FACTORS AFFECTING THE WELFARE OF NON-RACING HORSES IN PRINCE EDWARD ISLAND

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ABSTRACT

In North America, there are few representative, horse level data about the general welfare of horses (including prevalence of some specific welfare concerns). To help address this deficit, in the summer of 2002, a survey was conducted of the welfare and management of 312 non-racing horses (ponies, miniature horses, draft horses, and other horses that are not race horses) in Prince Edward Island, Canada. One hundred and seventeen horse owners were recruited by a random phone book search (response rate 68.4% among respondents owning horses).

Demographic data, information about management practices and data on the occurrence of stereotypic behaviour were collected through a pre-tested questionnaire. Equine health was assessed by the study veterinarian during a site visit, and fecal samples were taken to determine strongyle egg count.

A number of welfare related concerns were noted. Sixty two percent of horses had never had their teeth examined by a veterinarian and the prevalence of dental abnormalities was high (sharp enamel points, 9.1% and molar hooks, 13.5%). The mean ± SD fecal egg count was 428 ± 860 strongyle eggs per gram, and 76% of owners never removed manure from the pasture. Many horses had hoof wall problems: 26.8% of horses had hooves that were excessively long, 25.1% had hoof wall cracks, 32.0% had breaks in the hoof wall and 8.5% had white line disease. In addition, 54.9% (28/51) of draft horses had docked tails.

The effect of management on equine welfare was further assessed using two welfare-related endpoints: occurrence of stereotypic behaviour, and body condition score. Body condition score tended to be high (mean ± SD 5.7 ± 1.08 on a 9-point scale) and was higher in mares ($p<0.001$) and in horses examined later in the summer ($p=0.025$). The prevalences of crib-biting, wind-sucking and weaving were 3.8%, 3.8% and 4.8% respectively. The risk of having one of these stereotypies increased with age (OR= 2.0 for a 10 year increase, $p=0.013$) and use of a non-snaffle bit (OR=3.39, $p=0.026$). The risk tended to decrease with longer daily time at grass (OR= 0.59 for a 12 hour difference, $p=0.068$) and with horse type (draft horses were less likely than light horses to have a stereotypy OR=0.13, $p=0.054$). All relationships identified in the regression models are likely to be causal with the exception of the use of a non-snaffle bit and stereotypic behaviour.

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LIST OF ABBREVIATIONS

AAEP	American Association of Equine Practitioners
BCS	Body Condition Score
CARC	Canadian Agri-Food Research Council
CCC	Concordance Correlation Coefficient
CEF	Canadian Equestrian Federation
CI	Confidence Interval
COPD	Chronic Obstructive Pulmonary Disease
DRI	Daily Recommended Intake
IURD	Infectious Upper Respiratory Tract Disease
NAHMS	National Animal Health Monitoring System
OR	Odds Ratio
PEI	Prince Edward Island
SD	Standard Deviation
UFAW	Universities Federation for Animal Welfare

Chapter 1: Introduction

Animal welfare is a complex variable that encompasses physical health, mental health, and satisfaction of the animal's nature (genetically encoded traits reflected in breed and temperament) (1). An assessment of welfare must involve a broad spectrum of measurements because each animal has a multitude of coping mechanisms which may or may not be sufficient for the environmental and other influences to which it is subjected (2). Evaluation of welfare measurements can be guided by knowledge of the management factors which affect them. However, before the effect of management factors on equine welfare can be investigated, descriptive data on physical and mental welfare are required.

In North America, there are few representative, horse-level data about the effects of management practices on equine welfare. Also, it is not known if Canadian horse owners follow national guidelines on the care and handling of horses (3). In order to address these needs, a randomized survey of non-racing horses in Prince Edward Island (PEI) was conducted in the summer of 2002. The demographics, management practices and general health of non-racing horses in PEI are presented and discussed in Chapter 3. The effects of management factors on the two welfare endpoints (body condition score and occurrence of stereotypic behaviour) are discussed in Chapter 4, and conclusions from the survey are presented in Chapter 5.

Chapter 2: Literature Review

2.1 Animal Welfare

Over the last thirty years, public concern about animal welfare has increased and animal welfare science has become an established academic discipline (4). However, historically there has been more public concern for laboratory and companion animals than for farm animals or horses. To the author's knowledge, no representative studies have been conducted to describe the welfare of horses in Canada. Animal welfare is a complex variable and the direction of any study of welfare will depend on how welfare is defined.

2.1.1 Defining animal welfare

There has been much discussion regarding what "animal welfare" actually is. The word "welfare" is derived from the German *wel faren*, to fare well, and may be broadly defined as the state of being or doing well, a condition of health, happiness, and comfort (5). Definitions of animal welfare have been characterized by various people and are summarized in Table 2.1.

Table 2.1: Definitions of animal welfare

DEFINITION	AUTHOR	COMMENT
THE FIVE FREEDOMS: animal welfare consists of freedom from hunger and thirst, freedom from discomfort, freedom from pain, injury and disease, freedom from fear and distress, and freedom to express normal behaviour	Farm Animal Welfare Council (6)	The Five Freedoms provide a useful framework in which to explain the many aspects of welfare (7). However, the approach has some limitations as attaining all five freedoms is unrealistic in wild or domesticated animals (8). For example, during the transport of farm animals, it is likely that at least three freedoms would be violated (freedom from hunger and thirst, freedom from discomfort and freedom to express normal behaviours). Thus, according to the Five Freedoms, farm animals should not be transported, but this is unreasonable.
WHAT WE DO FOR ANIMALS: animal welfare is what we (as owners, care-givers, and veterinarians) do for animals	Blood and Studdert (9)	What humans do for animals could include environmental surveillance as well as the treatment and prevention of disease. According to the authors, welfare is what is given to the animal by a human and does not encompass the animal's experiences.
FEELINGS-BASED: animal welfare is about the feelings of the animal. The animal's feelings include suffering and pain.	Dawkins (10); Duncan (11)	Suffering occurs either when the severity of stresses exceeds the capacity of the animal to cope or when the animal is unable to take constructive action under a stressful situation (8). Suffering is difficult to assess. Also, with this definition of welfare, suffering could not occur in an anesthetized animal, because the animal cannot feel (12). Thus, the welfare of an anesthetized dog with a broken leg is not a consideration.

DEFINITION	AUTHOR	COMMENT
NATURE: The environment of an animal should reflect the natural habitat in which the animal has evolved to live. Welfare is optimal when "the animal is showing no evidence of distress and is able to perform all the behaviour within its repertoire, provided this does not cause suffering to others." ((13), p.344, line 29-31).	Kiley-Worthington (13)	Maintaining animals in a naturalistic habitat is not always feasible and not necessarily advantageous to the animal. For example, horses in the wild do not always have access to shelter from insects or harsh weather. Also, in the wild, animals do not have access to anthelmintics or antibiotics.
COPING: welfare is a reflection of the animal's attempt to cope with its environment.	Broom (14)	This definition has tended to focus on physical functioning and physiological measures. These measures have limitations (see section 2.2.1).
FITNESS: Welfare is the animal's capacity to avoid suffering and maintain fitness	Webster (15)	This definition may be criticised because fitness is a biological concept that signifies the ability of the animal to reproduce (11) and fitness is not substantially affected by some factors relevant to welfare. For example, environmental restrictions on behaviour, such as lack of social contact could cause an animal to be frustrated but might not affect the animal's ability to reproduce.

Given the variety of definitions of animal welfare and that ethical concerns about the quality of life of animals are increasing (16), Duncan and Fraser (1) formulated a holistic definition of animal welfare. They defined welfare as the state of the animal's mind (mental health) and body (physical health) and the extent to which its nature (genetically encoded traits reflected in breed and temperament (17)) is satisfied. These

three areas of welfare overlap. For example, pain can have effects on both the physical and mental welfare of an animal. The definition (1) takes into account earlier definitions and covers the areas that are of ethical concern to the public (16). This definition of animal welfare (1) will be adopted in this thesis.

2.2 Assessing animal welfare

There is no single measurement that can be taken to indicate level of welfare (18). Each animal has a multitude of coping mechanisms which may or may not be sufficient for a given environment. Thus, an assessment of welfare must involve a broad spectrum of measurements (2) and may be approached by addressing each of the three dimensions of animal welfare suggested by Duncan and Fraser (1).

2.2.1 Assessing equine welfare: the horse's body

A popular belief has been that if an animal's body is healthy, then the animal is faring well. Fraser et al (15) have noted two arguments for emphasizing physical state in the evaluation of welfare. The first argument is that we must study an animal's ability to function because we cannot study feelings. Fraser et al argued that it is difficult to study feelings from the animal's point of view, and such research is subject to anthropomorphism. In addition, within a strict Cartesian framework (i.e. that animals are machines without minds (19), research on the feelings of animals is futile and the study of animal welfare involves an investigation of the functioning alone.

The second argument for emphasizing physical state when evaluating welfare is

that we can study functioning instead of feelings because the two are intimately related (16). Duncan and Fraser (1) also suggested that feelings and functioning are related. However, there is a limit to this relationship; for example, if horses are housed alone, they are less likely to acquire an infectious disease or to be injured by another horse, therefore their physical functioning (physical welfare) may be optimal, but they may suffer from frustration)negative feelings) if housing limits the opportunities to socialize or limits the grazing time (20). The assessment of mental welfare is reviewed in Section 2.2.8.

The physical state of an animal is the most objective dimension of animal welfare and it may be assessed by measurements such as reproductive success, levels of growth, injury, disease, malnutrition and longevity (1). McGlone (21) argued that welfare is compromised only when the physical functioning of the animal is so poor that the animal is unable to survive or reproduce (21) but many people would disagree with this argument because it ignores pain[1] and distress. These negative states are difficult to evaluate, but they may be assessed using biochemical measurements such as cortisol or beta-endorphins. However, these parameters do not always indicate distress. For example, cortisol levels are often increased during mating (22).

In the case of horses, clinical signs of optimal physical health are alertness, responsiveness to stimuli, pink mucosae, good body condition (without being fat), a body temperature of 38.0 ±1.0 °C, a respiration rate of 18-40 breaths per minute, and a resting pulse of 30 to 40 beats per minute (23-25). (Some of these parameters may vary with breed, age, and physiological state). Physical welfare can also be assessed by the

[1] Underlined words are defined in the glossary at the end of the thesis

presence of diseases, some of which are considered to be more detrimental to welfare than others. The most common diseases diagnosed by veterinarians were examined in a postal survey in which members of the American Association of Equine Practitioners (AAEP) were asked to rank the medical problems of adult horses by frequency (26). The response rate was low (39.1%) and the study excluded veterinarians who were not members of the AAEP. The top-ranked medical problem was colic (abdominal pain), followed by viral respiratory disease, endometritis, dermatitis, and parasitism (26). Surgical and lameness problems were not evaluated in the study.

The present study examines the effects of management factors on equine welfare. Therefore, the following review of equine physical welfare will examine diseases in North America that are influenced by management: intestinal parasites, chronic obstructive pulmonary disease, strangles, influenza, some skin conditions, laminitis, hoof wall abnormalities, and dental disorders. Nutrition will also be briefly reviewed.

2.2.2 Intestinal parasites

Most horses are infected with some intestinal parasites without serious consequence to the horses' health (27). The effect of the parasites depends on multiple factors, including age, pregnancy and immune status (28). Clinical signs range from diarrhea to loss of condition to sudden death due to cardiovascular failure (29-31). Intestinal parasites have been reported as one of the most common causes of colic itself, a major cause of death in horses (28) There are a wide variety of intestinal parasites known to infect horses (32). The major types are large strongyles (e.g. *Strongylus vulgaris*),

small strongyles or cyathostomes, and tapeworms (28). Examples of other intestinal parasites are ascarids in foals *(Parascaris equorum)* and *Oxyuris equi* (the pinworm) (28).

2.2.2.1 Strongylus species (large strongyles)

Large strongyles (Strongyloidea) are one of the major intestinal parasites affecting the horse (33). The species that affect horses are *Strongylus vulgaris*, *Strongylus edentatus* and *Strongylus equinus* (34). *Strongylus vulgaris* larvae are the most pathogenic. They enter the horse when ingested as larvae with grass, and then follow a migratory phase, which may damage the cranial mesenteric artery. This vessel supplies blood to the small intestine, cecum and ascending colon. The presence of the larvae in the artery may result in thrombosis, embolisms, aneurysms, and intestinal infarction, all of which may lead to colic (28). The migratory phase is completed in the large intestine and the cecum where the strongyles mature into adults and lay eggs (34). The eggs are excreted in the feces onto pasture where they hatch; the larvae develop in the fecal mass, and the cycle is repeated (34,35). In Prince Edward Island, there is likely to be a greater degree of strongyle transmission between horses from July to September, when pasture contamination due to egg shedding by the parasite is thought to be at a maximum (36).

Most horses host large strongyles at some point during their lives (32). Infection with large strongyles may adversely affect horses of all ages by causing colic, unthriftiness and anaemia (27). The prevalence of *S. vulgaris* among horses with colic has been estimated at 90% (37), but this figure is based on anecdotal observations and there are no recent estimates available. *Strongylus* infestations may be eliminated by

treatment with benzimidazoles, ivermectin or moxidectin (27,30). Large strongyles are not usually detrimental to horses that have received adequate regular anthelmintic treatment (27). De-worming and other control strategies are discussed in Section 2.2.2.4.

2.2.2.2 Cyathostomes (small strongyles)

Cyathostomes (sub-family Cyathostominae, e.g. *Cycliocephalus, Gyalocephalus, Cylicocyclus*) are important parasitic pathogens of the horse (27,38,39). The life cycle begins when the horse ingests larvae. Upon entering the large intestine and cecum they undergo a period of arrested development before developing into adults (27,40). Adults shed eggs which are excreted with feces. Clinical signs of cyathostome infestations include decreased performance, weight loss, rough coat and gastrointestinal impairment including colic(41). The pathogenic effects of cyathostomes are usually less serious than those of large strongyles, because the cyathostome larvae do not migrate beyond the mucous membrane of the cecum and colon (28). However, cyathostomes may cause a life-threatening condition, larval cyathostomosis, which occurs when there is a synchronous emergence of large numbers of larvae from the intestinal mucosa, causing clinical signs that range from diarrhea to colic (27,41,42). The condition is seasonal, with the highest occurrence in the winter and spring. Fecal egg counts cannot be used to diagnose larval cyathostomosis (42).

2.2.2.3 Tapeworms

Unlike strongyles, tapeworms belong to the class Cestoda. The most common equine tapeworm is *Anoplocephala perfoliata* and its life cycle involves an intermediate host, the oribatid mite (28). The mites live in grass and ingest tapeworm eggs present in the horses' feces. The eggs hatch inside the mite and develop into cysticercoids. Tapeworm infestation begins when the horse ingests infected mites and the cysticercoids are freed during digestion. The cysticeroids attach to the intestinal wall at the ileocaecal junction where they mature into adults. Gravid segments break off the adults and are excreted in the feces (35). Previous studies of tapeworms in horses have produced prevalence estimates ranging from 13% to 82% (43,44,45).

Although the majority of horses tolerate low levels of tapeworm infestation, individuals from a herd occasionally develop high tapeworm burdens which may result in colic (46). Tapeworms have been associated with ileal impaction colic and spasmodic colic (46), and a dose-response relationship has been proposed (i.e. the risk of colic increases with tapeworm load) (47). However, in a case control study of equine colic, significant associations between tapeworm burdens and colic were not identified (48).

2.2.2.4 Parasite control programs

Parasite control is an essential management practice for maintenance of good health. However, Proudman and Matthews (27) stated that horse owners hold serious misconceptions about parasite control strategies which lead to the suffering of many

horses due to diseases caused by intestinal parasitism. Control of intestinal parasites may be accomplished effectively with pasture management strategies and regular treatment of horses with anthelmintic drugs (33). Pasture management involves removing feces from occupied pastures twice weekly, separating highly infected horses from the rest of the herd, preventing over-grazing of pastures and avoiding overstocking (27,32,33). While an effective pasture management program is the best means of reducing parasitic infection in the horse, de-worming is also important (27,30). There are three common types of de-worming regimens for northern temperate regions: routine de-worming of all horses, strategic dosing and targeted strategic dosing. Routine de-worming of all horses is simple and effective but is often more expensive because all horses must be de-wormed approximately six times per year, and this may increase the risk of developing anthelminthic resistance (27). Daily de-worming with pyrantel tartrate has also shown promise as an effective parasite control strategy (49-52). Strategic dosing (also known as spring/summer treatment) is less expensive(33)and involves treatment throughout the spring and summer of all horses on the premises to eliminate egg production by the parasites (33). Targeted strategic dosing is often even less expensive and reduces the risk of anthelminthic resistance (27). Targeted strategic dosing involves obtaining a fecal egg count prior to medicating at the critical times of the year and dosing only those animals with parasite burdens of more than 200 eggs per gram of feces (27). A limitation of targeted strategic dosing is that fecal egg counts are not a reliable means of diagnosing the intensity of infection (27).

2.2.2.5 Cyathostome resistance

An impending problem with equine parasite control is cyathostome resistance to anthelmintics. Resistance can develop if an incorrect dosage of anthelmintic is administered to the horse (27). To prevent resistance, the appropriate dosage may be estimated by using a girth tape to estimate the horse's body mass. It is thought that most horse owners do not use a girth tape, therefore, the dose of anthelmintic is often incorrect. However, the methods that horse owners use to estimate dosages have not been researched.

Resistance occurs when parasites are able to tolerate the effects of a given dose of anthelmintic. These parasites survive and reproduce, eventually giving rise to a population that is not affected by the anthelmintic (53). Resistance is indicated by a reduction in the time required for eggs to reappear in feces following treatment (41). There are four main drug classes of anthelmintics for controlling cyathostomes in horses: benzimidazoles, tetrahydropyrimidines (including pyrantel), avermectins/milbemycins (including ivermectin and moxidectin) and piperazine (30,41). Of these, the benzimidazoles and possibly pyrantel are believed to be ineffective in specific geographic areas (27). At least ten species of cyathostomes have developed resistance to benzimidazole in the United States (54) and resistance to pyrantel has been found in the United States, Norway, and Denmark (41). Information regarding cyathostome resistance in Prince Edward Island is not currently available.

2.2.3 Respiratory diseases influenced by management practices

There are several respiratory diseases in which the occurrence or course of the disease may be influenced by management practices. Chief among these respiratory diseases are chronic obstructive pulmonary disease (COPD), strangles and equine influenza.

2.2.3.1 Chronic obstructive pulmonary disease

Chronic obstructive pulmonary disease (COPD) or "heaves" is a respiratory condition caused by repeated exposure to allergens such as mold spores from hay and straw in an enclosed environment (55). Stables are often a storage area for hay, straw, and other bedding materials. Poor drainage from these areas may lead to the accumulation of fungal toxins and spores, and other organic materials such as pollen and feed (56). When these environmental conditions arise, the horse may develop a sensitivity due to chronic exposure to inhaled fungal spores (55), which may result in COPD. The clinical signs of COPD range in severity from a simple cough to an increased respiratory rate, with the inability to work without becoming dyspnoeic, and chronic loss of weight (55,57) The best method to control COPD is to optimize air quality. Methods of maintaining air hygiene are: good ventilation, storing hay or straw away from the horse's stall, keeping manure piles away from barn, and using bedding which is not dusty (58).

2.2.3.2 *Strangles*

Strangles is a serious and highly contagious disease that has been reported to be common worldwide (59). It is a bacterial infection of the respiratory tract caused by *Streptococcus equi*. Clinical signs include nasal discharge, coughing and swelling of the lymph nodes in the head and neck that may obstruct the airway (60). Infection sometimes spreads to other parts of the body, including the lungs, liver, spleen, kidneys, brain, and digestive system. This spread of infection beyond the upper respiratory tract, known as "bastard strangles" (61) and affects approximately 20% of infected horses (60).

Many management measures may be taken to control the transmission of strangles, including sanitation and vaccination (59,60,62). Sanitation is the primary means of prevention because transmission is through ingestion or inhalation of the bacteria (62). Vaccination had limited value in the past because all vaccines were administered by intramuscular injections which elicited a systemic immune response (60). These injections only reduced the rate of infection by about 50% (59,63). A new intranasal vaccine has been developed (Pinnacle I.N, Fort Dodge, IA, USA) which elicits a secretory antibody response in the local respiratory tissues (60). Although this intranasal vaccine gives some hope for reducing the frequency and severity of strangles, to date, it has not been proven to reduce the rate of infection any more than the intramuscular vaccine (59,60). To the author's knowledge, no publications are available regarding the prevalence of strangles, or frequency of vaccination for the disease in Canada.

2.2.3.3 *Equine influenza*

Equine influenza is a viral disease characterized by a sudden onset of high fever, nasal discharge and lethargy (64). Due to its rapid transmission, it is an important cause of acute infectious upper respiratory tract disease (IURD) (65). Although influenza is highly infectious, there is evidence that horse owners do little to prevent it. In a non-randomized survey in Saskatchewan, it was found that few precautions (e.g. vaccination) were taken by horse trainers to reduce the spread of influenza (65). A randomized study of the efficacy of a commercial intramuscular vaccine found no clear advantage of vaccinating horses against influenza (66). However, a new intranasal vaccine (Flu Avert, Heska Corporation, Fort Collins, CO) shows promise in controlling equine influenza virus (67). Stable hygiene is nonetheless crucial to prevent and control the disease. Hygenic management involves isolation of new horses prior to introduction to the herd, and appropriate sanitation procedures.

2.2.4 Skin diseases influenced by management practices

When horses are kept in wet, muddy, or damp environments, skin diseases can occur including thrush, pastern dermatitis and rain scald (68). Thrush is a condition of the hoof, caused by standing in moist, wet or muddy conditions (Section 2.2.5.2). The actinomycete, *Dermatophilus congolensis* is responsible for both pastern dermatitis and rain scald. Pastern dermatitis, or mud fever, is an irritation of the skin at the back of the pastern or heel due to standing or working in muddy or moist conditions (31). Pastern dermatitis may be prevented by keeping the legs clean and dry, by ensuring that the horse

is kept in conditions that are well drained and not muddy, and is groomed regularly (31,32). Rain scald is a skin infection of the back, loins, quarters and shoulders which results in hair loss and purulent scabs. If the horse has adequate shelter or a New Zealand rug (a waterproof blanket), then rain scald is rare (31).

2.2.5 Diseases of the foot influenced by management practices

The horse's foot has three main functions: supporting the weight of the horse, absorbing the energy of concussion, and preventing slipping (31). The foot, representing only 0.1% of the horse's bodyweight, is the site of most equine lamenesses (69,70). Regular hoof care (routine cleaning with a hoof pick and trimming every four to eight weeks) helps to prevent hoof abnormalities (31,69,71). Permitting the hoof to grow too long or become mis-shapen may cause serious damage to the legs and feet resulting in conditions such as tendonitis, heel pain, corns, thrush, and gravel infection (32).

2.2.5.1 Conditions of the hoof wall

There are several structures which make up the equine hoof: the hoof horn, wall and frog. If these structures are abnormal, lameness may result. Hoof wall abnormalities often result in increased susceptibility to infection from the environment and in trauma due to an inability to transfer the forces of locomotion correctly (72). Causes of these abnormalities may be environmental, managerial, genetic, nutritional, or a combination of factors (72). Hoof wall abnormalities have a great impact upon the welfare and performance of horses and are a major concern for horse owners, veterinarians and

farriers (73). Hoof wall abnormalities range from superficial or deep cracks to flaky or fragile walls (72). In a non-representative survey of equine hoof wall problems and associated factors in Texas, it was found that 28% of horses had some type of hoof wall abnormality (73).

2.2.5.2 Thrush

Thrush is an infection of the frog caused by poor foot care and lack of hygiene (31). Thrush is caused by the anaerobic bacteria, *Spherophorus necrophorus* which cause necrosis of the tissues of the frog and a black or gray discharge characterized by a foul smell (71). In extreme cases, thrush may cause lameness (71,74).

2.2.5.3 Laminitis

Laminitis is a noninfectious disease of the hoof in which there is inflammation of the sensitive laminae. This is often severely painful due to circulatory congestion within the foot (71). Laminitis can be acute or chronic. Acute laminitis continues for approximately 72 hours, until the horse either recovers fully or experiences digital collapse (rotation or sinking of the third phalanx) at which point the disease is considered chronic (75). The mechanism which causes laminitis is caused is not fully understood, but there are a number of factors which predispose a horse to laminitis (76). One of these is carbohydrate overload from ingestion of lush pasture, excess grain intake, or a feed change to high-energy legumes (76). Other management factors that are reported to be associated with laminitis are physical impact from exercising a horse excessively on a

hard surface, trimming hooves irregularly or excessively, overfeeding, and the use of black-walnut wood shavings (which are toxic to horses) for bedding (31,76). A non-randomized study of laminitis cases admitted to the University of Missouri Veterinary Hospital and Clinic between 1965 and 1971 (77) found that intact mares and stallions and especially ponies accounted for the greatest number of laminitis cases (77). This was an uncontrolled study, cases of chronic and acute laminitis were not distinguished in the sample, and the horses were all patients from the same hospital (n=161). A second study examining risk factors for laminitis at the Texas Veterinary Medical Centre separated cases of chronic and acute laminitis (78). The study sample was more representative of the equine population in the area as it included cases from nine different veterinary practices (n=108 horses). The results indicate that age, breed and body weight were not risk factors for acute laminitis, but age was a factor for cases of chronic laminitis (with older horses at higher risk). The authors also found that mares were more likely to develop chronic laminitis but mares may have been over-represented (78). The major cause of laminitis in the study was gastrointestinal disease (54%).

Management is considered a primary means of prevention of the equine foot conditions outlined above (79). To the author's knowledge, no studies have been conducted in Canada to examine the prevalence of the above conditions or the management relevant to them, nor have there been studies conducted to determine the quality of hoof care provided to Canadian horses. Obtaining an understanding of hoof care practices and the state of the equine foot may be useful to assess welfare. It would also provide a starting point for better education of horse owners in order to prevent

neglect of hoof care, if necessary.

2.2.6 Dental abnormalities

Dental diseases are a major cause of unthriftiness and poor performance in working horses and have been ranked in the top seven most common medical problems encountered by veterinarians (26). However, this ranking was based on a study that was not representative of the general equine population (26). A post-mortem survey of the prevalence of equine dental disease and oral pathology (n=500) in Illinois confirmed that dental disorders are common, with sharp enamel points, ulcerations and abnormal wear being some of the more obvious problems (80). Unfortunately, the published data from the survey does not include frequencies of each abnormality or details of the study design (80). Apart from the latter study, there have not been any published data that identify the prevalence, type, or severity of equine dental abnormalities in North America.

Deformities of the mouth may lead to loss of condition and to behavioural problems due to pain where the bit lies. A veterinarian can check for dental abnormalities and can also correct them. Horses should have their mouths examined every 6 to 12 months, depending on the age and occupation of a horse (81). A national survey of equine health and management in the United States in 1998 indicated that 55.6% of equine operations did not provide any dental care (82). The lack of dental care is a significant welfare concern when the consequences from dental disorders are considered. Often, by the time a disorder has been discovered, treatment is more difficult and the risk of a health problem associated with a dental abnormality to the equine patient is increased

(83).

2.2.7 Nutrition and physical welfare

Equine nutrition has been reviewed in detail (84,85). There are six main nutrient groups which are essential to the maintenance of a healthy horse: water, proteins, fats, carbohydrates, vitamins and minerals. Each of these nutrient groups has specific and unique functions. An excess or deficiency in any nutrient may result in loss of condition, disease, or poor performance. Specific diseases related to poor nutrition include (but are not limited to) developmental orthopedic diseases, laminitis, colic, white muscle disease, and nutritional secondary hyperparathyroidism (86). Clinical signs of poor nutrition include poor coat quality, loss of condition, reduced milk production in lactating mares (from inadequate protein or carbohydrates), colic, laminitis (from excessive carbohydrates), metabolic bone disease (from calcium and phosphorus imbalances), poor fertility (from vitamin deficiencies and excessive carbohydrates) and diarrhea (from numerous dietary imbalances) (84).

The patterns of feeding behaviour in feral (87) and stabled horses (88,89) have been observed. Free ranging horses spend between 60 and 80% of their day grazing, depending on the quality and availability of forage (90). A non-randomized study of Thoroughbreds in the United Kingdom found that there was a reduction in the prevalence of stereotypies (crib-biting, wind-sucking and weaving) in horses fed larger amounts of forage daily, and that the risk of performing a stereotypy increased markedly when the amount of forage fed fell below 6.8 kg per day (91). Also, behaviours such as

coprophagy and wood-chewing are more prevalent in horses fed pelleted diets when compared to horses fed primarily forage (91,92). McGreevy et al (91) also found that horses offered more than one forage type were less likely to perform a stereotypic behaviour. Variety within the diet is an important option for satisfying the foraging motivation of the horse (91).

A controlled experiment that examined the behavioural effects of offering multiple forages has been reported (93). When the behaviour of horses fed six types of forage was compared to the behaviour of horses fed one type only, it was found that horses fed multiple forage types ate less straw and spent less time performing behaviours indicative of frustration (e.g. moving and looking out of the stall). The results were not all statistically significant, which may have been due to the small sample size (n=12). However, the findings do warrant further study and they suggest that horses with fewer choices of forage may be more highly motivated to express foraging and searching behaviours and that horses prefer variety in the diet. Three horses in that study exhibited stereotypic behaviour when being fed a single forage type, but never did so when receiving multiple forages (93). Although these results are highly speculative due to the small sample size, they indicate the need for more research concerning stereotypic behaviour and multiple feed choices.

A survey of equine management practices was conducted in 1998 by the United States Department of Agriculture (82). This survey was at the barn level and examined the frequency at which dried forage and concentrated feed were fed, the use of supplements and the availability and source of water (82). However, there were no

assessments of nutrient composition in any individual's diet, nor was there any mention of the amounts of feed given or nutrition related diseases. To the best of the author's knowledge, there are no published data on feeding practices or representative nutritional assessments of horses in Canada.

2.2.8 Equine welfare: the horse's mind

2.2.8.1 Behavioural assessment and mental welfare

The behaviour of an animal is a reflection of how it perceives the surrounding environment. Behaviour is a useful indicator of mental welfare because it illustrates the animals' needs, preferences and sometimes their internal states (10,94). Behavioural research methods that have been used to assess mental welfare are: 1) comparison of the domesticated animal, whose welfare may be at risk, to the species in its natural environment, 2) choice experiments and 3) operant conditioning (95). The first method involves observation of the behaviour of the domesticated animal and of its counterparts in the wild to determine their respective behavioural repertoires (ethogram). Individuals living in an environment which allows them to exhibit their full range of behaviours will rarely exhibit stereotypies, i.e. these animals do not appear to be frustrated (96).

Choice experiments can be used to answer questions about animal welfare, such as which feed or bedding type the animal prefers. The experiments must be designed so that the previous experiences of the animal are taken into consideration and so that the results will reflect the animal's true preferences rather than what the animal is familiar

with (97). For example, when domestic fowl were given a choice of floor types, their previous experience with floor types was found to influence their choices (97). In order to draw conclusions about the animal's welfare using choice experiments, the strength of the preference must be quantified (98). Operant conditioning can be used to measure the preference strength. Operant conditioning is a form of associative learning in which the animal increases or decreases the performance of a behaviour in response to a positive or negative reinforcer (99). The animal is trained to work (e.g. by pressing a lever) to obtain a commodity such as food or social contact (100). Welfare can be further assessed by applying consumer demand theory to operant methods (101). A price (e.g. x number of lever presses) is placed on a commodity such as access to bedding, food, or visual contact with another animal. As the price increases, this can be plotted against the rate of consumption of the commodity, creating a demand curve. This has been used to determine the environmental requirements of pigs by creating an experiment in which the pigs had to work for one of three commodities (food, contact with another pig and a stimulus change called 'door opening') (100). The resulting demand curves illustrated the elasticity of demand for each commodity, showing that food was a more essential item (i.e. more inelastic) than 'door opening'. Maximum price is also useful to compare the demand for one commodity with that for another and can be used to establish behavioural priorities (102). An additional behavioural measure that can be used as an index of mental welfare is the performance of stereotypies.

2.2.8.2 Stereotypies

Even though domesticated horses generally have their basic needs met (i.e. food, water and shelter), they cannot always perform highly motivated species-specific behaviour such as continuous grazing and social behaviour. Constraints on highly motivated behaviours may lead to behavioral abnormalities such as stereotypies, conflict behaviour and re-directed behaviours (103). Stereotypies are behaviour patterns which are repetitive, invariant and (apparently) functionless (104,105). They are generally thought to result from frustration, such as the inability to exhibit a highly motivated behaviour like foraging (96). Stereotypies may allow the animal to cope with stress on a physiological level, since it has been found that after the performance of a stereotypy (crib-biting in horses), there is a release of endogenous opioids in the central nervous system and a significant decrease in heart rate (106). Equine stereotypies include behaviour patterns such as crib-biting, wind-sucking, stall-walking, weaving, tooth grinding, and flank biting. The prevalence of stereotypies is estimated to range between 5-35% of domesticated horses (107-109).

2.2.8.2.1 Significance of stereotypies

To a horse owner, stereotypies may be a concern as their cause may not be apparent and it is very difficult to stop a horse from performing them (110). However, animal welfare scientists are beginning to question the significance of stereotypies (111). The behaviours have been thought always to indicate reduced welfare because they are hypothesized to result from past or present frustration (a negative mental state) (105).

Welfare is said to be worse if the stereotypic behaviour dominates the life of the individual (i.e. is very time consuming or appears to substitute for behavioural responses in a way which impairs adaptation to the environment) (96). For example, some equine locomotory stereotypies may result in weight loss (112), and crib-biting causes tooth-wear and may lead to the ingestion of splinters (113,114). However, a stereotypy may be beneficial if it allows the animal to cope with frustration. Animals that are not showing the behaviour may therefore be of greater welfare concern because they are less able to cope with a frustrating environment or situation (111). Conversely, absence of a stereotypy may mean that there is, in fact, no frustration present (115). The above aspects of stereotypies require research, but at present, the performance of a stereotypy is considered an acceptable index of mental welfare because of the behaviours' association with frustration (see Section 2.2.8.2.2).

2.2.8.2.2 Causes of stereotypies

Stereotypic behaviours are rarely observed in free-ranging horses (116). Stereotypies often reflect some naturally occurring pattern of behaviour which the animal is unable to complete due to environmental constraints (111). These behaviour patterns can be appetitive (e.g. courtship behaviour) or consummatory (e.g. mating) (117). Once a stereotypy has developed, various environmental factors can influence its frequency and morphology (111). Oral stereotypies might be more frequent when there is an inadequate nutrient balance or there are inadequate opportunities to forage (117). For example, provision of straw to food-restricted sows appears to reduce the development of chain and

bar manipulation, a common stereotypic behaviour in pregnant sows (118). Also, in a non-representative telephone survey, McBride and Long (119) found an apparent reduction in the frequency of crib biting and wind-sucking in horses when increased amounts of forage were provided (119). This finding is consistent with the motivational basis for stereotypies, i.e. that the behaviour (e.g. crib-biting) is a response to a specific motivation (e.g. foraging) which can not be fulfilled (101). The horse therefore redirects its motivation; for example, when the motivation to forage cannot be fufilled, the horse redirects its eating behaviour to the stall door (crib-biting).

The neurobiology of equine stereotypies has not been well described, but β-endorphins (120) and dopamine (121) appear to be involved, as in other species (122). The development of a stereotypic behaviour is multifactorial and a single managerial factor cannot be assumed to be the cause. There is a need for studies using truly representative samples of horses, to identify prevalences, types of stereotypies, and the associated management factors involved with stereotypy occurrence. Factors which may contribute to the occurrence of a stereotypy are genetics, individual variation and managerial factors.

There is little evidence that the occurrence of a stereotypic behaviour is inherited. However, in a non-representative survey of Thoroughbred horses in Italy, it was found that crib-biting, weaving and stall-walking occurred more frequently within closely related horses that would be expected by chance alone (123). The authors concluded that genetics were associated with the onset of a stereotypic behaviour. Managerial factors were not examined in the study, and horses that were related are more likely to have been

managed similarly. Genetic predisposition to stereotypic behaviours, if proven, might explain why some horses within a stable develop a stereotypy while others in the stable, do not (124). Another explanation for variations in the occurrence of stereotypies in horses that are kept in the same environment, is that different horses may have had different experiences in early life which affected their threshold for tolerating frustration or anxiety (125). Research on feline behaviour has correlated differences in individual levels of 'boldness' or 'nervousness' with differences in experiences in early life (126). In domestic dogs, it is believed that early experience is a determining factor in adult temperament (127), and fearful behaviour has been attributed to genetics (128) and to early experiences (129). A four-year prospective survey of factors affecting the development of stereotypies (crib-biting, weaving, and box-walking) and a redirected behaviour (wood-chewing) was conducted in young Thoroughbreds (n=225) (130). The study found that foals of mares that were of low or middle social ranking were less likely to develop a stereotypic or redirected behaviour than foals of dominant mares, and that the method of weaning was strongly associated with the development of such a behaviour (130). These findings indicate that early experiences can affect the development of an abnormal behaviour. However, further research is needed on the relationship between early experience, individual anxiety levels and the development of a stereotypic behaviour. There have been no other published data on the effects of early life experiences on the development of equine stereotypic behaviour (to the author's knowledge).

2.2.8.2.3 Managerial factors and stereotypies

Several surveys have been reported that describe the prevalence of stereotypic behaviour in various breeds of horse (91,107-109). A limitation of surveys is that participation is always voluntary and there is a possibility that owners of horses with stereotypies might be less likely to participate than owners whose horses do not perform stereotypies (or vice versa). However, little can be done to eliminate this obstacle.

A non-randomized survey was conducted in Britain to examine possible links between stereotypic occurrence and the discipline of the horse (dressage, eventing, and endurance) (109). The stereotypies under examination were wood-chewing, weaving, crib-biting, wind-sucking, and box-walking. Time spent in the stable was correlated with an increased risk of stereotypic behaviour in dressage and eventing horses (109). Data were on the horse level and were acquired on 1750 horses, all of which were owned by members of the British Horse Society.

In a postal survey of 22 English and Welsh racehorse trainers, time spent in the stable had the strongest association with prevalence of stereotypic behaviour (91). Other associated factors were feeding practices, training practices and housing. The survey was on the barn level and was not representative of the entire British population because only horses kept in racing yards were included in the study.

Luescher et al (107) surveyed 769 horses from Thoroughbred, Standardbred and pleasure-riding stables in Southwestern Ontario, Canada in order to determine the prevalence of stereotypies and the effect of breed, sex, age and management factors on prevalence. Although the sample was not random (all stables were listed in a stable

directory), data were collected on the horse level. The type and amount of exercise received and the degree of contact with other horses were the most significant factors associated with an increased frequency of stereotypic behaviour.

A survey was conducted in Australia to determine the prevalence of stereotypic behaviours in 3009 Thoroughbred horses (108). This randomized survey examined how time spent out of the stable affected stereotypic behaviour, with no significant relationship being found. The authors suggested that there may have been an error in their design, because it was not established if any horse performed more than one type of stereotypy. Literature on the prevalence of more than one stereotypy per individual has not been published. The results of the Australian study (108) contrast with those of the Ontario study (107) and the United Kingdom studies (91,107,109). The reason may be that the Australian study (108) did not examine the type and size of either the pasture or stable where the horses were kept. Also, management practices and climate differ greatly between Australia, North America, and the United Kingdom.

In a non-representative telephone survey of 300 registered horse owners and stable managers in Britain, the principal care-givers of horses were asked about management practices associated with stereotypic behaviour (119). It was found that the care-givers held several misconceptions about stereotypic behaviours, leading them to introduce management changes in attempt to eliminate the stereotypy (e.g. the use of a collar to prevent crib-biting). The use of equipment such as a crib-biting collar is troubling because restricting the animal from crib-biting increases the β-endorphin levels which is an indicator of stress (131).

Broom and Kennedy (96) suggested that, rather than using equipment such as a cribbing collar, the prevention and treatment of stereotypies would be more successful with improved management, e.g increased space, opportunities for social interaction and roughage availability.

Studies such as those mentioned above are useful for investigating management factors associated with the occurrence of a stereotypy. As can be seen from the varied results, the causes of stereotypies in horses may involve management factors such as confinement which prevent the animal from performing natural behaviours (e.g. grazing, social interaction) that it would perform in the wild.

2.2.9 Equine welfare: satisfying the horse's nature

Rollin (17) refers to the nature and needs of an animal (the "pigness" of a pig or "horseness" of a horse) as the "telos", a word which originally was coined by Aristotle (4) and has also been interpreted as "beingness" (132). Rollin (17) suggested that animals should be raised in ways that respect their natures. An animal's nature is its genetically encoded traits which are reflected in breed and temperament (17). Nature is not a quantifiable property, so there are some difficulties in assessing whether an animal's nature is satisfied. However, the satisfaction of the nature can be indirectly assessed through an examination of the animal's behaviour (is the animal able to perform its full behavioural repertoire?) and environment (how similar is its environment to the environment in which the animal would exist in the wild?) (1). A limitation is that the domesticated horse is living in a situation far removed from the wild and so will not have

a behavioural repertoire that is fully comparable to that of the wild horse. For example, domesticated horses do not need to travel great distances to find water or food and they do not have a threat of predators. However, many motivations are comparable between wild and domestic horses because there have been no great changes in the horse's genetics since it was domesticated five to six thousand years ago (124,133). Wild and domesticated equines therefore have similar motivations and natural instincts (134), (e.g. to flee from a predator).

The motivation of any horse to graze, breed, interact and move about would be present both in the wild and in domesticated situations. If those motivations are not satisfied, then behaviours may arise such as stereotypies or redirected behaviours. There are disagreements concerning how a "natural" way of life influences the welfare of an animal. It is believed that allowing animals to exhibit "natural" behaviours or live "natural" lives enhances the welfare (16). For the horse, these behaviours include sexual behaviour, maternal behaviour, developmental behaviour, social behaviour, play behaviour, rest behaviour, and feeding behaviour (135). Although the environment of a domesticated horse cannot provide the freedom available in the wild, there are small manipulations which can create more "natural" circumstances for domesticated horses, e.g. by feeding hay on the ground where the horse is accustomed to obtaining food, rather than in a hay net or rack. In this example, there is some compromise between satisfying the nature of an animal, and a risk of reduced physical welfare. When hay is fed on the stable floor, there is a risk that the horse will ingest parasite eggs because the hay has become contaminated with feces (136) (if the stall is not cleaned regularly). However,

when hay is supplied in a rack or in a net tied above the ground, there is an increased risk of particles getting into the eyes and nose, causing irritation. Feeding hay above floor level has also been suggested to increase the risk of developing dental hooks and to affect muscle and nerve functions (137), but this has not been proven. Lack of "natural" management of the horse may lead to poor mental welfare, e.g. when horses are kept in a stable rather than in a pasture. In order to maintain optimal welfare from the "natural" standpoint, horses should be kept outside, where horses in the wild would live, and not in a stable. However, in the pasture there is an increased risk of injury from other horses or fencing materials, an increased exposure to adverse weather conditions and insects, and an increased risk of parasite infestation. Conversely, without opportunities for movement outside the stable, horses may become frustrated and may respond by performing locomotory stereotypies such as weaving or box-walking (131). Another limitation of the "natural" argument for equine management is that we normally do not allow domestic horses to breed freely at the time of their choosing or with the mate of their choosing. Furthermore, the wild horse does not exist without suffering. Exhaustion, thirst, hunger, fear and pain are quite "natural" for the wild animal. Do we want to impose these conditions on our domesticated animals so that their lives can be more "natural"? Thus, optimal welfare from the natural perspective does not necessarily indicate optimal physical and mental welfare. The balance between optimal "natural" welfare versus optimal mental and physical welfare is complex and depends on the ethical concerns and the values of the persons involved (16).

2.3 Assessing welfare

If the welfare of an animal is to be assessed, all three dimensions of welfare (1) should be considered. Although there have been useful studies on equine welfare from the physical health (82,138-140) and the mental health perspectives (93,107-109,141), to the knowledge of the author, no studies have examined the extent to which the nature of the horse is satisfied or assessed equine welfare by including all three dimensions. The assessment of welfare is complex. Mason and Mendl (142) described three particular problems. These are that different measures do not always co-vary, that the significance of some measures is difficult to interpret and that, even when one study produces an unambiguous conclusion, a repeated experiment might yield the opposite result (142). An example where different measurements of welfare do not necessarily produce the same conclusion is when the size of a battery cage (for laying hens) is reduced (22). When the cage size is reduced, natural welfare is compromised because the environment becomes even less representative of the hens' natural environment (there is less environmental control, room to wing flap, etc.). However, the corticosteroid levels of hens remain unchanged (physical welfare is not compromised) (22). The interpretation of welfare measures may be difficult in situations involving changes in corticosteroid level because corticosteroid levels can rise for reasons which may be detrimental to the animal's welfare or for natural reasons which are not detrimental, e.g. breeding (143). For example, in repeated trials that compared caged and loose-housed hens, there were contradictory findings about the changes in corticosteroid level (22).

Other physiological parameters that can be evaluated to assess welfare are indices

of acute stress, such as cortisol, plasma levels of β-endorphin, adrenaline and noradrenaline and also increased cardiac output (131,144). The major disadvantage with using physiological parameters to evaluate welfare is that their levels differ between individuals (144); also the collection procedure itself (e.g. restraint and drawing blood) may be stressful, causing a change in the physiological parameter of interest and distorting the experiment (22,142).

2.3.1 Assessment of equine welfare in the field

Physical health is the most objectively measurable dimension of equine welfare and can be broadly assessed through clinical examination for signs of disease, pain and physical dysfunction (e.g. dental abnormalities, hoof wall abnormalities, body condition score, (BCS), and laboratory examination for parasite burdens). Disease assessment in the field can be difficult as blood tests or other laboratory tests may be required to make a diagnosis. Body condition score is a useful health index because it is easy to assess in the field and a low BCS may reflect factors such as a heavy parasite burden, inadequate nutrition, poor dental care or disease (145).

The mental health of a horse may be broadly assessed by the presence or absence of a stereotypic behaviour. The presence of a stereotypy by itself does not give a clear picture of the animal's welfare, but when used with other measures such as BCS, stereotypic behaviour can give some indication of how well the horse is coping with its environment and how well its nature is satisfied.

The natural dimension of the horse's welfare can be evaluated by examining the

extent to which the physical environment permits species-specific behaviour (146), e.g. the availability of more than one forage type and whether hay is fed on the ground or in a hay net. A simple assessment of how natural the horse's life is would not lead to a firm conclusion about overall welfare. For example, it is not natural for a horse to have its teeth floated or hooves trimmed. However, information about physical health measures, stereotypic behaviour occurrence and management factors which affect the "naturalness" of the animal's environment, would give a more complete picture of welfare than any of those measures by themselves.

2.4 Equine management

Management refers to the act of managing, handling, controlling or directing (147). Equine management involves not only meeting the horse's physical needs, but also providing for the horse's mental well-being and the satisfaction of its nature. Management of physical welfare involves decisions about preventative health care (e.g. choice of vaccines and de-wormer), hoof care regimen, turnout time, and diet. In addition, the horse's hygiene level and physical environment may affect the likelihood of disease (148). Management of mental and natural aspects of welfare includes factors such as time spent out of the stall, contact with other animals, exercise and stable ventilation and lighting (148).

If horses are managed well, they will probably exhibit a normal range of behaviours, satisfactory performance and low incidence of disease. Poor equine management (lack of turn-out time, over-feeding of concentrates, lack of contact with

other animals) has been associated with compromised welfare as assessed though health and behavioural measures (76,91,107). Horses in the wild may spend up to 60% of their time grazing, which involves continuous locomotion and a choice of grass types (149). However, a national survey of operations in the United States indicated that 34.4% of operations confined horses indoors in summer and 43.2% in winter (82). Eighteen percent of horses were confined indoors more than half the time in the winter with 40.4% doing so in the Northeast region which is geographically closest to Prince Edward Island (82). These data indicate that many horses are not permitted the necessary time to graze in the spring, summer and fall months. Such horses are at increased risk of developing unwanted behaviours because their management does not supply the physical or behavioural environment they require (150).

Horses should be vaccinated against tetanus and locally prevalent diseases, be de-wormed regularly, have their teeth rasped when required, have hooves properly cared for, and that attention be given to any injuries or changes in the horse's health (31). In Canada, the Canadian Agri-Food Research Council has published guidelines for care and management of horses (3). A survey of horse management, behaviour and health is an essential starting point for the future improvement of equine welfare in Canada. The survey would provide a body of information regarding where management needs improving and could indicate where management may be contributing to reduced physical health or to behavioural problems. A suitable study area would be required where a random sample of horses could be selected.

2.5 Horses in Prince Edward Island

Although Canadian horses are no longer required for transportation, they still play a significant role in agriculture, sport and recreation throughout Canada, including Prince Edward Island (PEI) (151). Horses in PEI can be arbitrarily separated into two general groups: racing and non-racing. Racing horses are kept for the purpose of money-making and entertainment and are likely managed very differently than non-racing horses. For example, racing horses are most likely kept in a stall more and exercised more often and more intensely than non-racing horses. Non-racing horses include all horses not used for racing, e.g. backyard pets, riding horses and horses used for farm labour. The only available data on non-racing horses in PEI comes from two studies (152,153). The first was a national study conducted to obtain a profile of Canadian horse owners, riders and drivers and to acquire data on economic and other issues facing the non-racing horse industry (152). The sample was non-representative as participants were members of the Canadian Equestrian Federation (CEF) or of other provincial federations and breed and discipline associations, or were on commercial subscription or mailing lists. The survey included 14 horse owners from PEI and results showed that 11 of these owners had owned horses for more than 10 years, 10 had attended college or university and nine were involved in western pleasure riding. The total number of horses owned by this group of people was 62, making the average number of horses owned per person 4.43. This survey did not examine the individual horses or their welfare. The second study of horses in PEI was conducted in 1999 to determine the number of horses living in the province (153). The inventory separated the equine population into three categories: standardbreds, draft

horses and light/pleasure horses. Based on breed registration data and consultation with industry stakeholders, the estimated provincial total was 6,238 of which 4,747 were non-racing (Kent Oakes, Prince Edward Island Department of Agriculture and Forestry, personal communication). This figure included an estimation of both registered and non-registered horses and both racing and non-racing horses. There are no data about the welfare of non-racing horses in PEI, but the province is a suitable area for a preliminary study of equine welfare in Canada.

2.6 Study objectives

The objectives of the present study are: (1) to describe the demographics, health status and management of non-racing horses in PEI and (2) to determine management factors that reduce welfare, as indicated by body condition score and stereotypic behaviour.

Chapter 3: Demographics, management and welfare of non-racing horses in Prince Edward Island

3.1 Introduction

There is a wide variety of equine management systems in place in Prince Edward Island (PEI), ranging from intensive boarding facilities with large numbers of horses to backyard establishments which typically house fewer horses. Each management system may have positive as well as negative effects on a horse's welfare. Animal welfare may be considered a three dimensional concept encompassing the animal's body (physical health), mind (mental health), and nature (genetically encoded traits reflected in breed and temperament (17)) (1). An assessment of welfare must involve a broad spectrum of measurements because each animal has a multitude of coping mechanisms which may or may not be sufficient for the environment or other influences to which it is subjected (2). Physical welfare may be assessed in part by body condition score (BCS) and mental welfare by the occurrence of stereotypic behaviour (see Section 2.2.8). Stereotypies are behavioural patterns which are repetitive, invariant and apparently functionless (104). They serve as a marker for reduced welfare because the behaviours indicate frustration (18).

Surveys of equine management have been conducted in the United States (82) and the United Kingdom (138,154), but not in Canada. In 1998, a national randomized survey was conducted in the USA to describe equine health and management (82). This survey was done at the barn level and there were no health assessments of individual

horses, no data on behaviour and no links were made to welfare. A non-representative survey of horse owners in the UK was conducted to identify the distribution, management and level of activity of horses kept in riding stables (138). This study did provide horse-level data on management, but there were no veterinary assessments of health or data on behaviour. In Canada, the Canadian Agri-Food Research Council (CARC) have produced national guidelines for the care and handling of horses (3), but it is not known if these guidelines are being followed because there are no data on how Canadian horses are being managed. Market research has provided a non-representative profile of the horse industry across the country, but did not assess welfare directly (152).

The objective of the present study was to describe the management, physical health and mental health (through stereotypic behaviour) of a representative sample of non-racing horses (miniature horses, ponies, draft horses and other horses that are not used for racing purposes) in Prince Edward Island. This paper presents the descriptive data that were obtained from the study. A second paper will present the specific factors that were found to influence two welfare endpoints (stereotypic behaviour and BCS; see Chapter 4).

3.2 Materials and methods

The following protocol was approved by the Research Ethics Board and the Animal Care Committee of the University of Prince Edward Island.

The sample size was estimated assuming that the prevalences of stereotypy and low BCS were 10% (107,109) and that the data would provide prevalence estimates

within 4% of the true prevalence 95% of the time. The sample size estimate also allowed for clustering within stables (the "barn effect"; correlation coefficient of r=0.3)(155) and for a 30% non-response rate after enrollment into the study (155) The sample size was calculated based on the assumption that approximately 450 horses would be required. A previous study estimated that there are 4.43 horses per horse owner in PEI (152), but this was felt to be an overestimate and three horses per horse owner was assumed, therefore 150 horse owners were estimated to be required.

Owners of non-racing horses were recruited by a random phone book search (Appendix 1). Pages were randomly selected through a computer-generated list of numbers from the 2001 provincial phone book and all residential numbers from two of the four columns in each page were called from February to August 2002. Informed consent was obtained by mailing interested owners a leaflet describing the study together with a consent form and stamped return envelope (Appendices 2 and 3). In order to encourage participation, the study was publicized on local radio and television and in local newspapers. In addition, interested owners were sent the information in envelopes addressed by hand and stamped rather than franked (156).

A mail questionnaire was designed with two sections, each in a booklet format. Section I was printed on white paper while Section II was on blue paper with the horse's name written on the cover. Section I (Appendix 4) addressed general information about the owner and stable (e.g. experience with horses, manure disposal, access to a trailer). Section II (Appendix 5) pertained to each individual non-racing horse and included questions about its work and exercise, stabling and pasture, dental care, hoof care, de-

worming, stereotypic behaviour, transportation and feeding. Questions were developed after reviewing comparable surveys (82,138,152,154) and the CARC guidelines (3). Questions were open-ended, closed-ended or partially close-ended, depending on the type of information desired.

The questionnaire was pre-tested with 11 horse owners who had not been recruited for the study. Minor changes were made after pre-testing with the first four owners and the new draft was used for the following four after which further minor changes were made. The final draft was pre-tested with the last three owners. It took approximately 5 minutes to complete Section I and 10-15 minutes to complete each Section II.

From June to August 2002, the owners who had returned their signed consent forms were contacted by telephone to arrange a site visit. The questionnaires were mailed to participating owners with a cover letter not less than one week before the visit (Appendices 4, 5, and 6). During the visit, a veterinarian, technician and the animal welfare researcher met the horse owner at the location where the horse was kept in order to examine the horse, and obtain feed and fecal samples. The questionnaire was collected at this time. If the owner had not yet completed the questionnaire, a self-addressed, stamped envelope was provided.

The veterinarian completed a physical examination of the horse(s) which included a dental examination, BCS, and lameness examination (see Appendix 7). The researcher also assigned a BCS to each horse, so that the inter-rater agreement could be assessed using the concordance correlation coefficient (CCC) (157) and the Bland and Altman's

limit of agreement plot (158). Body condition score was evaluated on a scale of one to nine, with one being emaciated and nine being extremely fat (159). Each horse's height, weight and rectal temperature were also recorded. The weight of light horses was measured using a Horse and Pony height-weight tape (The Coburn Company Inc, Whitewater, WI). The girth of draft and miniature horses was measured with a sewing tape and converted into weight using a conversion table (160)(161). Height was measured using an aluminum height stick with a liquid level to ensure correct alignment with the ground. Rectal temperature was taken using a digital thermometer (model #5531, Life Brand. Toronto, ON). If data could not be obtained (i.e. the horse was fractious), it was indicated in the relevant section of the report as missing. The report was signed and dated by the veterinarian and a carbon copy was given to the horse owner. Non-veterinary information was also collected (Appendix 8).

A fecal sample was collected from each horse on the day of the site visit. If the horse did not defecate during the visit, manure was taken from the stall or pasture and it was noted where the sample was taken and if it was fresh. The samples were kept in a cooler containing ice and then in a refrigerator at 5°C until fecal egg counts (FEC) were performed. The number of strongyle-type eggs was counted using the Cornell-McMaster dilution egg counting technique (28). A detailed description of the technique is given in Appendix 9.

Any observable stereotypic behaviour was recorded. In addition, information about each horse's feed and the amount of hay or grain fed was obtained. If hay was fed, the amount fed per meal was also weighed using the hanging scale and a sample was

taken for analysis using a uni-forage sampler (Star Quality Samplers, Edmonton, AB). Hay samples were obtained from at least 3 different bales. If grain was fed, the amount was weighed using a digital hand-held hanging scale (Extech Instruments, Waltham, MA, USA: Model #160393), with a graduation of 28 g (1 oz.) and capacity of 15 kg (33 lbs.). If the grain was not a commercial preparation, a sample of approximately 0.45 kg (1 lb.) was taken for analysis of energy content (Appendix 10).

An analysis of each horse's energy requirements was performed using a specialized equine nutrition program (PC-Horse, Version 1.24, Knut Hove, Agricultural University of Norway, Aas, Norway). Information about the horse's age, breed, amount of work done, hours spent at grass, and weight, and also the amounts and types of feed given were entered into the program, producing a summary of the amount of energy required and the amount provided. An example of the program output is shown in Appendix 11. A complete nutrition analysis was beyond the scope of the study.

The results of the fecal egg count, feed analysis and nutritional analysis were mailed to each owner with a cover letter (Appendices 11-14), indicating whether the owner should seek veterinary advice because an analysis was outside the normal range.

An abuse policy was formulated in the event that, during site visits, study personnel encountered a horse that appeared to be at risk of physical abuse. The policy was designed to help decide whether or not to report the horse's owner to the PEI Department of Agriculture and Forestry for further investigation. The policy was developed based on legal advice, advice from three ethicists and on a similar policy for dogs (162). The policy was compiled to reduce the risk of false positives, so that any

owner who did provide adequate care to their animal had a minimal chance of being falsely reported. Details of the policy are presented in Appendix 15.

All questionnaires, veterinary reports and additional site visit information were coded according to the owner and horse. A three digit code was assigned to each owner for the owner-level data (e.g. 012). Each horse was assigned a five digit code which included the owner's code plus a two digit horse identifier (e.g. 012-01). Data were entered into EpiData (The EpiData Association, Odense, Denmark, http://www.epidata.dk.) by two people (the animal welfare researcher and a hired student). The two data files were checked for consistency and a single, accurate file was kept.

Data files from the EpiData program were transferred into Stata 7 (Stata Corporation, Texas, USA). Descriptive statistics were generated from the questionnaire, the veterinary report and other on-site data. The mean, standard deviation (SD), and 95% confidence interval (CI) were calculated as appropriate. Categorical and dichotomous variables were examined using frequencies in each group. Pearsons χ^2 was calculated to determine if there was a difference in the prevalence of hoof wall abnormalities and dental abnormalities between the three types of horses.

3.3 Results

Approximately 10,700 households were phoned out of 86,643 residential numbers listed in the 2001 PEI phonebook (12.3%). Respondents in 171 households reported having a non-racing horse, but 54 of them did not participate. Five of the owners did not

want to learn more about the study. Thirty-six chose not to participate on receipt of the information about the study for the following reasons; they did not want to commit time to the survey (33/36), they believed that surveys are a waste of time (2/36), or they were not interested in the study (1/36). A further 11 owners did not answer their telephone after being mailed the information and two owners sold their horses after completing the consent form. Thus, the response rate was 68.4% (117/171) and 312 horses were recruited for the study.

Horses were classified according to type, i.e. as miniature, light and draft (N=34, 227 and 51 respectively). The most common breeds are summarized in Figure 3.1. Many horses were a cross between at least two breeds (18.6%, 58/284). In some cases, the breed was unknown (9.9%, 31/284). The mean ± SD number of horses owned per person was 2.93 ± 4.1 (range, from 1 to 34). Owners reported using the horses for a variety of purposes; the most common uses are summarized in Figure 3.2 (these data were not mutually exclusive).

Thirty percent (35/110) of owners who completed Section I were members of a horse-related organization. The mean ± SD years of experience that the owner had been caring for horses was 19.1± 15.1, mean ± SD years owning horses was 17.1 ± 13.9 and the mean ± SD years riding or driving was 18.0 ± 14.9.

The mean BCS ± SD was 5.7 ± 1.08. The inter-rater agreement of BCS between the veterinarian and researcher was 0.85 and the 95% limits of agreement was -1.1 to 1.1, therefore, 95% of observation pairs were within approximately one point of each other. Heart rate, respiratory rate and rectal temperature were 47.6 ± 11.6 beats per minute, 26.4

± 12.1 breaths per minute and 37.6 ± 0.41 °C, respectively. Eighteen percent (57/311) of horses had abdominal breathing and 1.3% (4/311) had a 'heaves line'. Other results from the veterinary examination are summarized in Table 3.1.

Eleven percent (32/292) of horses had never had their hooves trimmed or shod by a farrier. The most common foot problems reported by owners were thrush (8.4%, 25/299), laminitis (5.02%, 15/299) and abscesses (3.0%, 9/299). Navicular syndrome was reported to have been a problem in 2.3% (7/299) of horses. Hoof wall abnormalities for 306 horses (6 horses were fractious and the veterinarian was unable to examine their hooves) are described in Table 3.2. Forty-five percent (138/306) of horses had a hoof wall abnormality. Most abnormalities were more prevalent in draft horses than miniature or light horses, with the exception of excessive length of toe.

Sixty-three percent (187/298) of horses had never had their teeth examined by a veterinarian. Amongst the 111 horses whose teeth had been examined by a veterinarian, 2.7% (3/111) of horses had their teeth checked more than once per year, 37.8% (42/111) had their teeth checked annually, 33.3% (37/111) had their teeth checked once every 2-3 years and 22.5% (25/111) had their teeth checked less often than once every three years. The prevalence of dental abnormalities in 298 horses is summarized in Table 3.3. Fourteen horses were fractious and the veterinarian was unable to examine their teeth.

The prevalence of stereotypies (crib-biting, wind-sucking, weaving, wood-chewing, and stall digging) is summarized in Table 3.4 (the questionnaire for 20 horses was not fully completed); further details are given in Chapter 4.

Figure 3.1 Common breeds represented among 312 non-racing horses in Prince Edward Island

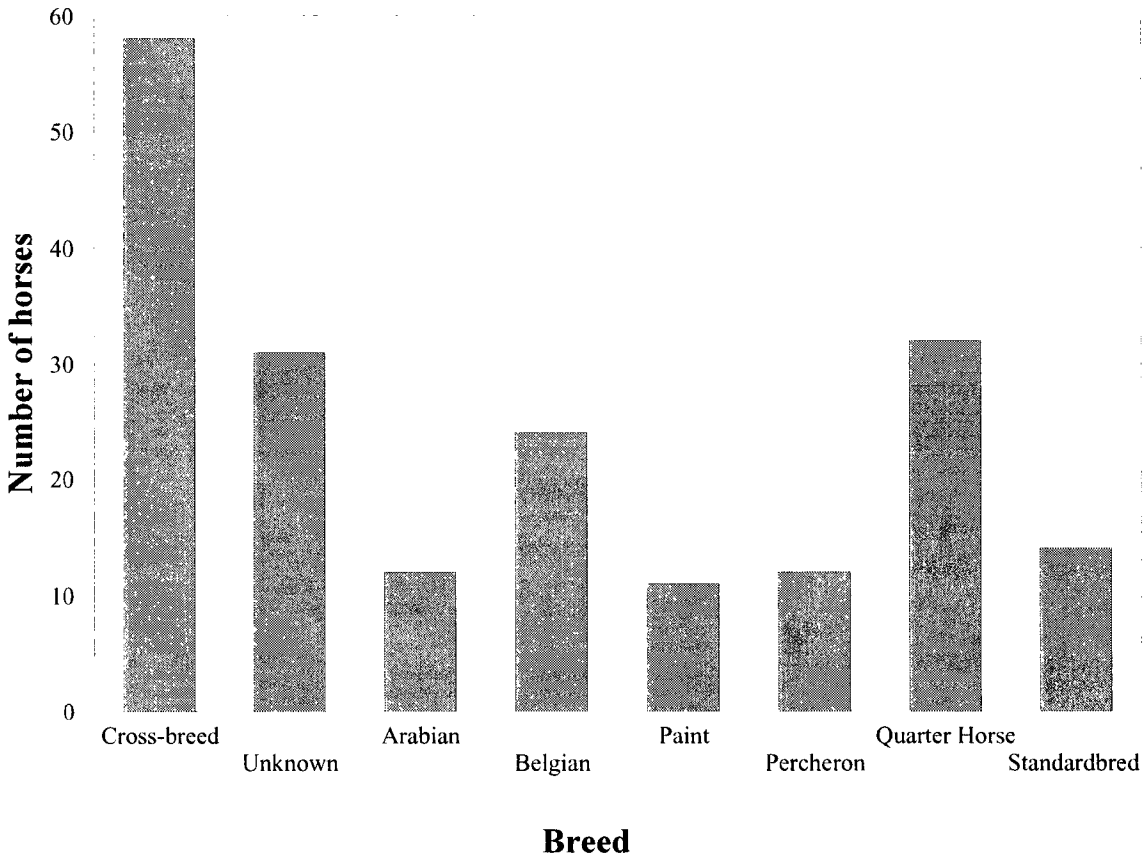


Figure 3.2 **Common uses of 312 non-racing horses in Prince Edward Island (data not mutually exclusive)**

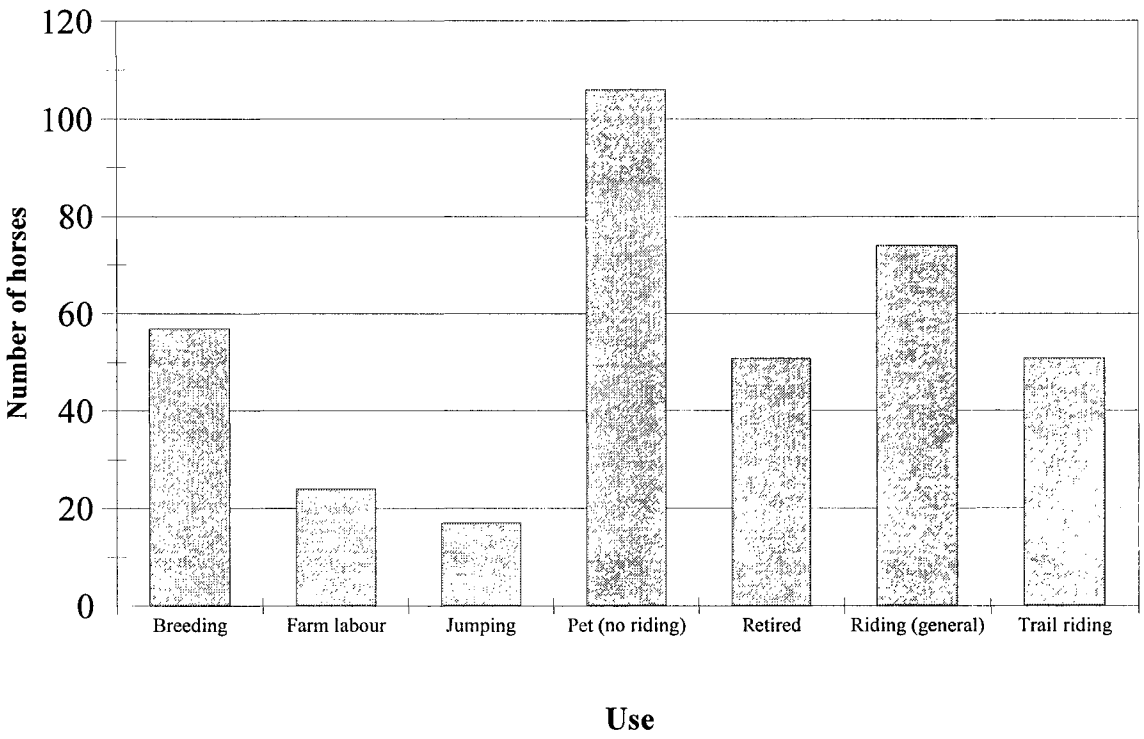


Table 3.1 General veterinary findings on physical examination of 312 non-racing horses in Prince Edward Island

Description		N / total	%	Reason for missing data, if any
Loose feces		21 / 298	7.0	Feces not seen in all horses
Dry feces		6 / 298	2.0	Feces not seen in all horses
~5% dehydration (from pinch test)		33 / 305	10.8	Horses fractious
Tail docked	Draft	28 / 51	54.9	
	Light	0 / 227	0	
	Miniature	0 / 34	0	
Vibrissae (whiskers) removed				
	Draft	5 / 46	9.8	Unknown
	Light	20 / 206	8.8	Unknown
	Miniature	4 /30	11.8	Unknown
Gait irregularity		54 / 290	18.6	Horse fractious or no safe space to see horses trot
Musculoskeletal disease[1]		26 / 312	8.3	
BCS equal to or over 6.5		89 / 311	28.6	Unknown
BCS equal to or under 3.5		6 / 311	1.9	Unknown
FEC (strongyle eggs per gram)				
	0	104 / 225	46.2	Feces not collected from all horses
	1-300	55 / 225	24.5	Feces not collected from all horses
	300	66 / 225	29.3	Feces not collected from all horses

[1] Musculoskeletal disease could have been anywhere on the body or limbs

Table 3.2 **Hoof wall abnormalities found on physical examination of 306 non-racing horses in Prince Edward Island. Categories are not mutually exclusive.**

Hoof wall abnormality	Horse Type Miniature		Light		Draft		χ^2	p
	N=34	%	N=221	%	N=51	%		
Cracks	0	0	48	21.7	29	56.8	40.0	<0.001
Breaks	3	8.8	69	31.2	26	51.0	16.9	<0.001
White line disease	0	0	20	9.1	6	11.8	3.9	0.14
Excessive length	9	26.5	66	29.9	7	13.7	5.5	0.064

Table 3.3 **Dental abnormalities found on physical examination of 298 non-racing horses in Prince Edward Island. Categories are not mutually exclusive.**

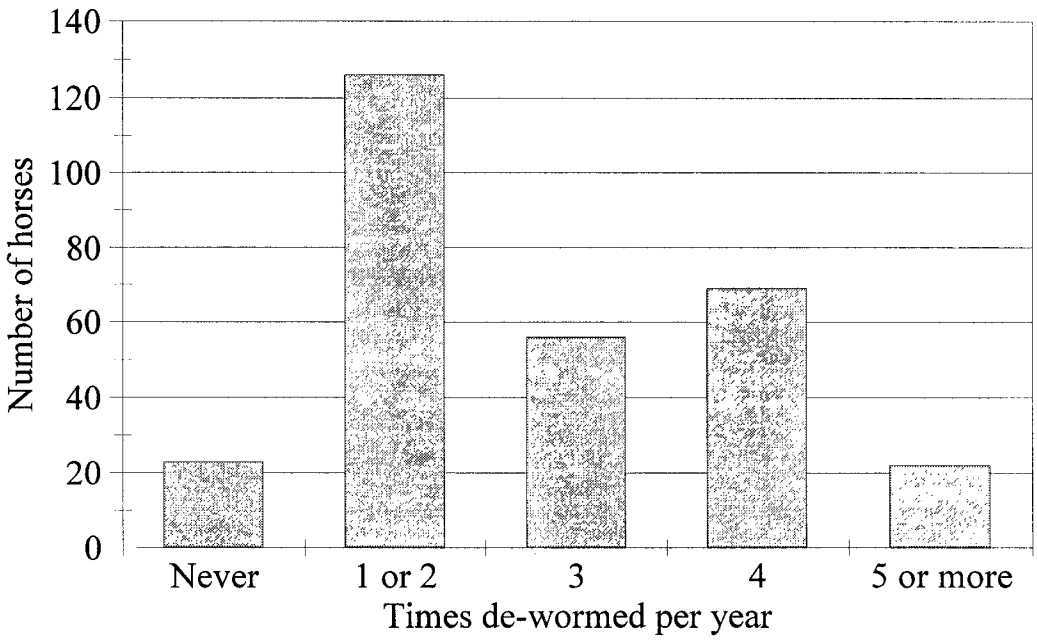
Abnormality	Horse Type Miniature		Light		Draft		χ^2	p
	N=34	%	N=213	%	N=51	%		
Sharp enamel points	3	8.8	19	8.9	5	10.0	0.06	0.97
Molar hook	4	11.8	21	9.9	15	30.0	14.1	0.001
Wave mouth	3	8.8	7[a]	3.3	0	0.0	4.84	0.09
Teeth missing	0	0	4	1.9	1	2.0	0.66	0.72
Malocclusion	1	2.9	5	2.4	0	0.0	1.3	0.52

[a] N=205

Table 3.4 **Prevalence of stereotypies in 292 non-racing horses in Prince Edward Island, as indicated by the horse owner**

Behaviour	N	%
Crib-biting	11	3.8
Wind-sucking	11	3.8
Weaving	14	4.8
Wood-chewing	62	21.2
Stall-digging	13	4.5

Figure 3.3 **Frequency of de-worming in 296 non-racing horses in Prince Edward Island**



Twenty three percent (67/297) of horses were never kept in a stall. Amongst the remaining 77%, the most common bedding materials were straw (68.8%, 159/230) and shavings (26.5%, 61/230). General management practices are summarized in Table 3.5.

Only 38.2% (42/110) of owners that completed Section I vaccinated any of their horses. Amongst these horses, the most common vaccine given was for tetanus (85.7%, 36/42).

The frequency of de-worming in 296 horses (16 Section IIs were not complete) is summarized in Figure 3.3. The most commonly used de-worming medications were ivermectin (Eqvalan; Merial Limited, Duluth GA, USA) and pyrantel pamoate (Strongid; Pfizer Inc., New York, NY), with 39.6% and 26.0% horses having had these respective medications in the year 2002 (up to the time when the owners completed the questionnaire). Seventy-five percent (82/109) of owners never removed manure from the pasture in which their horses grazed.

Forty-seven percent (142/299) of horses were reported to have been transported in the previous year. Ten percent (14/142) of these horses were difficult to load (put on the trailer). Amongst the horses that had ever been transported, the most common methods of enticing horses onto the trailer were with food (28.5%, 35/123), lunge line (23.6%, 29/123) and by putting another horse on first (23.6%, 29/123).

In a separate question, it was found that 6% (17/296) of horses were ridden in a martingale and 3.4% (10/296) of horses wore a cribbing collar. Only 39.3% (117/298) of horses had been ridden or driven with a bit in the 4 weeks preceding completion of the questionnaire. Some owners did not know the type of bit that had been used. Amongst

the responses, the most commonly used bits were snaffle (77.9%, 88/113) and curb (17.9%, 20/112). The others were pelhams and kimberwicks, (8.9%, 10/112) and gags (3.6%, 4/112).

Horses were fed forage approximately 1.1 ± 1.3 times per day in the summer and 2.7 ± 0.93 times per day in the winter. Fifteen percent of horses had salt added to their feed (45/293), 72.7 % (213/293) of horses had access to a salt lick or mineral block, and 17.2 % (51/296) of horses were fed supplements. The mean percentage of daily recommended intake of energy that horses received was 160.1 ± 54.7.

A full list of descriptive statistics, including answers to all questions in the questionnaire, veterinary report data, and non-veterinary data is presented in Appendix 16.

Table 3.5 Summary statistics of general management practices for 312 non-racing horses in Prince Edward Island. The mean, standard deviation and inter-quartile range are presented.

Management practice	Mean	SD	25th percentile	50th percentile	75th percentile
Number of hours spent in a stall per day (summer)	5.1	7.4	0	0	9
Number of hours spent in a stall per day (winter)	15.0	6.5	11	14	21
Frequency of farrier care (weeks)	11.5	8.0	7	9	13
Number of hours worked per week	1.9	4.6	0	0	2

3.4 Discussion

To the knowledge of the author, this is the first report of a horse-level study of equine welfare and management in North America and the first such study based on a true random sampling protocol. Given the high response rate (68%), the results may be generalized to all non-racing horse owners in Prince Edward Island who have a listed telephone number (156). However, no generalizations can be made about the non-responders and about horse owners from households without a listed telephone number. It is estimated that five percent of all PEI households are not listed in the phone book (Aliant Telecom, personal communication). The study has generated many new descriptive data and indicates existing or potential welfare concerns in the following areas: BCS, tail docking, whisker removal, abdominal respiration, parasite control, dental care, hoof wall abnormalities, behaviour, and vaccination.

The number of horses owned per owner was lower than the estimate made by Evans (152), but was based on a more representative sample of non-racing horse owners in PEI than was Evans' survey.

The inter-rater agreement for BCS was good (163). Disagreement between the two raters may be explained by their very different backgrounds. One rater was an experienced veterinarian and the other, while an experienced horse person, had no previous experience in health assessments. The relatively high BCSs could have reflected the time of year that the population was sampled, over-feeding of horses or lack of exercise. However, the data indicate that horses were being fed more energy than is required. It was beyond the scope of the study to do a detailed analysis of diet. The role of factors affecting BCS is

affecting BCS is examined in chapter 4. Obesity may cause laminitis, problems with breeding and may also affect longevity (68,164). However, a high BCS by itself does not necessarily indicate reduced welfare unless physical functioning is affected or there are associated constraints on the behaviour of the horse. There were very few horses with a BCS below 3.5, which suggests that low BCSs were not prevalent in PEI during the summer that the study was conducted.

The CARC guidelines state that tail docking of horses for cosmetic reasons is unacceptable (3). Over half of the draft horses sampled had a docked tail, indicating the need for further research on tail docking procedures, the effects of docking on behaviour, and better education of draft horse owners about the CARC guidelines. The present survey did not acquire data on who did the docking, but anecdotal information suggests that horse owners in PEI dock tails by applying an elastic band to the tail (elastration) which constricts blood flow, resulting in necrosis of the tail which subsequently falls off. Unlike lambs (165,166) and pigs (167), whose tails are docked to prevent flystrike or tail-biting respectively, there are no obvious advantages of docking in horses and no studies have been conducted which examine potential benefits to the horse. Hypothetical benefits for owners are eligibility for draft horse competitions, increased cleanliness and a reduced risk of the tail being caught in equipment. However, docking may involve serious disadvantages to the horse, such as pain associated with the procedure and lack of use of the full tail to control flies. These concerns are comparable to those expressed for dairy cows that have had their tails docked (168).

Horses that are involved in competition frequently have their facial vibrissae

clipped and hairs removed from their inner ears, to give a neater appearance. In the present study, the practice of removing vibrissae was evident in all three types of horses. Effects of vibrissae removal have not been studied. The only available reference was from internet discussions among applied ethologists, and others who have termed whisker removal as a cosmetic operation which may cause sensory deficit (169).

A large proportion of horses exhibited abdominal breathing. These data are difficult to interpret because, while abdominal respiration is not necessarily indicative of pulmonary disease, abdominal respiration can occur when there is an increased effort required for breathing, usually due to painful air movement in the thorax or decreased pulmonary compliance due to chronic respiratory disease (23). The high proportion of non-racing horses with abdominal breathing in PEI may be associated with high environmental temperatures, overweight horses, exposure to poor quality (i.e. moldy or dusty) hay or straw or an underlying pathological condition (e.g. chronic obstructive pulmonary disease). It was outside the scope of the present study to determine the cause of abdominal breathing, as this requires a specialized examination of the respiratory system.

The CARC guidelines recommend that a parasite control program be established in consultation with a veterinarian and that the program should include pasture management and regular de-worming (3). The findings of the present study show that many horses had FECs above the acceptable range, and that many horse owners were not following this guideline regarding pasture management (3). Transmission of strongyles in PEI is greatest during the grazing season from July to September and parasite control programs should

focus on this period (36). Also, veterinarians recommended that the average FEC for a herd remain less than 200 eggs per gram at all times (170).

A high FEC in an otherwise healthy horse does not necessarily indicate reduced welfare. However, this does mean that the horse may have an increased risk of parasite related colic (171). Conversely, a FEC of zero does not necessarily indicate that these horses had no intestinal parasites present, but could indicate that no strongyles were shedding eggs at the time of sampling. Almost half of the horses in the present study had a FEC of zero. The FECs are different from values reported in the literature, but many of these have utilized postmortem examinations, the gold standard (163), and not a FEC to determine the prevalences (172-174). Also, the studies have not been representative of the equine population. Previous studies have been conducted to determine the prevalence of strongyles. A non-randomized Australian postmortem survey found that 89% (51/57) of horses were infected with strongyles, although not all of the horses had sufficiently high level of strongyles to cause harm (172). In a non-randomized study of equine FECs in Sweden, it was found that 78% (923/1183) of horses shed strongyle eggs and that this output was highest in horses aged 2 and 3 years (173). In a non-randomized necropsy survey of horses in Kentucky, only two of 52 horses had evidence of *Strongylus vulgaris* infestations, leading the authors to believe that the control of this parasite had greatly improved (174). In the present study, the prevalence of small strongyles (cyathostomes) versus large strongyles (*Strongylus* spp.) from the FEC was not determined, but it has been shown that cyathostomes account for approximately 90-100% of strongyle-type eggs in equine feces (38,170). The results of the present study indicate that strongyles remain a

common parasite in non-racing horses in PEI. Although strongyle infestation does not appear to reduce BCS, the risk of colic due to strongyles remains a concern. The high FECs were consistent with the lack of manure removal from the pasture and an inadequate use of anthelmintics.

Studies on parasite control methods are less common than prevalence studies. In a non-representative telephone survey of Thoroughbred trainers in England, 51% (54/106) of yards removed feces from the pasture, but not always with sufficient frequency to prevent pasture contamination (175). Those data suggest that the frequency of manure removal from the pasture may be higher in England than it is in PEI which could indicate that owner ignorance or non-compliance with recommendations is higher in PEI (82). Regarding anthelmintic use, it was beyond the scope of the present study to examine the doses of anthelmintic given to each horse or the specific pattens of anthelmintic drug use. This would have been useful to determine if owners were using anthelmintics effectively. Improper use of anthelmintics may lead to cyathostome resistance, an impending problem in horses (27).

The CARC guidelines recommend that horses' teeth be examined at least annually (3). This guideline was not followed by the majority of owners. This is similar to the finding of the American equine survey (82) in which over half of the establishments sampled did not provide any type of dental care. The present research and the American study (82) suggest that North American owners may not be well informed about equine dental care. Owner education may be needed because dental abnormalities may cause pain when the horse is being ridden (due to interference with the bit) and may interfere with

normal eating habits (176).

Horse owners in the present study were not asked if they knew about the CARC guidelines (because knowledge about the guidelines does not necessarily indicate that owners follow them). However, it would be interesting to investigate owner's usage of the CARC guidelines.

Almost 50 % of the horses had a hoof wall abnormality, but hoof wall abnormalities did not appear to be associated with lameness. These abnormalities were especially common in draft horses. However, draft horses had a lower frequency of excessive length of hoof than other types of horses. This may indicate that the hooves of draft horses break off or wear more easily than hooves of light or miniature horses. In comparison, a non-representative study of hoof wall abnormalities amongst riding horses in Texas indicated that 28% of the horses (21/75) had some type of hoof wall abnormality, as reported by their owner (73). That study had a low response rate (as low as 15% in one stable) which may explain why fewer horses appeared to have hoof wall abnormalities than in the present study. The frequency of hoof care in the present study was lower than recommended by veterinary guidelines (69,177). The low frequency of hoof care may be due to a shortage of farriers in PEI or to the neglect of owners.

The prevalence of stereotypic behaviours in the present study (crib-biting, wind-sucking, weaving, and wood-chewing) is comparable to results from other studies. The prevalence of crib-biting or wind-sucking has been reported to vary from 3.1 to 8.3%, weaving from 1.6 to 9.4% and wood-chewing from 5.1 to 20.0% (107-109). While the prevalences of crib-biting, wind-sucking and weaving in PEI fell within the range of

reported values, wood-chewing was slightly more common than has been previously estimated (108). However, this may reflect the fact that wood-chewing is not always stereotypic (178). It was beyond the scope of the study to thoroughly explain a stereotypic behaviour pattern to respondents, so the estimated prevalence of wood-chewing and other stereotypies listed may be inaccurate. Wood-chewing has been associated with nutritional imbalances such as lack of roughage in the diet and abnormal levels of lactate, propionate and acetate in the caecum (179). Crib-biting, wind-sucking and weaving are not always considered stereotypic behaviours either (180). These behaviours may be a coping response to frustration, that has not fully developed into a stereotypy (i.e. they are not completely invariant or repetitive behaviour patterns) or they may be a normal conflict behaviour (181). Nevertheless, they indicate past or present frustration with the environment or motivational conflict, and therefore are valid markers of mental welfare.

Vaccination frequency was low and differed from the findings of NAHMS (82) and from Mellor et al (138). The NAHMS survey found that on nearly 40% of operations, at least one resident equid was not vaccinated against any disease (82), whereas Mellor et al (138) found that 82% of all horses were vaccinated. This large number of vaccinated horses may have been a reflection of the study population, which did not include horses used for purposes other than riding (e.g. pets). The consequence of not vaccinating horses is an increased risk of infectious disease, but this risk is lower in horses that have reduced exposure to other horses. The risk of tetanus is not dependent on exposure to other horses or species and all horses should be regularly vaccinated for tetanus.

Even though owners reported many years of experience caring for, riding or

driving and owning horses, there was still evidence of poor management (e.g. lack of dental care, hoof care, parasite control, and vaccination). An educational leaflet is therefore being produced which addresses key management factors affecting non-racing horses in PEI (feeding, de-worming, vaccinating, hoof care, and behaviour), see Appendix 17. The leaflet will be distributed to the owners who participated, to veterinary clinics in PEI and to equine interest groups.

This study has described managerial factors, indicators of physical health status and prevalences of stereotypic behaviours in non-racing horses in PEI. The sample was randomly chosen and the results are representative of non-racing horses and owners in PEI. This study has indicated that the prevalence of wood-chewing, vaccination frequency and prevalence of strongyles are different from what has been previously reported. The results indicate that the standard of management of non-racing horses in PEI did not meet national guidelines in four of the areas examined (parasite control, hoof care, dental care and tail-docking). Also, the study has indicated that the effects of whisker removal and tail docking and the significance of hoof wall diseases in draft horses require further research.

Chapter 4: Factors affecting the welfare of non-racing horses in Prince Edward Island

4.1 Introduction

The management and welfare of non-racing horses in Prince Edward Island (PEI) have been described in Chapter 3. This chapter examines factors affecting the welfare of non-racing horses in PEI. Welfare is a complex property that encompasses physical health, mental health, and satisfaction of the animal's nature (genetically encoded traits reflected in breed and temperament (17)) (1). There is no single objective measurement that can be taken to indicate level of welfare (18) and there is no established method of assessing equine welfare. However, two indices that may be readily assessed in a survey of welfare are body condition score (BCS; index of physical welfare) and performance of stereotypic behaviour (index of mental welfare and satisfaction of nature).

Body condition scoring provides an estimate of body fat cover. In the horse, a low BCS may be due to a heavy parasite burden, inadequate nutrition, poor dental care or disease, and would therefore suggest reduced physical welfare (145). A high BCS is more difficult to interpret, but may also indicate reduced welfare as overweight horses are at a higher risk of laminitis and infertility (76,182,183). There are different scales available to assess BCS in horses, providing scores that range from zero to five (184,185) and from one to nine (159). The scale of one to nine is more widely used and assuming a trained rater, this scale has the potential to be more precise.

Stereotypies are behavioural patterns which are repetitive, invariant and apparently functionless (104,105). In horses, they include crib-biting, wind-sucking, stall-walking,

and weaving. Stereotypies are generally thought to result from the frustration caused when environmental constraints prevent a horse from exhibiting a highly motivated behaviour, e.g. social interaction or foraging (96). Welfare is said to be worse if stereotypic behaviour dominates the life of the individual by being very time consuming or if it appears to substitute for behavioural responses in a way which impairs adaptation to the environment (96). For example, some equine locomotory stereotypies may result in weight loss (112), and crib-biting causes tooth-wear (113,114) and may result in the ingestion of splinters (111). Studies have examined factors affecting the occurrence of stereotypic behaviour in Thoroughbred race horses, dressage, event and endurance horses and other riding horses (91,107,109). The results have identified the following risk factors: forage availability, bedding type, opportunities for contact with other horses, time spent in the stable, and amount of forced exercise. However, none of the studies used a random or representative sample of horses, and they did not include horses kept as pets or for breeding (91,107,109). There is, therefore, a need for a randomized study of management factors affecting the occurrence of stereotypies in horses kept for purposes other than racing (e.g. farm labour, pet, breeding).

The objective of the present study was to investigate management factors affecting two welfare endpoints (BCS and stereotypic behaviour) in non-racing horses in Prince Edward Island.

4.2 Materials and methods

A survey of non-racing horses in PEI was conducted in the summer of 2002. A

non-racing horse was defined as any miniature horse, pony, draft horse or other horse that is not used for racing purposes. One hundred and seventeen horse owners and 312 horses were recruited though a random phone book search. The recruitment of horse owners, questionnaire design and data collection have been described in Chapter 3. The occurrence of crib-biting, wind-sucking and weaving, and information about management factors were reported by the horse owner in a mailed questionnaire. A site visit was conducted during which the questionnaire was collected, the study veterinarian performed a physical examination on each horse and the weights of hay and grain fed to each horse were established. Body conditions scores were assigned to each horse by the study veterinarian during the site visit. Body condition score was evaluated on a scale of one to nine, with one being emaciated and nine being extremely fat (159).

4.2.1 Body condition score

The inter-rater validity of the BCS measure was calculated and was reported in Section 3.3. A causal diagram was drawn using potential predictors of BCS. A univariable analysis was performed between BCS and each predictor variable in order to evaluate the significance of the relationship. The combined effects of management practices on BCS were assessed using linear regression. The assumption of linearity between BCS and each predictor variable was evaluated using kernal smoothed scatterplots of BCS plotted against each continuous predictor variable.

Linear regression was performed. Variables with multiple categories (e.g. type) were entered as categorical independent variables (dummy variables). Only variables

showing an unconditional association with a significance of $p \leq 0.20$ were kept in the model with the exception of potential confounding variables (sex, type of horse [miniature, light and draft] and age) which were forced into the model. A combination of stepwise selection procedures and manual comparisons of possible models was used to determine a final model. The possibility that terms removed from the model were confounding variables was evaluated at the end of the model-building by reinserting them into the model and assessing the magnitude of the change in the other coefficients. Interaction terms were created and checked for significance in the final model, and significant terms ($p \leq 0.1$) were retained.

The multiple correlation coefficient (R^2) was used to evaluate the fit of the linear model (186). Also, homoscedasticity and normality of residuals were assessed using graphical techniques. A more detailed examination of outliers, leverage points and influential points was then conducted.

4.2.2 Stereotypic behaviour

A causal diagram was drawn using potential predictors and a univariable analysis was performed between stereotypic behaviour and each predictor variable. The combined effects of management practices on stereotypic behaviour was assessed using logistic regression. The logistic model was built in the same manner as the linear model, confounding and interaction were checked and the Hosmer-Lemeshow χ^2 test was used to evaluate the fit of the model (186). As with linear regression, an evaluation of residuals was conducted.

4.2.3 Clustering

There was a concern about possible clustering of observations by barn (the "barn effect"), i.e. that horses owned by the same person or living in the same barn were more alike than horses owned by different people or living in different barns. The effect of clustering in the model depends on the size of the intra-cluster correlation (ϱ) and the cluster size (187). The final linear and logistic models were refit using a generalized estimating equation from which estimates of ϱ were obtained. Considering the average cluster size was 2.7 and there were low intra-class correlations ($\varrho = 0.076$ for linear model and $\varrho = 0.0050$ for logistic model), clustering was determined not to be a significant concern (186).

All statistical analyses were carried out using Stata 7 (Stata Corporation, College Station, Texas, USA).

4.3 Results

The response rate for the survey was 68.4%. The mean BCS ± SD was 5.7 ± 1.0. The distribution of BCS is shown in Figure 4.1. The prevalence of stereotypic behaviour (crib-biting, wind-sucking and weaving) was 12.3 % (36/292). The prevalence of stereotypies in each horse type is presented in Table 4.1. The questionnaire for 20 horses was not fully complete.

Significant predictors of BCS, as identified by unconditional analyses, were: the number of years that the owner had owned horses, whether or not the owner was a member

of a horse-related organization, the number of hours that the horse spent in a stall daily in the summer and the date on which the horse was examined. Nonsignificant predictors of BCS were age of the horse, number of hours worked per week, fecal egg count (strongyle eggs per gram), presence of a dental abnormality, the date of the last dental examination, percentage of daily recommended intake of energy, and whether or not the horse exhibited a stereotypy. Descriptive statistics for the variables listed above are summarized in Table 4.2.

Table 4.1 Prevalence of stereotypies in 292 non-racing horses in Prince Edward Island, as indicated by the horse owner.

	Horse Type					
Behaviour	Miniature		Light		Draft	
	N=34	%	N=211	%	N=47	%
Crib-biting	1	2.9	10	4.7	0	0
Wind-sucking	0	0	10	4.7	1	2.1
Weaving	0	0	13	6.2	1	2.1

Figure 4.1 **Distribution of body condition score, on a scale of 1-9 (159), in 312 non-racing horses in Prince Edward Island.**

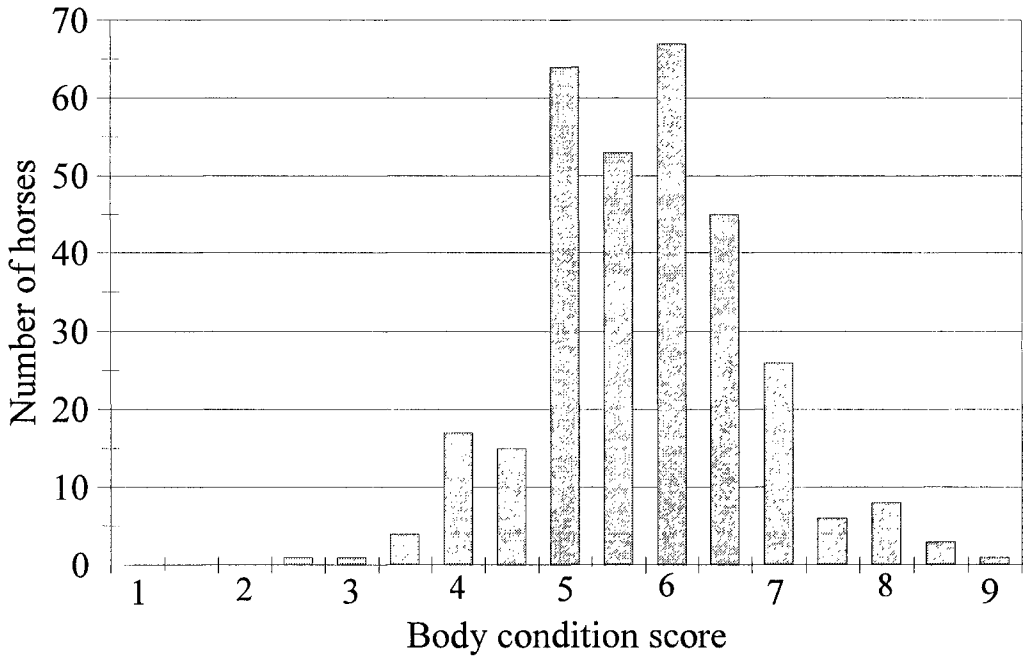


Table 4.2 A summary of the predictor variables for body condition score that were examined in the univariable analysis and the significance level of each.

Variable Name	Description	Descriptive statistic	p
Age	Age of the horse, as identified by the owner	$\mu \pm SD = 9.5 \pm 7.3$ years	0.80
Years owning	The number of years that the owner had been owning horses	$\mu \pm SD = 17.1 \pm$ 13.9 years	0.16
Member	Whether the owner was a member of a horse-related organization or not	35/110	0.12
Stall hours (summer)	The number of hours per day that the horse spent in a stall in the summer	$\mu \pm SD = 5.1 \pm 7.4$ hours per day	0.16
Date	The date on which the horse was examined by the study veterinarian	Range= 02/07/2002 to 26/10/2002	0.02
Hours work	The number of hours per week that the horse was ridden or driven	$\mu \pm SD = 1.9 \pm 4.7$	0.40
FEC	Fecal egg count	$\mu \pm SD = 420 \pm 850$ strongyle eggs per gram	0.72
Dental abnormality	Presence of a molar hook, sharp enamel points or wave mouth	Molar hook: 40/296 Enamel point: 27/297 Wave mouth: 10/296	0.89 0.82 0.36
Dental exam date	The date that a veterinarian last examined the horse's teeth	$\mu \pm SD = 2000 \pm 4$ years	0.46
% dri (energy)	The percentage of the daily recommended intake of energy that the horse received	$\mu \pm SD = 160\ \% \pm$ 55 %	0.67
Stereotypy	Whether the horse exhibited a stereotypy or not (crib-biting, wind-sucking or weaving)	36/292 see Table 4.1	0.33

Table 4.3 Final linear regression model of body condition score in non-racing horses in Prince Edward Island

Factor	Coefficient	95% Confidence Interval	p
Years owning horses	-0.018	-0.042 - 0.006	0.087
Member of a horse-related organization	-0.15	-0.56 - 0.25	0.091
Date of examination	0.004	0.00 - 0.009	0.052
Sex: Gelding compared to a mare	-0.40	-0.64 - -0.16	0.001
Stallion compared to a mare	-0.78	-1.2 - -0.35	0.00
Interaction term (years owning * membership)	0.017	0.0014 - 0.033	0.033

$R^2 = 0.10$, adj. $R^2 = 0.08$

Table 4.4 Table illustrating the decrease in body condition score resulting from owner experience (years owning horses) and membership of a horse-related organization (values represent the decrease in body condition score on a scale of 1-9).

		Member of a horse-related organization?	
		Yes	No
Experience (years owning horses)	0 years	0.00	-0.15
	10 years	-0.18	-0.16
	20 years	-0.36	-0.17

Linear regression identified four variables that influenced BCS (Table 4.3). Once these variables were included in the model, no other predictor variables were statistically significant. The R^2 for the linear regression model was 0.10 and the analysis of residuals confirmed that the major assumptions of linear regression were met (no data points were identified as outliers or influential points). Horses whose owners belonged to a horse-related organization had a mean BCS that was 0.15 units lower than horses whose owners did not belong to a horse-related organization. The effect of experience owning horses depended on whether or not the owner was a member of a horse-related organization (Table 4.4). The mean BCS increased with the date of examination, therefore for every month (30 days) increase from July to September, the BCS increased by 0.12 units. Geldings and stallions had a mean BCS of 0.4 and 0.78 units lower than mares, respectively. The variables described above explained 10% of the variability of BCS in non-racing horses (Table 4.3). A path model summarizing the relationship between variables and BCS, as indicated by linear regression is presented in Figure 4.2.

Significant predictors of stereotypic behaviour identified by unconditional analyses were the number of times that hay was fed per day in the summer, the number of hours that the horse spent in a pasture with grass per day, the use of straw bedding (as opposed to shavings, sawdust, peat, or no bedding), the use of a non-snaffle bit (pelham, kimberwick, curb, or gag) and the number of hours that the horse was worked per week. Nonsignificant predictors were the number of times per day that the horse was fed hay in the winter, the number of hours per day spent in a stall in the summer, the ability to touch other horses from the stall, and the ability to see other horses from the stall. Descriptive statistics for

the variables listed above are summarized in Table 4.5.

Table 4.5. A summary of the predictor variables for stereotypic behaviour that were examined in the univariable analysis and the significance level of each.

Variable name	Description	Descriptive statistics	p
Hay (summer)	Number of times that hay was fed per day in the summer	$\mu \pm SD = 1.1 \pm 1.3$ times per day	0.04
Hay (winter)	Number of times that hay was fed per day in the winter	$\mu \pm SD = 2.7 \pm 0.93$ times per day	0.18
Stall hours (summer)	The number of hours per day that the horse spent in a stall in the summer	$\mu \pm SD = 5.1 \pm 7.4$ hours per day	0.52
Hours grass	Number of hours per day that the horse spent in a pasture with grass	$\mu \pm SD = 17 \pm 9.0$ hours per day	0.09
Straw	Whether horses had straw for bedding (as opposed to shavings, sawdust, peat, or no bedding)	159/312	0.07
Non-snaffle	The use of a non-snaffle bit (pelham, kimberwick, curb, or gag)	29/312	0.03
Hours work	The number of hours that the horse was ridden or driven per week	$\mu \pm SD = 1.9 \pm 4.7$ hours per week Range = 0 to 46	0.07
Touch	Whether the horse could touch other horses from the stall or not	123/232	0.24
See	Whether the horse could see other horses from the stall or not	199/231	0.84

Table 4.6 Final logistic regression model of stereotypic behaviour in non-racing horses in Prince Edward Island

Factor	Coefficient	Odds Ratio[a]	95% Confidence Interval (OR)	p
Hours per day spent in a pasture with grass	-0.057	0.94	0.91 - 0.99	0.019
Hours worked per week	0.119	1.13	1.0 - 1.2	0.016
Use of a non-snaffle bit	1.21	3.4	1.1 - 7.2	0.046
Age of horse	0.67	1.07	1.0 - 1.1	0.05
Type of horse:				
Miniature compared to light	-1.22	0.30	0.033 - 2.5	0.68
Draft compared to light	-1.83	0.16	0.27 - 1.2	0.68
Hosmer-Lemeshow χ^2= 1.90 (p=0.98)				

[a] Odds ratios calculated based on logistic regression coefficients

Figure 4.2 **Path diagram showing relationship between factors affecting body condition score in non-racing horses in Prince Edward Island. Coefficients are indicated beside the arrows.**

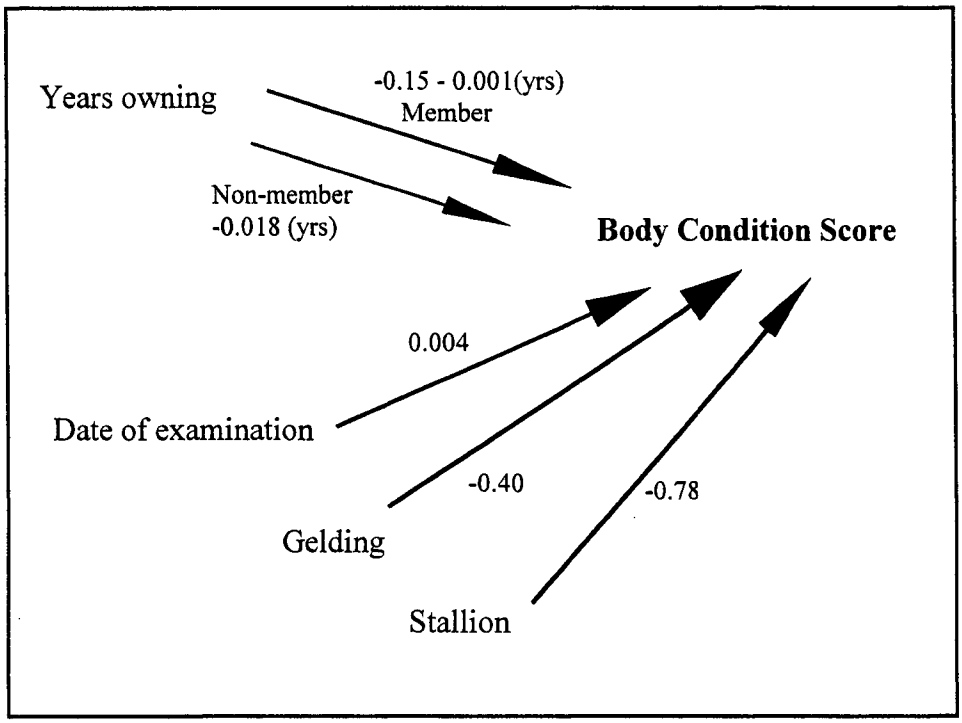
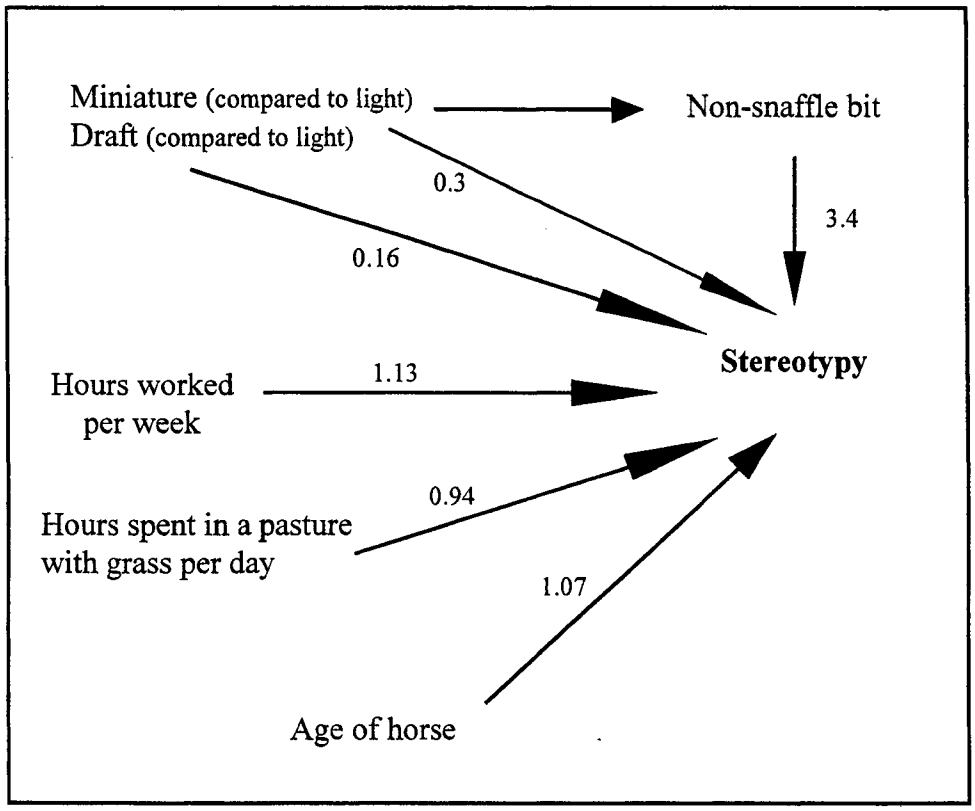


Figure 4.3 Path diagram showing relationship between factors affecting the occurrence of stereotypic behaviour in non-racing horses in Prince Edward Island. Odds ratios are indicated beside the arrows.



Logistic regression modeling identified five variables associated with the occurrence of stereotypic behaviour (Table 4.6): hours per day spent in a pasture with grass, hours worked per week, use of a non-snaffle bit, type of horse, and age of horse. The odds of a horse having a stereotypy decreased 0.94 times for every additional hour per day that the horse spent in a pasture with grass. An increase in 12 hours at grass per day would therefore reduce the odds of having a stereotypy by 0.47 times (0.94^{12}). Similarly, an increase in age of 10 years would approximately double the odds of having a stereotypy (1.07^{10}), and an increase in 5 hours of work per week would increase the odds by 1.8

(1.13^5). The goodness of fit of the logistic regression model was acceptable.

A path model summarizing the relationship between variables and stereotypic behaviour, as indicated by logistic regression is presented in Figure 4.3.

4.4 Discussion

The results of this study suggest several factors that may influence BCS and the occurrence of stereotypic behaviour in non-racing horses in PEI.

4.4.1 Body Condition Score

Body condition scores were generally high and this could have been due to over-feeding or lack of exercise. Horses with a high BCS were clinically healthy, but their future welfare may be at risk because overweight horses are at increased risk of laminitis (76) and infertility (68). These horses might also have a decreased ability to cool the body because fat is an insulator (84), and might have required longer to recover from work (188). There have been no studies reported that examine BCS in a random group of domestic horses. However in a non-randomized study of a variety of horses including Thoroughbred racehorses, Standardbreds and ponies, the most prevalent BCS on a scale of 0 to 5 was 3.5, slightly above optimal (184). The present study shows similar results. Body condition scores have also been reported in a group of feral ponies in Assateague Island (USA) (189). The horses were scored on a scale of zero to five by visual examination and the mean BCS was 2.47, slightly less than optimal. This probably reflects the fact that feral horses generally do not have the opportunity to eat high-energy

grains, are not de-wormed, and would spend much more time moving about than domestic horses.

Two owner factors (experience owning horses and membership of a horse-related organization) were significant predictors for BCS, although their effects on BCS were not substantial. There was some correlation between these terms, indicating that people who had owned horses for a long time were more likely to be a member of a horse-related organization. Experience and membership may provide a horse owner with more information (e.g. through magazine subscriptions) about feeding practices and their effects on body condition. Also, membership of a horse-related organization may indicate an increased interest in equine management, nutrition and health. However, the small effect of membership on BCS in the model suggests that an owner in PEI would be unlikely to improve the BCS of their horse by joining a horse-related organization.

The date of the physical examination was associated with BCS. The sampling period occurred from July to September 2002 and the increasing BCS over the summer may be due to an increased availability of high quality grass (i.e. more nutrient dense) as the summer progressed. A detailed analysis of the amount and nutritional composition of food available to the horse throughout the summer would be required in order to verify this hypothesis.

Sex of the horse was found to be a significant risk factor for BCS. Stallions may have had a lower BCS due to the high energy requirement of breeding throughout the summer (190). Conversely, the study on body condition in feral ponies on Assateague Island showed that stallions had higher BCSs than mares (189). The results of the present

study suggest that owners may need advice about nutrition of stallions during the breeding season in order to prevent decreased BCS and advice about nutrition of mares in order to prevent infertility due to obesity (84,182).

The factors described above only explain ten percent of the variability in BCS of non-racing horses in PEI. These factors are of minor biological significance and additional factors which influence BCS need to be investigated. Such factors might include grass quality, total nutrient intake, and genetics because body condition may have a hereditary component as has been reported in humans (191-193).

4.4.2 Stereotypic behaviour

Risk factors associated with the occurrence of stereotypic behaviour have been investigated previously (91,107,109). They are: forage availability and type, bedding type, total number of horses in a yard, opportunities for contact with other horses (91), time spent in the stable (109), physical contact with other horses, and amount of forced exercise (107). These risk factors were identified in horses that were kept at boarding stables, in horses used for riding and in race horses, but the studies were not based on random samples.

The present study examined three stereotypic behaviours. Crib-biting, wind-sucking and weaving are common stereotypies that most horse owners would be able to identify. Some cases of the reported behaviours may not have been fully stereotypic but were developing stereotypies or redirected behaviours. Even if this were the case, horses with any of the three behaviours would still be of welfare concern because developing

stereotypies and redirected behaviours are responses to frustration or motivational conflict (101,181), both of which compromise mental welfare. Other potential stereotypies were not included in the statistical analysis because they may be associated with factors other than frustration (e.g. wood-chewing can be caused by nutritional deficiencies (179)). Also, owners may not have known if such behaviours were stereotypies or not and this may have reduced the validity of their reports. The utility of stereotypies as an index of the welfare of a population may be questioned because, although a stereotypy may be beneficial if it allows the animal to cope with frustration, animals that are not showing stereotypic behaviour may be frustrated but unable to cope. Such animals would be of greater welfare concern than horses with a stereotypy (111). Conversely the absence of a stereotypy may mean that there is no frustration present (115). The above aspects of stereotypies require further research but, at present, the performance of a stereotypy is considered an acceptable index of reduced mental welfare and lack of satisfaction of nature because of the behaviour's association with frustration.

The three stereotypies were not distinguished in the statistical analysis because each type had a low prevalence; a larger sample would have been required in order to investigate factors affecting each stereotypy. If there had been more cases of each type of stereotypy, more variables might have been significant in the model.

The 95% confidence intervals of the odds ratios of three of the five significant predictors of stereotypic behaviour included one, which may limit the biological significance of the findings, but may also reflect relatively high variability in the sample of horses surveyed.

The present results indicate that increasing the number of hours spent daily in a pasture with grass was associated with a decreased risk of stereotypic behaviour. Turn-out in a pasture with grass would allow the horse an opportunity to graze and perhaps to have social interaction. The number of hours spent in a pasture with another horse was not investigated in the present study. In order to optimize the mind and nature dimensions of welfare, horses should be allowed as many opportunities as possible to graze, move about and interact with other horses, providing that they are not at risk of overeating or being injured (194).

The number of hours worked per week and use of a non-snaffle bit were risk factors for stereotypic behaviours and could indicate an increase in the horse's physical restriction. While a horse is ridden or driven, its environmental control is reduced greatly which may be distressing for some animals. For example, the head may be positioned so that the horse is unable to lift or lower it, and the speed and direction of movement is also out of the horse's control. The nature of the relationship between bits and behaviour in the study is not clear. The use of a non-snaffle bit might not cause stereotypic behaviour, but a nervous or excitable horse may be more difficult to ride, thus requiring a non-snaffle (stronger) bit, and may also be more likely to perform a stereotypic behaviour. An assumption with the bit type was that all bits are used in the same manner and that snaffle bits are always less harsh than non-snaffle bits. A snaffle bit could be very harsh if the bit were made from wire or if the rider or driver pulled on the reins. Conversely, a non-snaffle bit (e.g. curb) might not be harsh if it were made of soft rubber or if the rider did not pull on the reins. Owners were not asked about the material from which their bits

were made in the present study. Questions about the amount that a rider pulls on the reins would have been very subjective and difficult for owners to answer, and some horse owners may have found such a question intrusive, leading to non-participation in the survey. There has been no research published on the behavioural effects of bits made from different materials, but research is being conducted regarding oral behaviour and swallowing frequency with different snaffle bits (Dr. Hilary Clayton, University of Michigan, personal communication).

The risk of having a stereotypy increased with age, perhaps because, as a horse becomes older, the probability increases that it will have encountered a frustrating situation. Type of horse was not a statistically significant factor but it was retained in the model because it was a confounding factor for the use of a non-snaffle bit: miniature horses were never ridden or driven in a non-snaffle bit and draft horses were rarely ridden or driven in one. The numeric difference in prevalence of stereotypic behaviours between the three types of horses is interesting. To the author's knowledge, behaviour of the three types of horses has not been compared previously and there has been no research on stereotypic behaviour in miniature or draft horses. The three types of horses may have different levels of nervousness or excitability, and draft and miniature horses might be more tolerant of frustration than light horses.

The present study has identified several management factors that are associated with the occurrence of stereotypic behaviour in non-racing horses in PEI. The goodness of fit test for logistic regression was not significant, suggesting that there is no reason to believe the model does not fit the data. Data were collected regarding all the risk factors

that have been previously identified (91,107,109), but none of these factors was significant. This may reflect differences in the equine populations studied. Previous studies have examined populations of horses kept at a boarding stable and riding horses, while the present study included horses kept in a backyard, pets, horses used for breeding, and others (Section 3.3). The management of the two populations is probably very different and there may be other differences such as breeds of horses and environment. For example, Quarter horses were the most prevalent breed in the present study (Section 3.3), but Quarter horses do not appear to be common in the United Kingdom.

This study was the first of its kind in North America and it has identified some managerial factors that may influence BCS and the occurrence of stereotypic behaviour in non-racing horses in PEI. The results indicate a need for further research on additional factors leading to high BCS in non-racing horses and on behavioural and physical consequences of high BCS. Research is also indicated on the relationship between the development of stereotypic behaviour and excitability level of the horse, type of bit, and bit material, and the development and occurrence of stereotypic behaviour of miniature and draft horses.

Chapter 5: Summary and future research

This thesis has presented results of the first randomized horse-level survey of equine welfare and management in North America. The major findings are summarized below, with their implications.

- Tail docking was common in draft horses, which contravenes the national guidelines (3) (Chapter 3). There is a need for studies on pain associated with the docking procedure and on the behavioural consequences of tail docking to better determine how serious a welfare concern this is. In the meantime, horse owners need to be encouraged to avoid the practice.
- Facial vibrissae (whiskers) were clipped in all three types of horses (miniature, light and draft) (Chapter 3). Research is needed on the effects of vibrissae removal because the removal might reduce the horse's ability to remove flies and there is a possibility that it causes sensory deficit.
- A large proportion of horses exhibited abdominal breathing, which could indicate an underlying pathological respiratory condition. The cause of abdominal breathing was not determined but warrants further investigation (Chapter 3).
- Fecal egg counts were high and manure was rarely removed from the pasture (Chapter 3). This indicated that strongyles remain a common parasite in non-racing horses in PEI and that owners need more education about parasite control strategies.

- There was a high prevalence of dental abnormalities and lack of dental care (Chapter 3). These results suggest that owners were not well informed about equine dental care. This is a welfare concern because dental abnormalities can cause pain and can interfere with normal eating habits (176).
- Hoof wall abnormalities were common, especially in draft horses. Also, the frequency of hoof care was lower than is recommended by veterinary guidelines (Chapter 3). Anecdotal evidence suggests that these results might be due to a lack of farriers in PEI or a lack of organization by owners in arranging farrier visits.
- Vaccination frequency was low, which indicates a possible increased risk of infectious disease (Chapter 3).
- The CARC guidelines for equine care (3) were not being followed in the areas of parasite control, hoof care and dental care (Chapter 3). In order to address this, an educational leaflet (Appendix 17) is being produced for horse owners in Atlantic Canada and will be made available through veterinarians and equine interest groups.
- The mean body condition score was high. Horses with a high BCS are at increased risk of laminitis (76) and infertility (68). There is a need for research on additional physical and behavioural consequences of a high score. Only eight percent of the variability in BCS was explained by the potential risk factors evaluated in this study (Chapter 3). Further research

is indicated to identify additional factors affecting BCS.

- The prevalence of stereotypic behaviour was comparable with previous studies. The variables that were associated with stereotypic behaviour were: type of horse (miniature, light or draft), age of horse, the number of hours per day that the horse spent in a pasture with grass, the number of hours that the horse was worked per week and the use of a non-snaffle bit. These relationships are probably causal, with the exception of the relationship with bit type (the selection of bit type might be a response to behaviour rather than a cause of stereotypy). The results provide some insight into the nature of stereotypies and can be incorporated into owner education programs while additional studies are conducted.

This study has provided data which can be used both for the development of owner education programs and as a basis for the design of future research studies. A similar survey of non-racing horses in other parts of Canada, and of the race horse population in PEI would provide useful comparisons. If a similar study were to be conducted, participating owners should be provided with information about the properties of stereotypic behaviour, so that more behaviours could be examined and the identification of each behaviour would be certain. Larger sample sizes would provide more power for the evaluation of factors affecting difference stereotypic behaviours. In addition, owners could be asked if they knew about or owned a copy of the CARC guidelines.

In conclusion, this study has been the first of its kind in North America. Several equine management practices were identified that need improvement in Prince Edward Island. The data may be applicable to horses elsewhere in Canada; therefore, the educational leaflet will be available to veterinary practices across Canada.

Glossary

Appetitive behaviour pattern	Introductory phase of an operant behavioural sequence that is directed towards finding a means to satisfy an interest (e.g. searching for food) (after Hurnik et al (134).
Consummatory behaviour pattern	The second phase of an operant behaviour sequence during which the animal satisfies its interest (e.g. capture and consumption of prey)(134).
Crib-biting	An oral stereotypic behaviour in which the horse grasps a fixed object with its incisors and pulls back, drawing air into the cranial oesophagus while making a grunting noise (134;195).
Distress	Stress beyond the animal's ability to cope. Results from factors such as "excessive fear, loss of companion or object which has a strong psychological bond, physical discomfort, food or water deprivation, pain etc." (134, p.53, line 25)
Ethogram	A catalogue of behaviours exhibited by an animal.
Motivation	"Urge to perform a given behavioural action." (134, p.116, line 4)
Natural instinct	A tendency to act in a manner which is typical of the species and is not learned (134).
Non-racing horse	Any horse, pony, miniature horse or light horse that is not kept for racing purposes.
Pain	"Unpleasant sensation, usually localized, resulting from noxious stimulation or injury" (134, p.131, line 12).
Stress	"The psychophysiological consequences of challenging, tense or noxious situations"(134, p.177, line 17)

Suffering	"A psychological state of a sentient organism resulting from perception of harm... and inferred from observable signs exhibited by the animal" (134, p.179, line 12).
Weaving	Stereotypic behaviour in which the horse's head and neck move from side to side; it is sometimes associated with the transfer of body weight from one side to another (134).
Wind-sucking	A similar behaviour to crib-biting, except the horse does not grasp a fixed object with the incisors (195).

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APPENDICES

APPENDIX 1: RECRUITMENT OF OWNERS

Owners of non-racing horses were recruited by a random phone book search from February to August, 2002. One hundred pages were randomly selected from the 235 pages of the 2001 Prince Edward Island phone book using computer generated random numbers. There were four columns on each page; the two outside columns were selected and calls were made to every residential number in these columns. If there was no answer or an answering machine, or if the line was busy, the number was called again at a later date. Three attempts were made to contact each household. If there was an answering machine on the third attempt, a message was left which briefly described the study and asked that any horse owners in the household contact the study office. In order to increase participation and to avoid causing annoyance to non-horse owners, the study was publicised on the local media though newspaper articles, an interview with CBC radio, and a posting on a local independent television station.

Once a horse owner was identified, it was verified that their horses were not standardbred race horses and a short description of the study was given. If the owner was interested in participating, their name and address was obtained. A letter, information leaflet, consent form and a stamped, addressed return envelope (See Appendix 2-3) were mailed out within the next two days. The leaflet described the aims of study, confidentiality, benefits of taking part and the reason why the owner was selected. The information package was addressed to the owner by hand to increase response rates. If the owner decided to participate, they signed the consent form and returned it. If the owner decided not to participate, a section of the consent form asked them to give their

reason and to return the consent form in the envelope provided. Those owners who had been sent the information but had not returned the consent form within 3-4 weeks were contacted to verify that they had received the package and were asked to return the consent form at their earliest convenience.

APPENDIX 2: INFORMATION LEAFLET AND CONSENT FORM SENT TO OWNERS INTERESTED IN PARTICIPATING IN THE SURVEY

The Prince Edward Island Non-Racing Horse Survey 2002

Sponsored by:

Sir James Dunn Animal Welfare Centre

Atlantic Veterinary College
University of Prince Edward Island

Aim of study
We are doing this study in order to describe how non-racing horses are managed on Prince Edward Island. By "non-racing" horses we mean any horse, pony, miniature horse or draft horse that is not involved in standard-bred racing. We will be asking horse owners about feeding, general health and behaviour. We will use our findings to suggest methods of improving the welfare of non-racing horses in P.E.I. This is the first study of its kind on P.E.I. We hope our findings will be very useful for horse owners here.

Why were you selected?
Your name was randomly selected from the phone-book without any prior knowledge of you or your horse/s. Random selection means that every person with a phone in P.E.I. has an equal chance of being asked to participate. This process ensures that the survey is representative of P.E.I.

What your participation would involve
We would ask for information about a maximum of four horses per owner. If you own more than four non-racing horses, we would randomly choose four of them for our study. We would meet you once at the place where you keep your horse/s. Two weeks before we met, we would send you a questionnaire. It would take 20-30 minutes to fill out. We would ask that you do this prior to our meeting.
At the meeting, a veterinarian would examine your horses. This examination would include a general physical evaluation with lameness and dental exams. We would also do a body condition score and we would weigh the amount of feed and hay (if applicable) given to each horse and take samples. We would collect a manure sample from the horse/s at that time or we would give you a pre-addressed, pre-stamped package in which to mail us a sample. The entire process should take no more than 25 minutes per horse. We would not take any blood.

Confidentiality and voluntary participation
We recognize the importance of confidentiality. No names will be put on the survey. Subject to our policy on animal abuse, all information which horse owners provide is strictly confidential; the only people who will have access to the data are the study personnel and study results will be presented in such a way that no individual reply can be traced.
Participation in the survey is completely voluntary and anyone may decide to withdraw from the study at any time without prejudice. A person's decision to participate or withdraw will in no way affect any service that they might receive from the Atlantic Veterinary College.

Benefits of taking part in the survey
After our visit, we would send you a summary of findings. This would include the worm egg count from the manure sample, the nutrition analysis and the results of the physical examination. The veterinarian would not make any diagnosis but if there were concerns, we would advise you to consult your regular vet. When the study is over, each participant will receive a leaflet which summarizes the findings. The leaflet will include information on those areas which may be of interest or of concern. It will also include suggestions for management of horses that may help to improve their physical and mental welfare. This leaflet will be made available to horse owners across P.E.I.

Risks of taking part
We are not aware of any increased risks to you or your horses from taking part in this survey. All study personnel who would visit you and your horses are experienced in the handling and care of horses. Survey personnel will not take the place of your regular veterinarian and will not provide ongoing advice about your horses. Neither the University of Prince Edward Island nor the Atlantic Veterinary College nor study personnel can accept any liability for any adverse event that occurs to you or your property or your animals arising out of your participation in the P.E.I. Non Racing Horse Survey.

Consent Form

We recommend that you keep a copy of the form and the information on the left, for your records. Please do not detach this form from the page on the left.

If you do NOT wish to take part in the P.E.I. Non-Racing Horse Survey

Please return this form in the envelope provided. If you would like to give your reason for not taking part, please check one or more of the options below.

- ☐ I do not want to commit time to the project.
- ☐ I do not plan to own any horses in the summer of 2002.
- ☐ I believe surveys are a waste of time.
- ☐ Other: _____

_____

If you would like to take part in the P.E.I. Non-Racing Horse Survey and you are under 18 years old

Please have a parent or guardian fill out the attached sheet. If there is no attached sheet, please let us know and we will send one.

If you would like to take part in the P.E.I. Non-Racing Horse Survey and you are 18 years old or more

Please indicate your consent by reading and signing under the statement below.

I have read and understood the information on page one and hereby give my free consent to participate in the P.E.I. Non-Racing Horse Survey. I also understand that, in the future, I am free to ask any questions regarding this survey. I am at least 18 years old. I am the legal owner (or legal agent of the owner) of non-racing horses.

Signature:_____Date:_____

Please provide background information about your horses by answering the questions on the back of this page.

-2-

To help us plan our visit, could you please tell us:

1. How many non-racing horses do you expect to own in the Summer of 2002? _____

2. Does somebody else take care of your horses? *(Please circle 'Yes' or 'No')*

   YES ⇨ *Please go to question 3.*
   NO ⇨ *Please go to question 4*

3. If somebody else takes care of your horse/s, do you give us consent to contact the stable manager? *(Please circle 'Yes' or 'No')*

   YES ⇨ *Please sign to indicate your agreement and then go on to question 4* _____
   NO

4. Please provide details of where your horse/s are kept:

   Location #1
   Owner of property or stable manager:_____

   Address:_____

   _____

   Phone: _____

   Location #2
   Owner of property or stable manager:_____

   Address:_____

   _____

   Phone: _____

If you need more space, please attach an additional page.

Thank you very much for your help!

Please use the enclosed envelope to return this leaflet to:

The P.E.I. Non-Racing Horse Survey

If the horse owner is under the age of 18 and would like to take part in the survey, please have a parent or guardian fill out this page:

Who is the most appropriate person to give us information about the management of the horse/s? *(Please give their name)*

_____

If this person is under the age of 18, please continue below.

I, *(name of parent or guardian)*_____

have read the information on page one of the attached leaflet and give

permission for *(name of child)*_____

to participate in the P.E.I. Non-Racing Horse Survey.

Signature of parent of guardian:

_____

Date:_____

Please return this to us in the envelope provided. We will then contact you to arrange a short meeting with you and your child. This will ensure that your child understands what the survey is about.

APPENDIX 3: COVER LETTER FOR INFORMATION PACKAGE

Date

Address

Dear (Name),

Re: The P.E.I. Non-Racing Horse Survey

Thank you very much for your interest in this study which is part of my Master of Science degree. I am working on the project with Dr. Caroline Hewson, the Research Chair of the Sir James Dunn Animal Welfare Centre and Dr. Chris Riley at the Atlantic Veterinary College.

I have enclosed full information about the P.E.I. Non-Racing Horse Survey. The survey will take place from July to September 2002. If you decide to take part, we will phone you to arrange a convenient time to visit. We will then mail you a questionnaire two weeks prior to visiting. When we visit, we will ask you some questions about your horse/s and a veterinarian will do a general physical examination for each of your horses.

Please be assured that this is a research project and not for commercial use. There will be no cost to you for participating. The survey is funded by the Sir James Dunn Animal Welfare Centre which is an independent non-profit organization dedicated to research and education about horses, cats, and dogs. (Website address: http://www.upei.ca/~awc/).

This study has been approved by the University's Research Ethics Board. If you have any questions about the ethics of this survey please contact the Office of the Vice President of Research and Development, University of Prince Edward Island,
or by e-mail at

If you do decide to participate, please sign the consent form and return it to me in the pre-addressed envelope at your earliest convenience. If you prefer not to participate and would like to give your reason, please do so at the top of page 2 of the enclosed leaflet. Please return the consent form whether or not you wish to participate. Do not hesitate to contact me if you have any questions or comments.

Yours sincerely,

APPENDIX 4: QUESTIONNAIRE: SECTION I

COMMENTS

Your comments will be appreciated here. If necessary, please use an additional sheet of paper.

Thank you for your help. Please go to Section II

Please give your completed questionnaire to us when we visit on _____ (date), at_____(time).

The Prince Edward Island Non-Racing Horse Survey 2002

Sponsored by:

Sir James Dunn Animal Welfare Centre

Atlantic Veterinary College
University of Prince Edward Island

IMPORTANT

- *This survey is concerned only with non-racing horses: any horse, pony, miniature horse or draft horse that is not a standardbred race horse.*
- *This questionnaire has two sections; one is white and one is blue. You only need to fill out one white section. Then, you need to complete one blue section for* ***each*** *of the non-racing horses that we have selected for this study. The names of these horses are on the blue forms.*
- *Please answer all questions to the best of your ability. There is no right or wrong answer to any of the questions.*
- *If you have lost the letter or have any questions, please do not hesitate to contact me. (Julie Christie:* (902)393-9919 *or* jchristie@upei.ca*)*
- *Please give us your completed questionnaire when we visit on:*

_____ (date) at _____ (time)

ID # _____

PRINCE EDWARD ISLAND NON-RACING HORSE SURVEY

SECTION I

GENERAL INFORMATION

SECTION I: GENERAL

We will begin by asking you some questions about your horses, stabling and pasture.

Q-1 How many non-racing horses do you currently own? (any horse or pony that is not a standardbred racing horse) _____

PASTURE/PADDOCK/STALLS

Q-2 Approximately how many hours per day (in a 24 hour period) do your non-racing horses usually spend in a pasture or paddock?
- a. In the summer _____ HOURS OUT OF 24
- b. In the winter _____ HOURS OUT OF 24

Q-3 How often is manure usually removed from the pastures in which your horses graze? *(Please circle the number of your answer)*
- 1 EVERY 1-2 DAYS
- 2 EVERY 3-4 DAYS
- 3 EVERY 5-7 DAYS
- 4 LESS OFTEN THAN ONCE EVERY 7 DAYS
- 5 NEVER
- 6 OTHER: _____

Q-4 Is manure usually spread on pastures where your non-racing horses graze? *(Please circle a number)*
- 1 YES
- 2 NO
- 3 DON'T KNOW

Q-5 Are any of the following types of shelter currently available in the pasture or paddock? *(For each of the choices, please circle 'YES' or 'NO')*
- a. Trees YES NO
- b. Barn/stall /shed YES NO
- c. Other: _____

For office use only

1.[ ]

2.a[ ]
b[ ]

3.[ ]

4.[ ]

5.a[ ]
b[ ]
c[ ]

ID # _____

Q-6 Do your horses have any physical contact with any of the following animals while at pasture? *(For each of the listed animals, please circle 'YES' or 'NO')*
- a. Cows YES NO
- b. Pigs YES NO
- c. Sheep YES NO
- d. Goats YES NO
- e. Donkeys YES NO
- f. Poultry YES NO
- g. Llamas YES NO
- h. Dogs or Cats YES NO

Q-7 How often is manure usually removed from your stall(s) in the summer? *(Please circle the number of your answer)*
- 1 ONCE OR MORE PER DAY
- 2 2-5 TIMES PER WEEK
- 3 ONCE A WEEK
- 4 LESS THAN ONCE A WEEK
- 5 HORSE/S NOT KEPT IN STALL IN SUMMER

Q-8 How often is manure usually removed from your stall(s) in the winter?
- 1 ONCE OR MORE PER DAY
- 2 2-5 TIMES PER WEEK
- 3 ONCE A WEEK
- 4 LESS THAN ONCE A WEEK
- 5 HORSE/S NOT KEPT IN STALL IN WINTER

SALE OF HORSES

The following questions are about selling or trading horses.

Q-9i Have you ever sold, traded, or given away any of your non-racing horses ? *(Please circle your answer below)*
- 1 YES ⇨ *Please go on to Q-9ii*
- 2 NO ⇨ *Please skip to Q-12 on the next page*

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6.a[ ]
b[ ]
c[ ]
d[ ]
e[ ]
f[ ]
g[ ]
h[ ]

7. [ ]

8.[ ]

9i. [ ]

Q-9ii In the last 12 months, have you sold or traded any of your non-racing horses? *(Please circle 'YES' or 'NO')*

1 YES
2 NO

Q-10 Have you ever sold, traded, or given away a horse for any of the following reasons? *(In each case, please circle 'YES' or 'NO')*

a.	Wanted a more advanced or better trained horse	YES	NO
b.	Horse could not be used (e.g. lame)	YES	NO
c.	Horse was too difficult to handle/ride/drive	YES	NO
d.	Rider outgrew the horse	YES	NO
e.	Not enough time to care for the horse	YES	NO
f.	Moving	YES	NO
g.	Other: *(please state briefly)*_____		

Q-11 Have you ever sold any of your horses to the following?

a.	Horse dealer	YES	NO
b.	Another horse person	YES	NO
c.	Slaughter company	YES	NO
d.	Zoo	YES	NO
e.	Other *(please specify)*_____		

HEALTH CARE

The following questions are about your horses' health care and vaccinations. Please refer to old veterinary bills or records if you do not remember the information that we ask for.

Q-12 Are any of your non-racing horses currently vaccinated against any diseases? *(Please circle the number of your answer)*

1 YES ⇨ how many of your horses are vaccinated?_____
2 NO ⇨ *please skip to Q-14*
3 DON'T KNOW ⇨ *please skip to Q-14*

For office use only
9ii[ ]
10.a[ ] b[ ] c[ ] d[ ] e[ ] f[ ] g[ ]
11.a[ ] b[ ] c[ ] d[ ] e[ ]
12. a[ ] b[ ]

Q-13 Are your horses currently vaccinated against the following diseases? That is, have they have had a vaccination or booster in the last year? *(Please circle 'YES' or 'NO' or 'DON'T KNOW' for each vaccine).*

a.	Strangles	YES	NO	DON'T KNOW
b.	Rabies	YES	NO	DON'T KNOW
c.	Tetanus	YES	NO	DON'T KNOW
d.	Influenza (Flu)	YES	NO	DON'T KNOW
e.	Rhino	YES	NO	DON'T KNOW
f.	Encephalomyelitis	YES	NO	DON'T KNOW
g.	Other: *(please specify)* _____			

OWNER

Finally, we would like to ask you a about your horse-related activities.

Q-14 Are you currently a member of a horse-related club? (For example: Horse Trials PEI, Western Horse Association.)

1 YES
2 NO

Q-15 How many years of experience do you have with each of the following aspects of dealing with horses?

a.	Caring for them	_____ YEARS
b.	Owning them	_____ YEARS
c.	Riding or Driving them	_____ YEARS
d.	Other *(please specify)*: _____	_____ YEARS

Q-16 Do you have a trailer or access to a trailer?

1 YES
2 NO

You have finished Section I. If you have any comments on it, please write them on the back of this page. Otherwise, please go on to Section II.

For office use only
13. a[ ] b[ ] c[ ] d[ ] e[ ] f[ ] g[ ]
14.[ ]
15. a[ ] b[ ] c[ ] d[ ]
16.[ ]

APPENDIX 5: QUESTIONNAIRE: SECTION II

COMMENTS

Your comments will be appreciated here. If necessary, please use an additional sheet of paper.

Thank you for your help.

Please give your completed questionnaire to us when we visit on _____(date), at_____(time).

The Prince Edward Island Non-Racing Horse Survey

SECTION II
INDIVIDUAL HORSE INFORMATION

HORSE NAME:_____

- *Please be sure that you have filled out one of these sections for each of your non-racing horses.*
- *If you have more than four horses, please be sure that you have given us information on each of the horses which we have chosen for the study. Their names are on the front of the blue forms.*
- *Please answer all questions to the best of your ability. There is no right or wrong answer to any of the questions*
- *If you have any questions, please do not hesitate to contact me. (Julie Christie:*

SECTION II: INDIVIDUAL HORSE INFORMATION:

GENERAL INFORMATION

Q-1 a. How long have you owned this horse? _____ YEARS

b. Year of birth of horse: _____

c. Sex: *(Please circle a number)* 1 GELDING
2 STALLION
3 MARE

d. Breed: _____

WORK AND EXERCISE

The following questions are about the work, riding or driving of the horse at the present time:

Q-2 Is this horse currently used for any of the following purposes?
(Please circle 'YES' or 'NO' for each of the following)

a.	Breeding	YES	NO
b.	Retired	YES	NO
c.	Pet (no riding)	YES	NO
d.	Trail horse	YES	NO
e.	Riding horse (lessons, in training, etc.)	YES	NO
f.	Dressage	YES	NO
g.	Eventer	YES	NO
h.	Jumper / Hunter	YES	NO
i.	Western pleasure	YES	NO
j.	Western speed (barrels, cutting, etc.)	YES	NO
k.	Reining	YES	NO
l.	Endurance	YES	NO
m.	Driving	YES	NO
n.	Farm labor	YES	NO
o.	Other: (please explain) _____		

_____

_____

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1a.[ ]
b[ ]
c[ ]
d[ ]
2a[ ]
b[ ]
c[ ]
d[ ]
e[ ]
f[ ]
g[ ]
h[ ]
i[ ]
j[ ]
k[ ]
l[ ]
m[ ]
n[ ]
o[ ]

Q-3 Has the horse worn any of the following in the last 4 weeks?
(Please circle 'YES' or 'NO' or 'DON'T KNOW' for each)

a.	Martingale or Training fork	YES	NO	DON'T KNOW
b.	Kicking chains	YES	NO	DON'T KNOW
c.	Crib collar	YES	NO	DON'T KNOW
d.	Chambon	YES	NO	DON'T KNOW
e.	Muzzle	YES	NO	DON'T KNOW
f.	Other:*(Please explain)* _____			

_____

Q-4i Have you (or anyone else) used a bit on this horse in the last 4 weeks?
(Please circle your answer below)
1 YES ⇨ *Please go on to Q-4ii*
2 NO ⇨ *Please skip to Q-5*
3 DON'T KNOW ⇨ *Please skip to Q-5*

Q-4ii Have you or anyone else used any of the following kinds of bits on this horse in the last 4 weeks?

a.	Snaffle	YES	NO	DON'T KNOW
b.	Pelham or kimberwick	YES	NO	DON'T KNOW
c.	Curb	YES	NO	DON'T KNOW
d.	Gag	YES	NO	DON'T KNOW
e.	Other *(Please describe)* _____			

Q-5 What is the main type of work or exercise of this horse at present?
(Please circle the number of your answer)
1 MOSTLY WALK WITH SOME TROT/JOG
2 MOSTLY TROT/JOG WITH SOME CANTER/LOPE
3 ROUGHLY EQUAL AMOUNT OF THE 3 PACES (WALK, TROT/JOG, AND CANTER/LOPE)
4 WALK/TROT/CANTER AND JUMPING
5 NO WORK DONE
6 OTHER:*(Please describe)* _____

_____

_____

_____

For office use only

3a.[ ]
b[ ]
c[ ]
d[ ]
e[ ]
f[ ]
4i[ ]
4ii
a.[ ]
b.[ ]
c.[ ]
d.[ ]
e.[ ]
5[ ]

Q-6 Approximately how many hours per week is the horse currently ridden or driven?

_____ HOURS PER WEEK

For office use only
6[ ]

STABLING/STALLS AND PASTURE

We would like to know about the barn or stable where this horse is presently kept.

Q-7i Is this horse ever kept in a stall?

1 YES ⇨ *Please go on to Q-7ii*
2 NO ⇨ *Please skip to Q-13*

7i[ ]

Q-7ii Approximately how many hours out of 24 does this horse spend in a stall, assuming that the weather is good?

a. In the summer _____ HOURS OUT OF 24
b. In the winter _____ HOURS OUT OF 24

7ii
a[ ]
b[ ]

Q-8 What type of bedding is usually used in this horse's stall? *(Please circle the number that corresponds to your answer)*

1 SHAVINGS/SAWDUST
2 STRAW
3 PEAT
4 OTHER *(Please explain)* _____
5 NONE

8[ ]

Q-9 Does the horse's stall have windows or direct openings to the outside That is, can the horse see outdoors? *(Please circle your answer)*

1 YES
2 NO

9[ ]

Q-10 Does the stall in which this horse is usually kept have windows or other openings to the rest of the barn/stable?

1 YES
2 NO

10[ ]

Q-11 Can the horse see other horses from his/her stall?

1 YES
2 NO

11[ ]

Q-12 Can the horse touch other horses from its stall?

1 YES
2 NO

For office use only
12[ ]

Q -13 During the winter, do you...? *(Please circle 'YES' or 'NO' for each)*

a.	Put a blanket on this horse	YES	NO
b.	Give access to barn or shelter	YES	NO
c.	Heat the drinking water	YES	NO
d.	Increase the feed given	YES	NO
e.	Other: *(Please describe)* _____		

13
a[ ]
b[ ]
c[ ]
d[ ]
e[ ]

Q-14 When this horse is in a paddock or pasture, what is the usual number of horses in this pasture /paddock? _____

14[ ]

Q-15 Do you know the approximate size of pasture that this horse is turned out in? *(Please circle your answer below)*

1 YES ⇨ Please tell us the approximate size: _____ ACRES
2 NO

15a[ ]
b[ ]

TEETH

Q-16 Has a veterinarian or equine dentist ever looked at this horse's teeth? *(Please circle your answer below)*

1 YES ⇨ *Please go on to Q-17*
2 NO ⇨ *Please skip to Q-19*

Q-17 What was the approximate date of the last dental exam?

_____ MONTH _____ YEAR

16[ ]

Q-18 How often does a veterinarian or equine dentist look at this horse's teeth? *(Please circle the number of your answer)*

1 MORE THAN ONCE A YEAR
2 ONCE A YEAR
3 ONCE EVERY 2-3 YEARS
4 LESS THAN ONCE EVERY 3 YEARS

FEET

Q-19 How often are your horse's feet trimmed or shod?
EVERY _____ WEEKS *(Please fill in number)*

Q-20 Which of the following describes your horse's foot care:

1 ALWAYS BAREFOOT
2 ALWAYS SHOD
3 SOMETIMES SHOD, SOMETIMES BAREFOOT
4 OTHER *(Please describe)* _____

_____

Q-21 In the last 12 months, has the horse had any hoof problems? (By "problem", we mean anything that required special attention by a veterinarian or farrier).

1 NO
2 YES:*(Please explain)*_____

_____

_____

Q-22 Does your horse have a history of any of the following foot problems? *(Please circle 'YES' or 'NO' or 'DON'T KNOW' for each)*

a.	Abscess	YES	NO	DON'T KNOW
b.	Thrush	YES	NO	DON'T KNOW
c.	Mud fever or scratches	YES	NO	DON'T KNOW
d.	Laminitis or founder	YES	NO	DON'T KNOW
e.	Navicular	YES	NO	DON'T KNOW

For office use only

18[ ]
19[ ]
20[ ]
21[ ]
22a[ ]
b[ ]
c[ ]
d[ ]
e[ ]

ID #_____

DE-WORMING

Q-23 How often is this horse de-wormed?

1 DAILY
2 5 OR MORE TIMES PER YEAR (BUT NOT DAILY)
3 4 TIMES PER YEAR
4 3 TIMES PER YEAR
5 1-2 TIMES PER YEAR
6 NEVER ⇨ *Please skip to Q-27*

Q-24 Since January, how many times have you (or anyone else) de-wormed this horse?

_____

Q-25 Since January, have you or anyone else given this horse any of the following de-wormers? *(Please circle 'YES' or 'NO' or 'DON'T KNOW' for each of the following)*

a	Ivermectin	YES	NO	DON'T KNOW
b	Eqvalan	YES	NO	DON'T KNOW
c	Zimectrin	YES	NO	DON'T KNOW
d	Strongid (single dose)	YES	NO	DON'T KNOW
e	Strongid (double dose)	YES	NO	DON'T KNOW
f	Quest	YES	NO	DON'T KNOW
g	Anthelcide	YES	NO	DON'T KNOW
h	Other *(Please explain)*			

_____

Q-26i What was the date of this horse's last de-worming?

MONTH: _____ YEAR: _____

Q-26ii What kind of de-wormer did the horse receive at the last de-worming?

_____

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23[ ]
24[ ]
25
a[ ]
b[ ]
c[ ]
d[ ]
e[ ]
f[ ]
h[ ]
26i
[ ]
26ii[ ]

BEHAVIOUR

We are interested in knowing if your horse shows any repetitive behaviours.

Q-27 During the last 4 weeks, has your horse exhibited any of the following behaviours? *(For each, please circle 'YES' or 'NO').*

a.	Cribbing (Grabbing object with teeth and sucking air)	YES	NO
b.	Windsucking (Like cribbing but does not involve grabbing object)	YES	NO
c.	Wood chewing/licking	YES	NO
d.	Tongue playing	YES	NO
e.	Biting at flanks	YES	NO
f.	Head shaking or bobbing	YES	NO
g.	Lip flapping	YES	NO
h.	Leg lifting or pawing	YES	NO
i.	Teeth grinding	YES	NO
j.	Weaving (Moving head and neck from side to side repetitively)	YES	NO
k.	Stall walking	YES	NO
l.	Stall kicking	YES	NO
m.	Stall digging	YES	NO
n.	Fence walking	YES	NO
o.	Other: *please explain*_____		

_____

_____

_____

Q-28i If you answered 'Yes' to any of the above, did the horse show the behaviour(s) before you got him/her?

1 YES
2 NO
3 DON'T KNOW

Q-28ii Over the time that you have owned this horse, approximately how long has he/she been showing this behaviour(s)?

_____

For office use only

27.
a[ ]
b[ ]
c[ ]
d[ ]
e[ ]
f[ ]
g[ ]
h[ ]
i[ ]
j[ ]
k[ ]
l[ ]
m[ ]
n[ ]
o[ ]

28i
[ ]

28ii
[ ]

TRANSPORTATION

The following questions relate to any transportation of this horse since this time last year. Transportation is putting a horse into a trailer, horse box, plane, etc. Thinking back to this time last year, please answer the following questions.

Q-29 In the last 12 months, has this horse been transported at all? *(Please circle your answer below)*

1 YES ⇨ *Please go on to the next question (Q-30i)*
2 NO ⇨ *Please skip to Q-34i*
3 DON'T KNOW ⇨ *Please skip to Q-34i*

Q-30i In the last 12 months, approximately how many times has this horse been transported in a trailer?

_____ TRIPS IN THE LAST 12 MONTHS

Q-30ii What is the longest period of time that this horse has been in a trailer in the last 12 months? _____ HOURS

Q-31 Is this horse usually easy to load (put on a trailer)?

1 YES
2 NO
3 NEVER TRIED TO LOAD THIS HORSE ⇨*Please skip to Q-34i*

Q-32 If this horse does not load well (go easily into a trailer), what do you do to get them to go on?_____

_____

Q-33 In the last 12 months, have you used any of the following methods to get the horse on a trailer?

(Please circle 'YES' or 'NO' for each of the following)

a.	Lunge line	YES	NO
b.	Put another horse on first	YES	NO
c.	Whip	YES	NO
d.	Blindfold	YES	NO
e.	Sedation by drug	YES	NO
f.	Food	YES	NO

For office use only

29[ ]

30i[ ]

30ii
[ ]

31[ ]

32[ ]

33
a[ ]
b[ ]
c[ ]
d[ ]
e[ ]
f[ ]

FEEDING

Q-34i In the summer, how many times per day do you feed dry forage to this horse (hay, silage, chaff, or dengie) ?

_____ TIMES PER DAY

Q-34ii In the winter, how many times per day do you feed dry forage to this horse (hay, silage, chaff, or dengie) ?

_____ TIMES PER DAY

Q-35 If the horse is fed dry forage (e.g. hay), how is the forage usually fed? *(Please circle one answer)*

1 ON THE GROUND
2 IN A HAY RACK
3 IN A HAY NET
4 ROUND BALES
5 OTHER *(Please explain)* _____

Q-36i In the winter, how many times per day do you feed grain or pellets to this horse?

_____ TIMES PER DAY

Q-36ii In the summer, how many times per day do you feed grain or pellets to this horse?

_____ TIMES PER DAY

Q-37 How many hours per day does this horse currently spend in a pasture with grass?

_____ HOURS PER DAY

Q-38 Do you currently feed the horse any supplements, minerals, or vitamins?

1 YES ⇨ What kind? _____

_____

2 NO

For office use only

34i[ ]

34ii[ ]

35[ ]

36i[ ]

36ii[ ]

37[ ]

38
a[ ]
b[ ]

ID # _____

Q-39 a. Do you currently add salt to the horse's feed? YES NO
b. Does this horse currently have access to a mineral block or salt lick? YES NO

Q-40i In the summer, does this horse have continuous access to water during the day?

1 YES
2 NO

Q-40ii In the summer, does the horse have continuous access to water during the night?

1 YES
2 NO

Q-41i In the winter, does this horse have continuous access to water during the day?

1 YES
2 NO

Q-41ii In the winter, does the horse have continuous access to water during the night?

1 YES
2 NO

Q-42 Is this horse currently under the care of a veterinarian for a medical condition?

1 YES
2 NO

For office use only

39a[ ]
b[ ]

40i[ ]

40ii[ ]

41i[ ]

41ii[ ]

42[ ]

You have finished Section II for this horse. Please be sure that you have filled out one of these for each of your non-racing horses that we have selected for the study. If you have more than four horses, please be sure that you have given us information on each of the four horses which we have randomly chosen for the study. If you have any comments, please write them on the back of this page. Thank you very much!

APPENDIX 6: COVER LETTER FOR QUESTIONNAIRE

Date

Address

Dear (Name),

Re: The P.E.I. Non-Racing Horse Survey

Thank you very much for your decision to participate in the PEI Non-Racing Horse Survey. The goal of the survey is to describe the care and health of non-racing horses in PEI and you are one of 150 owners who are helping us to do this.

This letter is a friendly reminder that we will be meeting on September 22nd, 2002 at 2pm, as we discussed over the telephone. Meanwhile, I enclose a questionnaire that has two sections. The first section is a white booklet and you need only fill out one of these. The second section is a blue booklet. You will need to fill out one of these for each of your horses in the study. The name/s of your horse/s is/are written on the cover of the blue booklet/s. I ask that you complete the questionnaires before our meeting. It takes 5-10 minutes to fill out Section I and 10-15 minutes for each Section II. If the horse owner is not able to read or write, or is under the age of 12, it may be necessary to have someone else fill out the questionnaire.

We will collect the questionnaires when we visit. We will also collect feed and fecal samples and the veterinarian, Dr. Pat Campbell, will do a physical exam on your horse(s). Dr. Campbell will not be able to give you specific veterinary advice because he is not your regular vet. However, after our visit we will send you a summary of the findings for each horse. This will include the fecal egg count, feed analysis, and the results of the veterinary examination.

The survey has been approved by the University's Research Ethics Board. If you have any questions about the ethics of the survey please contact the Office of the Vice President of Research and Development, UPEI, at by e-mail at .

Please do not hesitate to contact me if you have any questions or comments.

Yours sincerely,

APPENDIX 7: VETERINARIAN REPORT FROM SITE VISIT

ID #_____

HORSE NAME:_____ Date:_____

-1 = unable to obtain *office use*

1.	HEART RATE: _____ beats per minute	1.[ ]
2.	RESPIRATION RATE:_____ breaths per minute	2.[ ]
3.	RESPIRATION CHARACTER: 01 Normal 02 Abdominal 03 Heaves line 04 Other:_____	3.[ ]
4.	TEMPERATURE: _____ degrees Celsius	4.[ ]
5.	TAIL DOCKED? 01= YES 00= NO	5.[ ]
6.a	WEIGHT:_____ lbs	6a.[ ]
6.b	HEIGHT:_____ hands	6b.[ ]
7.	CLINICAL EVIDENCE OF MUSCULOSKELETAL DISEASE: 00= NO 01= YES 02=UNCERTAIN *If yes: please describe*_____ _____	7.[ ]
8.a	SKIN DISEASE: *(circle 'Y' or 'N' for each of the following)* a Y / N Ringworm b Y / N Laceration on limb c Y / N Laceration on body d Y / N Tumor (melanoma) e Y / N Tumor (sarcoid) f Y / N Tumor (other) g Y / N Hirsutism h Y / N Hair loss (generalized) i Y / N Dermotopholosis j Y / N Pastern dermatitis k Y / N Hair loss (focal) l Other: *If yes: please describe* _____	8.a a [ ] b [ ] c [ ] d [ ] e [ ] f [ ] g [ ] h [ ] i [ ] j [ ] k [ ] l [ ]

8.b	DEHYDRATION: 00 = None 01 = Inelastic skin (5%) 02 = Severely inelastic skin, mucous membranes and mouth dry (> 5%)	8.b[ ]
9.	AGE ESTIMATE : _____ years	9.[ ]
10.	TEETH: *(circle 'Y' or 'N' for each of the following)* a Y / N Sharp enamel points b Y / N Shear mouth c Y / N Wave mouth d Y / N Molar hook (rostral) e Y / N Molar hook (caudal) f Y / N Teeth missing: *Identify tooth if missing*: _____ g Y / N Infection h Y / N Malocclusion i Y / N Other:_____	10. a[ ] b[ ] c[ ] d[ ] e[ ] f[ ] g[ ] h[ ] i[ ]
11.	SHOEING: *(Circle one)* 01 All feet shod 02 Front feet shod only 03 No feet shod 04 Other:_____	11.[ ]
12.	HOOF WALL CONFORMATION:*(circle 'Y' or 'N' for each)* a Y / N Cracks b Y / N Avulsions c Y / N Under-run heels d Y / N Broken hoof e Y / N White line disease f Y / N Excessive length of toe g Y / N Abscess h Y / N Pastern axis i Y / N Other: *describe*_____	12. a[ ] b[ ] c[ ] d[ ] e[ ] f[ ] g[ ] h[ ] i[ ]
13.	GAIT IRREGULARITY: *(Circle one)* 01 None 02 Fore limb 03 Hind limb 04 Other:_____	13.a [ ]
14.	GRADE OF LAMENESS: *(from 0-5)*: _____	14.[ ]

15.	BODY CONDITION SCORE: *(from 1-9)*: _____	15.[ ]

16.	WHISKERS REMOVED? 01= YES 00= NO If Yes: where?_____	16.[ ]
17.	FECES *Circle one)* 01 Normal 02 Loose 03 Dry 04 None seen	17.[ ]
18.	SCARS? 01= YES 00= NO If yes, where?_____	18.[ ]
19.	NASAL DISCHARGE: *(Circle one)* 01 None 02 Clear 03 White 04 Yellow 05 Bloody 07 Other:_____	19.[ ]
20.	BEHAVIOUR: *(Circle one)* 01 Bright and Alert 02 Nervous or Spooky 03 Lethargic 04 Distressed 05 Stereotypy: *describe*_____ _____	20.[ ]
21.	OTHER OBSERVATIONS: 01= YES 00= NO _____ _____ _____ _____	21.[ ]

Veterinarian's Signature: _____ Date: _____

APPENDIX 8: NON-VETERINARY DATA SHEET FOR SITE VISIT

Owner ID # _____

Data Collection check list at site visit: Non-Veterinary Information

General Info:

Questionnaire collected	1 YES: *check number of section II's collected*: _____ 2 NO: *envelope provided for mailing?* YES NO	
Hay collected	1 YES 2 NO	
Hay type	1 SQUARE BALES 2 ROUND BALES 3 NONE	
Storage of grain	1 SEALED CONTAINER 2 NO CONTAINER (i.e. bag) 3 NO GRAIN AVAILABLE (but usually fed) 4 NO GRAIN FED	
Air temperature	_____ degrees Celsius	

Individual Horse Info:

Horse name: _____ **Horse ID #** _____

Fecal sample	1 FRESH 2 OWNER COLLECTED PRIOR 3 TAKEN FROM PASTURE/STALL 4 NONE COLLECTED	
Stereotypy observed	1 YES: _____ 2 NO 3 HORSE NOT OBSERVED	
Body Condition Score	_____ *(between 1-9)*	
Type of grain fed	_____	
Weight of grain fed per meal	_____ X _____ TIMES PER DAY	
Grain collected	1 YES 2 NO	
Weight of Hay per meal	_____ X _____ TIMES PER DAY	

Owner ID # _____

Horse name: _____ **Horse ID #** _____

Fecal sample	1 FRESH 2 OWNER COLLECTED PRIOR 3 TAKEN FROM PASTURE/STALL 4 NONE COLLECTED	
Stereotypy observed	1 YES: _____ 2 NO 3 HORSE NOT OBSERVED	
Body Condition Score	_____ *(between 1-9)*	
Type of grain fed	_____	
Weight of grain fed per meal	_____ X _____ TIMES PER DAY	
Grain collected	1 YES 2 NO	
Weight of Hay per meal	_____ X _____ TIMES PER DAY	

Horse name: _____ **Horse ID #** _____

Fecal sample	1 FRESH 2 OWNER COLLECTED PRIOR 3 TAKEN FROM PASTURE/STALL 4 NONE COLLECTED	
Stereotypy observed	1 YES: _____ 2 NO 3 HORSE NOT OBSERVED	
Body Condition Score	_____ *(between 1-9)*	
Type of grain fed	_____	
Weight of grain fed per meal	_____ X _____ TIMES PER DAY	
Grain collected	1 YES 2 NO	
Weight of Hay per meal	_____ X _____ TIMES PER DAY	

APPENDIX 9: FECAL ANALYSIS

The Cornell-McMaster dilution egg counting technique was applied (Bowman 1999, p.290). Ten grams of feces were weighed and added to 150 mL distilled water. The mixture was vigorously stirred for two minutes. On a home-made double counting slide, 300 μL of a sugar solution (made from 5000g sucrose, 4L water and 32 grams phenol crystals) was mixed with 300 μL of the fecal solution. A second slide was prepared in the same way to ensure a more accurate count. Both slides were allowed to stand for a minimum of 15 minutes before counting. The number of *Strongylus* type eggs was counted and multiplied by a factor of 50 to obtain the fecal egg count (eggs per gram).

Bowman D (1999), *Georgis' Parasitology for Veterinarians*, W.B. Saunders Co., Philadelphia

APPENDIX 10: FEED ANALYSIS

Hay and grain were analyzed at the Soil and Feed Testing Laboratory of the Prince Edward Island Department of Agriculture (440 University Ave., Charlottetown, PEI., C1A 7N3) using the following procedures:

Sample preparation

Approximately 80-90 grams of sample were measured accurately into a 3lb brown paper bag which was left in an oven for 16 hours. Hay samples was left at 60 ± 10° C, grain at 105 ± 10° C. The following morning, the dry weight was measured and the % dry matter was calculated using the following formula:

$$\%DM = (\text{wt of dried sample})/(\text{wt of original sample}) \times 100$$

Following standard laboratory procedures, feed was ground to a diameter of 1 mm using the Thomas Wiley Silage Grinder #4 (Arthur H. Thomas Company, Philadelphia, PA).

Digestible Energy

Acid detergent fibre (ADF) was determined according to standard procedures (Komarek *et al* 1994) using an Ankom Fibre analyzer (Ankom Technology Corp, Fairport, NY). Digestible energy (DE) was calculated using the following formula:

$$DE = 4.618 + (-0.0573 * ADF)$$

Komarek AR, Robertson JB, Van Soest PJ (1994), A comparison of methods for determining ADF using the filter bag technique versus conventional filtration, *J Dairy Sci* 77: 114

APPENDIX 11: NUTRITIONAL ANALYSIS EXAMPLE

Horse: "007-03"

Weight 275 kg. Maintenance
Time at grass (hours): 18
Diet Produced 08/21/2002. Feeding costs not calculated

DIET
21.0 kg Summer pasture
1.2 kg Shur-Gain Multi-Texture Sweet Feed

NUTRIENT COMPOSITION

Nutrient		Required	Intake	Balance	
Energy	MCal/day	8.7	10.0	1.4	116*
Crude protein	g/day	347.4	786.0	438.6	226*
Lysine	g/day	12.2	16.8	4.6	138
Calcium	g/day	13.8	27.6	13.9	201
Phosphorus	g/day	9.6	19.4	9.8	202
Magnesium	g/day	5.2	6.3	1.2	122
Sodium	g/day	5.4	15.3	9.9	282
Iron	mg/day	217.1	462.0	244.9	213
Copper	mg/day	56.5	21.8	-34.6	39*
Manganese	mg/day	217.1	176.4	-40.7	81
Zinc	mg/day	225.8	193.2	-32.6	86
Selenium	mg/day	0.6	0.0	-0.5	7*
Cobalt	mg/day	0.6	0.8	0.3	149
Iodine	mg/day	0.6	0.8	0.2	134
Vitamin A	IU/day	12375	55200	42825	446
Vitamin D	IU/day	1694	5880	4186	347
Vitamin E	IU/day	282	540	258	191
Vitamin B1	mg/day	13	13	-0	97
Vitamin B2	mg/day	9	59	50	677
Vitamin B6	mg/day	4	0	-4	0
Vitamin B12	mg/day	0.04	0.00	-0.04	0
Niacin	mg/day	43	353	309	812
Folic acid	mg/day	4	21	17	484

Calcium/Phosphorus-ratio 1.4
Crude protein 78.3 g/MCal
*: Content of nutrient outside optimal area

Feeding Produced 08/21/2002 Licence: Julie Christie□26B65177A1BC1951□□

APPENDIX 12: COVER LETTER FOR SITE VISIT FINDINGS

Date

Address

Dear (Name),

Re: The P.E.I. Non-Racing Horse Survey

Thank you very much for your participation in the PEI Non-Racing Horse Survey. You have helped us to achieve our goals of describing the care and health of non-racing horses in PEI. Enclosed is a summary of our findings including a nutrition analysis, veterinary examination summary and fecal egg count for each of your horse/s.

We have not yet finished with our analysis of all the findings throughout Prince Edward Island. We will have completed data analysis in the Spring of 2003, at which point we will mail you a booklet summarizing the care and health of non-racing horses in PEI. This booklet will also include information on those areas which may be of interest or of concern and include suggestions for management that may help to improve their physical and mental welfare.

All information that you have provided is strictly confidential. The only people that have access to the data are the study personnel. The booklet will not include information that can be linked to any individual animal or horse owner.

This study has been approved by the University's Research Ethics Board. If you have any questions about the ethics of this survey please contact the Office of the Vice President of Research and Development, UPEI, at by e-mail at

Please do not hesitate to contact me about any questions or comments.

Yours sincerely,

APPENDIX 13: FEED ANALYSIS EXAMPLE

DR MARY MCNIVEN
C/O ATLANTIC VET COLLEGE, UPEI
550 UNIVERSITY AVE
CHARLOTTETOWN, PE
C1A 4P3

Soil & Feed Testing Laboratory
PEI Department of Agriculture
& Forestry
440 University Avenue
PO Box 1600, Charlottetown, PEI
C1A 7N3
Fax: (902) 368-6299
Telephone: (902) 368-5628

Standards Council of Canada Accredited Laboratory Scope of Accreditation 424 — Conseil canadien des normes Laboratoire accrédité Portée d'accréditation 424 TM

National Forage Testing Association 2002 Certified Chemistry NFTA Excellence In Forage Testing

Prince Edward Island Canada

Client: 1617
Accession: 10963
Samples Reported: 01/08/2002
Samples Received: 30/07/2002

Analysis Performed	Lab #: 10963-5 Feed Type MIXED HAY Sample Id 019		Lab #: 10963-6 Feed Type MIXED HAY Sample Id 036		Lab #: 10963-7 Feed Type MIXED RATION Sample Id 019 Ration		Lab #: 10963-8 Feed Type MIXED RATION Sample Id 049	
	Results as Fed basis	Results Dry Matter basis	Results as Fed basis	Results Dry Matter basis	Results as Fed basis	Results Dry Matter basis	Results as Fed basis	Results Dry Matter basis
Dry Matter %	86.60		74.40		87.50		87.30	
Crude Protein %	7.06	8.15	5.35	7.19	12.91	14.75	10.65	12.20
ADF %	31.04	35.84	30.47	40.96				
TDN %	51.08	58.98	39.95	53.69				
NEl Mcal/kg	1.13	1.30	0.86	1.15				
EST D.E. MCal/kg	2.22	2.56	1.69	2.27				
Calcium %	0.44	0.51	0.15	0.20	0.48	0.55	0.59	0.68
Phosphorus %	0.20	0.23	0.16	0.21	0.46	0.53	0.52	0.59
Magnesium %	0.12	0.14	0.06	0.08	0.22	0.25	0.19	0.22
Potassium %	1.54	1.78	1.28	1.72	0.64	0.73	0.48	0.55
Salt NaCl %					0.43	0.49	0.92	1.05
Copper ppm	3.99	4.61	1.94	2.61	19.11	21.84	27.14	31.09
Zinc ppm	11.22	12.96	15.27	20.53	80.41	91.90	86.19	98.73
Sodium %					0.17	0.19	0.36	0.41
NEg Mcal/kg	0.55	0.63	0.38	0.51				
NEm Mcal/kg	1.15	1.33	0.90	1.21				

We are currently members of the Association of American Feed Control Officials (AAFCO), The National Forage Testing Association Program (NFTA) and the Canadian Grain Commission (CGC).
We are accredited by the Standards Council of Canada (SCC) and ISO 9002 recognized.

*Protein and Moisture analysis on whole grains done on the Infratec 1225 **Procedure for fat analysis taken from AAFCO methods Moistures: 135C for 2 hours

ADF	973.18
ASH	942.05
Crude Protein*	990.03

Fat	3.09**
Minerals	968.08
Moisture*	930.15

Copies to:

Senior Lab Technologist: Harvey Cairns
Approved by:

Visit our home page on the World Wide Web www.gov.pe.ca/af/soilfeed

APPENDIX 14: COVER SHEET FOR SITE VISIT FINDINGS

Prince Edward Island Non-Racing Horse Survey

Summary of findings from site visit and analysis

1. **Veterinary exam**: Did the exam indicated that any of the horses require veterinary attention?
   - ☐ NO
   - ☐ YES: If yes, why? _____

2. **Fecal egg counts**: Normal count is less than 150 eggs per gram of feces

Horse name	Count (eggs per gram of feces)	Contact your regular veterinarian (Yes or No)

3. **Nutritional analysis**:
A summary of the nutritional analysis is attached. The information on this page has been estimated by a computer program based on your horse's breed, age, exercise, and feed. The page shows four columns of numbers:

- The first column ("Required") indicates the amount of each nutrient that the horse requires.
- The second column ("Intake") indicates how much of each nutrient that your horse is receiving.
- The third column ("Balance") shows the difference between the first and second columns.
- The final column describes the percentage of each nutrient that your horse is receiving. For example, if the last column for crude protein is 156, the horse is receiving 56% more protein than is required. If, however, the last column were 79, the horse is receiving 79% of what he/she requires. If there is a star (*) next to any of the values in the last column, it means that the nutrient is outside the ideal range (the horse is either getting too much or too little of the nutrient).

Please contact your veterinarian or nutritionist if you have any concerns about feeding your horse/s.

4. **Feed analysis**
If your horse is fed hay or non-commercial grain, the feed was analyzed for nutrient composition and the results are attached. If your horse is fed a commercial grain, the nutrient composition is shown on your feed bag.

- ☐ Grain ⇨ *See attached "Feed test report" for grain composition*
- ☐ Hay ⇨ *See attached "Feed test report" for hay composition*
- ☐ None

APPENDIX 15: ABUSE POLICY

THE PRINCE EDWARD ISLAND NON-RACING HORSE SURVEY: GUIDELINES

Background

The purpose of the P.E.I. Non-Racing Horse Survey is to describe the status of non-racing horses in P.E.I.. In the unlikely event that a horse's welfare appears to be at grave risk for several reasons, the team would like the opportunity to notify the appropriate authority (PEI Department of Agriculture and Forestry), without breaching confidentiality. To address this, the second draft of the consent form, used since ~April, states that "Subject to our policy on animal abuse, all information which horse owners provide is strictly confidential...". This permits the team to notify the PEI Department of Agriculture and Forestry in the unlikely event of having serious concern about a horse's welfare. However, the team may not notify the PEI Department of Agriculture and Forestry about horses of concern whose owners signed the original consent form (approximately before April 1st). To report those owners would be a breach of confidentiality, owing to the wording of the original form.

Purpose of Guidelines

The guidelines will help personnel who, during the survey, encounter a horse that is in grave distress and/or at grave risk, to decide whether to advise the P.E.I. Department of Agriculture about the concern. The guidelines have been compiled to reduce the risk of false positives.

Use of Guidelines

Five categories have been described in the guidelines: *Body condition, Weather safety, Environmental health, Physical care and Veterinary assessment (general physical exam).* Within each category are scores ranging from 1 to 5; each score is described by a number of specific criteria (detailed in the following pages). In order for a horse to be assigned a particular score, some or all of the criteria for that score must be present. The exception is the category, *Veterinary assessment*: this has a binary score - a horse either has or does not have a listed clinical sign.

For each of the five categories, judgement may be exercised in assigning a score. In order to forward a concern to the PEI Department of Agriculture, at least three of the following scores must apply:

- body condition score below 3,
- weather safety score of 3 or higher,
- environmental health score of 3 or higher,
- physical care score above 3,
- condition requiring immediate or urgent veterinary treatment.

Upon completion of the visit where any of the study team feel there may be grave risk to the welfare of the horse/s, each person will immediately compile notes for each of the five categories in the guidelines (see pages 2-5). No discussions will take place until after everyone has made their notes. A meeting will then be held at the earliest convenience with at least two of the following supervisory committee members: Dr. C. Hewson, Dr. L. Bate, Dr. C. Riley, and Dr. M. McNiven.

THE PRINCE EDWARD ISLAND NON-RACING HORSE SURVEY: GUIDELINE CATEGORIES

I. Body condition

Body condition of horses is scored on a scale of 1-9. This scoring system was originally developed by Henneke et al. (1983). A score of 1 indicates an extremely thin horse and a score of 9 an extremely fat horse. Body condition is assessed by a visual examination and palpation in each of six areas: the loin, ribs, tailhead, withers, neck, and shoulder. Body condition will be assessed by the project veterinarian at the site visit.

II. Weather safety (Summer / early fall)

The weather safety score is assessed by:

- the environmental temperature to which the horse is exposed,
- availability of clean water and shelter.

The scale ranges from 1 to 3, 3 being reason for grave concern and 1 being adequate. When assigning a score, the following points are considered:

- If there is no water available at the time of visit (or the water is extensively contaminated with organic or other debris), there is said to be no water available.
- Shelter is defined as trees, walls, the side of a building, sheds, stalls, or any other building that provides shade or protection from the elements. There must be enough shelter space for each horse in the pasture or paddock to stand comfortably. The minimum shelter size or shaded area is equivalent to the recommended loading density for the transportation of an adult horse: 0.7 m x 2.5m or 1.75m^2 per horse *(EU recommended loading capacities for domestic solipeds (equines) by road or rail under Directive 95/29/EC)*. This space will not be measured but the EU guideline will be mapped out and memorized by the team before site visits
- Add one point if horse is obese (BCS of 8 or 9).
- Add one point if air temperature is above 25 ° C.

3 **Reason for grave concern**

- There is no shelter available to the horse during the day.
- There was no water available to horse at time of visit.

2 **Reason for concern**

- There is some shelter available to the horse, but it may not meet the specifications outlined above or there may be too many horses in pasture for each to have protection from sun or insects.
- Water is available

1 **Adequate**

- There is adequate shelter available for the horse.
- Clean water is available.

III. Environmental health

The environmental health score is based on accumulation of feces, odor, urine, mud, garbage and debris in the surrounding environment. Other factors such as the presence of dangerous items and the contamination of food or water will also be taken into consideration. The scale ranges from 1-4 with 4 being reason for grave concern and 1 being adequate

4 **Reason for grave concern**

- The stall or pasture in which the horse resides has weeks of accumulation of manure and/or urine.
- The odor will be very apparent and footing very deep and wet. The animal will not be able to avoid this footing, manure, and smell.
- There is a large accumulation of garbage, debris, and/or dangerous items in the stall or pasture.
- The food and/or water is visibly contaminated.

3 **Reason for concern**

- The stall or pasture will have many days' accumulation of manure and/or urine which is difficult for the horse to avoid.
- There is a moderate amount of garbage, debris, and/or clutter which restricts the movement or comfort of the horse.
- Dangerous items are present and pose a risk of injury.
- Significant odor present and wet conditions.
- Any food that is available to the horse may or may not be visibly contaminated.

2 **Marginal**

- The stall or pasture in which the horse resides has several days of accumulation of manure and/or urine.
- The horse is able to avoid contact with these conditions.
- There is debris and clutter present but this does not prohibit the horse from lying down comfortably.
- There are no dangerous items that could cause injury.
- Any food that is available to the horse is not visibly contaminated.

1 **Adequate**

- The stall or pasture is dry and has very little accumulation of manure, garbage, or clutter.
- There is no contamination of the food or water
- There are no dangerous items that could cause injury.

IV. Physical care

The physical care score is assessed by the horse's hoof condition, presence of intestinal parasites, and fitting of halter. The scale ranges from 1 to 5 with a score of 5 being reason for grave concern and a score of 1 being adequate.

5 **Reason for grave concern**

- The hooves are severely overgrown and prevent normal movement.
- There may be obvious presence of intestinal parasites (through fecal examination) which are at dangerous levels for the horse's health.
- The halter, if present may be embedded in the hair or cause obvious pain to the head area due to broken clasps or improper fitting.

4 **Reason for concern**

- The hooves are significantly overgrown and cause difficulties in movement. Hooves may be badly chipped or cracked.
- There may be very high levels of parasites in the feces.
- The halter, if present may be too tight and may cause an abrasion.

3 **Marginal**

- Hooves are overdue for a trim and cause somewhat abnormal movement.
- There may be high parasite levels in the feces.
- The halter, if present, is too loose, posing a risk of it catching, or is too tight, but not so as to cause an abrasion

2	**Lapsed**	• Hooves are overgrown but do not prevent normal movement. If shoes are worn, there may be a missing shoe. • The parasite levels in the feces may be above the normal range. • The halter, if present, fits comfortably.
1	**Adequate**	• Hooves are not in need of trimming. • Intestinal parasite levels are within the normal range for a horse. • The halter, if present, fits comfortably.

V. Veterinary assessment : general physical exam

The project veterinarian will perform a general physical examination at the site visit. They will determine if the horse has a serious illness or wound that requires veterinary attention. If any of the following is observed and is not currently receiving veterinary attention, then the project veterinarian will identify the horse as being in being in immediate or urgent need of veterinary treatment.

- Chronic and extensive untreated skin lesions or disease (e.g. ringworm, lice, mud fever).
- Lame so that horse is reluctant to bear weight or non-weight bearing on one leg (grade of 4 or 5).
- Profuse untreated diarrhea.
- Profuse purulent or bloody nasal discharge.
- Severe difficulty in breathing (respiratory distress).
- Severe wound that is clearly visible (eg. Infected and/or untreated).
- Dehydration of more than 5% and no access to water (note: both >5% dehydration and lack of water must be present to conclude that the horse is in need of veterinary attention).
- Rectal temperature above 40 ° C.

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Henneke DR, Potter GD, Kreider JL, Yeates BF (1983). Relationships between condition score, physical measurements, and body fat percentage in mares. *Equine Veterinary Journal*. 15 (4): 371-372

Maryland Horse Council (2001) Equine Minimum Standards of care. Http://www.everyoneneedsahome.org/eqminstd.htm

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THE PRINCE EDWARD ISLAND NON-RACING HORSE SURVEY:
GUIDELINES: POST SITE VISIT NOTES

Body condition score: _____

Weather safety score: _____

Environmental health score: _____

Physical care score: _____

Veterinary care required? YES NO

Other:

APPENDIX 16: Summary of all data collected from questionnaire and site visit

16.1 Continuous Data (mean and standard deviation)

16.1.1 Horse level continuous data (Veterinary Report)

	Miniature horses (n=34)	Light horses (n=224[1])	Draft horses (n=51)
Heart rate	55 ± 13	47 ± 11	47 ± 11
Respiratory rate	34 ± 20	25 ± 11	28 ± 9
Body temperature (°C)	37.49 ± 0.36	37.4 ± 0.43	37.76 ± 0.28
Weight (lbs)	242 ± 77.2	913 ± 260	1556 ± 450.9
Height (inches)	34.04 ± 3.2	56.8 ± 6.2	66.7 ± 5.84
Age	5.60 ± 4.6	10.4 ± 7.8	8.27 ± 5.49
Body condition score	5.63 ± 0.75	5.64 ± 0.98	6.38 ± 1.14

16.1.2 Horse level continuous data (Section II)

Q-1a: Years owned horse	4 ± 3	7 ± 7	4 ± 4
Q-1b: Year of birth of horse	1996 ± 5	1991 ± 9	1995 ± 6
Q-6: Hours of work per week	0.68 ± 1.47	1.51 ± 2.64	4.64 ± 9.57
Q-7iia: Hrs. per day in stall (summer)	7.7 ± 7.1	4.5 ± 7.1	6.8 ± 8.6
Q-7iib: Hrs per day in stall (winter)	15.1 ± 5.5	15.1 ± 6.2	14.9 ± 8.6
Q-14: Number horses in pasture	7 ± 7	3 ± 2	3 ± 2
Q-15b:Size of pasture (acres)	3.2 ± 3.9	6.0 ± 8.8	7.5 ± 5.4
Q-17: Date of last dental exam	2000 ± 1.3	2000 ± 3.9	2000 ± 2.6

[1] Any missing data was caused by owners not completing the full questionnaire or the horse being fractious at the site visit. Three Section IIs and 7 Section Is of the questionnaire were not completed at all.

Q-19: Freq. of farrier care (weeks)	10 ± 4	12 ± 9	12 ± 7
Q-24: Times de-wormed since Jan.	3 ± 2	1 ± 1	1 ± 1
Q-26i: Year of last de-worming	2002 ± 0.18	2001.9 ± 0.3	2001.6 ± 0.5
Q-30i: Times transported in last year	5 ± 3	4 ± 4	8 ± 12
Q-30ii: Longest time spent in transport in past year	2.3 ± 1.3	2.1 ± 5.6	3.2 ± 1.8
Q-34i: Times fed forage per day (summer)	2 ± 1	1 ± 1	1 ± 1
Q-34ii:Times fed forage per day (winter)	3 ± 1	3 ± 1	2 ± 1
Q-36i: Times fed grain per day (winter)	2 ± 1	2 ± 1	2 ± 1
Q-36ii: Times fed grain per day (summer)	1 ± 1	1 ± 1	1 ± 1
Q-37: Hours in pasture with grass (current)	10.8 ± 10.2	18.5 ± 8.4	16.6 ± 9.1

16.1.3 Horse level continuous data (Non-veterinary data)

Weight of grain per meal (lbs)	0.39 ± 0.2	2.3 ± 1.6	4.3 ± 3.7
Times fed grain per day	1 ± 1	2 ± 1	2 ± 0
Weight of hay per meal (lbs)	3.6 ± 2.7	8.4 ± 5.5	16.7 ± 14
Times fed hay per day	2 ± 1	2 ± 1	2 ± 1

16.1.4 Owner level continuous data (Section I)

Q-1: Number of non-racing horses owned	2.93 ± 4.13
Q-2a: Hours spent in pasture per day (summer)	19.7 ± 6.6
Q-2b: Hours spent in pasture per day (winter)	10.1 ± 7.7

Q-12a: Number of horses vaccinated	2.5 ± 1.78
Q-15a: Years experience caring for horses	19.1 ± 15.1
Q-15b: Years experience owning horses	17.1 ± 13.9
Q-15c: Years experience riding or driving	18.0 ± 14.9
Non-veterinary horse level continuous data:	
Average air temperature at site visit (degrees Celsius)	22.9 ± 4.5

16.2 Categorical data (frequency and percentage)

16.2.1 Horse level categorical data (Veterinary Report)

		Miniature horse (n=34)	Light horse (n=224)	Draft horse (n=51)
General				
Respiration character	Normal	24 (70.6%)	182(80.9%)	43 (84.3%)
	Abdominal	10 (29.4%)	39 (17.3%)	8 (15.7%)
	Heaves line	0	4 (1.8%)	0
Tail docked	Yes	0	0	28 (54.9%)
	No	34 (100%)	225(100%)	23 (45.1%)
Musculoskeletal disease	No	32 (94.1%)	202 (89.4%)	47 (92.2%)
	Yes	2 (5.9%)	20 (8.9%)	4 (7.8%)
	Uncertain	0	4 (1.8%)	0
Dehydration	None	33 (97.1%)	190 (86.0%)	49 (98.0%)
	5%	1 (2.9%)	31 (14.0%)	1 (2.0%)
	>5%	0	0	0
Feces	Normal	25 (73.5%)	127 (59.4%)	38 (77.6%)
	Loose	1 (2.9%)	18 (8.4%)	2 (4.1%)
	Dry	1 (2.9%)	5 (2.3%)	0
	None seen	7 (30.6%)	64 (29.9%)	9 (18.4%)

Behaviour	Bright and alert	32 (94.1%)	190 (84.1%)	45 (88.2%)
	Nervous	2 (5.9%)	26 (11.5%)	6 (11.8%)
	Lethargic	0	3 (1.3%)	0
	Distressed	0	1 (0.4%)	0
	Stereotypy	0	6 (2.7%)	0
Gait irregularity	Hindlimb	1 (3.0%)	18 (8.6%)	2 (4.3%)
	Forelimb	2 (6.1%)	23 (10.9%)	5 (10.9%)
	Other	0	2 (0.95%)	2 (2.2%)
Whiskers removed		4 (11.8%)	20 (8.8%)	5 (9.8%)
TEETH				
Sharp enamel points		3 (8.8%)	19 (8.9%)	5 (10.0%)
Molar hook		4 (11.8%)	21 (9.9%)	15 (30.0%)
Wave mouth		3 (8.82%)	7 (3.3%)	0
Teeth missing		0	4 (1.9%)	1 (2.0%)
Malocclusion		1 (2.9%)	5 (2.4%)	0
FEET				
Shoeing	All feet shod	0	4 (1.8%)	16 (31.4%)
	Front feet shod	0	19 (8.4%)	0
	No feet shod	34 (100%)	200 (88.5%)	34 (66.7%)
Cracks		0	48 (21.7%)	29 (56.8%)
Broken hoof		3 (8.8%)	69 (31.2%)	26 (51.0%)
White line disease		0	20 (9.1 %)	6 (11.8%)
Excessive length		9 (26.5%)	66 (29.9%)	7 (13.7%)

16.2.2 Horse level categorical data (Section II)

Q-1c:Sex	Gelding	107 (35.8%)
	Stallion	23 (7.7%)
	Mare	169 (56.5%)

Q-1d: Breed	American Creme	1
	American Saddle Bred	2
	American Saddlebred	2
	American Saddlebred x Pinto	1
	Appaloosa (App)	10
	App x Arab	1
	App x TB	1
	Arab	12
	Arab x Hanovarian	1
	Arab x Morgan	1
	Arab x Percheron	1
	Arab x Standard bred	1
	Arab x Standardbred	2
	Arab x Welsh	2
	Belgian	24
	Belgian - Standard Bred	1
	Belgian x American Saddlebred	1
	Belgian x Percheron	1
	Belgian x QH	1
	Canadian	9
	Canadian Sporthorse	2
	Canadian x Percheron	1
	Clydesdale	5
	Draft	2
	Dutch Warmblood\	1
	French Canadian	1
	Grade	3
	Hannovarian x TB x Standardbred	1
	Mini	32
	Mini x Pony	1
	Mini x Shetland	1
	Morgan	6
	Morgan x QH	1
	Newfoundland	6
	Norwegian Fjord	3
	Paint	11
	Paint x Morgan	1

	Palomino	1
	Percheron	12
	Pinto	4
	Pony	14
	Quarter horse (QH)	34
	QH x American Saddle	1
	QH x App	3
	QH x Arab	3
	QH x Clydesdale	1
	QH x Draft	1
	QH x Morgan	3
	QH x Paint	1
	QH x TB	2
	QH x TB x Morgan	1
	QH x Work Horse	1
	QH x app x TB	1
	Shetland	1
	Shetland Pony	2
	Shetland x Newfoundland	1
	Shire x TB	1
	Standard x arab	1
	Standardbred	20
	Standardbred/Trakhener	1
	TB	3
	TB x Canadian x Standardbred	1
	TB x Hannovarian	3
	TB x Morgan	1
	TB x Percheron	1
	TB x QH	1
	Thoroughbred/Trakhener	1
	Welsh	4
	Welsh x Arab	1
	Unknown	31
Q-2 Use	Breeding	57 (19.1%)
	Retired	51 (17.1%)
	Pet (no riding)	106 (35.5%)
	Trail horse	51 (17.1%)
	Riding horse	74 (24.8%)
	Dressage	7 (2.3%)

	Eventing	5 (1.7%)
	Jumper/Hunter	17 (5.7%)
	Western Pleasure	41 (13.7%)
	Western Speed	8 (2.7%)
	Reining	5 (1.7%)
	Endurance	3 (1.0%)
	Driving	45 (15.1%)
	Farm labor	24 (8.0%)
Q-3: Equipment Used	Martingale or training fork	17 (5.7%)
	Kicking chains	1 (0.3%)
	Crib collar	10 (3.4%)
	Chambon	3 (1.0%)
	Muzzle	1(0.3%)
Q-4i:Use of bit in last 4 weeks	Yes	117 (39.3%)
	No	181 (60.7%)
Q-4ii: Type of bit used (if any had been used in the 4 weeks before completing the questionnaire)	Snaffle	88 (77.9%)
	Pelham or Kimblewick	10 (8.9%)
	Curb	20 (17.9%)
	Gag	4 (3.6%)
Q-5: Type of work or exercise	1 Mostly walk 2 Mostly trot/jog 3 Equal amounts of paces 4 Three paces/ jumping 5 No work done 6 Other	79 (26.8%) 18 (6.1%) 29 (9.8%) 7 (2.4%) 158 (53.6%) 4 (1.4%)
STABLING		
Q-7i: Horse ever kept in a stall (YES)		230 (77.4%)
Q-8: Bedding	Shavings or Sawdust	61 (26.4%)

	Straw	159 (68.8%)
	Peat	3 (1.3%)
	None	3 (1.3%)
Q-9: Stall with openings to outside		167 (72.3%)
Q-10: Stall with openings to barn		218 (94.4%)
Q-11: Ability to see other horses from stall		199 (86.2%)
Q-12: Ability to touch other horses from stall		123 (53.0%)
Q-13: Winter care	Blanket	43 (14.5%)
	Shelter access	277 (93.6%)
	Warm water	69 (23.3%)
	Increased feed	211 (71.5%)
Q-16: Has veterinarian ever looked at teeth?	Yes	111 (37.2%)
	No	187 (62.8%)
Q-18: Frequency of dental care, if provided	More than once per year	3 (2.7%)
	Once per year	42 (37.8%)
	Once every 2-3 years	37 (33.3%)
	Less than once every 3 years	25 (22.5%)
Q-20: Hoof Care	Always barefoot	227 (76.7%)
	Always shod	10 (3.4%)
	Sometimes shod	59 (19.9%)
Q-21: Hoof problems in last year		23 (7.7%)
Q-22: Foot problem history	Abscess	9 (3.0%)
	Thrush	25 (8.4%)
	Mud fever	7 (2.3%)
	Laminitis or founder	15 (5.0%)
	Navicular	7 (2.3%)

DEWORMING		
Q-23: Frequency	Daily	0
	5 or more per year	22 (7.4%)
	4 per year	69 (23.3%)
	3 per year	56 (18.9%)
	1-2 per year	126 (42.6%)
	Never	23 (7.8%)
Q-25: Type of de-wormer used since January	Ivermectin	102 (39.6%)
	Eqvalan	54 (20.2%)
	Zimectrin	20 (7.5%)
	Strongid (single)	54 (20.2%)
	Strongid (double)	16 (6.0%)
	Quest	50 (18.7%)
	Anthelcide	7 (2.6%)
BEHAVIOUR		
Q-27: Behaviour	Cribbing	11 (3.8%)
	Windsucking	11 (3.8%)
	Wood chewing	62 (21.2%)
	Tongue playing	9 (3.0%)
	Biting at flanks	5 (1.7%)
	Head Shaking	16 (5.5%)
	Lip flapping	16 (5.5%)
	Leg lifting	38 (13.0%)
	Tooth grinding	4 (1.4%)
	Weaving	14 (4.8%)
	Stall walking	8 (2.7%)

	Stall kicking	9 (3.1%)
	Stall digging	13 (4.5%)
	Fence walking	9 (3.1%)
Q-28i: Did the horse show the behaviour before acquired	Yes	32 (27.0%)
	No	27 (22.7%)
	Don't Know	60 (50.4%)
Q-29: Has horse been transported in last year		142 (47.2%)
Q-31: Is the horse easy to load	Yes	121 (86.4%)
	No	14 (10.0%)
	Never tried	5 (3.6%)
Q-33: Methods used for loading	Lunge line	29 (23.6%)
	Put another horse on	29 (23.6%)
	Whip	11 (8.9%)
	Blindfold	2 (1.6%)
	Sedation by drug	2 (1.6%)
	Food	35 (28.5%)
Q-35: Placement of hay	Ground	151 (50.8%)
	Hay rack	53 (17.9%)
	Hay net	3 (1.01%)
	Round bales	87 (29.3%)
Q-38: Are supplements fed?		51 (17.2%)
Q-39a: Salt added to feed		45 (15.0%)
Q-39b: Access to mineral block		213 (72.7%)
Q-40i: Continuous access to water during day (summer)		287 (97.6%)
Q-40ii: Continuous access to water during night (summer)		286 (97.3%)
Q-41i: Continuous access to water during day (winter)		250 (85.6%)

Q-41ii: Continuous access to water during night (winter)	237 (81.2%)
Q-42: Horse under care of veterinarian	11 (3.7%)

16.2.3 Owner (barn) level categorical data (Section I)

Q-3: Frequency of manure removal from pasture	Every 1-2 days	2 (1.8%)
	Every 3-4 days	1(0.9%)
	Every 5-7 days	6 (5.5%)
	Less often than once every 7 days	18 (16.5%)
	Never	82 (75.2%)
Q-4: Manure spread on pastures		26 (26.6%)
Q-5: Shelter types	Trees	67 (60.9%)
	Barn/stall/shed	72 (66.1%)
Q-6: Contact with other species	Cows	19 (17.3%)
	Pigs	1 (0.9%)
	Sheep	4 (3.6%)
	Goats	5 (4.6%)
	Donkeys	4 (3.6%)
	Poultry	7 (6.4%)
	Llamas	2 (1.8%)
	Dogs or cats	86 (78.2%)
Q-7: Frequency of manure removal from stall (summer)	Once or more per day	31 (28.4%)
	2-5 times per week	8 (7.3%)
	Once a week	11 (10.1%)
	Less than once a week	2 (1.8%)
	Horse not kept in stall	57 (52.3%)

Q-8: Frequency of manure removal from stall (winter)	Once or more per day	49 (45.4%)
	2-5 times per week	22 (20.4%)
	once a week	17 (15.7%)
	less than once a week	8 (7.4%)
	Horse not kept in stall	12 (11.1%)
Q-9i: Has owner ever sold a horse		56 (48.6%)
Q-9ii: Has owner sold a horse in last year		19 (34.6%)
Q-10: Reason for sale	Wanted more advanced horse	13 (24.1%)
	Horse unuseable	10 (18.5%)
	Horse too difficult	8 (14.8%)
	Rider outgrew	6 (11.1%)
	Lack of time	11 (20.4%)
	Moving	4 (7.4%)
Q-11: Person who bought horse	Horse dealer	16 (29.6%)
	Horse person	43 (79.6%)
	Slaughter company	3 (5.6%)
Q-12: Are any horses vaccinated		42 (38.2%)
Q-13: Vaccination (if any are given)	Strangles	4 (9.8%)
	Rabies	10 (25.0%)
	Tetanus	36 (85.7%)
	Influenza	24 (60.0%)
	Rhino	24 (60.0%)
	Encephalmyelitis	4 (10.0%)
	Other	
Q-14: Is owner a member of horse related club		35 (30.0%)
Q-16: Does owner have access to trailer		73 (67.0%)

16.2.4 Owner level categorical data (Non-veterinary data)

Hay collected at sit visit		29 (25.2%)
Hay type	Square bales	40 (35.4%)
	Round bales	8 (7.1%)
	None	65 (57.5%)
Storage of grain	Sealed container	44 (41.5%)
	No container	16 (15.1%)
	No grain available	1 (0.94%)
	No grain fed	45 (42.5%)

APPENDIX 17: EDUCATIONAL LEAFLET

this prevents them from brushing flies off their bodies. The Canadian Agri-Food Research Council and the Canadian Veterinary Medical Association are opposed to tail-docking.

Horse with docked tail

What are these tips based on?

The advice in this leaflet is based on research done by graduate student Julie Christie at the Atlantic Veterinary College, University of Prince Edward Island. During the summer of 2002, 117 PEI horse owners with 312 horses took part in a survey of horse management and health. The horses included miniatures, ponies, light horses and draft horses, but not race horses. During the survey, a veterinarian examined each horse and the owner filled out a questionnaire.

What did the survey show?

The survey showed that there are a wide variety of non-racing horses in PEI. Many of the horses in the survey were pets or were used for general riding. They were kept in a variety of ways and management was generally good. There were no major health problems, but the survey did pick up some areas for improvement. These included removal of manure from the pasture to decrease the parasite load, and more regular dental and farrier care. The study also found that many horses were overfed.

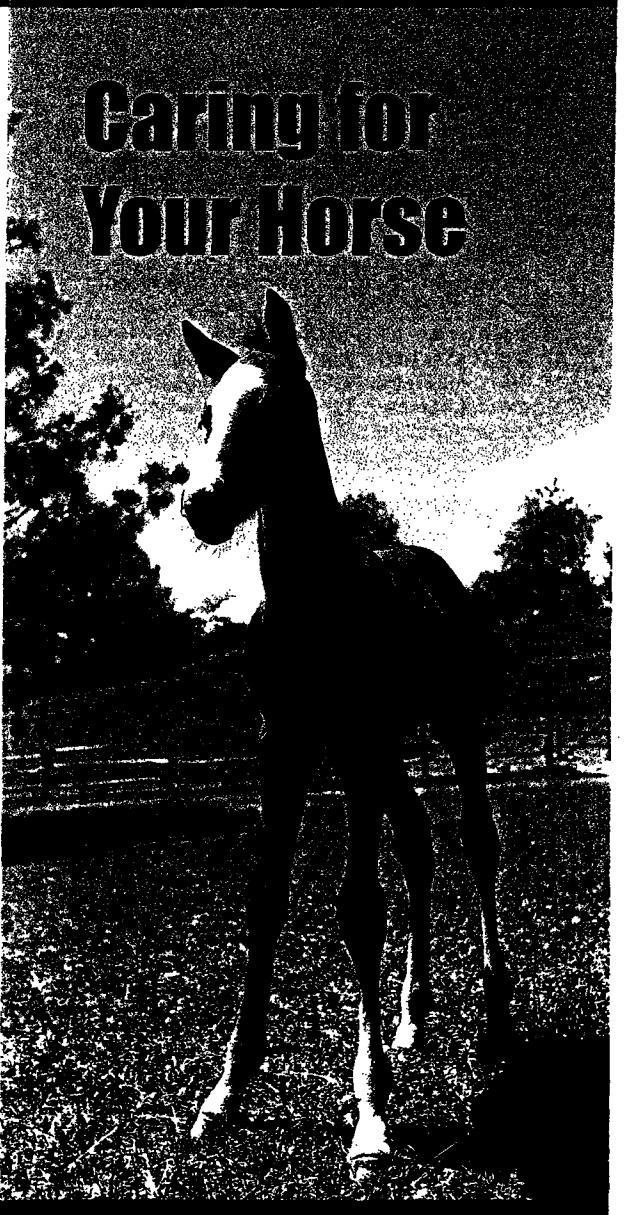
The most common physical problems were a high fecal egg count from intestinal parasites, hoof cracks and breaks, and uneven wear of the molar teeth. The most common behaviour problems were wood chewing, weaving and behaviours related to flies landing on the horse.

The survey was the first of its kind in Canada and used a random sample of animals. There was a high rate of participation by owners so the results were representative of PEI owners and their horses, and are relevant to horses across Canada. The survey was sponsored by the Sir James Dunn Animal Welfare Centre, Atlantic Veterinary College.

Sir James Dunn Animal Welfare Centre
ATLANTIC VETERINARY COLLEGE • UNIVERSITY OF PRINCE EDWARD ISLAND

The Sir James Dunn Animal Welfare Centre exists to provide tangible benefits to animals, through research, service and education. For further information, please visit our website at:
www.upei.ca/awc

Caring for Your Horse



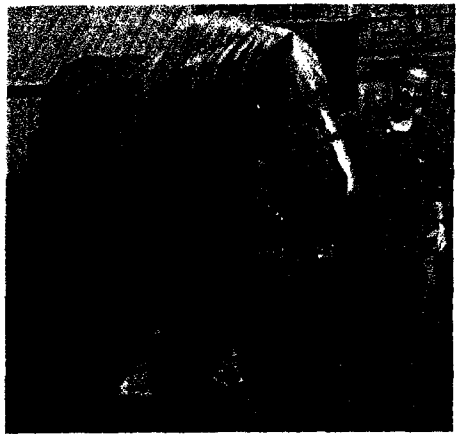
Animal Welfare Series: Brochure # 5

General

Horses should be examined at least once per year by a veterinarian. There may be a health or a lameness problem that is not obvious to you, and the teeth may need rasping if they have sharp points. Veterinarians can answer your questions on vaccinating, de-worming and management.

Feeding

Usually, grass and good quality hay are enough for your horse. Horses do not normally need grains such as oats, corn or sweet feed. Too much grain makes horses overweight and puts them at risk of getting laminitis, a very serious disease of the foot. However, if a horse is underweight or lactating or at the end of a pregnancy, your veterinarian may recommend grains.



Overweight horse

Most horses do not need dietary supplements unless the grass or hay is deficient. For example, if the soil is very low in selenium and trace minerals, a salt lick that contains these nutrients should be available in the stall or pasture.

De-worming

Worms (parasites) in the gut are the most common cause of colic. To help prevent this:

- remove manure from the pasture twice per week from the spring to the fall;
- consult your veterinarian about how often to de-worm and what type of de-wormer to give; and
- use a girth tape to judge your horse's weight so that you give the right amount of de-wormer. This is important because inaccurate dosing can make worms become resistant to de-wormers.

Vaccination

Tetanus vaccination is essential for all horses. Consult your veterinarian about which other vaccines are necessary for your horse. The vaccination programme will depend on things like the age of your horse.

Behaviour

Horses today are not very different from horses in the wild. They have the same drive to be outside, to socialize with other horses and to spend about 60% of their time grazing. Therefore, try to reduce the time that your horse spends in the stall. When s/he is in the stall, make sure that s/he has plenty of hay.

If possible, try to keep your horse with friends. Groups of 4 to 10 horses can be ideal, but even the company of one other horse is better than keeping your horse alone. Animals such as sheep, goats and donkeys can also be suitable companions. Donkeys can give horses an infection called lungworm, so talk to your veterinarian if you plan to keep a donkey with your horse.

Horse with sheep for company

Giving your horse company can help reduce frustration and may prevent or reduce undesirable behaviours like fence walking, weaving and crib-biting. If your horse cribs, try to give her/him more time in a pasture or give her/him more hay. Cover the place where s/he cribs with a material like rubber so that s/he doesn't wear her/his teeth down or swallow splinters. Crib collars are not recommended.

Hooves

Hooves should be trimmed every 4 to 8 weeks to prevent problems like the ones in the picture. Many hoof-related problems can be prevented by regular hoof-trimming. We recommend that you keep records of when your horse's feet are trimmed and that you book your farrier well in advance.

Fly management

Flies spread diseases and are irritating to horses. Reduce the amount of contact that your horse has with flies by providing lots of shelter or by keeping your horse indoors. This is especially important during the hottest part of summer days when flies are at their worst. Fly masks will prevent flies from landing on your horse's face, and you can apply special fly spray to the rest of the body. Horses should not have their tails docked because