Epidemiology of horses leaving the racing and breeding industries

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CHAPTER ONE: LITERATURE REVIEW

1.1 Introduction

The careers of racehorses are, by definition, limited. At the 2002 Royal Society for the Prevention of Cruelty to Animals Australia (RSPCA Australia) Scientific Seminar entitled "Equine welfare: balancing tradition and science", attendees, who included academics, veterinarians, race industry professionals, animal welfare organisations and hobbyists, expressed concern over the fate of ex-racehorses. Industry representatives admitted that although vast amounts of research had been conducted into enhancing and improving racing performance, no known documentation exists as to the fate of horses leaving the industry. Given the cherished status of racehorses in Australia, the suggestion that the horsemeat industry may be an appropriate destination for these horses was debated with much passion.

Although the relationship between the racing and horsemeat industries has been anecdotally established, its magnitude and scope, as well as its welfare implications have not been investigated.

The aim of this literature review is to determine the size and nature of the racing and horsemeat industries, as well as the forces that influence it. Likewise, it will investigate studies that have previously described the numbers of horses leaving the race industry, and possible risk factors for this. This will establish the magnitude of the problem and aid in determining possible lines of future investigation.

1.2 The Australian racehorse population

It is estimated that between 0.9 and 1.5 million horses inhabit Australia and of these 300 000 are feral (Gordon 2001). Although it is difficult to categorise the roles of these horses, four basic groups of uses of horses in Western cultures have been identified. These are: recreational/social use, breeding, sport/competition and meat production (Endenburg 1999). The race industry not only encompasses breeding and sport/competition, but also influences the remaining groupings.

Horses associated with the racing industry represent the largest single category of the horse population. Those horses actively involved in the industry are estimated to have totaled 147 272 in 1998/99 (Gordon 2001). This includes the four subsections of the racehorse industry: Thoroughbred and Standardbred (harness) racing and breeding.

Despite a significant decline in both the total number of horses and the number of racehorses since 1989 (Gordon 2001; Pilkington and Wilson 1991), Australia remains one of the largest racing nations in the world. Not only does the nation have the highest per capita ownership of Thoroughbred horses, it is also the place of birth for 17% of the world's Thoroughbred foals (Ross 2003).

The race industry is also economically very important to Australia. Although estimates vary, it is credited with contributing over half of the $6.329 billion horse-related activities that contribute to the nation's Gross Domestic Product (Gordon 2001). It is also estimated that the Thoroughbred racing industry alone is responsible for the employment of approximately 250 000 people (Anon 2001).

For this reason, declines in the industry's viability are a source of great concern. The success of the industry and, following this, the welfare and wastage of the horses involved, is intimately tied to public perceptions of the race industry and participation within it (Bourke 1995).

1.3 Racehorse ownership in Australia – past and present

Racehorse ownership has long been identified with privilege and social status. Horses have represented strength, power and the 'warrior aristocracy' since Medieval times (Endenburg 1999), and the racing of these animals naturally evolved as a product of rivalry between owners. Despite this elitist background, the popularity of the sport amongst the general population gained momentum in England in the mid-seventeenth century as races became integrated with annual events. So races were held in combination with fairs, festivals and religious holidays that were enjoyed by all classes of people and were often accompanied by drinking, gambling and ribald behaviour (Vamplew 1976). This undesirable spectator behaviour, together with a lack of suitable horses, were the principal reasons for the initial banning of racing in convict Australia. However, even before the first officially sanctioned flat race in Sydney in 1810, the sport had been punctuated directly and indirectly by political intervention, economic dilemmas and social predicaments and scandals. The sport's supporters, though, advocated it as a means of testing the quality of Australian horses, and rewarding the efforts of trainers and breeders (Painter and Waterhouse 1992). The gold rush of the 1850s and the economic consequences meant that racing was elevated from the ranks

of a sport to that of an industry (Duckworth 2001). During this time visiting American adventurers also introduced the trotting style of racing (Anon 2003a).

Although racing, particularly Thoroughbred racing, remained a source of prestige for the upper class, it also, paradoxically, provided a means of unifying the population with much-needed entertainment and a common passion (Painter and Waterhouse 1992).

The emotional aspect of horse racing is still evident. The results of a survey of Standardbred horse owners (Roberts 2000), found that the emotional gains, including the "entertainment" and "thrill of winning", were the elements of their ownership with which they were most satisfied. Major race meets, such as the Melbourne spring carnival, are lauded as great social events. In 2000 it is estimated 5.12 million spectators attended races (Gordon 2001). At these meets, successful horses are treated as celebrities – witness the tremendous popular interest in Lonhro prior to his retirement this year.

However, entertainment and prestige are not the only aspects that drive the racehorse industry, and although the emotional element of horse racing is evident, the participating horses are usually viewed in light of their performance and success. Profit has long been an important impetus for racing, with some arguing that originally one of the primary functions of racing was to prove a horse's ability prior to sale. In addition to this, entrepreneurs have capitalised on the sport since its inception, mainly through gambling (Vamplew 1976).

Since the agricultural revolution, popular demand for economic gain has grown and inevitably has influenced modern racing. This resulted in the racing of younger horses, the popularity of sweepstake races and a reduction in race distances, along with an increased professionalism of the industry (Vamplew 1976). By the beginning of the 20th century, the Australian race industry became a more financially orientated enterprise, and in the 1960s the Totaliser Agency Board (TAB) was introduced to control the nation's large gambling industry and to raise revenue for the government. The role of gambling is such that recent advances in technology, such as televised meets and telephone and internet betting, have been predicted to result in future diminishing numbers of people attending race meets (Duckworth 2001). Declines in attendance have already been observed at harness racing meets (Gordon 2001).

The impact of gambling on the race industry, and as a result, on the racehorse population, cannot be underestimated. It has been claimed that the unfair distribution of TAB funds between the codes has been a key factor in the diminishing popularity and feasibility of harness racing (Alchin and Pearce 1993). In addition to this, further decreases in racing followers due to the growing popularity of alternative gambling enterprises have been predicted (Bourke 1995).

However, gambling is not the only monetary influence in the race industry. The influence of financial gain to the owners of the horses is an important consideration. Ownership of these horses is viewed by some members of the public as a type of financial investment, as was found in a report commissioned by the Australian Harness Racing Council in 2000. Although harness racing has fewer financial incentives and prestige than its Thoroughbred counterpart, almost half of all surveyed owners would have spent their money on real estate, shares or other business ventures, had they not otherwise been involved in racing. Over half of those surveyed also expected to make a profit (Roberts 2000).

Despite such expectations, ownership has been shown to be largely unprofitable. This was shown by the responses of Standardbred owners – 90% of whom admitted to not making a profit (Roberts 2000). A general lack of financial rewards is also true for Thoroughbred racing. This is because although the total prize money on offer in Australian Thoroughbred racing is third largest in the world, at $318,150,688 (Ross 2003), the high costs of horse maintenance, and the large number of horses and race meets, mean that this figure does not translate into economic gain for most owners. The International Federation of Racehorse Associations expresses the average financial returns as the average amount of money won by horses that have started in at least one race, over the average amount of money spent on keep and training. Australia has one of the lowest returns – with only 37%. Internationally the average returns vary from 185% in Argentina to 15% in Belgium (Anon 2003b). However, the true mean percentages of profit would be significantly lower than this, as it does not take into account the large numbers of horses that either do not enter training, or who trained but do not start in at least one race.

These findings reflect the results of a longitudinal study conducted in Queensland by More (1999), who found that during the first year of racing 710 out of the 1804 Thoroughbred horses (39.4%) studied earned no money at all. Although the highest earnings for an

individual horse was $871 030, it was calculated that using a conservative minimum training cost estimate of $8 400/year, only 237 horses (13.1%) would have had race earnings that covered the training expenses involved (More 1999).

The dissatisfaction with earnings has been identified as a primary reason for many who are involved in harness racing relinquishing ownership (Pollock and Brownlie 2001).

1.4 Wastage in the Thoroughbred and Standardbred industries

An increasing number of studies have investigated horse wastage occurring in the racing industry at various stages of a horse's life. Wastage here is defined as the number of horses leaving the industry. Its importance, in an economic sense, is that it represents great losses of potential revenue to the industry (Dyer 1998; Jeffcott *et al.* 1982).

A recent study estimated that over one-third of the Victorian Thoroughbred horse population in race training is replaced each year (Bourke 1995). The structure of the breeding industry is such that it depends on the need for 'replacement' racehorses. However, this high rate of horse turn-over is seen as detrimental, not only in terms of the questionable fate of the horses leaving the industry, but in terms of owner dissatisfaction, and subsequent further reductions in racehorse ownership (Bourke 1995).

Many recent studies have been based on a study conducted in the United Kingdom (Jeffcott *et al.* 1982). This analysed wastage in the Thoroughbred race industry from conception to 4 years of age in 1974. It calculated a total wastage rate of 72.8%, which equated to an estimated £15.2 million loss. This wastage rate included 13.9% of live foals that were not named (that is, registered), 20.1% of named horses that were not trained between the ages of two and four, and 6.2% of trained animals in this age group that did not race (Jeffcott *et al.* 1982).

The authors (Jeffcott *et al.* 1982) then surveyed 762 randomly selected horses to elucidate the reasons for horses not appearing in what could be considered 'sufficient' numbers of races. It was found that 26.5% of these selected horses did not race at all. The most significant reason for a horse not competing, or competing in fewer races than the average racehorse, was that they showed little ability. From a veterinary perspective, however, the

most significant causes of reduced performance were lameness – with 53% of horses affected by lameness at any one period of time during the season, followed by respiratory problems (Jeffcott *et al.* 1982).

A similar Australian study identified a considerable amount of wastage within a cohort of Thoroughbred racehorses by following the racing careers of 553 Thoroughbreds that were sold at the prestigious Australian Easter Yearling Sale in Sydney in 1991 (Bailey *et al.* 1999). Although this cohort is not representative of the entire Thoroughbred population, a total of 14.6% of these horses had not raced by the age of six years. Mares were more likely not to have raced, a result hypothesised to reflect opportunities for them in the breeding industry. It was also found that male horses that started racing at a younger age and which had an increased number of rest days between racing had a considerably longer career (Bailey *et al.* 1999).

A study conducted in Queensland (More 1999) also noted that only 71% of horses that started racing as 2 or 3 year olds continued to race for at least 1 further year, and 46% for at least 2 further years after their first start. Likewise, key predictors of racing life were investigated, and similarly included age at first racing, sex, date of birth and performance during the first year of racing as determined by the number of race starts and winnings. It found that horses that started racing at two years old were less likely to stop racing in the first two years. Additionally, males were less likely to stop racing in this time period, but this may not be an indicator of superior performance, but rather a reflection of the lack of non-racing alternatives for males as opposed to mares (that may enter breeding establishments). Contrary to popular belief, births late in the official race year were advantageous to length of racing career.

The wastage described by the Queensland study did not include that which occurs prior to horses starting in a race. A widely accepted figure is that only 300 of 1000 Thoroughbred foals born actually end up racing (Bailey *et al.* 1999; Bourke 1995).

The wastage rates in the Standardbred industry are comparable. A questionnaire was sent to Western Australian breeders and owners whose horses were identified as not having raced (Dyer 1998). It was found that 29.1% of foals are unnamed, that is, not registered. This is generally because the animals were thought to be unable to be competitive, were not a

financially feasible proposition, and were at the "lower end of the market". Of the named horses, 25.73% did not race. The reasons given for not racing were: death, injury, lack of speed, being erratic/dangerous, badly gaited, and lack of time.. Although fewer mares and fillies were named and raced, the outcome for them was decidedly more optimistic than that for geldings, due to the prospect of subsequent breeding careers. It was also proposed that registered Standardbred horses are likely to receive better care than those unregistered ones, at least until they are no longer able to compete (Dyer 1998).

These studies (Bailey *et al.* 1997; Dyer 1998; Jeffcott *et al.* 1982; More 1999) highlighted the short duration of the career of the majority of racehorses, despite the fact that these horses were assumed to have been bred specifically for this purpose. Although health and performance are inextricably linked, the majority of horses appear to leave for performance rather than health-related reasons. It has been purported that this performance-related wastage has been borne out of the unrealistic expectations of owners. It is possible the reasons for leaving racing, and those factors identified by previous studies, such as age, sex, time spent in training and racing success (More 1999), may affect the subsequent destinations of these horses.

No published study has described the wastage rates of Thoroughbred and Standardbred breeding mares and stallions in Australia. However, industry statistics (Ross 2003) show the number of breeding mares and stallions has decreased over time. From a peak in the 1980s of approximately 43 000 Thoroughbred mares and 3 900 Thoroughbred stallions eligible to breed in a year, the corresponding numbers in 2002 were 28 809 mares and 1 010 stallions. This was despite the fact that the percentage of foals born from registered mares had increased from approximately 40% in the 1980s to 61% in 2002. That means that although the number of Thoroughbred foals born had decreased from around 19 000 foals in the 1980s to 17 676 in 2002, the decrease was not in proportion to the decline in the breeding population (Ross 2003). Therefore, although there had been declines in the breeding population, the number of foals born in a given year had been reasonably consistent due to increased percentage of foals per registered mare. It was proposed that the culling of older or infertile mares have been critical to this increased foaling percentage (Bourke 1995). This may also be a reflection of advances in veterinary reproductive knowledge and technology.

In the Standardbred breeding industry, the number of services had also decreased substantially. However, a decline in the number of foalings had accompanied this decrease in Standardbred breeding. Although industry reports have described the decline in the breeding population, they tended to focus on the consequence of this on the foal crop, rather than the breeding horses themselves (Dyer 1998).

1.5 Administration of the race industry

The way in which the race industry is structured means that information regarding the movements of individual horses is difficult to acquire.

The Thoroughbred industry is composed of a national administrative body, the Australian Racing Board (ARB), of which the State and Territory Principal Racing Authorities are members. These are: Racing NSW, Racing Victoria Ltd, Queensland Racing, Racing & Wagering WA, Thoroughbred Racing SA Ltd, Darwin Turf Club, Tasmanian Thoroughbred Racing Council and the Canberra Racing Club Inc. These state authorities are responsible for, amongst other things, the registration of race clubs and the licensing of industry participants (Ross 2003).

A similar structure exists within Australian harness racing. The six State Controlling Bodies (together with the four Principal Clubs) have membership of the national body, the Australian Harness Racing Council (AHRC). This national body provides a common link between the State Controlling Bodies (Harness Racing New South Wales, Queensland Harness Racing Board, Harness Racing SA Ltd, Harness Racing Tasmania, Harness Racing Victoria, Western Australian Trotting Association). This is important as each State has differing administrative structures and functions. The National Council is also responsible for the integrity of the Australian Trotting Studbook and the maintenance of the Central Register of Names (Anon 2004b).

In contrast, the Thoroughbred industry's Studbook and Registrar are separately managed. The Australian Studbook acts to ensure the "integrity of Thoroughbred breeding", and is a jointly owned venture of the Australian Jockey Club and the Victorian Racing Club (Anon 2004c). This is achieved by the registration of breeding mares and stallions in the form of "returns" that need to be completed each breeding season.

Thoroughbred registration and naming is administered by the Registrar of Racehorses, which is based at the Racing NSW headquarters (Ross 2003). The Racing Services Bureau, under the auspices of Racing Victoria, is then responsible for maintaining the results of all registered Thoroughbred race meets throughout Australia. Data available include: name, sex, foal date, details of each racing start (finish position, weight carried, track condition, race distance, race type– flat/hurdle/steeple, date and location of race meet), in addition to the horses' starts per season, wins and total earnings. However, due to limitations of the previous database in place prior to 1996, complete records of horses racing prior to this are not available. The Racing Services Bureau database is not linked to that of the Studbook, which hinders the ability to trace horses that left racing to enter breeding establishments.

Previous Australian research (More 1999) overcame the difficulty presented by the fragmented roles of the various controlling bodies by restricting the study population to horses residing in specific locations and with specific racing histories. Other research (Bailey *et al.* 1999) used a restricted sampling frame of horses that were offered for sale at specific auctions. This, however, is likely to cause significant bias in the results. In addition to this, the ability to determine risk factors for the wastage and destinations of racing and breeding horses, a cross-sectional approach would be advantageous so that comparisons could be made between locations, ages and racing histories of horses, as well as between different sectors of the race industry.

Questionnaires to trainers have also been used to examine wastage and to determine reasons for horses leaving the industry (Bailey *et al.* 1997; Dyer 1998; Jeffcott *et al.* 1982) . The advantage of conducting a survey is that data collected has the potential to describes the actual wastage in the population, rather than be biased by the specifics of the record-keeping systems of the controlling bodies. This is because industry statistics do not include the entire racehorse population. No records exist for horses that were in training without starting in one racing, or for breeding horses that were not registered to breed in a specific year.

Additionally, the race industry does not document the destinations of racehorses once they leave racing and breeding.

1.6 The ex-racehorse

The dynamic nature of the racehorse population coupled with the size of the industry, means that horse wastage is potentially a large-scale problem.

It is believed by lay people that many ex-racing horses enter breeding enterprises. This is an inferred reason for many mares leaving racing at a younger age than geldings (Bailey *et al.* 1997; More 1999). However, declines have been described in the breeding population (Dyer 1998; Ross 2003). These declines may result in a two-fold problem: not only could there be additional wastage in this breeding sector, but fewer avenues may exist for horses leaving racing.

In addition to the apparent lack of demand for surplus (breeding and racing) horses in the other horse-related industries, there are various problems and costs associated with keeping horses in contemporary Australia. Public health regulations restrict the agistment of horses in urban areas, and otherwise raise the costs of horse care. In addition to this, the fear of native habitat destruction has led to further restrictions on horse ownership (Gordon 2001). Feed costs have also increased as a result of droughts (Pollock 2003). Overall, there does not appear to be the required space, finance or skill to care of this large surplus of horses.

Much of the race industry is influenced by economic factors. However, after completing their racing careers, the market value of these racehorses drops drastically and they become virtually worthless. The low market value of the animals means that they become very affordable but may be purchased by people who do not have adequate financial resources, and perhaps knowledge, for the basic care required for animals that were bred to be elite athletes.

In addition to this, Thoroughbreds are known to be “highly strung” (Duckworth 2001). The training of these animals is focused on speed and performance. Although professional trainers have used these traits to produce elite performance horses most notably in the Olympic disciplines, these are attributes not usually desired in pleasure riding, especially by novice owners and riders. This raises serious welfare concerns, and may represent reasons for further wastage of these horses subsequent to their leaving the racing industry. RSPCA

president Hugh Wirth commented on the role of the welfare organisation's contact with ex-racehorses:

" We tend to see the worst abuse [of ex-racehorses], which is the end result of a disastrous trail through multiple owners, from racecourse down to standing neglected in one of these paddocks... owned but not cared for and starving"

(Schwartz 2002)

Consequently, wastage subsequent to leaving the racing or breeding industry may occur and have serious welfare ramifications.

In non-racing contexts, previous studies (Odberg and Bouissou 1999) have hypothesised a possible link between behavioural problems in the ridden horse and slaughter. This was a result of the low average age at death recorded by an official registrar for all studbooks in France, of 10.31 years. It was proposed that behavioural reasons or physical problems as a result of poor riding or training were a principal factor for this low age (Odberg and Bouissou 1999). It is possible this may be a cause of further wastage in the ex-racehorse.

Standardbred horses, although in terms of temperament are more suited to the novice horse-person, also require careful retraining once leaving the race industry. This is because they need to be broken to saddle. Unlike the Thoroughbred though, the ex-harness racing horse is not generally seen as a desirable performance riding mount. This is largely due to the distinct gait of these horses (Duckworth 2001). Although attempts through the Standardbred Pleasure and Performance Horse Association have been made to reduce the stigma associated with these horses and find suitable riding homes for them, no significant "secondary market" for these horses has been identified, particularly geldings, once leaving racing.

The fate of these horses has not been properly explored. Many animal welfare groups have hypothesised a link between the ex-racehorse and the horsemeat industry.

The unwanted, rejected and "failed" [race] horses: Most, and we are referring to millions, are sent to the knackery for glue, pet food and fertiliser. Very few find a good home, though some are sent to Korea, USA, Japan and other countries where racing "standards" are lower. But they will almost certainly be killed long before their natural day.

(Anon 1998)

In the Australian media the story of the potential Olympic show-jumper, "Mr Burns" featured prominently. After 12 race starts and only $3170 winnings, this Thoroughbred was sold to a Sydney knackery, from which he was 'rescued' (Presnell 2004). Many similar emotionally-charged stories regarding the relationship between the racing and horsemeat industries have recently appeared in the media (Anon 2004a; Paulick 2003).

1.7 The Australian horsemeat industry and the ex-racehorse

The Australian horsemeat industry has two distinct components: abattoirs exporting meat for human consumption and knackeries selling the meat as petfood for consumption in Australia.

A survey conducted in 1991 (Pilkington and Wilson 1991) of approximately thirty licensed knackeries in Australia found that an estimated 7,500 horses were slaughtered for petfood and, to a lesser extent, other horse by-products such as hides and hair. However, at this time operators were not optimistic about the future of the industry, citing problems with sales tax, lack of horses available, horse welfare organisations and the higher prices paid by the two export abattoirs (Pilkington and Wilson 1991).

The market for horsemeat for human consumption is dominated by France, Italy, Belgium/Luxembourg, Switzerland, the Netherlands and Japan, which import 90% of the world's horsemeat. The former four prefer unprocessed horsemeat as opposed to the 'manufacturing grade' preferred by the latter two countries. There are around thirty countries that export the meat, of which Australia has a relatively low market share. The differences in attitudes towards horsemeat production vary greatly between these countries. For example, in France, horses are purpose-bred for meat and are considered a viable means of increasing both land utilisation and the profitability of beef enterprises (Pilkington and Wilson 1991).

The export of horsemeat from Australia came to prominence in 1977. The annual figures between 1977 and 1995 varied between 6000-9000 tonnes (Gordon 2001; Pilkington and Wilson 1991). Currently, only two abattoirs are licensed to export horsemeat – one based at Caboolture, Queensland (Australian Chevaline Industries) and the other at Petersborough,

South Australia (Metro Meats). These processing plants, together with the now defunct plant in the Northern Territory, were estimated to have slaughtered between 40,000 and 45,000 horses in 1991. The majority of these horses were feral, however the rate at which these feral horses were slaughtered was unsustainable in terms of the future numbers of feral horses available to be harvested. It was proposed that an increased number of domestic horses would fill this demand. Standardbred ex-racehorses were seen as ideal candidates. This is because, unlike their Thoroughbred counterparts, there is no significant "secondary market" for Standardbred horses once they have completed their racing careers (Pilkington and Wilson 1991). As seen in Table 1.1, since that time though, the numbers of horses processed as reflected by the decline in the weight of horse meat processed, have significantly decreased. Although the reasons behind the dramatic decline in 2000 may relate to a strong beef market that year, the impact of the lack of feral horses is a possible reason behind a general reduction in numbers.

Year	**Weight (kg)**
1995	6 574 365
1996	5 187 946
1997	5 123 405
1998	6 048 932
1999	5 743 494
2000	3 471 261

Table 1.1: Mass (kg) of horsemeat exported from Australia in 1995-2000 (Gordon 2001)

Anecdotally, the sources of horses entering knackeries and abattoirs have been loosely identified. Representatives of meat processing plants, or private dealers trading with them, are known to source horses from public auctions. A significantly large proportion of these are thought to be ex-racehorses. In addition to this, owners sell their horses directly to the horsemeat processing plant. This may be due to health or behavioural problems in the horses, economic difficulties, or simply not wanting the horse any longer. Some plants also have direct relationships with race trainers and studs. Feral horses may also still be processed, and although not widespread, feral horsemeat is the only form of horsemeat that can be sold legally for human consumption in Australia. This is because the Food Standards Code classifies it as 'game meat' due to its lack of drug residues. On a much smaller scale, and not widely publicised, the abattoir in South Australia breeds horses specifically for meat. This is similar to what occurs in European countries such as Italy, where the high consumer demand and specific taste preferences mean that this is a feasible proposition (Duckworth 2001).

No published study has quantified the demographics of horses entering slaughterhouses in Australia. A study conducted in Germany between 1974 and 1982 (Odberg and Bouissou 1999), though, found that the average age of the 2970 horses studied was 8.5 years old – with 'old age' the reason for slaughter for only 19 of the horses. The largest group of horses entering this slaughterhouse was the ridden Warmblood horse (2532 horses), then ponies (173), Haflingers (141), racing horses (80 Standardbreds and 13 Thoroughbreds) and draught horses that may have been bred specifically to produce meat (31). Most owners did not provide a reason for the sale of their horse for slaughter (Odberg and Bouissou 1999). Although these figures are certainly indicative of problems surrounding the horse industry, a direct correlation between breeds and ages of horses entering knackeries and abattoirs between Germany and Australia would not be appropriate. This is because the number of registered Thoroughbred racehorses in Australia was more than eight times the number in Germany in 2002 (Ross 2003). It is also possible that in Australia Thoroughbreds are a more common ridden horse than Warmbloods, which is possibly not the case in Germany.

In addition to this, the European and Australian meat industries are structured very differently. In Europe is a more independent industry based around the production of horsemeat for human consumption, while the Australian system largely deals with refuse from other horse industries (Pilkington and Wilson 1991).

Although hippophagy, the consumption of horsemeat, is largely taboo in Australia, there are historical bases to this practice which is responsible for the slaughter of a far greater number of horses in this country than that for domestic pet meat. Evidence exists that suggests hippophagy has occurred since between 130 000 and 14 000 years ago in the Paleolithic era when horses were viewed purely as game animals (Levine 1999). This relationship with the horse as a source of food was maintained as horses were domesticated and maintained in herds between 5000 and 3000BC (Endenburg 1999). Although later the ridden horse was greatly cherished for the way in which it influenced human life, with some tribes burying their dead with their revered mounts, the consumption of its meat continued at religious festivals. However, many of these tribes were later converted to Christianity, which preached that hippophagy was a sin (Duckworth 2001).

The economic milieu has also been proposed as being responsible for the rise in prominence of hippophagy in continental Europe in the 18th century. It has been argued that this rise in

popularity was a result of war and revolution causing both shortages of meat and the money to support horses that were no longer working. This was perceived by some to be beneficial to the welfare of these horses, as it was argued that the horses would be better looked after when the cab drivers perceived their health to be a type of financial investment which could be redeemed when the horses were no longer able to work (Duckworth 2001).

It has also been argued that the horsemeat market promotes positive horse welfare. This is because it provides a humane alternative for horses that could otherwise be abused or neglected. A study conducted in the United States (Grandin *et al.* 1999) found that of the 1008 horses studied entering slaughteryards, 7.7% (78 horses) had serious welfare problems – including emaciation, laminitis/limb problems affecting mobility, severe lesions and tumours and behavioural problems. Of these serious welfare conditions, 77% were caused by abuse or neglect by owners. This led the authors to conclude that should the horse-slaughter market close, it is likely that an increase of severe neglect would be seen as the horsemeat industry represents a humane alternative for these horses (Grandin *et al.* 1999). It is likely that if these results could be extrapolated to the industry in Australia, a large percentage of those abused and neglected horses would be ex-racehorses. This is due to the low market value of the ex-racehorse and the high costs of care and experience needed. In addition to providing a humane alternative for these horses, the horsemeat market also establishes the base market value of these animals. Hence, it may also reduce the abuse and neglect of such animals by elevating their price and making inappropriate purchase of horses financially prohibitive.

1.8 Scope of study

High wastage rates in the racing horse population have been identified, along with possible reasons for them. A fluctuating horse population in both racing and breeding industries has also been described. And, although the serious implications of this to the industry have been acknowledged, no research has investigated the destinations of the large number of racing and breeding horses leaving the race industry. So, this study is designed to identify the current wastage rates and determine the fates of these animals. As part of this, the possible relationship between the racehorse and horsemeat industries will be investigated.

As the first investigation of its type in the Australian horse industry, the current study is an example of descriptive epidemiology – observing and recording data that characterises the fate of these horses, with the aim of possibly identifying key causal factors. It is also expected that this study may generate further hypotheses that can be more fully explored in later studies, or identify additional aspects of the industry that require subsequent investigation (Thrusfield 1997).

Race industry stakeholders appear to represent diverse interests, and the racehorse population is dynamic. Consequently, the importance of a broad study population was critical. The fragmented roles of the various industry administrative bodies, and the limitations of their record keeping means that they are unable to accurately trace the movements of all horses involved.

The study aims to provide information that will aid in promoting responsible horse ownership and work towards improving the welfare of horses involved in the various industries. This is also of great relevance to the race industry – given the evidence of both the declining racehorse population and the declining viability of racing-related enterprises, and their dependence on positive public perceptions.

CHAPTER TWO: METHODS AND MATERIALS

2.1 Introduction

At the commencement of this study, in early February 2004, all those who attended the 2002 RSPCA Scientific Seminar were contacted via e-mail. This was in order to better

understand the concerns of key industry players and obtain possible industry assistance. Significant interest was expressed in the study, with many articulating the belief that gaining this information was of paramount importance. A wide range of suggestions was also offered. Some expressed the wish that the role of abattoirs and knackeries as a legitimate industry, which providing a humane alternative for abused, neglected and unwell horses, be investigated. The majority of respondents though, were more interested in the implications the horsemeat industry had for the other horse industries – in particular the racing industry, and to a lesser extent, that of pleasure riding. Several respondents claimed that the study of the horsemeat industry may be beneficial in that it may illustrate the problems behind inappropriate training that "has a premium on relatively fast results" – and may lead to subsequent health problems. It was suggested that it would be beneficial to collect key data, such as age, breed, sex and condition score, from a national survey of meat processing plants as a means of ascertaining the reasons (whether "behavioral, medical, conformational and economic") for horses entering the plants.

The investigation was thus divided into two parts, exploring:

i) A preliminary exploration of the horsemeat industry

ii) An investigation into the numbers of horses leaving the racehorse industry and the reasons for this, as well as fates of these animals.

2.2 The horsemeat industry

2.2.1 Objectives of investigation

This preliminary investigation into the horsemeat industry was to ascertain basic data relating to horses entering the industry and their source. It also aimed to assess the

feasibility of future more in-depth research into this industry, in terms of the co-operation of industry stakeholders and the quality of data obtainable.

2.2.2 Details of industry stakeholders (preliminary investigation)

In order to determine what information was available regarding horses slaughtered in Australia, government agencies and industry bodies were contacted. It was found that horse knackeries are governed at State level – under the auspices of SafeFood (New South Wales), PrimeSafe (Victoria), SafeFood (Queensland), Department of Primary Industries and Resources (South Australia), Department of Primary Industries, Water and Environment (Tasmania) and the Western Australian Department of Health (Western Australia), respectively. The Northern Territory no longer processes any horsemeat.

The contact details of all knackeries in Australia were obtained. These agencies were also questioned about the licensing of 'knakeries', plants processing meat for petfood. This was to determine those aspects of the industry that could be investigated using existing records. It was found that none of these agencies are required to maintain any records regarding the processing of meat for pet food, and so none were able to provide any data relating to horses entering slaughterhouses. Indeed some were unable to specify what species of animal were processed at the plant.

The Australian Quarantine Inspection Service (AQIS) provided the contact details for the two export human-grade horsemeat "abattoirs". These plants are based in Caboolture, Queensland and Petersborough, South Australia. However, since both plants are owned by foreign companies, a reluctance to divulge commercial-in-confidence records, such as numbers of horses processed, was envisaged. This presented issues regarding the collection of data, as the information would have to be recorded in a way in which each plant would not be able to deduce the data provided by the other plant. This problem was compounded by the fact that horses entering abattoirs are likely to be significantly different from those entering knackeries, meaning that the data would not be able to be grouped together with those from the knackeries. As such, the target population for this part of the investigation was restricted to knackeries.

2.2.3 Investigative procedure

A telephone interview was conducted to obtain basic information regarding the suitability of the plants for the study and basic data available. This information included whether any records describing the number and type of horses processed were maintained. This is important information not just from the point of view of crude data available, but in terms of determining whether the plant would be suitable for studying, as it would determine whether the plants impose any selection criteria upon horses entering, which might bias the results of the investigation. For example, there could be regional differences in horses entering plants due to, for example, proximity to a race course. In addition to this, a sufficient number of horses entering knackeries would need to be studied in order that generalisable and statistically significant trends and risk factors could be identified.

Telephone interviews were the most appropriate method of investigation due to concerns about varying literacy levels and the diverse geographical locations (Thrusfield 1997). It was also a preferable method due to the highly emotive nature of the horse industry, and the stigma associated with horse slaughtering. This was probably a principal reason for previous studies of horses entering knackeries and abattoirs in Australia having had low participation rates (Pilkington and Wilson 1991). Assessing the willingness of industry stakeholders to co-operate was one of the key aims of this part of the investigation, as it is essential for the quality of future data collection.

2.2.4 Telephone interview design

A script for the interviews was constructed to overcome possible bias due to inconsistencies in telephone manner and phrasing.

Only managers or owners of the processing plants were interviewed. These interviews were designed to be of short-duration, due to most interviewees being short of time during business hours.

2.3 The racehorse industry

2.3.1 Investigative procedure / methods of investigation

All national and State race industry governing bodies were contacted to determine the information that is recorded and available, and whether this would be adequate for describing the current status of horse wastage. Unfortunately, due to the fragmented roles of regulatory bodies, the specifics of the record-keeping databases and the lack of knowledge regarding the movements of all horses, the use of industry statistics was subject to serious limitations (see sections 1.5 and 1.8).

A standardised questionnaire for the Standardbred and Thoroughbred breeding and racing industries meant that these enterprises could be compared in terms of both the wastage involved and the destination of the respective horses. Questionnaires have a broad scope which is appropriate for an early observational investigation that focuses on a diverse industry. Additionally, the data collected by a questionnaire has the potential to describe the actual wastage in the population, rather than being biased by the specifics of the record-keeping systems of the controlling systems. The destinations of horses leaving can also be identified.

2.3.2 Questionnaire objectives

The purpose of the questionnaire was principally to define current wastage rates and flux in the horse population in Thoroughbred and Standardbred racing and breeding. Additionally, it aimed to identify the reasons for horses leaving the industry, the destinations of the horses, and possible risk factors that influence the various outcomes.

For the purpose of this study, "wastage rates" were defined as the percentage of horses leaving racing stables or breeding studs, rather than the number leaving the industry. This is because it could not accurately be determined whether the horses leaving subsequently entered other enterprises within the race industry or not.

Both descriptive and analytical methods were adopted to determine these aspects. In terms of the population statistics required, that is, the wastage rates, the investigation took the form of a descriptive cross-sectional study. However, in addition to describing the frequencies of certain destinations, a retrospective case-control study approach was used to examine the fate of horses leaving racehorse industries.

2.3.3 Study Population

Race industry participants are an eclectic group of people and a large sector of the racehorse-owning population depends on professionals in the industry, including trainers and studmasters, to guide them. There are also various forms of ownership, such as syndicates, in which not all owners may be fully informed about the specifics of their horse. Therefore, it is likely that a survey of trainers and studmasters would provide better-informed data overall than those that might be provided by the owners and would also have the potential to report on wastage rates over a greater number of horses. In addition to this, trainers and studmasters are industry stakeholders who presumably have a greater interest in the results of this study, which might result in increased participation.

2.3.4 Participant Selection

Trainer selection

Thoroughbred and Standardbred trainers are required to be licensed by State or Territory racing authorities. At the beginning of this study, these bodies were contacted in order to obtain listings and contact details for all trainers. Some of the Thoroughbred regulatory bodies publish lists of registered trainers and contact details in their monthly race calendar or other publicly accessible lists. These were obtained for NSW (*Racing NSW*), Victoria (*Inside Racing, Racing Victoria*), South Australia (www.racingsa.com.au), Western Australia (*Racing Western Australia: The Racing Calendar*). Listings were taken from the May 2004 editions of these journals. Meanwhile, the details of trainers registered in Tasmania, the Northern Territory and Queensland were obtained directly from the racing authorities (Tasmanian Thoroughbred Racing Council, Darwin Turf Club, and Queensland Racing respectively).

Details of registered harness racing trainers were acquired using a similar system. An annual publication, *The 2003-2004 License Holders Directory and General Rule Book* is published by Harness Racing Victoria, Harness Racing South Australia and Harness Racing Tasmania, and a listing of these States trainers is provided. Western Australia (Western Australian Trotting Association) and Queensland (Queensland Harness Racing Board) do not publish this information, but provided contact details directly.

Unfortunately, the only remaining harness racing authority, Harness Racing NSW, was unable to disclose the names and contact details of its registered trainers, due to Privacy regulations. For this reason, NSW Standardbred trainers who had horses listed as starting in a race in official racing guides (NSW Harness Racing, http://www.harness.org.au/formframe1.htm) between 16th June 2004 and 29th of June 2004, and whose contact details were listed in the White Pages directory, were selected. This two-week time period covered the following 17 race meets:

Menangle at Harold Park 16/06/04, Bankstown 17/06/04, Harold Park (Sydney) 18/06/04, Parkes 18/06/04, Temora 19/06/04, Newcastle 19/06/04, Fairfield 21/06/04, Harold Park (Sydney) 22/06/2004, Menangle at Harold Park 23/06/2004, Maitland 24/06/2004, Bankstown 24/06/2004, Harold Park (Sydney) 25/06/2004, Dubbo 25/06/2004, Newcastle 26/06/2004, Wagga Wagga 26/06/2004, Fairfield 28/06/2004, Harold Park (Sydney) 29/06/2004.

In order to gain an understanding of the wastage of the entire industry, trainers of all license and racing types. For example, all Thoroughbred trainers, regardless of whether they were owner-trainers, class one trainers, or only trained horses for jumping or picnic races were selected. This is because the wastage rates and horse destinations of different categories and locations of trainers are likely to be significantly different. For example, it is commonly acknowledged that horses in city racing stables that do not perform adequately are often sold to owner-trainers in the country where the races are not as competitive. Consequently, horses leaving country stables because of poor performance may be more likely to leave the race. This sampling method also means that the influence of the different licensing types between the two racing codes would not provide additional bias.

Studmaster selection

Although all trainers were selected regardless of size of stables, licensing types or location, studmasters were defined as owners or managers of studs if they had a stallion standing for service in the current breeding season. This was principally because Standardbred mares do

not have to complete "return" forms annually, and so the active breeding population is unknown, and, additionally, the details of studs with stallions was the only information available regarding Standardbred studmasters, and was obtained through publicly listed information (http://www.harness.org.au/ausbreed/studs/INDEX.HTM). So that the Thoroughbred breeding industry could be compared to the Standardbred, it was decided that this would form the selection criterion. Although this does present differences between the racing and breeding participants, it has important advantages. For example, perhaps unlike racing establishments, there are many smaller-scale breeding enterprises whose primary aim is not the breeding of racehorses although they do keep their mares registered. This is evidenced by the contact details available from the Australian (Thoroughbred) Studbook. Although there are approximately 11 000 breeders, approximately 7 000 of these only have one mare. A further 1 900 have two mares, 750 have three mares, 400 have four mares, 950 have five or more mares. For horse wastage to be accurately examined a study population with significant numbers of horse must be studied. There are approximately 700 stallion-owning studs, which is approximately equal to the number of studs with five or more mares. So, it is likely if a study population of stallion-owning studs is adopted, the number of horses described would be statistically significant.

2.3.5 Sampling methods

As this study is the first to investigate the destinations of horses leaving racing and breeding, there were no indications of the expected data and frequencies. This is information that would be valuable when deciding on sampling fractions. However, based on the numbers of registered trainers and lists of studmasters, a sampling fraction of 25% was considered to be adequate to provide statistically significant results. Trainers and studmasters were selected via stratified random sampling. This was because the study aimed to analyse cross-State/Territory differences and, as such, accurate representation of all States and Territories – especially those with fewer numbers - was essential. The trainers were divided into 'strata' at the level of State/Territory. In a method known as 'proportional allocation', 25% of these trainers from each 'strata' (State/Territory) were then randomly selected (Thrusfield 1997). However, to ensure adequate respondents, a minimum of ten trainers/studmasters for each State/Territory was also employed. If there were fewer than ten, all trainers/studmasters were selected (see Tables 2.1 and 2.2).

	Thoroughbred	Standardbred	*Total:*

NSW + ACT	1312 (328)	* (221)	1312 (549)
NT	37 (10)	N/A	37 (10)
Qld	1343 (336)	397 (100)	1740 (436)
SA	363 (91)	307 (77)	670 (168)
Tas	40 (10)	249 (63)	289 (73)
Vict	1260 (315)	1352 (338)	2612 (653)
WA	669 (168)	725 (182)	1394 (350)
Total:	5024 (1258)	3030 (981)	*8054 (2239)*

* Different selection criteria

Table 2.1: Number of registered trainers (number of selected trainers).

	Thoroughbred	Standardbred	*Total:*
NSW + ACT	192 (48)	75 (19)	267 (67)
NT	1 (1)	N/A	1 (1)
Qld	143 (36)	33 (10)	176 (46)
SA	32 (10)	24 (10)	56 (20)
Tas	15 (10)	9 (9)	24 (19)
Vict	136 (34)	102 (26)	238 (60)
WA	69 (18)	27 (10)	96 (28)
Total:	588 (157)	270 (84)	*828 (241)*

Table 2.2: Number of studs with a stallion currently standing (number of studs selected).

However, in New South Wales all Standardbred trainers, as identified by previously discussed methods, were selected. This is because the recruitment of these participants differed from that of other industry participants, and due to the lower numbers of trainer contact details available, the selection of one-quarter of these trainers would not have been adequate.

2.3.6 Questionnaire construction

To encourage participation and accurate responses, the anonymity of respondents to the various questionnaires had to be assured. This is because the fate of horses leaving the race industry is potentially controversial, as was suggested by the emotional debates between horse enthusiasts and professionals at the RSPCA Scientific Seminar.

Section I - Trainer / studmaster characteristics

Although all questionnaires were anonymous, key trainer information was required to ascertain relative response rates and determine whether the respondents were representative of the total surveyed population. This information included location at a State or Territory

level, and, for trainers, whether they were based at a metropolitan city racetrack and were owner-trainers (Appendices 1 and 2). For breeders, questions that related to the size of their operation were included: "how many mares were serviced in a given breeding year?" and "how many foals were subsequently born?" (Appendices 3 and 4)

These trainer/studmaster data were also important as they could have influenced the fate of the horses leaving their stables/stud, and as such, were later analysed as possible risk factors for this.

Key information about stud farms' and racing stables' horse populations was required to determine wastage rates. This was also used to determine whether the size of horse turn-over in a stable/stud influenced the fate of those horses leaving the industry.

To calculate wastage rates in a given year, the number of horses present at a fixed date had to be determined, along with the number entering and leaving throughout the following year. For studmasters, these numbers needed to be determined for both mares and stallions separately.

The official Thoroughbred year begins on the 1st August, whereas the Standardbred year begins on the 1st September. Trainers and studs record information according to these dates, and so these were used in the questionnaire. A table was constructed to ensure responding was as efficient as possible. The survey was sent in June/July, and was designed to avoid additional bias by collecting data for an entire year which was consistent for the two industry codes. For this reason, although the quality of data recalled may have been affected, the 2002-2003 year was selected. Unfortunately, however, most of the listings of trainers and studmasters available were those for the 2003-2004 season. This may be a source of sampling error, as some of those who were registered for the previous year may not be registered in 2003-2004, and so not surveyed. The inverse is also true in that some trainers and studmasters may have received surveys for which they were not be able to provide the relevant information about horse wastage rates. This is unavoidable, given industry constraints.

The questions were formatted so that a gradual progression from the less demanding questions, such as location of stables/stud, gave way to questions that required more

thought, such as specifics of their horse population. This is a standard survey design strategy to encourage participants to start the questionnaire, after which most participants have been shown to feel committed to completing the remaining questions – thus contributing to a higher participation rate (Thomas and Nelson 1996).

In addition to this, the initial questions required the participant to indicate a correct response from a list of categories offered. For example, ticking the State/Territory in which the stables/stud was based and, for trainers, ticking whether they were based at a metropolitan city race track and whether they owned the horses in their training stables. These latter two questions were also phrased in a manner to avoid a "carry over"(Thrusfield 1997) between questions. This effect occurs when the answer to one question influences that of the next. In this case, trainers were asked whether they were based at a metropolitan city racetrack. The next question was whether they owned the horses they were training. Anecdotally, a greater percentage of trainers not based at city racetracks own the horses they train, and so would answer 'no' followed by a 'yes', thereby requiring the trainer to carefully consider each question.

Section II – Characteristics & destinations of horses leaving the race in dustry

To describe the fate of horses leaving the race industries, specific information regarding the horses that had left racing stables and studs was required. For this reason, the questionnaire included questions relating to the details of horses that had left the participants' stable/stud. If the details of horses that had previously left on specified dates were required, the provision of this information could be seen as tedious and the quality of recall could be affected. Therefore, it was decided that the details of the last five horses to have left the stables/stud would be sufficient – a so-called "(non-probability) convenience sampling" (Thrusfield 1997).

The amount of specific information required meant that it was essential that this section of the questionnaire appeared simple and not onerous. For this reason a simple table for the details of the five horses was constructed, with a large number of closed or semi-open-ended questions. This is because closed-ended questions are not only less time consuming for the respondent (thereby promoting increased response rate) and are easier to analyse (Vaillancourt *et al.* 1991), but requires them to stay focused on the 'most correct' answer,

which is essential given the diverse nature of the racehorse population and those associated with the industry.

Racing trainers

Factors which have previously been shown to influence age of leaving the racing industry (Bailey *et al.* 1999) were hypothesised to be pertinent to the destinations of horses leaving the racing industry. Therefore, questioning of the sex, number of years in racing and class of racing achieved (as a measure of success) were included in addition to the specific age at departure (Appendices 1 and 2). The influence of genetic merit, perceived or otherwise, has not been described. However, anecdotally, a horse carrying desirable bloodlines is more likely to go to stud after racing than is a horse without them. A measure of this is the purchase price of the horse. Although many trainers are not the owners of the horses, a significant number of them would be aware of the economic worth of the horses in their stable, and so this question was included. The age at purchase was asked, as well, as this influences the price expected, younger horses being generally cheaper because they are untried and require time and effort before their form can be determined.

Additionally, the reason for the horse leaving was sought. This is because the reason for leaving most likely influences the destination of the horse. For example, the destination of an injured racing horse may differ from that of a horse that was unable to perform adequately. Key reasons for leaving racing have been identified by previous research – and includes most notably poor performance and injuries or illness (Bourke 1995; Jeffcott *et al.* 1982).

As such, trainers were asked to nominate the principal reason from the following options:

- illness/injury
- poor performance/slow
- unsuitable temperament/behaviour

Due to evidence suggesting mares leave racing earlier than geldings specifically to go to stud (Bailey *et al.* 1997), the option of "to breed" was created. A "dumping category" of "other" was also included, to cover those possibly less frequent reasons that were not provided (Thrusfield 1997).

Ascertaining the destinations of these horses was potentially problematic because no previous research had investigated this aspect of the industry, and so, various plausible

reasons needed to be anticipated for the participant to circle. As such, these categories were based on anecdotal evidence and suggestions from industry stakeholders.

Additional difficulties arose when formulating these responses since the organisation of training stables differs significantly. Some trainers are licensed only to train their own horses, and hence potentially have more extensive knowledge about horses leaving their stables, whilst others run more commercial enterprises in which the owner may not fully inform the trainer of these particulars. This is especially true if the horse left as a result of disputes between the two parties.

For these reasons, and for the sake of respondent's ease of completion, broad categories of destinations were needed. "Knackeries" as a possible destination was included due to the widely hypothesised relationship between the two industries. Additionally, due to the link between horses leaving racing to join studs (Bailey *et al.* 1997), the category "stud" was used.

Furthermore, horses frequently move between trainers, whether as a result of owner-trainer conflicts, financial considerations, or location issues. For example, they may move to destinations where the racing field is more or less competitive. So, the destination of "different trainer" was also included.

Horses are also frequently rested from training, by being sent to "spell" in a paddock. It was decided that this destination should be included, as horses may not return to racing from spelling, for example because of unresolved injuries, with many possibly retiring to paddock. The ultimate destinations of these horses would largely be unknown to trainers. So, this represents one of the limitations of the current questionnaire.

Racing horses are also frequently sold at auction – both during, and at the end of, their racing careers. Trainers often do not know the fate of horses in their care subsequent to sale, and hence it was necessary to include this as an independent category. Although these categories were designed to be "mutually exclusive and exhaustive" (Thrusfield 1997), a level of potential duplication was identified. For example, a horse may leave a training stables to go to "auction", and may then go to a "stud" or "knackery", or even a "different trainer". For this reason, although not ideal, "auction" was placed lower down in the list of

destinations from which trainers were required to circle only one, in the hope that if this was the case, the other more descriptive options were chosen preferentially.

The question was asked as a "semi-closed" question – with the additional, "dumping" category of "other" included to contain destinations which were not covered by the primary categories provided (Thrusfield 1997). Participants were asked to specify these locations, which may assist in the design of future surveys. This is the advantage of semi-closed questions (Vaillancourt *et al.* 1991)

Studmasters

To make comparisons between racing and breeding horses, the studmaster questionnaire included similar questions. Wastage has not been explored in as much depth in breeding horses, so the information regarding racing horse wastage was used as a guideline for the expected influences on the fate of breeding horses.

The details of the last five breeding horses (mares or stallions) to have left the stud were required. As with racing horses, information regarding the sex, purchase price and age at purchase and number of years at stud were required. In order to gauge fertility "success", studmasters were also asked about the number of foals born to each mare or sired by each stallion. Likewise, an additional question was included to determine whether these breeding horses had raced prior to entering the stud, as a means of exploring the relationship between these two industries, as shown in Appendices 3 and 4.

The options for participants to chose for "reasons for leaving" the stud, were generated after industry consultation and anecdotal knowledge. These included:

- poor fertility
- illness/injury
- poor performance of progeny / undesirable bloodlines
- behavioural / handling problems.

As with the questionnaire issued to race trainers, both the "reasons for leaving" and the "destination" questions for studmasters were designed as semi-closed questions.

The destinations of breeding horses were also adapted from those for racing horses. However, "spelling" is not a routine practice for breeding horses, and as such this was

converted to "retire to pasture". In place of "different trainer", "different stud" was listed. All other possible destinations were the same as those offered to race trainers.

2.3.7 Questionnaire design

Good questionnaire design focuses not only on the accuracy and the appropriateness of the questions posed, but also on encouraging participation. For this reason, key survey-design strategies were employed. One of these proven strategies employed was the hand addressing and stamping each envelope (Vaillancourt *et al.* 1991). This personalises the questionnaire, and encourages participants to open the letter. To further encourage participation, a reply-paid envelope was attached (Thrusfield 1997), as arranged with Australia Post.

In addition to this, an introductory covering letter was included. This described the aims and importance of the study, the basis on which participants were selected and the approximate time required to complete the questionnaire. The fact that participation was purely voluntary and no penalties existed for not participating was also emphasised. Lay terms were used in the introductory letter as well as the survey itself. This was particularly important not only for ease of understanding and reduced ambiguity, but due to the varying levels of education of trainers and breeders. The host institution for the research, the University of Sydney was clearly stated along with the contact numbers for the researchers and the Human Ethics Committee, to confirm authenticity and provide a point of contact should they be needed.

These were all requirements of the University of Sydney Human Ethics Committee, whose approval was granted as a result of submissions on 5th April 2004 and modifications/amendments in May 2004. This approval is required for any study conducted from within the University, that administers questionnaires to human participants. Approval is obligatory to protect the rights of both the University and the human subjects of the study.

The survey was limited to one double-sided page with the "trainer/studmaster characteristics" on the one side and the table for the "horse characteristics" on the other. Adequate spaces were left between questions to enhance reader comprehension and increase participation (Vaillancourt *et al.* 1991). The use of a shaded background and lighter boxes for answers was employed to emphasise the minimal need for writing. The survey was also

printed on pale coloured paper to visually differentiate it from the introductory letter. A heading of "anonymous survey" was printed on the top of the questionnaire to allay possible concerns that may have arisen after the provision of potentially controversial answers.

The questions were designed to be succinct and unambiguous. This is one of the most important considerations of self-completed questionnaires, as there is no-one present to explain the questions to the participants. Accordingly, the survey was pre-tested on representatives from the breeding and racing industries in order to assess the design and the degree of comprehension (Vaillancourt *et al.* 1991). These participants provided some important feedback about the questionnaire. However, they were all based in New South Wales and had already expressed interest in the results of the study. So their selection may have been a source of bias. In order to further increase response rates, the questionnaire was sent to participants twice – once at the beginning of July and then again at the end of August, as a reminder.

2.3.8 Statistical Analyses

The information from returned surveys was entered into an Excel database (Microsoft 1997). These data were then edited and analysed with the use of Minitab computer software (Minitab 2004). The frequencies of the various responses were analysed, as were the response rates of trainers and studmasters in order to ascertain the generalisability of the results.

Tests were performed to evaluate three key aspects of the race industries:

1) Wastage rates and changes in the horse population over the study period. Risk factors for these outcomes were also analysed.
2) Destinations of and reasons for horses leaving racehorse industries. Risk factors for these outcomes at the level of training stable or breeding stud, or at the level of the individual horse were also assessed.
3) The knackery as a specific destination for horses leaving racing and breeding. To assess the relationships between the racehorse and horsemeat industries, tests were performed specifically to ascertain risk factors for entering knackeries. This was achieved by appointing destinations as "entering knackery" or "not entering knackery".

Wastage rates of the respondent racing stables and breeding studs were defined for the purpose of this investigation as the number of horses leaving racing stables and breeding studs divided by the total number present at a given establishment during the study period. The number of horses present was calculated by the addition of the number of horses present at the beginning of the period to the number entering over the course of the 2002/2003 official race season. These rates were calculated for individual stables/studs, as well for the entire study population.

To determine possible risk factors for the wastage, its rates in individual stables and studs were analysed using a general linear model, a form of ANOVA (Analysis of Variances) for unbalanced data. This model was chosen as the data were continuous and their distribution unknown. The wastage rates between the various industries were then compared using two-sample t-tests.

The destinations of horses leaving the industry were described, and risk factors for various outcomes were investigated. Before these tests were performed the information provided under the dumping category of "other" was analysed and arranged into distinct groups. General linear model ANOVAs were once again performed to assess any possible factors that influenced destinations. This was performed for continuous data, such as age at leaving, time at stud. In contrast, categorical (nominal) data, such as reasons for leaving, were analysed using the non-parametric chi-squared tests.

Finally, the same tests were performed, with the destinations grouped into "entering knackeries" or "not entering knackeries". For all the tests performed, a 5% significance threshold was adopted.

Descriptive statistics were performed to describe trends after significant relationships were identified.

Means were reported with standard errors (SE).

2.4 Summary

Two separate investigations were conducted. An preliminary study of the horsemeat industry was performed to describe the basic characteristics of horses entering, and the information recorded by, processing plants. This was achieved by a telephone interview of all knackeries.

To characterise the wastage that occurs in the race industry, questionnaires were sent to randomly selected Thoroughbred and Standardbred trainers and studmasters. Wastage rates were calculated as the number of horses leaving training stables or breeding studs divided by the number of horses present during the 2002-2003 official race year. Additionally, participants were asked to provide information relating to the last five horses to have left their stable/stud. The destinations of these horses were required, along with the reasons why the horses left and descriptive data that could be analysed as possible risk factors for the various outcomes. Particular emphasis was given to ascertaining risk factors for horses entering the horsemeat industry.

CHAPTER THREE: THE HORSEMEAT INDUSTRY

3.1 Introduction

The work described in this chapter sought to establish basic characteristics of the horsemeat industry. As described in Chapter 2, a telephone interview was conducted with managers of knackeries to establish the general types of horses entering the horses processing plants, and to confirm the existence of the anecdotally described relationship between the horsemeat and racehorse industries.

No research has heretofore characterised the horses entering the horsemeat industry in Australia. However, overseas studies have described the importance of the industry in providing an alternative to abuse or neglect (Grandin *et al.* 1999). Consequently, this part of the study was a preliminary investigation to ascertain the size and scope of the industry. Additionally, industry stakeholder interest in further studies was gauged.

3.2 Results

Of the knackeries present throughout Australia, 60.60% were contactable and participated in the telephone interview (Table 3.1).

State/Territory	Number of knackeries	Number responding to telephone interview
New South Wales	6	5
Queensland	2	1
Victoria	16*	9
Tasmania	3	0
South Australia	4	3
Northern Territory	0	-
Western Australia	2	2

* Three of these knackeries were owned by a single company

Table 3.1: The number of knackeries present and the number participating in the interview.

Of the twenty knackeries that participated, only three plants processed 200 or more horses per month. Three plants did not process horses at all, and a further seven had processed fewer than ten horses in the previous month. These were generally old, sick or injured horses. The reasons given for not processing horses as a commercial enterprise was a lack of horses available and the reluctance of the public to purchase horsemeat. The growing market for packaged supermarket pet meat means that all ingredients must be listed on the packaging. This was proposed as a factor affecting public perceptions and the increasing

reluctance to buy the meat. Plants that processed larger numbers of horses tended to process younger horses. The managers of these plants suggested these horses tended to be sold to the slaughterhouse as a result of economic difficulties, such as due to the drought. They also reported slaughtering large numbers of racehorses.

The mean number of horses processed per month was 53.7 (± 16.6), with a range of 0 – 240 horses (see Figure 3.1). Managers reported seasonal variations in these numbers, with more horses processed in the summer months.

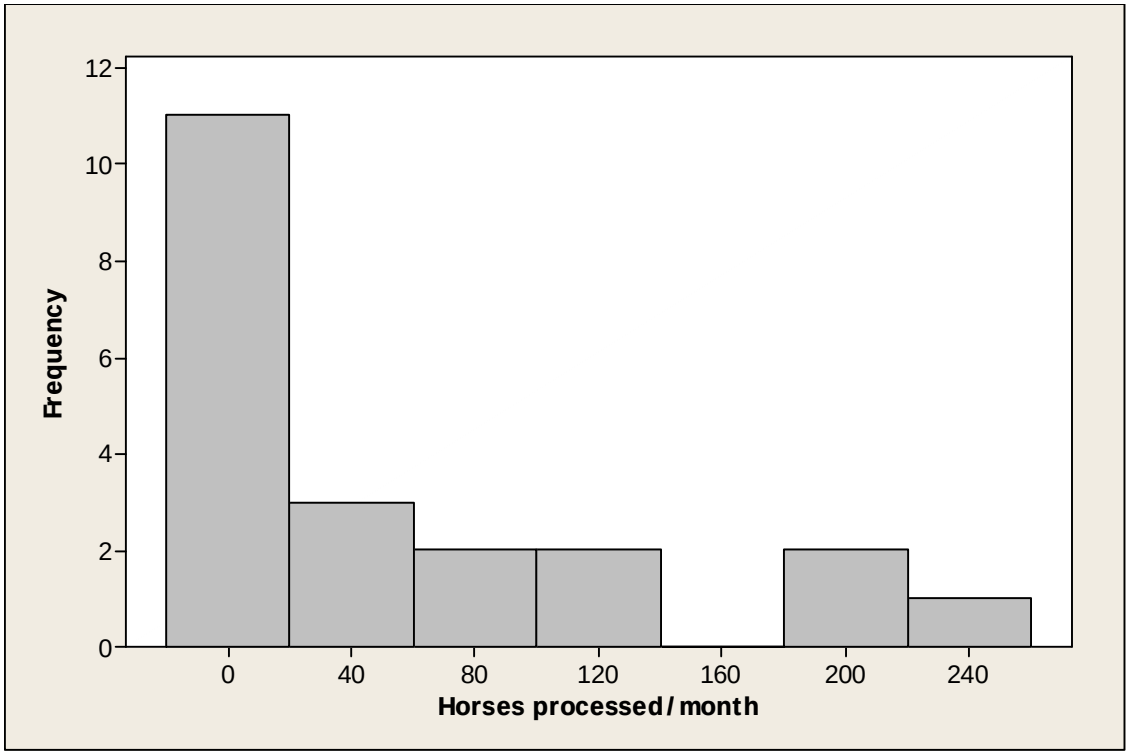

Figure 3.1: Number of horses processed per month in individual knackeries.

3.3 Discussion

3.3.1 Industry participation

Response rates for this telephone interview were comparable to those from a previous written questionnaire that had had been conducted to ascertain the size and economic contribution of the knackeries in Australia (Pilkington and Wilson 1991). It is likely that those who were not contactable were of smaller sizes. This is because larger and more commercially orientated knackeries had office staff that answered calls. It is also possible that, given previous industry concerns, some of these uncontactable plants were no longer processing horses.

It is highly probable that overall industry reluctance to co-operate with studies will continue until public perceptions change and the stigma associated with horsemeat processing plants decline.

3.3.2 Numbers of horses processed by knackeries

Although there are seasonal variations in the number of horses processed, with managers reporting increased numbers in the summer months, the number of horses processed would correspond to a conservative combined annual count of 13 536 horses being slaughtered in the plants surveyed.

If it is assumed that the slaughterhouses surveyed were representative of the nation's knackeries, a total of approximately 20 000 horses may be slaughtered in knackeries alone throughout Australia per year. Those plants that did not respond were more likely to be smaller-scale and less commercially orientated, so, this may be an over-estimation of the true number of horses processed in knackeries.

The lack of record-keeping by the knackeries means that the figures provided by them are inexact, meaning that the accuracy of the results of this survey are questionable. This is given further credence, as the numbers obtained represented a significant increase to the 7 500 horses estimated to have been slaughtered in 1991(Pilkington and Wilson 1991). This increase is unexpected given industry concerns both at that time and as was expressed during the interview by managers of the plants. The reliability and validity of the data obtained by telephone interviews, is debatable.

3.3.3 Types of horses processed and records maintained

The smaller plants generally processed sick, old or injured horses, as a type of community service rather than as a commercial enterprise. This is probably a reflection of the lower economic feasibility for smaller plants to process horses alone – and as such, this largely process other species such as cattle and in some cases kangaroo. This is in contrast to plants that processed increased numbers of horses, the majority of which were young horses due to the drought and horses leaving the race industry (breeding and racing).

None of the selected plants maintained records regarding the sources of the horses processed, nor possible reasons for slaughter. Consequently, to ascertain this, such data would have to be inferred from the physical characteristics of the horses processed. So, for example, one could record age, breed and condition score. To gain valid data, a researcher would be required to visit a substantial number of plants throughout the country and throughout the year to record these physical attributes.

3.4 Summary

Preliminary information describing the types of horses processed by knackeries in Australia was ascertained for the first time. This information is important in that it provides indications that two key populations of horses enter knackeries: the older, sick or injured horse, and the horse that is no longer economical feasible to maintain (including younger horses from properties affected by the drought and the ex-racehorse).

Although the figures managers of knackeries provided in this study indicate increased numbers of horses being processed, this is unlikely. This is due to the concerns expressed by the managers relating to decreased productivity of their plants. Although a study of the abattoirs in Australia was unrealised due to potential commercial-in-confidence issues, previous studies have described declines in the numbers of horses processed by these plants (Gordon 2001). Additionally, the accuracy of the numbers of horses processed by the plants that participated in the current study are questionable due to the lack of record-keeping.

The limited record-keeping also means that the specific reasons for horses entering the horsemeat processing plants are largely unknown. Additionally, the general reasons for horse slaughter provided by managers of knackeries may be biased. This is because it has been hypothesised that in Europe, for example, owners selling horses to slaughterhouses were more likely to provide reasons for this regarding horses' injuries or illnesses rather than other, more accurate, reasons due to the stigma associated with horse slaughter (Odberg and Bouissou 1999).

Surveys of slaughterhouses cannot determine characteristics of racehorses entering these plants from those that enter other industries, such as performance riding. Therefore, investigations of these horses leaving the race industry may provide predictive data on the relative destinations of horses leaving the race industry as a whole, rather than simply

quantifying the number of racehorses entering slaughterhouses. It would also be able to describe possible risk factors for slaughter.

Further investigations of Australian slaughterhouses should probably assess the characteristics of general horse wastage throughout Australia, not simply race-related wastage. These studies have the possibility of identifying welfare problems in various categories of the wider horse population, as has occurred with overseas research (Grandin *et al.* 1999; Odberg and Bouissou 1999).

Due to the diverse nature of the industry, a large number of plants and locations would need to be studied. However, for this to be feasible, further industry co-operation needs to be established. This is dependent on reducing the stigma associated with the industry. It is hoped that the current study may help to establish the important role of the horsemeat industry and may as a result further the scope of further investigations.

CHAPTER FOUR: THE RACEHORSE INDUSTRY

4.1 Introduction

The work in this chapter sought to calculate the 'wastage rate', that is, rate at which horses left Thoroughbred and Standardbred racing and breeding industries. Past research (Bailey *et al.* 1999; Jeffcott *et al.* 1982) has examined the wastage rates according the age, or the stage in terms of registration procedures, at which horses have left the race industry. However, previous to this study only one estimate existed describing the total wastage that occurs in the Australian race industry during the period of one year. This estimate is that one-third of the Victorian Thoroughbred racing population is replaced in a given year (Bourke 1995).

No known studies have described the destinations of horses leaving the race industry. This was of particular concern given the suggestion of large wastage rates (Bourke 1995) and the declining racehorse population (Gordon 2001; Roberts 2000) in the race industry. Consequently, the destinations of horses leaving the industry were examined, together with the reasons for leaving and other descriptive information. As discussed in Chapter 2, this was achieved through questionnaires sent to trainers and breeders.

This chapter describes the generalisability of the results of the questionnaires through the comparison of respondent characteristics with industry statistics. The wastage rates in all sectors of the race industry were calculated, and risk factors at the level of the trainer/breeder were examined through the use of general linear model ANOVAs. Additionally, the destinations of horses leaving racing and breeding were investigated. Descriptive information was analysed to determine any risk factors that influence these outcomes at the level of the horse and the level of the stud. Particular emphasis was given to the investigation of risk factors associated with the knackery destination, to ascertain the nature of the relationship between the racehorse and horse meat industries. These analyses were conducted through use of ANOVAs and chi-squared tests and subsequent use of descriptive statistics to illustrate trends (see Chapter 2).

The results for the wastage rates and destinations of horses from each industry were analysed separately, and then compared.

4.2 Respondents

4.2.1 Results

Response rates

Response rates to the questionnaires were 30% (378 questionnaires returned) for Thoroughbred race trainers, 32% (318 questionnaires) for Standardbred race trainers, 26% (41 questionnaires) for Thoroughbred studmasters and 17% (14 questionnaires) for Standardbred studmasters. However, a number of questionnaires were returned unopened due to:

- changes of address
- post office box ownership being relinquished.
- incorrect addresses provided by the race authorities

The number returned unopened accounted for a total of 24 Thoroughbred trainer and 40 Standardbred trainer questionnaires, in addition to three each from Thoroughbred and Standardbred studmasters. However, as the reasons for returning questionnaires could not be verified, this information was not used in the calculation of response rates.

The respondents provided horse population statistics for 4 654 Thoroughbred racehorses, 2 966 Standardbred racehorses, 2 339 Thoroughbred breeding horses and 713 Standardbred breeding horses. The respondents also described the fate of 1 362 horses leaving Thoroughbred racing, 1 175 horses leaving Standardbred (harness) racing, 153 horses leaving Thoroughbred breeding and 51 horses leaving Standardbred breeding.

Although the response rates were similar for Thoroughbred breeding and racing and Standardbred racing, the rate for Standardbred breeders was substantially lower. This means the ability to compare the Standardbred breeding industry with the others was compromised.

Due to the low number of trainers and breeders (and as a result the low number of questionnaires completed) in the Australian Capital Territory, the Northern Territory and Tasmania, these states were grouped together with larger States – New South Wales, South Australia and Victoria, respectively, according to geographical proximity. This was decided upon due to concerns that low numbers of questionnaires could produce results that were not representative. The response rates per State or Territory were established to determine whether response rates were comparable throughout Australia (see Table 4.1).

State/ Territory	Thoroughbred trainer	Standardbred trainer	Thoroughbred breeder	Standardbred breeder
NSW & ACT	21.04	28.96	29.12	5.26
SA & NT	45.54	38.96	9.09	30.00
Qld	34.23	40.00	22.22	0
Vic & Tas	51.38	31.67	29.54	19.23
WA	38.10	31.87	22.22	50.00

Table 4.1: Response rates (%) per State or Territory

Chi-squared tests were performed to determine whether significant differences existed between these response rates. There were significant differences for Thoroughbred trainers ($P < 0.001$), but not for Thoroughbred breeders ($P = 0.630$) or Standardbred trainers ($P = 0.244$). This means that there were significantly different numbers of responses from Thoroughbred trainers in some States/Territories which may have resulted in over-representation of some data. This is a potential source of bias that may affect the generalisability of the study. There were too few results for this to be accurately determined for Standardbred breeders.

Respondent characteristics

Thoroughbred trainers

Of respondent Thoroughbred trainers, 11.55% had stables based at Metropolitan racetracks. Additionally, 47.83% of the respondents claimed to own all the horses in their stables. A mean of 5.4 (± 0.432) horses per racing stable at the start of the study period was described.

Eight respondents returned the survey uncompleted, stating they were unable to provide the details required due to being "hobbyists" or owner-trainers. A further six trainers also returned the survey uncompleted, as they had only gained their license to train in the current race year, and so were unable to provide information relating to the 2002/2003 year required.

Standardbred trainers

For Standardbred trainers there was a mean of 5.01 (± 0.277) horses/trainer at the beginning of the study period. It was also found that of the respondents, 92.11% were not based at a metropolitan city racetrack. In addition to this, 47.96% owned all the horses that they trained, 45.45% owned some and 6.58% did not own any of the horses.

Two trainers returned the questionnaire uncompleted due to no longer having any horses in training and three because they were hobbyists and felt unable to properly answer the questions.

Thoroughbred studmasters

The respondents had a mean of 33.7 (± 15.8) breeding mares and 1.90 (± 0.31) stallions at the start of the study period. In the year 2002-2003, a mean of 73.8 (± 35.60) mares were serviced at their stud and there was a mean foal crop of 30.6 (± 13.8). A foaling percentage was calculated by dividing the number of foals born at stud over the number of mares serviced. The mean foaling percentage was 56.87% (± 5.01).

Three studmasters returned the survey uncompleted due to no longer running a commercial farm.

Standardbred studmasters

Respondents had a mean of 11.64 (± 1.87) breeding mares and 1.43 (± 0.23) stallions at the beginning of the study period. In the year 2002 – 2003, a mean of 49.9 (± 17.4) mares were serviced at their stud and had a foal crop of 10.79 (± 4.20). The mean foaling percentage was 66.70 % (± 20.10).

Three Standardbred studmasters returned the survey uncompleted as they had since retired.

4.2.2 Discussion

Response rates

Although the total number of responses was sufficient to perform statistical analyses, the generalisability of the data was questionable due to the low response rates. This is true of questionnaires in which the response rate is less than 70%, due to possible response bias – that is, systemic differences between the population that responds and the population that does not (Thrusfield 1997). Therefore, comparisons were made with available industry statistics to ascertain whether the respondents were representative of the larger trainer and studmaster population, that is, the target population (see 'respondent characteristics').

Respondent characteristics

Thoroughbred trainers

The distribution of city-country Thoroughbred trainers who responded was analogous to those of the wider population. This is because industry statistics showed that 13% of trainers are based in Metropolitan regions (Anon 2001), which is comparable to the 11.55% of current respondents based in these regions.

Of those trainers who responded, 47.25% claimed to own all the horses in their stables. However, for the same year, only 20.4% of registered Thoroughbred trainers were listed as owner-trainers (Ross 2003). This discrepancy appears to question the validity of the study. However, although there are considerable difference between these figures, trainers other than those who are registered as "owner-trainers" may train only their own horses, and so it is still possible that the respondents were actually representative of the wider population.

Thoroughbred racing industry statistics also describe the total number of racing horses and the number of trainers. Using these numbers as a crude guide, the average number of racing horses per trainer is 5.71 (Ross 2003). The mean number of horses per respondent was 5.40 (± 0.43). Although this appears comparable, the industry statistics do not include those horses in training for racing that have not started in a race. Therefore, this may mean that trainers who responded may actually have fewer horses than those who did not respond.

However, a total of eight Thoroughbred trainers returned the survey uncompleted as they felt unable to complete the majority of the questions in the detail required due to only being "hobbyist" trainers. This was also the reason given for the return of three questionnaires to Standardbred race trainers. It is likely that this is also the reason for many more of the study population not responding to the questionnaire. Therefore, it appears that those trainers who responded to the survey represented those from moderately-sized racing stables.

Additionally, a further six Thoroughbred trainers wrote that, as they had only been registered as trainers for the current year, they were not able to complete the survey because of questions referring to the previous racing year. Two Standardbred trainers also responded that they were no longer training horses. Once again, it is likely that this was the case for several other trainers who did not respond.

Standardbred trainers

The mean of 5.01 (± 0.28) horses/ trainer described by respondents is substantially greater than that calculated from the most currently available numbers of racing Standardbreds and numbers of licensed trainers (1999-2000) – 2.5 horses/trainer (Anon 2002). This may be an accurate representation though, as the industry statistics include only horses which have started in at least one race, whereas the survey data also includes those horses in training that have not raced. Unfortunately, no other information was available to compare other characteristics of the respondent trainers with that of the target population.

Due to the privacy regulations preventing Harness Racing NSW from releasing lists of licensed persons, and the subsequent different selection criteria for trainers in this state, possible selection bias may have occurred. This is because only New South Wales trainers with horses racing in a two-week period were contacted. This might mean that those responding represented larger training stables and perhaps more city trainers than country. However, although caution must be used in comparing the data acquired from these trainers with that obtained from others, it provides information that may be able to provide a rudimentary understanding of the state of harness racing in NSW.

Thoroughbred studmasters

Due to only studs with stallions currently standing at stud being selected for the study, no reference material exists to compare respondent Thoroughbred studmasters with non-respondents.

Three Thoroughbred breeders, though, failed to complete the survey due to no longer breeding horses as a commercial enterprise. This may represent a principal reason why the response rates for studmasters were low, and especially if this is extrapolated to the Standardbred industry, in which it is commonly recognised that many breeding ventures are non-commercially focused. A further three (Standardbred) studmasters responded that they were no longer breeding horses at all.

Standardbred studmasters

As with Thoroughbred studmasters, no reference material exists to compare respondent Standardbred studmasters with non-respondents.

4.2.3 Summary / proposals for future investigations

The study population of registered trainers and breeders was selected to establish data that were independent of the specifics of the record-keeping of race authorities and so better describe the actual horse populace. However, the generalisability of the results was limited by the inability to determine whether respondent trainers and breeders were representative of the target population. To rectify this, coded surveys to identify respondents, and specific information describing all trainers and breeders of the target population would be required. This information was not obtainable from race industry bodies, and so basic descriptive data, including location and ownership of racing horses and size of the enterprise, were used as crude indicators. This method cannot provide precise information regarding the generalisability of the results, however a basic congruence between the respondent and target populations was described.

It is hoped that this study will further encourage industry support so that further information from race authorities may be obtained in the future. This may enable the future use of coded surveys. Coded surveys will further assist in analysing the generalisability of the results, although it may have a negative effect on response rates due to anonymity concerns. Even so, the reliability and generalisability of the results may be higher even with a lower response rate.

Additionally, to improve the accuracy of future surveys, questionnaires should be issued at the conclusion of the official race year (31st July for Thoroughbred horses, 31st August for Standardbred). This means that respondents' recollection of population figures would be more accurate, and that the selected trainers and breeders would be those registered for the relevant study period.

4.3 Wastage Rates

4.3.1 Results

Thoroughbred racing horses

A total of 5654 horses were under the care of respondent trainers in the study period 1st August 2002 to 31st July 2003 – with a mean of 5.40 (± 0.432) horses per trainer at the beginning of the study period (Table 4.2). The movements of these horses were used to describe the wastage rates.

		Mean	SE	Min	Max	Sum
Thoroughbred racing stables						
	No. initially present	5.40	0.43	0	120	2468
	No. entering	4.79	0.50	0	150	2186
	No. leaving	3.94	0.46	0	150	1795
	Wastage rate (%)	37.50	1.21	0	100	-
	Net population change	+0.86	0.17	-20	+35	+391
Standardbred racing stables						
	No. initially present	5.01	0.28	0	30	1583
	No. entering	4.42	0.37	0	40	1383
	No. leaving	3.61	0.28	0	28	1129
	Wastage rate (%)	35.54	1.43	0	100	-
	Net population change	+0.81	0.20	-10	+30	+254

Table 4.2: Descriptive statistics of the horse population in respondent racing stables.

Individual stables were calculated to have a mean wastage rate of 37.50% (± 1.21), with a minimum 0% and maximum 100% wastage rates described (see Figure 4.1). A total wastage rate of 38.57% was determined for the entire study population.

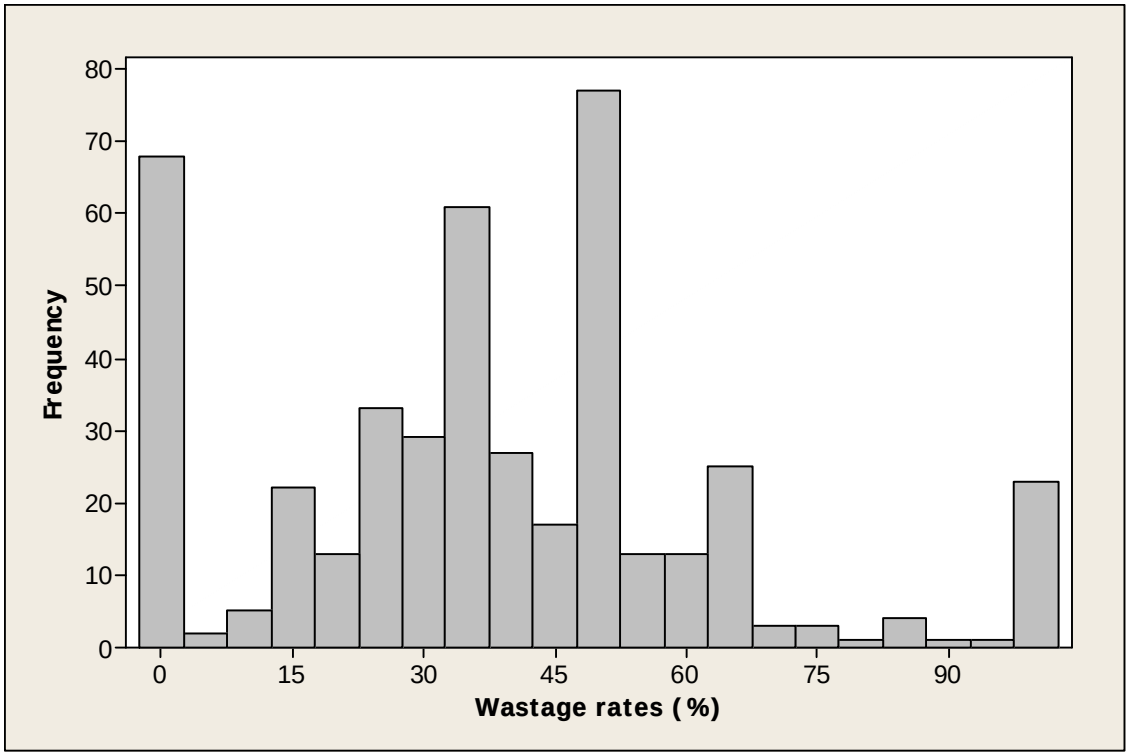

Figure 4.1: Distribution of wastage rates in Thoroughbred racing stables.

Ownership of the horses in training was shown not to influence the wastage rates (P = 0.170). Likewise, no association was found between wastage rates and the location of the stables – whether based at a metropolitan city racetrack or not (P = 0.546) or in a particular State or Territory (P = 0.123).

There was also no association between the size of racing stable (as judged by the number of horses initially present at the beginning of the study period) and the wastage rate (P = 0.734).

However, a relationship was found between the wastage rates and the net increase in horse population over the study period (P = 0.000). Those stables with smaller increases in the net population were found to have larger wastage rates.

Overall, race stables showed a net increase of 391 horses (15.84%) over the previous year. This equates to a mean gain of 0.86 (±0.17) horses per racing stable.

Statistical tests were once again used in order to determine any factors that influenced increases in the horse population in individual stables. Significant differences were found

between State/Territory location and gains in the horse population in individual stables(P = 0.013), see Table 4.3.

	Mean	SE
NSW & ACT	2.28	0.81
Qld	0.64	0.35
SA & NT	0.04	0.42
Vic	0.77	0.20
WA	0.57	0.30

Table 4.3: Net changes in the horse population of Thoroughbred racing stables by State/Territory **.**

Ownership of the horses also influenced the increase in horse population (P < 0.001). Those who did not own the horses in their stables had a mean increase of 2.62 horses (± 0.83) over the study period, as compared to 1.15 (± 0.35) horses for those who owned some of the horses, and 0.23 (± 0.08) horses for those who owned all of the horses.

There was no association between this increase in population and whether the stables were based at a metropolitan city racetrack (P = 0.133).

An association between size of the stable (as indicated by the number of horses present at the beginning of the study period), and the net increase in the horse population was evident (P < 0.001). Those with more horses present, typically showed greater increases in their horse population.

Standardbred racing horses

Respondent trainers had a total of 2 966 horses in training in the study period (1st September 2002 – 31st August 2003). A mean of 5.01 (± 0.28) horses were present at individual stables at the start of this period (Table 4.2). Individual stables were found to have a mean wastage rate of 35.54% (± 1.43), see Figure 4.2. Overall, the study population had a total wastage rate of 38.06% .

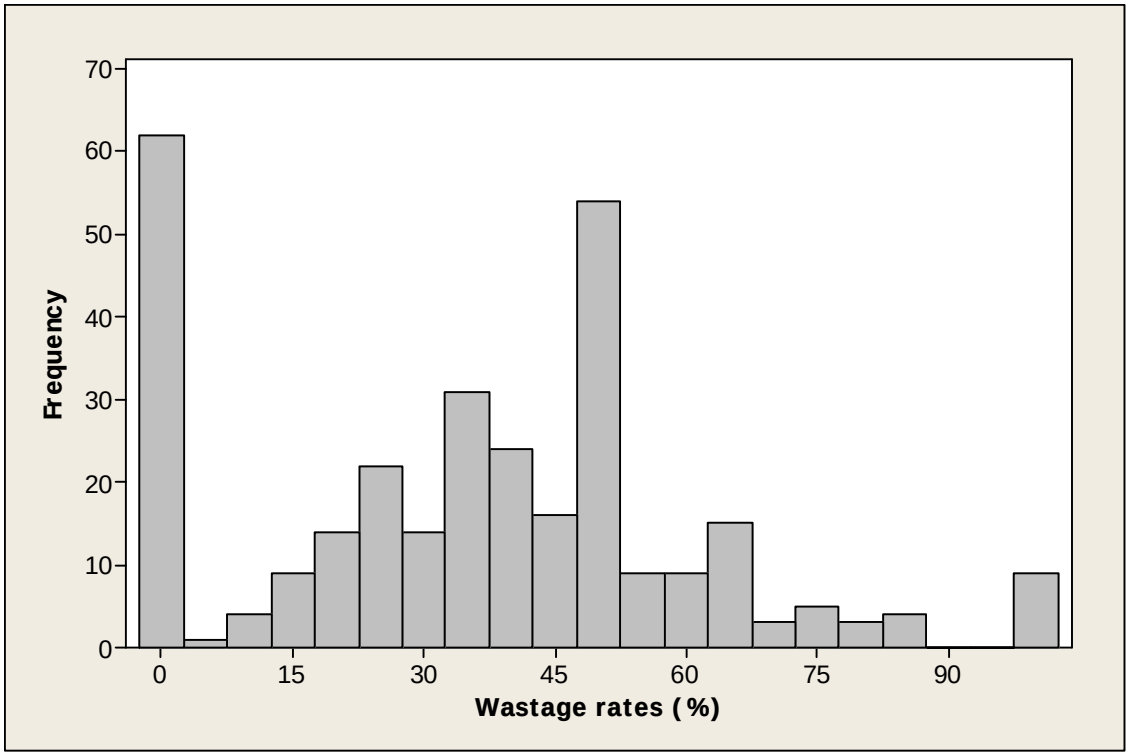

Figure 4.2: Distribution of wastage rates in Standardbred racing stables.

It was found that ownership, city or State location had no influence on the wastage rates of individual racing stables (P = 0.235, P = 0.0671 and P = 0.079 respectively). Likewise, no association was found between wastage rate and the size of the stable at the start of the study period (P = 0.787).

However, a strong relationship (P < 0.001) was found between the net increases in the horse population in racing stables and the rate of wastage. Those with smaller net gains in horse numbers at the end of the year were the stables with increased wastage rates. Overall, the Standardbred racing population increased by 254 horses (16.05%), which equates to a mean gain of 0.81 (±0.20) horses per racing stable.

An association between net increases in horse numbers and ownership status was found (P = 0.001), with those trainers having no ownership recording a mean increase of 2.70 (± 1.67) horses in the period, those with some ownership 1.32 (± 0.34), and those with ownership of all the horses an increase of only 0.09 (± 1.14).

A relationship between number of horses at the stable at the beginning of the study period and the net increase in horse numbers was also seen (P < 0.001). Those with more horses

present had greater net increases in the population over the study period. However, there was no relationship between an increase in the horse population in individual racing stables and the location of the stables in a metropolitan city racetrack or not (P = 0.456), nor a particular State or Territory location (P = 0.098).

Thoroughbred breeding horses

A total population of 2 251 breeding mares and 99 breeding stallions in the study period were described by respondents. Individual studs at the beginning of the study period had a mean of 33.70 (± 15.80) mares and 1.85 (± 0.311) stallions, see Table 4.4.

		Mean	**SE**	**Min**	**Max**	**Sum**
Breeding mares						
	No initially present	33.70	15.8	2	546	1279
	No. entering	27.00	10.6	0	373	972
	No. leaving	22.74	9.14	0	314	796
	Wastage rate (%)	32.67	4.27	0	87.50	-
	Net population change	+5.00	2.12	-9	+59	+175
Breeding stallions						
	No. initially present	1.85	0.31	1	10	76
	No. entering	0.62	0.12	0	3	23
	No. leaving	0.51	0.17	0	5	19
	Wastage rate (%)	18.35	4.80	0	100	-
	Net population change	+0.11	0.13	-3	+2	+4
TOTAL						
	No. initially present	35.40	0.31	3	556	1347
	No. entering	28.30	0.12	0	373	992
	No. leaving	23.23	0.17	0	314	813
	Wastage rate (%)	31.40	4.80	0	88.89	-
	Net population change	+5.11	0.13	-9	+59	+179

Table 4.4: Descriptive statistics of the horse population in respondent Thoroughbred breeding studs.

The total wastage rate for the population of mares was 35.36% and for stallions 19.19%, with individual studs having a mean rate for mares of 32.67% (± 4.27) and for stallions 18.35% (± 4.80).

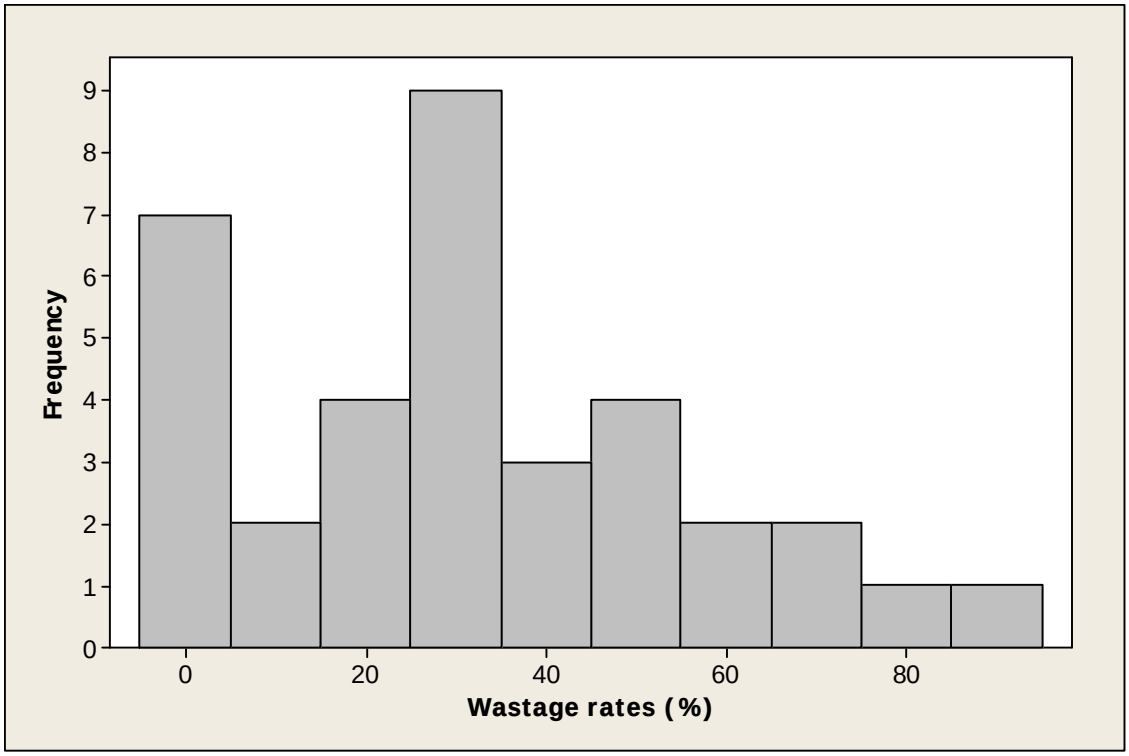

Figure 4.3: Distribution of wastage rates in Thoroughbred breeding studs.

The combined wastage rate for mares and stallions was 34.76%, and the mean for individual studs was 31.40% (± 4.80), see Figure 4.3.

No association was found between wastage rates and the location of the stud in a particular State or Territory level for mares (P = 0.183) or stallions (P = 0.296). Likewise no relationship was found between the wastage rates in mares and the number of mares served on the stud (P = 0.173), or number of foals born and the wastage rates in mares (P = 0.123). Additionally, no relationship between these number of mares served and number of foals born at the stud and the rate of stallion wastage (P = 0.710 and P = 0.138 respectively). The rate of stallion wastage did not influence that of mare wastage (P = 0.651).

There was no association between the size of the stud at the beginning of the study period and the wastage rates was present for stallions (P = 0.701) or mares (P = 0.103).

Unlike trainer survey results, no relationship was found between mare wastage rates and the net increase in the mare population in individual stables over the studied year (P = 0.580). However, a relationship was found in this domain for stallions (P < 0.001), with a similar

trend to that seen in horses in racing stables. That is, those studs with smaller increases in the stallion population over the study period tended to have increased stallion wastage rates. However, the accuracy of this is questionable due to the relatively small number of stallions described.

Overall, the Thoroughbred breeding population increased by 175 (13.68%) mares and 4 (5.26%) stallions in the 2002-2003 period. This increase in population was consistent between all States and Territories (P =0.803). A relationship between this increase in population and the number of mares served on the property was described (P < 0.001), those with more mares serviced having greater gains in breeding horse population.

Likewise, there was an association between the increase in the population and the number of foals born (P = 0.001). As with the previous relationship described, those studs with more foals born had greater increases in the breeding horse population.

Standardbred breeding horses

The movements of a total of 687 breeding mares and 26 breeding stallions were described during the study period (1st September 2002 – 31st August 2003). At the beginning of this time period, studs had a mean of 11.64 (± 1.87) mares and 1.43 (± 0.23) stallions, as described in Table 4.5.

		Mean	**SE**	**Min**	**Max**	**Sum**
Breeding mares						
	No initially present	11.64	1.87	3	28	163
	No. entering	37.40	15.6	0	170	524
	No. leaving	35.60	15.4	0	170	499
	Wastage rate (%)	38.05	8.83	0	87.42	-
	Net population change	+1.79	1.27	-5	+10	+25
Breeding stallions						
	No. initially present	1.429	0.23	0	3	20
	No. entering	0.429	0.14	0	1	6
	No. leaving	0.214	0.11	0	1	3
	Wastage rate (%)	9.52	5.16	0	50.00	-
	Net population change	+0.214	0.11	0	+1	+3
TOTAL						
	No. initially present	13.07	1.99	4	30	183
	No. entering	37.90	15.60	0	170	530
	No. leaving	35.90	15.40	0	170	502
	Wastage rate (%)	37.68	8.62	0	85.71	-
	Net population change	+2.00	1.31	-4	+11	+28

Table 4.5: Descriptive statistics of the horse population in respondent Standardbred breeding studs.

The total wastage rate for the mare population was 72.63% and for stallions was 11.54%. This translates to mean wastage rates of 38.05% (± 8.83) for mares and 9.52% (± 5.16) for stallions, for individual studs. For the entire breeding population, the overall wastage rate was 70.41%, with individual studs having a mean rate of 37.68% (± 8.62), see Figure 4.4.

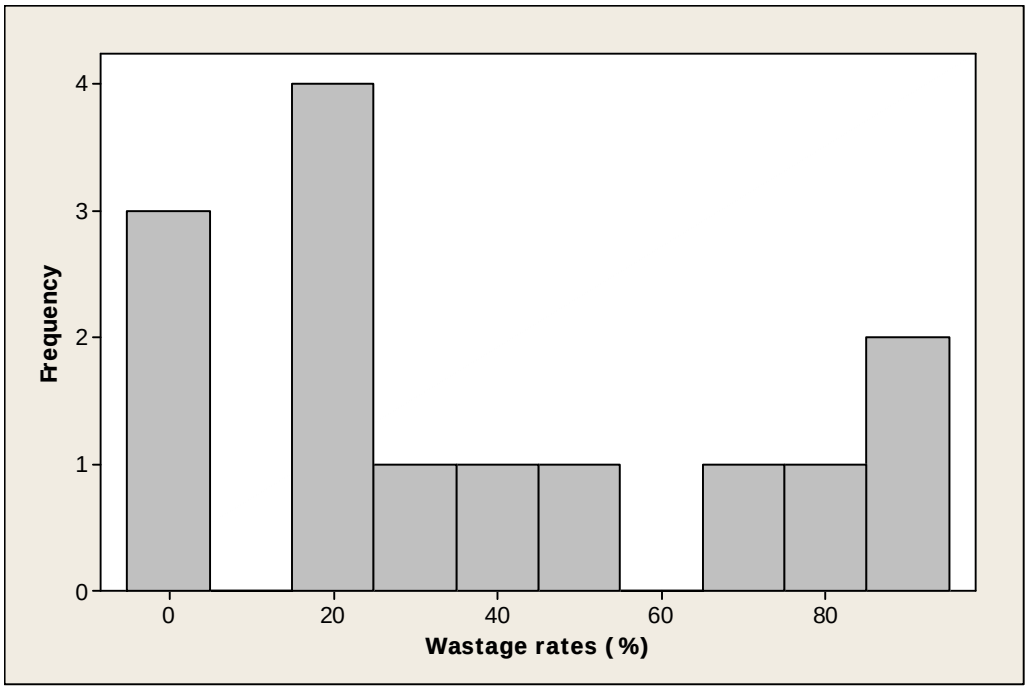

Figure 4.4: Distribution of wastage rates at Standardbred breeding studs.

No relationship was found between wastage rate and a particular State or Territory (P = 0.778 for comparison with the mare wastage rate, P = 0.176 for comparison with the stallion wastage rate), or the number of foals born (P = 0.199 for mares, P = 0.443 for stallions). There was no relationship between the wastage rates of individual studs and the number of mares they serviced (P = 0.173). No association was found between mare wastage rates and that for stallions (P = 0.819).

Additionally, no association was seen between wastage rates and the number of horses present at the commencement of the study period (P = 0.723 for mares, P = 0.852 for stallions), or the net gain in horse population over the year (P = 0.663 for mares, P = 0.355 for stallions). Overall, an increase of 25 mares (15.34%) and 3 stallions (15.00%) was reported throughout the year. Location at State or Territory level had no apparent influence on the change in total horse numbers (P = 0.661). Likewise, it was not affected by the

number of foals born in the study year (P = 0.134), or the number of mares served on the studs during this time frame (P = 0.144).

Comparisons between the wastage rates of the various industries

No significant differences were found between the wastage rates for Thoroughbred and Standardbred racing stables (P = 0.294). Likewise, there were no significant differences for that between Thoroughbred and Standardbred breeding studs (P = 0.518). No significant differences were found between the wastage rates of Thoroughbred racing and breeding enterprises (P = 0.158), or between Standardbred racing and breeding (P = 0.810). Likewise, no differences were apparent between breeding (combined Thoroughbred and Standardbred) and racing (combined Thoroughbred and Standardbred) enterprises (P= 0.372).

4.3.2 Discussion

Wastage rates

This study was the first to quantify the total wastage rates in racing and breeding horses in Australia. The only previously reported wastage rate for the total horse population, that is, across all age groups, was the estimate of one-third of the Victorian Thoroughbred population being replaced in one year (Bourke 1995). The wastage rates described by this study are significantly higher than that estimate, with 38.57% of horses leaving respondent Thoroughbred racing stables in the 2002-2003 race year, 38.06% leaving Standardbred racing stables, 34.76% leaving Thoroughbred breeding studs and 70.41% leaving Standardbred breeding studs. However, these larger wastage rates may be a reflection of the wastage of horses in training that did not start in a race, horses that were not included in the population of the previous study.

Additionally, many of the horses leaving racing stables and breeding studs would not have actually left the industry since they were going to different trainers or studs instead, and this is possibly a cause of wastage over-estimates in this study. If the results of the second part of the questionnaire describing the fates of horses leaving stables and studs are used to extrapolate the number of horses actually leaving the industry, the rates are more similar to that previous estimation. Given that approximately 17% of Thoroughbred racing horses go to different trainers, 29% of Standardbred racing horses go to different trainers and 29% and

13% of Thoroughbred and Standardbred breeding horses go to different studs (see section 4.4) the estimated wastage rates for horses *truly* leaving the industry are approximately 32%, 27%, 25% and 61% respectively. Therefore, the approximation that one-third of the horse population, regardless of whether they had started in a race or not, leave the racing industry every year may be correct for the wider Thoroughbred and Standardbred racing populations. The rates for the breeding industry are less reliable due to the low response rates from studmasters, but approximately one-quarter of Thoroughbred horses and two-thirds of Standardbred horses may leave the breeding industry each year.

Wastage rates within each industry were consistent throughout the various States and Territories in Australia. Likewise, the mean wastage rates of training stables and breeding studs were comparable. However, due to differing selection processes for trainers and studmasters, with all types of trainers being selected but only studs with a stallion standing in the current season, the rates should be compared with caution. In addition to this, the low response rate of Standardbred studmasters means that the information provided for this section of the industry is less reliable.

		Thoroughbred	**Standardbred**
Trainers			
	Ownership of horses	N (P = 0.170)	N (P = 0.235)
	City location	N (P = 0.546)	N (P = 0.067)
	State/Territory location	N (P = 0.123)	N (P = 0.079)
	Size of training stable	N (P = 0.734)	N (P = 0.787)
	Change in horse population in stable	Y (P < 0.001)	Y (P < 0.001)
Breeders*			
	State/Territory location	N (P = 0.183) (P = 0.296)	N (P = 0.778) (P = 0.176)
	Number of mares served in study period	N (P = 0.173) (P = 0.710)	N (P = 0.173) (P = 0.098)
	Number of foals born in study period	N (P = 0.123) (P = 0.138)	N (P = 0.199) (P = 0.443)
	Size of the breeding stud	N (P = 0.701) (P = 0.103)	N (P = 0.723) (P = 0.852)
	Change in horse population in stud	N (P = 0.580) Y (P < 0.001)	N (P = 0.663) (P = 0.355)

Y- association was found using a 5% significance threshold.
N- no association was found using a 5% significance threshold.

*Breeder data: first P-vale relates to the comparison with the mare wastage rate, second P-value to the comparison with stallion wastage rate.

Table 4.6: Summary of risk factors that influence the wastage rates of racing stables and breeding studs

As shown in Table 4.6**,** The only risk factor identified for the wastage rates of training stables was the net change in horse numbers over the study period. Those stables with smaller gains in the horse population during this time typically had greater wastage rates. This was also true of the Thoroughbred breeding stallion population. This may be a result of those enterprises with greater wastage rates not replacing those horses that have left. Consequently, this may reinforce concerns within the racing industry that smaller operators/trainers are leaving the industry.

This is given further credence by the fact that, although an overall net increase in the horse population was described, those racing stables with larger horse populations or other factors that identified them as more commercially orientated had greater increases in horse numbers than others over the study period. The more commercially-orientated enterprises are those with horses in training that they did not own.

Thoroughbred studs with more mares serviced and foals born also had greater increases in the horse breeding population, as described in Table 4.7**.** Although no risk factors for population gain were identified for Standardbred breeding studs, it appears that in the other industries it may be true that larger-scale and perhaps more financially driven enterprises generally had greater gains. This may be a result of the low response rates from Standardbred breeders causing bias of the results.

		Thoroughbred	Standardbred
Trainers			
	Ownership of horses	Y (P < 0.001)	Y (P = 0.001)
	State/Territory location	Y (P = 0.013)	N (P = 0.098)
	City location	N (P = 0.133)	N (P = 0.456)
	Size of training stables	Y (P < 0.001)	Y (P < 0.001)
Breeders			
	State/Territory location	N (P = 0.803)	N (P = 0.661)
	Number of mares served in study period	Y (P < 0.001)	N (P = 0.134)
	Number of foals born in study period	Y (P = 0.001)	N (P = 0.144)

Y- association was found using a 5% significance threshold.
N- no association was found using a 5% significance threshold

Table 4.7: Summary of factors that influence the changes in horse population during the study period in respondent stables/studs.

Given that industry statistics show significant declines in the horse population, the validity of the results of this study is debatable. Possible selection bias may have influenced the results, as trainers and studmasters of moderate-large sized enterprises were shown to have

been more likely to respond to the questionnaire (see section 4.2) and to have greater population increases.

In addition to this, the participants were recruited from current listings of registered trainers and studmasters, whereas the questionnaire required information from the previous official race year. It is possible that some smaller stables and studs may have closed during this time, hence representing significant declines in horse numbers which were not accounted for in this study. So, if this is the case, the wastage rates described by this study represent substantial underestimates.

Significance of results

If the wastage rates described in this study were extrapolated to the target horse population, a large number of horses would leave racing stables and breeding studs each year. Using statistics regarding the numbers of horses actively involved in racing and breeding in the 1998-1999 year as a point of reference (Gordon 2001), an estimated 12 400 Thoroughbred racing horses, 5 300 Standardbred racing horses, 12 000 Thoroughbred breeding horses and 7 200 Standardbred breeding horses would have left these enterprises. Once again it should be noted that this is likely to underestimate the numbers leaving, as official numbers of racehorses do not describe those horses in training for racing that have yet to start in a race, nor those breeding horses that did not have a "return" form lodged for the breeding season. However, these numbers do not include those horses moving between enterprises within their respective industries. If the results of the second section of the questionnaire, describing the destinations of horses leaving stables or studs are taken into account (see section 4.3) approximately 10 300 Thoroughbred racing horses, 3 800 Standardbred racing horses, and 8 000 Thoroughbred and 6 200 Standardbred breeding horses would have left their respective industries in the 12 month study period.

The large wastage rates identified by this study are of great concern to the race industry. This is because horses leaving racing and breeding represent significant financial losses (Dyer 1998; Jeffcott *et al.* 1982). Additionally, the viability of the racing industry is dependent on revenue generated by gambling (Alchin and Pearce 1993) and this relies on adequate numbers of horses racing and, subsequently, adequate numbers of races and race meets. This is of particular concern given that the Thoroughbred and Standardbred racing industries have described recent declines in the racehorse population (Gordon 2001; Roberts

2000). In order to address this, various campaigns have been launched by the race industries to promote racehorse ownership (Roberts 2000). However, one of the principle reasons for the decline in the horse population is owner dissatisfaction due to the transient/brief nature of the racing careers of their horses (Bourke 1995) and low financial returns (More 1999; Roberts 2000). Consequently, promoting ownership alone may increase the number of racehorses initially, only to further exacerbate horse wastage in the future.

The careers of all racing horses are, by definition, limited. All horses eventually leave the race industry. However, reducing the wastage rates whilst still maintaining racing fields with adequate numbers of horses is possible. This is because if the careers of racing horses are extended by addressing the reasons for which they left, the number of "replacement" horses required would be reduced. This means the industry would still be financially viable with adequate numbers of racing horses, but that the number of horses entering and subsequently leaving would be decreased. Additionally, by preventing premature horse retirement, owner dissatisfaction may also decrease. It is possible that this would result in fewer owners leaving the industry and, consequently, the wastage rates may further be reduced. Also, wastage, and the industry's response to it, are under considerable scrutiny by the media and various animal welfare organisations. The success of racing enterprises lies with public participation (Bourke 1995), and, so, positive public perceptions of the welfare of the horses involved is crucial.

Similarly, if the reasons for horses leaving breeding enterprises were addressed, fewer replacement breeding horses would be needed. This means that there would be less horse turn-over in the breeding industry. However, the breeding industry also relies on the need for the breeding of replacement horses for the racing industry. If the demand for the production of replacement racing horses was reduced, an initial increase in the wastage rates of breeding horses may be seen. However, as defined by this study (see Section 4.4), a significant number of horses leave racing to breed. If these horses were to continue in the racing industry, there would be more demand for breeding horses, and so reduced wastage rates of breeding horses may also result.

In order to prolong the working lives of racing and breeding horses, and subsequently reduce wastage rates, further studies are required. The identification of the reasons for horses leaving the industry is an important aspect of this, and has been examined in other parts of

this study (see Section 4.4). Future research investigating risk factors associated with these reasons is necessary to extend the racing and breeding lives of these horses, with the potential of reducing the wastage rates associated with the race industry. The important ramifications of this are explored in Section 4.4.

4.4 Destinations of horses leaving racing stables and breeding studs

4.4.1 Results

Question response rates

The questions regarding purchase price were not analysed, due to the relatively small response rates and the difficulty in analysing the relevance of the different prices at various different ages. However, the range of prices for Thoroughbred racing horses were $0 – $270 000 (mean $10 161 ± 987), Standardbred racing horses $0 - $150 000 (mean $5 669 ± 460), Thoroughbred breeding horses $0 - $100 000 (mean $4 864 ± 1 433), and Standardbred breeding horses $0 - $16 500 (mean $3 523 ± 1432).

Additionally, with the trainer questionnaire there were difficulties in analysing the significance of the racing class in which these horses competed. This was due to relatively low response rates to this question coupled with numerous different racing classes specified. However, of those trainers who provided answers for this question, 8.37% of Thoroughbred horses and 9.11% of Standardbred horses were described as being "unraced".

Thoroughbred racing horses

Descriptive statistics

The destinations and characteristics of 1 362 horses leaving Thoroughbred racing were obtained. Of these 694 (56.38%) were geldings, 517 (42.00 %) were mares and 20 (1.62%) were stallions. The sex of 131 of these horses was not specified.

The mean age of the horses when they left the participating racing stables was 4.79 (± 0.05) years, with a mean of 2.38 (± 0.04) years spent in race training.

As described in Table 4.7, the most common reason that was provided for Thoroughbred horses that left racing stables was poor performance (487 horses, 36.51%) followed by illness/injury (412 horses, 30.95%). "Other" reasons accounted for 16.75% of responses. These "other" were categorised into six categories for both Standardbred and Thoroughbred horses. This included "change in trainer" which was explained by respondents as being due to of time, location, or cost issues, or due to the horse temporarily leaving for further education with another trainer or breaker. The category of "owner factors" included those

trainers who were in conflict with owners of the horses or those who had not paid training fees, in addition to leases on the horse expiring.

	No. Thoroughbred horses (%)	No. Standardbred horses (%)
Illness/injury	421 (30.95%)	306 (27.08%)
Poor performance / slow	486 (36.51%)	398 (35.22%)
Unsuitable temperament /behaviour	85 (6.39%)	72 (6.37%)
To breed	125 (9.39%)	114 (10.09%)
Other	223 (16.75%)	240 (21.24%)
Change in trainer	47 (3.46%)	58 (5.13%)
Owner factors	21 (1.58%)	30 (2.65%)
Horse sold	26 (1.95%)	57 (5.04%)
To spell	25 (1.88%)	13 (1.15%)
Old age	46 (3.46%)	30 (2.65%)
Unspecified	58 (4.36%)	52 (4.60%)

Table 4.7: Reasons for Thoroughbred and Standardbred horses leaving racing stables

Most respondents chose 'other' as the principal destination of horses leaving their stables (Table 4.8). When the reasons behind 'other' were categorised, the most common destination was 'to stud' (18.23 %), followed by 'to different trainer' (17.18 %) and then auction/new owner (16.58%), spelling (11.25%) and other – performance riding (11.33%). Knackery was the next most popular, with 6.30% of horses described entering slaughterhouses.

	No. Thoroughbred horses (%)	No. Standardbred horses (%)
Stud	243 (18.23%)	184 (16.13%)
Spelling	150 (11.25%)	132 (11.57%)
Knackery	84 (6.30%)	189 (16.56%)
Different trainer	229 (17.18%)	326 (28.57%)
Auction / new owner	221 (16.58%)	127 (11.13%)
Other	406 (30.41%)	183 (16.04%)
Died	27 (2.03%)	11 (0.96%)
Returned to owner	22 (1.65%)	13 (1.14%)
Performance riding	151 (11.33%)	32 (2.80%)
Pleasure riding	41 (3.08%)	53 (4.65%)
Recreation cart horse	0	1 (0.09%)
Pony Club	27 (2.03%)	7 (0.61%)
Racing – other types/locations	9 (0.68%)	8 (0.70%)
Racing industry related work	2 (0.15%)	0
Retired to paddock	48 (3.60%)	32 (2.80%)
Stock work	24 (1.80%)	5 (0.44%)
Unspecified	55 (4.13%)	21 (1.84%)

Table 4.8: Destinations of Thoroughbred and Standardbred horses leaving racing stables

Once again the descriptions of "other" destinations were analysed and categorised into various groups. A large number of horses were described as entering showjumping,

dressage, showing, eventing, rodeos, "performance" pursuits, hunting, in addition to one horse entering the police force. These horses were grouped as entering "performance riding". Another group of "pleasure riding" and "pony club" was created due to the differing demands between horses that are ridden for performance and those simply for trail rides or for children. Two horses became clerk of course horses at racing clubs, and the destinations of these horses were described as "racing industry related". Those going to race overseas or to perform in different forms of racing (hurdle or picnic racing) were grouped as "racing – other types/locations". It was decided that these destinations were distinct from the category of "different trainers", and so a separate category was created.

However, for the purpose of analysing factors which may influence the destinations of horses, the different destinations and reasons listed under "other" were not used. This is because, had these options been offered to respondents, different trends may have been described.

Risk factors influencing destinations

Trainer factors

No association was found between the destinations of horses leaving Thoroughbred racing and the wastage rates of individual racing stables ($P = 0.850$). However, significant relationships emerged between destinations and the number of horses present at the start of the study period ($P < 0.001$), the net increase in the horse population in individual stables ($P < 0.001$), State/Territory location ($P < 0.001$), location at Metropolitan city racetracks ($P = 0.001$), ownership of the horses ($P < 0.001$).

Those leaving to 'spell' or to 'different trainers', typically left stables with a larger horse population at the beginning of the stud period. Those going to slaughterhouses came from stables with a smaller population. In addition to this, horses sent to 'spell', to different trainers or to slaughterhouses, typically came from stables with larger net gains in horse numbers over the study period (Table 4.9).

	Stud	Spelling	Knackery	Different trainer	Auction / new owner	Other
No. of horses in training at start of the study period	6.89 (± 0.64)	9.17 (± 1.50)	4.58 (± 0.34)	7.83 (± 0.72)	6.85 (± 0.89)	5.41 (± 0.46)
Net change in stables' horse population	+0.76 (± 0.24)	+2.70 (± 0.64)	+1.33 (± 0.38)	+1.06 (± 0.22)	+0.46 (± 0.30)	+0.48 (± 0.16)

Table 4.9: Descriptive statistics of Thoroughbred racing stables by destinations of horses (mean ± SE).

As described in Table 4.10, horses from Western Australia were more likely to enter knackeries and spelling than those leaving from any other State or Territory. Those from Victoria were more likely than those from any other state to leave to different trainers or to auctions.

	Stud	Spelling	Knackery	Different trainer	Auction / new owner	Other	Total
NSW & ACT	19.71	13.36	2.40	19.71	17.31	27.40	100
Qld	17.34	14.36	7.05	15.18	13.82	32.25	100
SA & NT	21.01	8.70	7.97	13.04	15.94	33.33	100
Vic & Tas	15.53	5.88	5.65	20.00	22.12	30.82	100
WA	22.63	16.32	9.47	14.21	9.47	27.89	100

Table 4.10: Percentage of Thoroughbred racing horses leaving to destinations by State/Territory.

Horses from stables not based at city racetracks were more likely to enter auction/new owner, knackeries, studs and 'other' destinations, than those based in the city. Horses from city-based stables were more likely to enter studs, spelling and go to different trainers (Table 4.11).

	Stud	Spelling	Knackery	Different trainer	Auction / new owner	Other	Total
Metropolitan	17.75	18.34	3.55	23.67	11.24	25.44	100
Non-metropolitan	18.38	10.18	6.73	16.13	17.43	31.15	100

Table 4.11: Percentage of horses leaving to destinations by stable location at a metropolitan city racetrack.

The influence of ownership of these horses were also seen ($P < 0.001$). A greater percentage of horses leaving trainers who own all the horses in their stables enter 'auctions/new owners', knackeries and "other" destinations, than those from trainers who do not own their horses. Those that do own some of the horses have greater proportions of horses going to different trainers and studs (Table 4.12).

	Stud	Spelling	Knackery	Different trainer	Auction / new owner	Other	Total
All horses	17.56	9.35	7.25	11.45	19.85	34.54	100
Some horses	19.64	9.97	6.50	21.30	14.65	27.95	100
No horses	14.69	23.78	2.10	28.18	13.99	27.27	100

Table 4.12: Percentage of Thoroughbred racing horses leaving to destinations by whether trainers owns all, some, or none of the horses in their stables.

Horse factors

A significant association between sex and destinations was seen (P= 0.000). Because of the inability of geldings to enter studs (apart from one gelding who was described as entering a stud as a "teaser"), the test was repeated with 'to stud' left out of the destinations to ensure that this category was not creating significant intrinsic inaccuracies. This was found not to be the case, as significant differences were still seen between sexes and destinations ($P < 0.001$). A higher percentage of geldings, than that of the other sexes, left to 'auction/new owner', 'knackeries' or 'other' destinations including performance and pleasure riding, as seen in Table 4.13. More mares entered stud subsequent to leaving.

	Stud	Spelling	Knackery	Different trainer	Auction / new owner	Other	Total
Gelding	0.14	10.27	8.39	18.96	17.95	44.28	100
Mare	44.19	10.85	3.29	13.18	14.34	14.15	100
Stallion	5.26	36.84	5.26	21.05	10.53	21.05	100

Table 4.13: Percentage of horses leaving to destinations by sex

A significant relationship was also found between age of leaving racing and destination ($P < 0.001$), as shown in Table 4.14. Those entering "other" destinations had the highest mean ages (5.55 years ± 0.10), followed by knackeries (5.23 years ± 0.20). The mean age of those leaving to spell was considerably lower (3.93 years ± 0.15).

	Stud	Spelling	Knackery	Different trainer	Auction / new owner	Other
Age at leaving in years	4.95 (± 0.09)	3.93 (± 0.15)	5.23 (± 0.20)	4.06 (± 0.09)	4.47 (± 0.10)	5.55 (± 0.10)
No. of years in race training	2.55 (± 0.09)	2.02 (± 0.13)	2.42 (± 0.19)	1.88 (± 0.07)	2.11 (± 0.09)	2.82 (± 0.09)

Table 4.14: Mean (±SE) age of leaving and years in training of Thoroughbred racing horses by destination.

Similarly, an association between time in race training and destination was found ($P < 0.001$). Those entering 'other' destinations (2.82 ± 0.09 years), studs

(2.55 ± 0.09 years) and knackeries (2.42 ± 0.19 years) had a greater mean number of years in race training. Those going to different trainers had a lower mean length of time spent in training, as did those going to spell (see Table 4.14).

A significant relationship was also found between reason for leaving racing and the destination of the horses subsequent to leaving ($P < 0.001$). Due to the relationship between the reason "to breed" and the destination "stud", these categories were removed during subsequent chi-squared testing to ensure that they did not unduly influence the tests. A significant association was still seen ($P < 0.001$).

Horses leaving because of "unsuitable temperament/behaviour" were more likely to enter knackeries than those horses leaving for any other reason (see Table 4.15). However, due to the greater number of horses leaving due to illnesses/injuries a larger number of horses entering knackeries had left the racing industry due to illness/injuries. This accounted for half of all horses entering knackeries.

		Destination						
Reason		Auction/ new owner	Different trainer	Knackery	Spelling	Stud	Other	Total
	Illness/ injury	10.54	4.90	10.29	17.65	17.40	39.22	100
	Poor performance	26.03	22.73	5.27	4.13	8.47	33.26	100
	To breed	2.40	0	0	4.80	92.00	0.80	100
	Unsuitable temperament /behaviour	19.05	21.43	15.48	8.33	15.48	20.24	100
	Other	13.96	35.14	1.35	18.02	1.35	30.18	100
	Total	16.55	17.08	6.35	10.96	18.37	30.69	

Table 4.15: Destinations of horses leaving Thoroughbred racing by reasons (%).

Knackery destinations

For Thoroughbred racing horses, compared to all other destinations, a significant relationship existed between State/Territory location ($P = 0.027$) or ownership status of the horse ($P = 0.039$) and knackery as a destination. Sex ($P = 0.001$) and age ($P = 0.022$) as well as the reason for leaving ($P < 0.001$) also influenced entering this destination.

Thoroughbred racing horses leaving racing for "unsuitable temperament/behaviour" were at greater risk for entering knackeries – followed by those with "illnesses or injuries".

Geldings also had an increased chance of entering knackeries compared to stallions or mares (Table 4.13). Those entering slaughterhouses had a mean age of leaving racing of 5.23 (± 0.20) years compared to 4.77 (± 0.05) years for other destinations. A larger percentage of horses leaving racing stables in Western Australia and South Australia entered knackeries. A larger fraction of horses leaving stables in which the trainer owned all the horses entered knackeries than those in which trainers owned some or none (Table 4.12).

Standardbred racing horses

Descriptive statistics

The destinations and attributes of a total of 1 175 horses leaving Standardbred racing were obtained. Of those that listed the sex of the horses (1053 horses), 56.32% (593) were geldings, 40.93% (431) were mares and 2.75% (29) were stallions. The mean age of these horses when they left racing was 4.99 (± 0.07) years. The mean number of years in training for racing was 2.65 (± 0.05) years.

The most common reason for leaving was 'poor performance/slow' (35.22%), followed by 'injury/illness' (27.08%) and then 'other' (21.24%), as shown in Table 4.7. These "other" reasons included changes in trainer due to time or financial constraints, location or for the education of the horse, accounting for a total of 5.13%, and the sale of the horse, 5.04%. The most common destinations (Table 4.8) for horses once leaving racing were to different trainers (28.57%), followed by knackeries (16.56%) and then to studs (16.13%) and 'other' destinations (16.04%) – including 4.65% that went to pleasure riding, 2.80% that were retired to paddock.

Risk factors influencing destination

Trainer factors

No association was observed between wastage rates of individual racing stables and the destinations of the horses leaving them (P = 0.171). There was also no association between size of the stable (as measured by the number of horses present at the beginning of the study period) and the destinations of the horses (P = 0.154), or between the increase in size of the training stables over the study period and the destinations of the horses (P = 0.139).

An association was found between the destinations of horses and the State in which the stables were based ($P < 0.001$). Horses from Victoria and Tasmania were more likely to enter studs. It was more common for horses in New South Wales to go to different trainers, those in Western Australia to go to spelling and those in South Australia to go to knackeries and auctions (Table 4.16).

State/ Territory	Stud	Spelling	Knackery	Different trainer	Auction / new owner	Other	Total
NSW & ACT	15.23	14.40	18.11	32.10	6.17	13.99	100
Qld	13.08	6.92	16.15	26.92	11.54	25.38	100
SA	16.00	5.60	29.60	24.00	15.20	9.60	100
Vic & Tas	18.72	11.89	12.78	30.40	11.89	14.32	100
WA	13.23	14.29	15.34	23.81	12.70	20.63	100

Table 4.16: Percentage of Standardbred racing horses leaving to destinations by State/Territory.

No association was found between destinations and whether or not the stables were based at a metropolitan city racetrack ($P = 0.105$). A relationship between whether trainers owned all, some or none of the horses they trained was found ($P < 0.001$). A larger percentage of horses leaving owner-trainers enter knackeries, auctions and "other" destinations (Table 4.17).

	Stud	Spelling	Knackery	Different trainer	Auction / new owner	Other	Total
All horses	14.97	7.38	19.96	24.73	13.67	19.31	100
Some horses	17.89	14.55	14.21	30.60	8.86	13.88	100
No horses	9.76	13.41	14.63	35.37	13.41	13.41	100

Table 4.17: Percentage of Standardbred racing horses leaving to destinations by whether owners owned all, some or none of the horses in their stable.

Horse factors

An association between sex and destination was found ($P < 0.001$). Although this was weakened when 'stud' was not included (due to the fact that geldings cannot enter studs), it still showed a significant relationship ($P = 0.017$). Geldings had an increased chance of entering knackeries and going to different trainers (Table 4.18).

	Stud	Spelling	Knackery	Different	Auction /	Other	Total

				trainer	New owner		
Gelding	0.34	12.71	17.80	36.27	12.37	20.51	100
Mare	38.93	9.79	15.62	19.11	8.62	7.93	100
Stallion	3.57	17.86	10.71	25.00	14.29	28.57	100

Table 4.18: Percentage of Standardbred racing horses leaving to destinations by sex.

A relationship was seen between the age that horses left the racing stables and their destinations ($P < 0.001$). Those leaving to "other" destinations, as well as auctions and studs, had a greater mean age than horses that went to the alternative destinations listed. Likewise, an association between length of time in training and destinations was found ($P < 0.001$). As above, those going to studs, "other" destinations and auctions had mostly spent more years in race training (Table 4.19).

	Stud	Spelling	Knackery	Different trainer	Auction / new owner	Other
Age in years at leaving	5.54 (± 0.13)	4.13 (± 0.19)	4.83 (± 0.18)	4.47 (± 0.11)	5.19 (± 0.20)	5.95 (± 0.20)
No. of years in racing training	3.21 (± 0.13)	2.14 (± 0.15)	2.27 (± 0.12)	2.39 (± 0.09)	2.77 (± 0.18)	3.22 (± 0.16)

Table 4.19: Mean (±SE) age of leaving and years in training of Standardbred racing horses by destination.

A strong association ($P < 0.001$) was seen between the destinations of these horses and the reasons provided for their leaving. This association was maintained when 'to breed' and 'stud' were omitted from the reasons and destinations, respectively ($P < 0.001$).

Those horses at increased risk of going to different trainers were those that left for "other" reasons compared to the rest of the cohort. Those that left due to "poor performance/slow" were at more likely to going to auctions and knackeries than those leaving for alternative reasons. Those that left due to "illness/injury" were more likely than other horses to go to spell or go to "other" destinations (Table 4.20).

	Destination							
Reason		Auction/ new owner	Different trainer	Knackery	Spelling	Stud	Other	Total
	Illness/ injury	5.94	9.24	21.78	20.79	15.84	26.40	100
	Poor performance	16.37	30.48	24.69	8.06	6.55	13.85	100
	To breed	0.88	0	0	3.51	93.86	1.75	100
	Unsuitable temperament /behaviour	7.14	42.86	22.86	5.71	2.86	18.57	100
	Other	15.42	57.92	2.50	10.00	0.42	13.75	100
	Total	11.21	28.29	16.55	11.30	16.37	16.28	

Table 4.20: Destinations of horses leaving Standardbred racing by reasons (%).

Knackery destination

For Standardbred racing horses, the only risk factors discovered for entering knackeries rather than all other destinations were State/Territory location ($P = 0.001$), number of years in training ($P = 0.002$) and reason for leaving ($P < 0.001$).

Horses leaving due to "poor performance/slow" had the greatest chance of entering knackeries (24.69% of those horses entered knackeries), followed by those leaving due to unsuitable temperament/behaviour (22.86%) or illness/injury (21.78%). Likewise a far greater percentage of horses leaving racing in South Australia entered knackeries (29.60% of horses leaving) than in other states. Those horses entering knackeries had generally spent less time in racing than those not entering knackeries – with a mean number of years of 2.27 (± 0.06) as compared to 2.73 (± 0.12) years.

Thoroughbred breeding horses

Descriptive statistics

The details of 153 horses leaving Thoroughbred studs were obtained. Of these, 133 (91.72%) were mares and 12 (8.28%) were stallions. Seven respondents did not specify sex.

The mean age of leaving studs was 12.00 (± 0.43) years for mares and 10.90 (± 2.06) years for stallions. Mares typically spent 4.52 (± 0.31) years at stud and stallions 5.45 years (± 1.87) years. The studied mares which left had had a mean 3.54 foals (± 0.43), in contrast to stallions, that had sired 43.70 foals (± 38.30).

Of the details provided for mares, 64.57% (82) had raced, in 11.81% (15) it was unknown, 23.62% (30) had not. For stallions, 50% (6) of surveyed stallions had raced with 50% (6)

not having raced . It is possible that these statistics are not reliable due to the low numbers of stallions reported.

As seen in Table 4.21, most participants specified "other" reasons for Thoroughbred horses leaving the studs (45.83%), with a total of 17.36% not specifying any further reason. These reasons were divided into distinct groups, as was done for horses leaving racing stables. Following this, the most common reason was 'poor performance of progeny / undesirable bloodlines' (16.67%) and 'poor fertility' (16.67%), followed by 'illness/injury' (15.28 %), and, then economic reasons (11.81%). It could be assumed that a large percentage of those "other" reasons that were not specified were mares returning to their home stud after being serviced by the respondent stud's stallion.

	No. Thoroughbred horses (%)	**No. Standardbred horses (%)**
Illness/injury	22 (15.28%)	7 (14.58%)
Poor fertility	24 (16.67%)	5 (10.42%)
Poor performance of progeny / undesirable bloodlines	24 (16.67%)	8 (16.67%)
Behavioural / handling problems	8 (5.56%)	3 (6.25%)
Other	66 (45.83%)	25 (52.08%)
Economic decision	17 (11.81%)	9 (18.75%)
Old age	8 (5.56%)	1 (2.08%)
Return to owner	4 (2.78%)	10 (20.83%)
Service at another stud	7 (4.86%)	2 (4.17%)
Sold	5 (3.47%)	0
Unspecified	25 (17.36%)	3 (6.25%)

Table 4.21: Reasons for Thoroughbred and Standardbred horses leaving breeding studs.

The most common destination for Thoroughbred breeding horses was "auction/new owner" (37.14%), followed by different stud (28.57%), 'other' destinations (16.43%) and knackery (11.43%), as seen in table 4.22.

	No. Thoroughbred horses (%)	**No. Standardbred horses (%)**
Retire to pasture	9 (6.43 %)	0
Knackery	16 (11.43%)	21 (43.75%)

Different stud	40 (28.57%)	6 (12.50%)
Auction / new owner	52 (37.14%)	6 (12.50%)
Other	23 (16.43%)	15 (31.25%)
Died	12 (8.57%)	1 (2.08%)
Performance riding	2 (1.43%)	0
Pleasure riding	1 (0.71%)	3 (6.25%)
Pony Club	2 (1.43%)	0
Returned to owner	3 (2.14%)	9 (18.75%)
Unspecified	3 (2.14%)	2 (4.17%)

Table 4.22: Destinations of Thoroughbred and Standardbred horses leaving breeding studs.

Risk factors influencing destinations

Stud factors

No relationship was found between (total) wastage rates of the stud and the destinations of horses leaving (P= 0.205), nor between (total) net increases in the horse population on the stud and destinations (P = 0.238).

No relationship was found between (total) initial size of the stud and the destination (P = 0.055). Likewise there was no association between destinations and the number of mares present alone (P = 0.103) or stallions present alone (P = 0.117). The number of foals born on the stud did not influence the destination of horses leaving (P = 0.211). Neither did the number of mares served in the study period (P = 0.188).

Unfortunately, due to the small number of respondents, statistical tests were unable to assess any relationships between the State or Territory in which the studs were based and the destinations of horses leaving there.

Horse factors

Additionally, due to low numbers of stallions described, a comparison of the destinations of stallions to mares leaving stud could not be ascertained. However, a strong association was seen between age of leaving and destination (P < 0.001). Those horses that retired to pasture and that entered knackeries were typically older (18.00 ± 1.90, and 16.00 ± 1.14 respectively) than those that went to auction or to different studs (9.54 ± 0.56, and 11.81 ± 0.60). The number of years the horses had been at stud also influenced their destinations (P= 0.000). As with age at leaving, those that retired to paddock or entered slaughterhouses had spent longer at stud than those that were auctioned or went to different studs

(Table 4.23).

	Retire to pasture	Knackery	Different stud	Auction / new owner	Other
Age at leaving stud in years	18.00 (± 1.90)	16.00 (± 1.14)	11.81 (± 0.60)	9.54 (± 0.56)	12.76 (± 1.26)
No. years at stud	9.44 (± 2.19)	6.53 (± 1.19)	3.20 (± 0.34)	4.00 (± 0.37)	5.00 (± 1.02)
No. of foals born	24.5 (± 19.10)	4.29 (± 0.94)	3.94 (± 0.76)	3.42 (± 0.51)	2.20 (± 0.76)

Table 4.23: Descriptive statistics of horses leaving Thoroughbred studs by destination (mean ± SE).

An association was found between the number of foals born to the horse and its destination on leaving the stud (P =0.011). The large number of foals born to horses retiring to pasture may have been a result of more stallions leaving for this destination, which are capable of producing increased numbers of offspring compared to mares. To analyse the influence of mare-stallion differences, the analysis was performed comparing number of foals born to the horse on mares alone and no relationship was seen (P = 0.191).

The impact of mare-stallion differences was not seen when analysing the effect of age at leaving and number of years in stud for the destinations of only mares (P < 0.001 and P = 0.002 respectively). So the influence of these factors was not affected by differences between the mare and stallion population. There was no association between whether the horse had raced previously and its destination (P = 0.120). There were too few numbers of horses to ascertain whether an association existed between destinations and reason for leaving. However, by observing the descriptive statistics, it appeared horses that left for reasons of "poor fertility" where more likely than horses leaving for other reasons, to go to knackeries. Similarly, horses leaving due to "poor performance of progeny / undesirable bloodlines" were more likely to retire to pasture than horses leaving for any other reason (see Table 4.24).

	Destination						
Reason		Auction/ new owner	Different stud	Knackery	Retire to pasture	Other	Total
	Illness/ injury	4.55	0	18.18	13.64	63.64	100
	Poor fertility	21.05	21.05	47.37	10.53	0	100
	Poor performance of progeny / undesirable bloodlines	33.33	45.83	8.33	22.22	4.17	100
	Behavioural/ handling problems	37.50	62.50	0	0	0	100
	Other	54.55	28.79	1.52	3.03	12.12	100
	Total	37.14	27.86	11.43	6.43	17.14	

Table 4.24: Destinations of horses leaving Thoroughbred breeding studs by reasons (%).

Knackery destinations

Relationships were observed between knackery destinations of Thoroughbred breeding horses, as compared with all other destinations, and the wastage rates at the stud from which they were leaving ($P = 0.010$), their age ($P = 0.001$) or the time at stud ($P = 0.039$).

Those horses leaving Thoroughbred breeding and entering knackeries typically left studs with higher wastage rates (51.44% ± 6.37) compared to those not entering knackeries (34.91% ± 2.26). There was also a strong association between the age at leaving the stud and entering knackeries – those entering knackeries had a mean age of 16.00 (± 4.56) years as compared to those leaving to different destinations, 11.45 (± 0.45) years. Those entering knackeries also had spent longer at stud – with a mean of 6.53 (± 1.19) years for those entering knackeries compared to 4.34 (± 0.34) years for other destinations.

Unfortunately, due to the low numbers of horses described, the relationship between horses entering slaughterhouses and sex or number of foals or reasons for leaving could not be ascertained.

Standardbred breeding horses

Descriptive statistics

A total of 51 horses leaving Standardbred studs were described. Data from such a low number are statistically questionable and are prone to bias.

A total of 40 (83.33%) of the described horses were mares and eight (16.67%) were stallions. Two of the horses sexes were not specified. The mean age of mares leaving was 11.93 (± 1.21) years and stallions 11.00 (± 3.06). The mean length of time at stud for mares was 5.86 (± 1.00) years and for stallions was 6.75 (± 2.53). The mean number of foals per mare leaving was: 5.10 (± 0.94) and per stallion 1.67 (± 1.20). The low number of foals sired per stallion indicates that the results of this study may have been affected by bias due to the low number of responses from Standardbred studmasters. Of horses described, 32.50% of mares (13) leaving had not raced, 47.50% (19) had raced, and in 20.00% (8) of cases the studmaster did not know. Four stallions had raced (50%), and four (50%) had not.

When the reasons for leaving were analysed and the descriptions of "other" destinations were grouped, the most common reason was for service at another stud, or leaving after being serviced at a foreign stud (20.83%), followed by economic reasons (18.75%), 'poor performance of progeny/ undesirable bloodlines' (16.67%), as seen in Table 4.21.

The most common destination for Standardbred breeding horses was the knackery (43.75%) as seen in table 4.22, followed by returning to owner (18.75%), and auction or different stud (12.50% each).

Risk factors influencing destination

Stud factors

A significant relationship ($P < 0.001$) existed between the destinations of horses and the wastage rate of the studs from which they came. Those going to auction came from studs with lower mean wastage rates compared to those going to different destinations (Table 4.25).

	Retire to pasture	Knackery	Different stud	Auction / new owner	Other
Wastage rate (%)	-	42.15 (± 6.68)	45.88 (± 8.57)	18.49 (± 0.30)	73.48 (± 4.51)
No. of stallions at stud at the start of the study period	-	1.810 (± 0.18)	1.333 (± 0.21)	2.833 (± 0.17)	1.333 (± 0.13)
No. of mares served during the study period	-	59.0 (± 15.5)	33.00 (± 4.05)	16.67 (± 1.67)	107.5 (± 17.7)

Table 4.25: Descriptive statistics of Standardbred studs by destinations of horses leaving (mean ± SE).

However, no association was seen between the increase in breeding horse population over the study period and destinations of horses leaving those studs ($P = 0.094$). Similarly, no relationship was established between the size of total or mare population at beginning of studied year and destination ($P = 0.770$ and $P = 0.695$). However, in contrast to Thoroughbred breeding horses, this was not the case for the size of the stallion population at the beginning of the year, which was related to destinations of horses leaving those studs ($P < 0.001$). As seen in Table 4.25, those entering auctions, and to a lesser extent knackeries, typically came from studs with more stallions, than those leaving for other destinations.

Although no association was seen between the number of foals born in the study period and destinations of horses leaving ($P = 0.204$), a relationship was demonstrated between the number of mares serviced at the stud and the destinations of horses leaving ($P = 0.011$). Those going to "other" destinations, or knackeries, came from studs with more mares served in the study period. However, the large variances for this and the small amount of data recorded means that the significance of this finding is questionable.

Due to the low numbers of surveys returned, the effect of State or Territory location on destinations could not be assessed.

Horse factors

Likewise, due to low numbers, the effect of sex and racing history on destinations could not be ascertained.

However, a relationship between age at leaving and destination was seen ($P = 0.001$). Those entering knackeries and different studs were older than those entering auctions or "other" destinations. Likewise, the number of years at stud also affected destination ($P = 0.002$). In

a similar trend to the age at leaving, as seen in Table 4.26, those entering knackeries, or different studs, tended to have spent longer at stud.

	Retire to pasture	Knackery	Different stud	Auction / new owner	Other
Age at leaving stud in years	-	16.00 (± 1.62)	12.83 (± 2.37)	5.17 (± 1.54)	8.07 (± 1.70)
No. years at stud	-	9.76 (± 1.47)	4.67 (± 1.36)	2.33 (± 0.99)	2.75 (± 1.34)

Table 4.26: Descriptive statistics of horses leaving Standardbred studs by destination (mean ± SE).

The number of foals had by the horses did not affect their destination (P = 0.070)

Unfortunately, again due to low numbers, the relationship between reasons for leaving and destinations could not be demonstrated. Observing the descriptive statistics, a possible association between leaving studs for poor fertility and going to knackeries could be interpreted (Table 4.27).

		Destination					
Reason		Auction/ new owner	Different stud	Knackery	Retire to pasture	Other	Total
	Illness/ injury	0	0	85.71	0	14.29	100
	Poor fertility	0	0	100.00	0	0	100
	Poor performance of progeny / undesirable bloodlines	12.50	12.50	50.00	0	25.00	100
	Behavioural/ handling problems	0	0	66.67	0	33.33	100
	Other	20.00	20.00	16.00	0	44.00	100
	Total	12.50	12.50	43.75	0	31.25	

Table 4.27: Destinations of horses leaving Standardbred breeding studs by reasons (%).

Knackery destinations

For the same reason of low response rates, the influence of sex, reasons for leaving or State location could not be assessed for a relationship between knackery destinations as distinct to all other destinations for Standardbred breeding horses. The only significant risk factors for entering slaughterhouses were the number of foals born in the stud in the study period (P = 0.041), the time the horse had spent at stud (P < 0.001) and the age at which the horse left the stud (P =0.000).

Those horses entering knackeries came from studs with a larger mean foal crop in the study period (20.52 ± 5.28 foals compared to 10.52 ± 0.87 foals). They had also typically spent longer at stud, with a mean 9.76 (± 1.47) years, as compared to the 3.08 (± 0.83) years spent in stud by horses leaving for other destinations. Those leaving for knackeries were generally older, having a mean age at leaving of 16.00 (± 1.62) years compared to those going to all other destinations with a mean age of 8.48 (± 1.21) years.

4.4.2 Discussion

Study limitations

The study saw the destinations of horses being described for the first time, as well as various risk factors and the reasons why they left. The racing and breeding industries represent both diverse groups of industry stakeholders and dynamic horse populations. This means that the current study was particularly important given the lack of true regulation of horses as they enter and leave the industry, and the welfare implications for these horses. However, it also means that the investigation of this population was inherently difficult.

Questions relating to the destinations of the last five horses to have left respondent stables and studs may have resulted in selection bias. This is because seasonal variations may exist affecting the reasons why horses leave racing or breeding. For example, at the end of the racing season, more horses may be leaving racing because of injuries, whereas at the start of the season, poor performance may have been a more popular reason. The generalisability of the data may have been affected but, more importantly, the quality of the information was enhanced because the data did not depend on the recall of events many months prior.

Response rates to the question relating to the success of the horse at racing (that is, what class of racing was achieved by the horse) were insufficient to analyse this relationship. Some respondents wrote in this space that the horse had been unraced. A question relating to whether the horse had started in at least one race would be more appropriate in future surveys.

Similarly, insufficient data were provided for the "purchase price" of the horse for any examination of the fates of more expensive horses with perhaps more desirable bloodlines compared with others that were not as valuable. Some respondents though replied that the

horse had been “homebred” (that is, bred by the owners). This would be a worthwhile question on its own in future questionnaires, as one would expect horses that were bred by their owners to have significantly different careers and fates than those that were not.

As this study was the first investigation into the fates of horses leaving the racing and breeding industries, the extent of trainer/breeder knowledge of the destinations of these horses was unknown. However, trainers and breeders generally had greater knowledge of destinations of their horses than was expected, as judged by the frequent selection of the dumping category of “other”. So, to aid in more accurate data collection, it would be beneficial for future questionnaires to present more definitive destinations and reasons for selection – for example, the addition of a category of “performance/pleasure riding horse” as a destination for racing horses.

Potential misclassification biases in the description of the reasons the horses left may have occurred. This is because the *principal* reason for leaving may not have been selected. For example, “illness/injuries” may be the cause of “poor performance / slow”, Likewise, “unsuitable temperament/behaviour” or improper training methods may be the cause of “illness/injuries”. In other cases some horses would have left racing specifically “to breed” due to their potential value as breeding horses alone, other horses might have been poor performers and have left to breed. It must be realised, also, that the reasons provided are industry-licensed trainers’ and studmasters’ opinions, they are not objective assessments.

Additional misclassification biases may have occurred in the description of destinations. That is because only the initial known destination was identified. For example, racing and breeding horses going to auction may ultimately enter different studs, training stables or knackeries. So, although it appears that a significantly greater percentage of horses enter knackeries from harness than from Thoroughbred racing and breeding, this survey took into account the first known destination of horses leaving. With a greater percentage of the Thoroughbred racing and breeding horses entering auctions, it is possible that more Thoroughbreds than Standardbreds ultimately went to slaughterhouses. Due to the stigma associated with the horsemeat industry, it is possible that more trainers and studmasters specified ‘auction’ for those horses entering knackeries subsequent to sale at auctions, than they would for those horses going to auction that were sold to different studs or training stables. It is also possible that a significant amount of wastage occurred subsequent to

horses entering equestrian pursuits. Additionally, it is possible that studmasters included the details of horses moving temporarily to different studs for service, from which they would return. The inability to determine the final destination of horses was one of the key limitations of the survey design.

The movement of horses between the numerous establishments is a cause of concern. This is because anecdotally a large percentage of horses subject to abuse or neglect moved between numerous enterprises (Schwartz 2002), with the horses' economic worth and conditions to which they are subjected gradually declining. This is an important aspect of racehorse wastage that requires further investigations.

The importance of improved record keeping in both the racehorse and horsemeat industries was also demonstrated by this study. Although records are kept by the industry relating to horses in training and registered to breed, there is no true regulation or monitoring of the actual movements of these horses, or those horses that have not started in a race or those not registered to breed in the current year. This is an important aspect of the horse industry, though, that must be addressed so that future studies can more accurately assess horse wastage and their destinations, which is of great industry interest. Disease control considerations should also prompt improved monitoring of horse movements.

To more objectively identify reasons for, and the final destinations of, horses leaving the racing industry a prospective study would be required. Additionally, for risk factors to be described in a more objective manner, an independent assessor could record the data. However, a long study period would be necessary to accurately determine factors that influenced the fate of these horses, as would a large sample population due to the diverse nature of the racing industry. This makes a study of this type very difficult. It is especially important, though, that the movements of horses leaving the race industry continue to be monitored. This is because of the dynamic nature of the industry and the presence of strong external pressures that can influence the state of the horse population.

Destinations of horses leaving racing and breeding

This study is the first to identify the destinations for horses leaving the racing industry, as well as associated risk factors for these outcomes. This includes the reasons why horses left the industry.

The reasons for Thoroughbred and Standardbred racing horses having left the industry were remarkably similar. In both industries, the most common reason being "poor performance / slow" (36.51% and 35.22% respectively), followed by "illness/injuries" (30.95%, 27.08%), "other" reasons (16.75%, 21.24%), "to breed" (9.39%, 10.09%) followed by "unsuitable temperament / behaviour" (6.39%, 6.37%).

However, the destinations of these two breeds of horses differed substantially. Thoroughbred horses were more likely than Standardbreds to go to stud, auctions or to enter ridden equestrian pursuits. In contrast, Standardbreds were more likely than Thoroughbreds to go to different trainers or directly to knackeries. From this, it appears that intrinsic differences may exist between the breeds that affect the suitability of these horses to enter different enterprises subsequent to leaving the race industry. It appears that Standardbred horses have fewer opportunities once leaving the racing industry. Thoroughbred horses seem to be have a greater ability to enter equestrian pursuits, in contrast to Standardbred horses. This may indicate the presence of stigma associated with the suitability and performance of ridden Standardbred horses, despite efforts by associations such as Standardbred Pleasure and Performance Horse Association to overcome this.

Likewise, similarities were identified between the reasons Thoroughbred and Standardbred horses left breeding enterprises. The most common reasons Thoroughbred breeding horses left was due to "poor performance of progeny / undesirable bloodlines", followed by poor fertility, illness/injury and "other" reasons. The most common "other" reason was due to economic constraints. The order of the prevalence of these reasons was the same for Standardbred breeding horses, with the exception of illness/injury being more a more common reason than poor fertility. Once again, however, the destinations of these horses differed substantially. Thoroughbred breeding horses were more likely to go to auctions or to different studs. Standardbred horses were at increased risk of going directly to knackeries or to "other" locations, which included going to other studs for the purpose of services with different stallions. As was reflected in the results for the racing industry, it appears that Standardbred breeding horses, as compared to Thoroughbreds, may have fewer options once leaving the breeding industry, leading them to directly enter knackeries. However, the validity of the descriptions of the destinations of Standardbred breeding horses may have been affected by the low response rate of studmasters, leading to bias.

Risk factors associated with specific destinations were identified at both the level of the trainer/breeder and at the level of the horse. Trainer factors affecting the destinations of Thoroughbred racing horses, as shown in Table 4.28, included the size of the training stable, the changes in the horse population over the study period, the State/Territory location, whether the stable was based at a metropolitan city racetrack and whether the trainers owned the horses they trained. The trainer factors that affected the destinations of Standardbred racing horses were similar, except no association was seen with the size or change in the horse population in the stables or the city location. This may be because the Standardbred racing industry is more uniform than the Thoroughbred which anecdotally represents diverse types of enterprises, particularly between country and city racing. All factors studied at the level of the horse influenced the destinations of Thoroughbred and Standardbred racing horses. These were age, sex, time spent in race training and the reason for leaving

		Thoroughbred	Standardbred
Trainer factors			
	wastage rates	N (P= 0.850)	N (P = 0.171)
	size of training stable	Y (P < 0.001)	N (P = 0.154)
	change in horse population	Y (P < 0.001)	N (P = 0.139)
	State/Territory location	Y (P < 0.001)	Y (P < 0.001)
	city location	Y (P < 0.001)	N (P = 0.105)
	ownership of horses	Y (P < 0.001)	Y (P < 0.001)
Horse factors			
	sex	Y (P < 0.001)	Y (P < 0.001)
	age	Y (P < 0.001)	Y (P < 0.001)
	time spent in race training	Y (P < 0.001)	Y (P < 0.001)
	reason for leaving	Y (P < 0.001)	Y (P < 0.001)

Y- association was found using a 5% significance threshold.
N- no association was found using a 5% significance threshold.

Table 4.28 : Summary of risk factors for the destinations of racing horses.

Significant indicators for the destinations of Standardbred breeding horses included the wastage rate of the stud, the number of stallions standing at stud and the number of mares served on the stud during the study period. Factors at the level of the horse included age and time spent at stud. These risk factors at the level of the horse were also found to influence the destinations of Thoroughbred breeding horses. However, no risk factors at the level of the stud were identified that influenced the destinations of Thoroughbred breeding horses (Table 4.29).

		Thoroughbred	Standardbred
Breeder factors			
	wastage rates	N (P = 0.205)	Y (P < 0.000)
	size of breeding stud	N (P = 0.055)	N(P = 0.770)*
	change in horse population	N (P = 0.238)	N (P = 0.094)
	number of mares served in study period	N (P = 0.188)	Y (P = 0.011)
	number of foals born in study period	N (P = 0.211)	N (P = 0.204)
	State/Territory location	-	-
Horse factors			
	sex	-	-
	Age	Y (P < 0.001)	Y (P = 0.001)
	Time spent in race training	Y (P < 0.001)	Y (P = 0.002)
	Number of foals	Y(P= 0.011)**	N (P = 0.070)
	Reason for leaving	-	-

Y- association was found using a 5% significance threshold.
N- no association was found using a 5% significance threshold

*A relationship was described between the number of stallions present at studs and the destinations of horses leaving them (P < 0.001).

** This is likely to be a reflection of mare-stallion differences (see Section 4.3**)**

Table 4.29: Summary of risk factors influencing the destinations of breeding horses.

Generally, younger horses and those from larger and perhaps more commercially-orientated establishments went to different enterprises within the racing or breeding industries. In the case of the racing industry, this relates to horses that left stables in which their trainer was not the owner, and, also, for Thoroughbred horses those that were located at metropolitan city racetracks. These horses typically left to different trainers or "to spell", which are usually temporary sabbaticals. Those racehorses that left with injuries or illness were more likely to go to spell, whilst "poor performance / slow" or "other" reasons were risk factors for horses that left for different trainers. It is possible that many of them left for smaller, and in the case of Thoroughbred racing, country-based establishments, where the racing was less competitive.

Meanwhile, those horses leaving for auctions or knackeries were more likely to come from smaller racing enterprises, in which the trainer owned all the horses. There were remarkable similarities between the demographics of Standardbred racing horses that went to auctions and those that went to knackeries. This is perhaps because many horses going to auctions are in turn purchased by horsemeat plants.

A strong relationship between the racing and breeding enterprises was also described. A large percentage of Thoroughbred and Standardbred racing horses left to breed (18.23% and 16.13% respectively). This relationship was confirmed by the description of the racing

histories of breeding horses. From the trainers who were aware of the histories of their horses, 70.96% and 57.50% of the Thoroughbred and Standardbred study populations, respectively, had raced.

Those horses leaving Thoroughbred studs were more likely to leave the breeding industry completely by going to knackeries or 'retiring to pasture' if they were older and had spent longer at stud. These horses typically left for reasons of 'poor fertility' or 'illness/injury' respectively. Therefore, previous hypotheses (Bourke 1995) that aged mares with poor fertility leaving the industry may be contributing to the increasing fertility rates may be accurate, despite the fact that this was the reason given for only 15.11% of horses leaving studs.

The knackery was described as a significant final destination for Thoroughbred and Standardbred racing and breeding horses. Respondents described 6.30% of Thoroughbred racing horses having entered knackeries, compared to 16.56% of Standardbred racing horses, 11.43% of Thoroughbred breeding horses and 43.75% of Standardbred breeding horses. Using the number of horses actively involved in racing and breeding in 1998/1999 (Gordon 2001) combined with the wastage rates defined by this study (see Section 4.3) and the percentage of horses leaving stables and studs for knackeries the approximate the numbers of racehorses entering slaughterhouses in a given year can be determined. From these calculations, the knackery may have represented the initial destinations of approximately 650 Thoroughbred racing horses, 650 Standardbred racing horses, 900 Thoroughbred breeding horses, and 3000 Standardbred breeding horses during the 2002/2003 official race year. This is an underestimation given these numbers include only those horses officially registered. That means that only those which started in a race or had a return form completed for the specific breeding season are described in these numbers.

Additionally, this does not take into account the horses leaving to other destinations that subsequently enter slaughterhouses. For example, the number of ex-racehorses going to auction, by the same method of calculations, would approximately equate to 1 700, 400, 3 000 and 800 horses for the Thoroughbred and Standardbred racing and breeding industries respectively. Lay knowledge suggests a significant number of these horses may subsequently enter knackeries. Subsequent studies focussing on auctions to determine further associations between the horsemeat and racehorse industries would be valuable.

Additionally, wastage of ex-racehorses subsequent to the initial destination may also result in further ex-racehorses entering slaughterhouses. For example, those racehorses entering equestrian pursuits, and subsequently found to be unsuitable, could be assumed to be at risk of entering knackeries. As this was not specified in this study, the numbers of horses estimated to have entered slaughterhouses could be a significant underestimate of the true numbers.

Those Standardbred racing horses that left for knackeries tended to have left racing due to poor performance and had spent less time in race training. Horses based in South Australia were at increased risk of entering slaughterhouses, which may be explained by the fact that one of the two export abattoirs is based in that State. These produce larger amounts of meat than knackeries. Geldings were more likely to enter slaughterhouses, as were horses of younger age. Thoroughbred horses leaving to slaughterhouses also tended to be geldings. However, these horses were older. Those leaving because of "unsuitable temperament / behaviour" had an increased risk. However, this was followed by horses leaving for "illness/injury", and due to the larger number of horses leaving for this reason as opposed to "unsuitable temperament/behaviour", a greater number of horses entering knackeries left due to illness or injury. This is despite the fact that musculoskeletal disease has been shown to be the most significant reason for medical problems, and most of the horses affected by this can be rehabilitated with current veterinary knowledge (Bourke 1995). Also at increased risk were those horses based in Western Australia and South Australia. A larger percentage of horses leaving stables in which the trainer owned all the horses entered knackeries. It was also a more common destination for horses previously based at stables at non-metropolitan race tracks. These descriptions of at-risk Standardbred and Thoroughbred horses suggest that there is currently no place for these horses in other aspects of the race industry.

The differences between the risk factors for Thoroughbred and Standardbred horses may reflect differences between city and country racing for the Thoroughbred and Standardbred industries. It is possible that many Thoroughbred horses in smaller (country-based) enterprises had already left the more demanding city racing, and as such, were older and had already been in training for longer. Alternatively, horses may simply have longer careers in country racing than those based in the city. The differences between city and country racing are perhaps smaller for Standardbreds than for Thoroughbreds. This means that unlike

Thoroughbred racing, where horses that are not performing adequately can move to less demanding country races, those leaving harness racing due to poor performance have no other opportunities within the race industry. This may account for the Standardbred horses entering knackeries leaving principally due to 'poor performance/slow', and being on average younger than the rest of the Standardbred racing cohort.

The horsemeat industry, therefore, is an important destination for horses leaving the racehorse industry. Slaughterhouses appear to provide the only practical choice for the large numbers of horses leaving the racing and breeding industries. This is because the other horse industries, such as equestrian enterprises are considerably smaller than the racing and breeding, and so are unable to absorb the large numbers of surplus horses.

However, stakeholders from the horsemeat industry have expressed concerns regarding the continued viability of their industry (see Chapter 3). This is largely due to public reluctance to buy horsemeat, making the production of this meat financially non-viable. This may result in a further reduction of horsemeat processing plants.

Given the low market value of ex-racehorses, the high costs of care and level of experience required, it is likely that if this large number of horses did not enter slaughterhouses, they would be prone to conditions in which their welfare would be a cause of concern. It is possible that this problem would worsen should there be a reduction in the number of horse processing plants. This is because the prices paid for horses by these plants are a principal determining factor for the minimum market value of horses. If the purchase price of horses was to decline, an increasing number of people without adequate financial resources, and, perhaps horse knowledge, may purchase these horses. This may have serious welfare ramifications.

Additionally, if the large numbers of horses leaving the industry continues to increase in the coming years (see Section 4.3) the number of horses reliant on slaughterhouse destinations may increase, due to the relatively constant demand for these horses in other industries such as performance/pleasure riding. If at the same time the number of slaughterhouses decreased, the scale of the possible welfare problem experienced by ex-racehorses may increase.

Due to the relatively fixed demand for ex-racehorses in other industries, such as performance riding, remedying the reasons for which horses left racing would not necessarily *directly* influence their destinations. This is because the non-race industries are considerably smaller and are unlikely to be able to absorb the large number of surplus ex-racehorses regardless of the attributes of these horses. However, addressing the reasons for which horses left racing or breeding may prevent premature retirement from the racing or breeding industries. If the careers of these horses were increased, fewer "replacement" horses would be needed to fill racing fields or to produce sufficient numbers of racing horses (see Section 4.3). This means that fewer numbers of horses would enter racing and breeding. Consequently, the number of horses leaving racing/breeding may be reduced and may be more congruent with the demand for these horses in other industries, and the number of horses reliant on slaughterhouse destinations would be reduced. This means that addressing the reasons for which horses leave the race industry, may thus indirectly have important ramifications for the destinations of these horses subsequent to leaving and their welfare.

In addition to indirectly influencing the destinations available to ex-racehorses, correcting/preventing the reasons horses leave racing and breeding, may also reduce subsequent wastage. This is because, for example, if horses that have left racing due to "unsuitable temperament or behaviour" and have entered one of the equestrian disciplines, they may leave this subsequent destination due to the original problem. Therefore, although this is beyond the scope of the current study, it may be reasonable to assume that the correction or prevention of the reasons horses leave racing, may have additional advantages in that further wastage may also be prevented.

This study has identified these reasons for which horses leaving racing and breeding. For horses leaving racing, these include "poor performance / slow", "illness / injury" and "unsuitable temperament / behaviour". Further research is needed to identify risk factors for horses leaving due to these reasons.

The need to identify possible training or breeding practices that address or prevent these problems is acute. This is because the large number of horses available to racing stables and studs may mean that it is currently more expedient and financially feasible for trainers and studmasters to acquire new horses rather than to use present practices to remedy problems in

existing horses. This may account for the large number of horses described in this study moving between different enterprises. In addition to the serious welfare concerns for the horses involved, this practice is not of benefit to the race industry. Owner dissatisfaction due to the short careers of horses has been shown to have resulted in these important stakeholders leaving the industry (Bourke 1995). The current media attention to horse wastage, and the various campaigns focusing on this that have been launched by animal welfare groups, may also result in decreased public participation in the industry in the future. Consequently, horse wastage is an issue that has serious ramifications that may affect the continued viability of the industry.

General Discussion

Achievements

This study was the first to describe total wastage rates of the racing and breeding horse populations. It was also the first to describe the reasons for, and destinations of, those horses leaving. Larger than expected percentages of horses leaving racing stables and breeding studs were observed. However, it is possible a considerable proportion of this was a result of horses moving between establishments within the race industry. These large wastage rates confirmed the importance of investigating the fate of horses leaving the industry. The destinations of horses leaving were identified and a significant relationship was observed between the racehorse and horsemeat industries. Risk factors associated with specific outcomes were described, as were reasons for horses leaving the industry.

Proposals for further work

The study identified initial destinations of horses leaving the race industry. However, one of the limitations of the questionnaire was the inability to describe the total movements of the horses. Future cross-sectional prospective studies, although requiring increased study periods and populations would be beneficial. This is because the fate of horses moving between numerous enterprises has been anecdotally linked to the eventual abuse of the animals. Additionally, wastage of ex-horses subsequent to leaving the race industry may be an important future investigation. The importance of improved industry monitoring of horse movements is essential.

The need for further studies focussing on factors and training techniques that may influence the reasons why horses leave the racing and breeding industries was also described. The current study identified the variety and prevalence of reasons why horses left the industries, but, to prolong the careers of these horses, further studies are required to investigate factors that can prevent or remedy these reasons. This may have important ramifications in terms of industry wastage rates, and the welfare of the horses subsequent to leaving the industry.

The current study has generated considerable public support within the wider horse

community. It is hoped that this interest will culminate in increasing industry support of future studies. This is because, as the current study has indicated, they have the potential to improve the welfare of the horses, and, additionally, improve public perceptions of the industries, thereby ensuring their continued viability.

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