, 22.7
Not able to, 12.0
DNA, 34.7

CONDITIONS

Shivers

There have been several studies conducted on shivers in horses in order to better understand the condition and develop effective treatment options. Some studies have focused on identifying potential genetic or environmental risk factors for the development of shivers. Other studies have investigated the use of various medications and surgical techniques for managing the condition.

Involuntary hind-leg flexion with a shivers affected horse when asked to back up.
(Photo credit: Dr Stephanie Valberg UC Davis)

Definition
Shivers is a gradually progressive, chronic neuromuscular disease in horses that is characterized by gait abnormalities when backing up. Typical signs of shivers include muscle tremors, trembling of thigh muscles and a flexed and trembling hind limb, difficulty picking up and holding up hind limbs, trembling of the tail while held erect[1].

There can be an abnormal pattern of pelvic limb movement present during specific movement phases that are apparently not the result of pain, weakness, or proprioceptive deficits[2].

Clinical presentation

Shivers is defined by the presence of a pelvic limb moving pattern that becomes apparent when these horses are moving backward[3]. The abnormal pelvic limb movement also occurs when the horse is asked to manually lift the pelvic limb and, in advanced cases, is present when horses initiate walking forward or turn sharply[3,4]. The disorder is a gradually progressive chronic movement[5].

Clinical signs usually become evident by 7 years of age[5] and as early as 1-2yrs of age in draught horses[4]. Commonly seen in male horses of warmblood, thoroughbred and draught breeds that are on average 17 hands tall and more but can affect other breeds[6,7].

Shivering, unlike Stringhalt, is rare at a walk and inapparent at the trot and canter[3,4]. There is no evidential link of shivers with PSSM[4].

Hind-leg flexion in shivers afflicted horse.
(Photo credit: Dr Stephanie Valberg UC Davis)

Pathology

With shivers, the sole pathological finding is a selective distal atonal degeneration in the cerebella Purkinje cells within the deep cerebella nuclei[8]. There appeared to be a reduction in the number of end-terminal synapses within the deep cerebella nuclei and degeneration being most evident in the lateral nuclei. There are arguments against a cerebellar origin with a lack of ataxia, a prominent feature of diffuse cerebellar disease[6,4]. A selective distal atonal degeneration in cerebellar Purkinje cells is seen as the sole pathological finding of shivers[6].

Genetic Base
There is evidence for and against a genetic predisposition for Shivers. Draper et al. 2015 indicate a genetic base due to the strong breed predilection, with largely draught, warmblood and thoroughbred breeds being affected. A genetic basis for shivering in tall breeds could explain the significantly taller height of affected horses vs control horses[3]. The evidence of the disease onset at such a young age could support a genetic basis for shivering. Over 40% of horses confirmed shivering, developed signs between 2 and 4 yrs of age and a majority had an age at onset of 5-7yrs[3]. Contradictory, within the same article there is also evidence against a genetic basis as the primary influence of height could influence the breeds affected[3]. Currently, there is no firm data to support or disprove a genetic basis for shivering[3,4,9].

Treatment
To date there is no proven effective treatment for shivers.

Currently, there is no firm data to support or disprove a genetic basis for Shivers.

Fragile Foal Syndrome

Definition
Originally known as Warmblood Fragile Foal Syndrome Type 1, is now known as Fragile Foal Syndrome (FFS), due to the conditions being present in other breeds. FFS is an inherited defect of connective tissue and is characterised by hyperextensible, abnormally thin, fragile skin and mucous membranes that are subject to open lesions. This genetic disorder became public knowledge in 2018 in the USA.

In 2021, published data indicated the identification of FFS in thoroughbreds, which is the first documented evidence of FFS outside of warmbloods. The repercussions of this research indicated a concern for this disease across different horse breeds and for wider genetic testing for breeding purposes[10].

Pathology
FFS is a monogenetic defect with autosomal recessive inheritance. It is caused by a recessive lethal missence point mutation in the procollagen-lysine, 2-oxoglutarate 5-deoxygenase1 (PLOD1) gene[10]. This gene acts on collagen synthesis and causes reduction in collagen cross links.

The frequency of FFS is relatively high in warmblood breeds and has a lower frequency in thoroughbreds. A recent study was found a few FFS carriers in Paint, Quarter and Hafliger horses. American Paint horse stallion offspring family consisted of 62.5% FFS carriers, demonstrating transmission of FFS[11].

Clinical presentation

Affected horses may also have hyperextensible limb joints, floppy ears, accumulation of fluid, subcutaneous emphysema, hepatomas and premature birth[12]. A majority of FFS homozygous foals are assumed lost by abortion during late gestation. Live-born affected foals show severe skin fragility, resulting in open lesions and joint hyper-elasticity, and often need to be euthanised shortly after birth[13]. There are also friction and pressure points resulting in open lesions which often occur *in-utero*.

Cross section of normal skin sample versus FFS sample.
(Photo credit: www.magasinet.hippson.se)

Genetic base

Fragile Foal Syndrome Type 1 is an autosomal recessive disease. Both males and females are equally affected, and two copies of the mutation are required to cause the disorder. Horses with one copy of the mutation do not show clinical signs but can transmit the mutation to their offspring. There is a DNA test available from submitted hair root samples to inform breeding decisions[12].

In Germany, the largest sport horse population in Europe, it is estimated that between 10-20% of warmblood horses are heterozygous and asymptomatic FFS carriers[14,15]. A similar percentage is described in warmblood sport horses in Brazil[16]. Losses in warmblood breeding caused by FFS could be greater than previously assumed[15].

The positive effect of the FFS carriers is with movement-related traits. There is a plausibly that these carrier horses present a higher degree of joint laxity, as was assessed by comparing carrier horses with non-carrier horses. Non-jumping horses, most of which would be used for dressage showed walk seeming to be the most affected gait. Dressage horses are selected for high mobility with extreme locomotion patterns, this could possibly be a product of impaired collagen structure of FFS carriers[13].

Treatment
The disease is present at birth and affected newborn foals are euthanised shortly after birth due to the poor prognosis of this untreatable condition.

Positive effect of the FFS carriers is the movement-related traits.

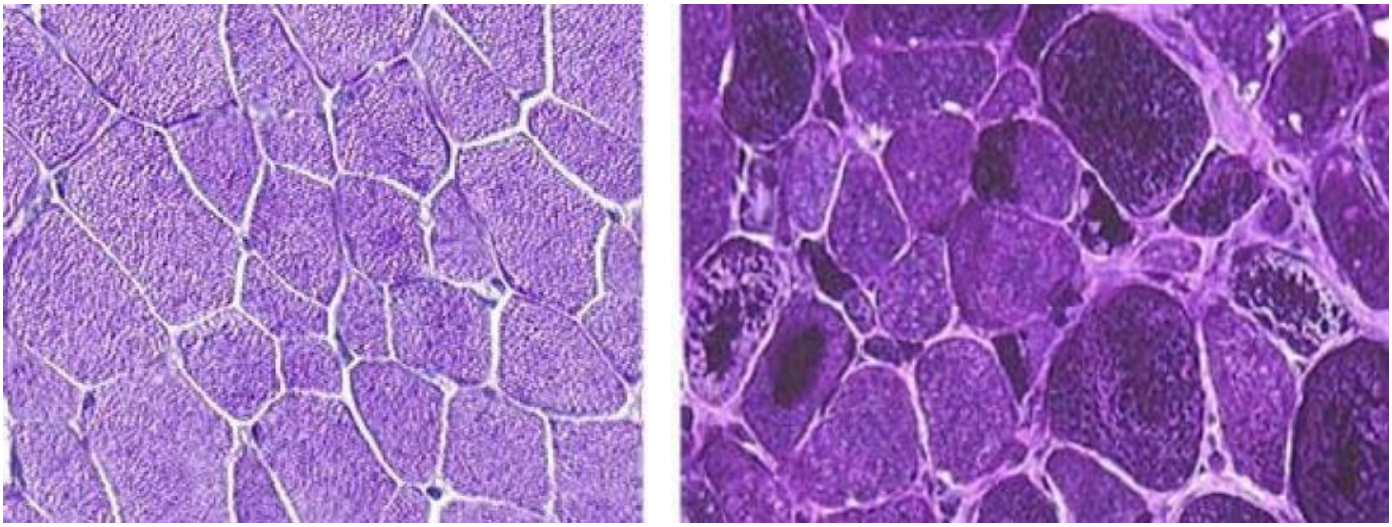
Type 1 Polysaccharide Storage Myopathy

Definition
Type 1 Polysaccharide Storage Myopathy (PSSM1) is caused by a genetic mutation in the glycogen synthase 1 gene (GYS1). Research has been conducted into this disease since 1995. Mutation occurs in many breeds that derive from continental Belgian breed crosses including Warmbloods. Thoroughbreds, Arabians and Standardbreds do not have the GYS1 mutation which causes PSSM1[17].

Clinical presentation
Horses with PSSM1 can have signs typically associated with tying-up, most commonly muscle stiffness, sweating, reluctant to move in conjunction with increased serum creatine kinase activity. There can also be symptoms present without exercise. During an episode, horses seem lazy, have shifting lameness, tense in abdomen and tremors in their flank and they may stretch out as if to urinate. The horses have painful, stiff and hard muscles, particularly in the hindquarters. Some horses will try pawing and rolling immediately after exercise. Most PSSM1 affected horses have a history of many episodes of muscle stiffness which can be quote severe with the horse unable to stand and being uncomfortable when lying down. Some mildly affected horses might only have a few episodes a year. The urine of these horses is usually coffee coloured, due to muscle proteins released in the bloodstream and passed into the urine. This high concentration of proteins in the serum and urine can damage the horses' kidneys if they become dehydrated[17].

Diagnosis is established by genetic testing of hair roots and muscle biopsy over 2 years of age, but definitive diagnosis requires genetic testing[17].

Pathology
PSS1 is characterised as the abnormal accumulation of the normal form of sugar stored in the muscle (glycogen) as well as an abnormal form of sugar (amylase-resistant polysaccharide). Classified as having a distinct genetic point mutation in the gene that codes for the skeletal muscle form of the glycogen synthase enzyme (GYS1) causing the enzyme to become overactive, resulting in a constant production of glycogen and resulting in a deficit of energy in the muscle cell. Quarter horses originally studied found that horses had 1.8-fold more glycogen (storage form of sugar) in their muscles, a deficit in energy when they exercised and persistent elevations in serum creatine kinase (CK) activity with exercise unless feed a lot starch high fat diet. Creatine kinase helps the muscles create energy, mostly found in the muscle and heart[17,18].



Muscle biopsy showing normal glycogen storage (left) and from a horse with a GYS1 gene mutation (right). The dark areas from the afflicted tissue sample show the excess glycogen stored in the muscle cells. (Photo credit: www.pssmawareness.com)

Genetic base

PSSM is a genetic disorder, it is an autosomal dominant trait. Only one parent needs to pass the genetic mutation on, so a 50% chance or greater that a PSSM1 horse's offspring will develop the disease[17].

Treatment

Although PSSM1 can not be cured, through a diet and exercise regime the disease and its clinical presentation can be managed. Carbohydrates high in starch such as sweet feed, corn, wheat, oats, barley and molasses cause exacerbate PSSM1. Extra calories can be provided in the form of fat. Management is through daily exercise, enhancing glucose utilisation and improving energy metabolism in skeletal muscle. If diet only is changed about 50% of horses improve. If both diet and exercise altered, then 90% of horses have had no or few episodes of tying-up. But PSSM1 horses will always be susceptible to this condition if exercise routine is disrupted or if they become ill from other causes clinical signs can develop again[17].

PSSM1 is an autosomal dominant trait, there is a 50% chance or greater that a PSSM1 horse's offspring will develop the disease.

Type 2 Polysaccharide Storage Myopathy (PSSM2)

Definition

Type 2 Polysaccharide Storage Myopathy (PSSM2) was discovered when not all the horses diagnosed with PSSM by muscle biopsy had the glycogen synthase 1 genetic mutation. Like PSSM1, PSSM2 has a similar type of tying up and muscle damage. PSSM2 does not have

excessive glycogen in their muscles and horses do not have muscle damage as their creatine kinase activity is normal in the bloodstream.

There is a subset of PSSM2 which is referred to PSSM2-ER which has high creative kinase in the bloodstream during tying-up episodes. PSSM2-ER responds to the same diet and exercise recommendations as PSSM1[19].

Clinical presentation
PSSM2 affected horses show a reluctance to go forward under saddle, reluctance to engage the hindquarters and exercise intolerance. Symptoms improve only 50% if the horse if given diet and exercise recommendations for PSSM1 (indicating a difference from PSS2-ER). In warmblood horses, this group of PSSM2 horses have myofibrillar myopathy (MRM) and their management is different from PSSM2-ER. Measurement and CK activity on the muscle biopsy is required to distinguish between PSSM2-ER and PSSM2.

In Warmbloods most cases of exercise intolerance and normal CK levels are likely related to myofibrillar myopathy. Affected breeds include Dutch Warmbloods, Swedish Warmbloods, Hanoverians, Selle Francais, Westphalian, Canadian Warmblood, Irish Sport Horse, Gelderlander, Husien[19]. In warmbloods there can be an undiagnosed gait abnormality, sore muscles and drop in energy level and unwillingness to perform after 5-10 minutes of exercise. They have a painful, firm back and hindquarter muscles, reluctance to collect and engage hindquarters, poor rounding over fences, and slow onset of atrophy especially when out of work. The mean age of onset is between 8-11 years of age[19].

Pathology
The specific cause of PSSM2 has not been identified. Research has identified two types of PSSM2. Firstly, PSSM2-ER as a glycogen storage disease that has high creatine kinase (CK) activity. Secondly, PSSM2-MFM which is characterised by exercise intolerance and normal CK activity. There is a possible link between PSSM2 and Myofibrillar Myopathy as some horses showed abnormal glycogen muscle accumulation and were diagnosed with PSSM2. Myofibrillar Myopathy is associated with abnormal clumping of a protein called desmin in muscles, which causes tying up symptoms as well. The link between these two diseases is not clear[19].

Genetic base
At this time researchers are not recommending a genetic test for PSSM2 or MFM as no scientific validated evidence that the variants for which genetic testing is available is linked to PSSM2 or MFM. Current there is no company is providing commercial tests for PSSM2 nor MFM.

Treatment
Horses with PSSM2-ER can be managed by a diet and exercise regime[20]. Horses with PSSM2-MFM have responded positively to increased amino acid intake and fat for calories and exercise regimes but the research not conclusive[21].

PSSM2 affected horses show a reluctance to go forward under saddle, reluctance to engage the hindquarters and exercise intolerance.

ANIMAL WELFARE

Spotlight on Weaning

Managing foal weaning has been through a trial-and-error practical approach since breeding horses became domestic. Currently, more scientific research has been undertaken to look into alleviating “weaning stress” by decreasing the potential psychological, physical and nutritional stressors associated with domestic weaning.

By observing and studying feral and semi-natural domesticated herds, scientific-based conclusions can be made to reduce the short- and long-term negative outcomes from weaning. Observed natural weaning occurred between 8-11 months old. There was no induced stress response from either the foal or the mare and there were no clear signs of rejection by dams just before or after weaning[22].

The origins of early artificial weaning may have arisen from the thought of best optimising the foal's physical development as material milk production decreases sharply by the third month of lactation[23] and the nutritional requirements of a 3–4-month-old foal exceeds the level of nutrients available from maternal milk[24]. This practice was widespread in professional breeding farms and followed by non-professional breeders. Recently, the reasons for early weaning have followed this practice have altered, and are based around early marketing of foals, switching foals' attention from mother to humans[25], management of foals' nutritional intake or optimising mares' reproductive efficiency. Early weaning is associated with many if not all of the following changes: maternal deprivation, social isolation, environmental and social changes, more intense human intervention, abrupt nutritional challenges, and changes in feeding and management practices[26].

Although there has not been much research around the effects of weaning on the mares, it has been well documented the levels of stress that artificial weaning causes on foals. Behavioural responses such as increased long-distance whinny calls, increased locomotion which result in associated risks of injury, altered feeding and sleeping patterns, aggressiveness, suspension of play and redirected suckling towards peers. Along with these observed responses there are internal stresses to the foals, elevated stress hormone (glucocorticoid) levels, changes in heart rate and decline in growth rates. Associated risks are decrease in immune response and negative impact on maturation of the gut microbiota. Some research has indicated that early weaning leads to other stereotypic behaviours like crib-biting, wood chewing and locomotor stereotypes[26,27]. Abnormal oral behaviours may occur prior to weaning but increase following weaning, indicators are that this is due to changes in diet and could be a coping mechanism for increased stomach acidity where there may be stomach discomfort. Locomotive behaviours could be the influence of housing and social environment after weaning, lower incidence has been associated with foals kept on grass[26]. Research has even linked altered learning ability in adult stereotypic horses as compared to normal horses[28,29] and some have indicated long term detrimental health effects of early weaning.

A recent study of a semi-natural herd of Icelandic mares and foals have found that natural weaning takes place gradually over several months with a gradual increase in the mare-foal distance and progressive decrease in suckling frequency with a change to a more varied diet and development of a larger social network. Foals are not weaned before the age of 9-11 months or before the birth of the next foal. The dam-offspring bond remains for a long time after nutritional separation. The ages at weaning vary considerably and can be due to the reproductive status of the mare. Pregnant mares tend to wean their foals on average 3-4 months before the birth of the next foal, non-pregnant mares tend to nurse their foals for a longer time. Previous breeding status of the mare, and the presence of yearling will initiate faster weaning. Also, the availability of food resources and weather

conditions and maternal body condition are potential factors. The mare-foal distance and suckling activities are mainly due to the foal's initiatives and there are variations among foals due to more of a closeness to dams rather than peer interaction. The main factor in the age of weaning is the conception rates of the mares, but in this study most of the mares were pregnant again and were in the presence of their foals and yearlings. There was no loss of body condition despite the harsh climatic situations and the absence of good supplements other than hay[22].

Gradual weaning has been proven to result in fewer behavioural responses than abrupt weaning. Gradual weaning techniques over a period of several weeks does not wholly imitate natural weaning as it does not mimic the natural dynamics of the dam-foal bond, suckling frequency does not decrease before weaning and mare-foal proximity remains stable until and even till after weaning. Gradual weaning techniques that allow the foal to retain olfactory, visual and auditory access to the mare result in less behavioural and physiological stress compared to abrupt weaning. Some research has shown that there in and increase in maternal behaviours if foals are reunited with foals with short term separation techniques[26].

Responses such as classic behavioural and physiologic signs of stress, foal-to-foal aggression, higher cortisol concentrations, and weight loss, can be mitigated with better weaning techniques. Group weaning is associate with a lower incidence of behavioural indicators of stress, if the animals are thoughtfully grouped together[26]. It has been shown that the importance of artificial weaning lies

not in the age of the foal or the preparation of the feeding transition, but by paying attention to the strength of the social bond between mother and foal[22].

Although more scientific research is required for what constitutes best practice in respect to animal welfare for weaning in the domestic environment, improvements to the management of domestic horses regarding weaning needs to be addressed. Current methods have been shown to lead to short and sometimes long-term severe negative outcomes of domestic horses. More research is needed to understand these long-term impacts of weaning on trainability and later maternal behaviour, and other detrimental effects on the performance horse.

SOCIAL LICENCE

Social licensing in the horse industry refers to the process by which horse breeders, trainers, and other industry professionals gain the approval and acceptance of society at large. This can be achieved through a variety of means, such as demonstrating ethical and humane treatment of horses, promoting conservation and preservation of equine breeds, and implementing sustainable business practices. Obtaining social licensing can help to improve the reputation of the horse industry and increase consumer trust in the products and services offered by industry professionals.

Definition

Laws state what can be done and what is legally not permissible. The second layer of permission in a society is known as a “social licence to operate” (SLO). A SLO is an intangible, implicit agreement between the public and an industry or group[30]. A social license is present when an industry or activity has the ongoing acceptance of approval from its stakeholders and general public. It is important to realise that the legality and the state of an industries social licence are entirely separate entities. A social licence is not an “all or nothing” phenomenon but a dynamic moving target on a spectrum from approval of an industry to outright withdrawal, depending on trust, credibility and societal opinions.

The existence of an SLO allows an industry to pursue its activities with minimal formalised restrictions because the activities have widespread societal approval. If the public reject an industry (as shown in other industries, mining, horse racing, greyhound racing, live animal exporting) then legal restrictions have been known to follow. Therefore, sufficient time, effort and monetary investment into ensuring an effective and progressive SLO for the sport horse industry is vital for the entire equestrian industry to survive[30].

Sport horse SLO threats

Any industry involving animals has become a hot topic and under scrutiny in many countries. For any animal-use activities an SLO is granted based on public concerns about safeguarding animal welfare, whether real or perceived. Public disquiet about animal welfare has grown considerably in the last decade, especially around enhancing animal’s quality of life and ethics-based welfare approaches to keeping animals that are used in recreation. Such a change in the public’s mindset can be seen in the shift of what has changed from being socially acceptable to not. Such recent changing public perception alterations can be seen with animals in circuses, wildlife in aquaria and zoos, hunting and dog fighting. These changes to perception of animal welfare can also be due to a rise in vegetarianism and veganism[30].

Direct threats to the sport horse industry's SLO would be the advances in technology and with scientific knowledge, stakeholder engagement, transparency and public relations. The rapid advances of modern technology, such as mobiles phones with cameras, has resulted in all aspects of conduct being exposed to public scrutiny. Social media developments have resulted in rapid changes in public perceptions and and increased rise in changes to surrounding government policies. The public visibility of equestrianism via social media and other general media outlets can also present a challenge to maintaining its SLO, i.e. injury during competition, falls, bad sportsmanship, and use of whips, this can be readily highlighted by those that oppose or wish to attack an industry. Mass media onslaughts can be associated with well-organised advocacy campaigns looking to ban particular activities and practices. In addition, a threat to the whole industry arises when some individuals have a history with practices that have become normalised but to others are deemed unacceptable[31]. Additionally, scientific knowledge has both enhanced societal understanding of animals but has also negatively affected animal use in recreation. With the increased use of technology, access to scientific research has been easier and animal welfare as a science has been the underpinning change to public attitudes and perceptions. Industry transparency is vital to public perception and trust, the use of valid measures to monitor animal welfare are vital to an industry's SLO. Resistance to transparency is a common theme to the erosion of an industry's SLO. Displaying honest public relations, especially with regards to animal welfare, is vital to retaining public trust and ultimately a SLO[32].

Maintaining an Equestrian SLO

Across many industries the most important aspect of maintaining a SLO is trust[33,34]. Earning and maintaining the trust of all of the industry stakeholders, including the public, is key to maintaining a SLO. The only way to do this, based on other industries, is to have a multifaceted approach including an ethics-based, proactive, progressive and holistic approach to equine welfare. By showing transparently of operations and being proactive with ownership of issues and embracing reform might be the key to maintaining a good public relationship.

Acting with integrity though all the levels of the industry should hold favour with all industry stakeholders and the general public, and not only would this good reputation be the key to having a social licence but will also help in times of crisis if a problem arises. Establishing shared values with all stakeholders has been shown to be 3-5 times more beneficial than demonstration of competence in the food industry[33]. Effective communication with all stakeholders is another facet of maintaining a SLO. Optimal stakeholder engagement is honest, transparent and collaborative consultation and communication.

Although to mitigate some of the negative issues around social license, the social benefits derived from sport horse activities and the demonstration of economic benefits can be shown. Economic benefit alone has been proven to not to improve public acceptance and trust. A holistic approach to welfare has proven to be important in other equestrian industries, such as thoroughbred racing[34]. Forward thinking rules and codes of conduct relating to animal welfare would help to maintain an equestrianism SLO. There are many animal-use activities that have faced challenges and that the sport horse industry as a whole can look at and help shape its SLO for the future[30].

CONCLUSION

While this second State of the Industry report has allowed us to create an overview of the industry's current landscape, going forward, with the collection of statistics of subsequent years, it will be possible to gather more data on trends, not only between studbooks, but also from the industry as a whole. Studbooks can measure their success, and for smaller studbooks, there is the opportunity to make comparisons with their peers, rather than to measure themselves against the bigger players in the industry. But these trends are important not only for our breeders and studbooks. The sectors of breeding and sport are closely connected and interdependent. And we hope to have captured the interest of other stakeholders in the industry – national federations, riders, owners etc. For the next SOI report, to examine further how the health of the breeding industry impacts on sport and vice versa, we hope to expand on how registrations of horses, the number of horses going into the sport, and the worldwide economic state influence the sectors. Covid-19 was not as detrimental to the breeding industry as initially anticipated, with foal numbers having actually continued to rise. But with worldwide pressures we are now facing, with war and an economic decline, we expect to see changes in the years to come.

In addition to the statistics of the industry we explored the frequency and types of breeding technologies used. This data was difficult to collect, and it is clear that there is a lack of transparency on the frequency of use of various techniques. ET, ICSI, cloning etc are techniques that are changing the landscape of breeding, but it will only be in years to come that we can establish quite how our industry has been shaped by these. Are there implications for inbreeding, for health, and other factors yet to become apparent to us? We hope to be able to shed some light on this in the future.

Collection of data will remain an important element of future reports. But insights into health and welfare, and the social license to operate will provide building blocks to good breeding practices. Selection for health, not just of performance, is an important consideration for every breeder. Some conditions that have been current in the media have been examined in this report, and future reports will continue to build on exploring other conditions that are note-worthy for our breeders.

In collaboration with Hartpury University, a separate project of the WBFSH on producing a Welfare Statement that will underpin elements of good breeding practices has been initiated. Results are anticipated at the end of 2024. There is a strong overlap between the State of the Industry report and the Welfare Statement, with topics of mutual importance. Social license to operate and welfare are continuing themes, and therefore will continue to form an important element of following State of the Industry Reports. We have started off with an overview of these two topics, and aim to further explore them, so that we can fulfil our responsibilities to our horses and our industry as a whole.

It is the love of the horse that is at the root of all of this, and we want to be able to continue and grow for years to come, so that our industry is healthy and sustainable.

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