The New Zealand Police Dogs

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ABSTRACT

This study aimed to identify characteristics of dogs to be used by the New Zealand Police Section for their dog breeding and selection programs. Only one scientific paper has been published on selecting dogs specifically for police dog work. Currently, no statistical analysis has been conducted on any of the New Zealand Police Dog Section's data.

A questionnaire on all aspects of police dog work was sent to the 120 operational police dog handlers working in New Zealand. The majority of handlers rated their dog high for a number of traits and areas of police dog work but their ideal dog rated very high for the same traits. The handlers ranked from highest to lowest the traits 'prey drive', 'trainability', 'activity', 'obedience', 'playfulness', 'independence' and 'aggressiveness'. This gives an indication of the relative emphasis that should be given to the traits in a selection program. Improved stud selection, better monitored foster homes, more consistency between regions and the training centre and having more dogs for selection are improvements that can be made.

Annual reports from dog trials for the years 1997 to 2000 were analysed by ANOVA to enable the calculation of repeatabilities for each activity. The activities 'heel free', 'retrieve', 'down stay', 'sendaway', 'recall and redirection', 'distance control', 'speak on command', 'track', 'article search', 'passive attack', 'chase and recall', 'chase and attack', and 'control' were measured in all four annual reports. The activity 'search and escort' was measured in 1999 and 2000. The highest repeatability (0.48) was for 'speak on command' and the lowest repeatability (0.03) was 'track'. There were insufficient data to enable the estimation of heritability values.

During the annual trials each activity should be separated into handler performance and dog performance to give an indication of the performance of the dog alone. If the traits

essential for each trial activity were identified and measured when the activity was being tested then a repeatability study on the trait alone could be conducted.

This report identifies several areas where changes in trait definition and the collection of information could be used to improve the efficiency of the police dog breeding program.

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1 GENERAL INTRODUCTION

Police dog teams have become an essential part of the New Zealand Police force and are popular with the public and the media. There are currently 120 operational general purpose police dog teams around the country. They are used for locating missing people, tracking down lost property, apprehending criminals and for street patrol. The New Zealand Police Dog Training Centre was set up in 1956. The Police Dog Section breeds police dogs and uses dogs donated from the general public and the Guide Dog Services.

The scientific literature on the breeding and selection of police dogs is limited to one paper. In this paper a series of behavioural tests were conducted on puppies from eight weeks to nine months of age to test the predictability value of the tests in identifying the future working ability of the puppies as police dogs (Slabbert and Odendaal, 1999). At present, no research has been conducted on police dogs in New Zealand.

This present study aims to change this by:

- conducting a questionnaire aimed at the police dog handlers
- analysing the annual reports of the current operational police dogs
- analysing the breeding lines of current police dog breeding stock

The major goal of this study is to use the available data to set up a selection and breeding programme to improve the standard of the police dogs bred at the Dog Training Centre in Trentham.

1.1 POLICE DOGS

Dogs were first used for law enforcement in Ghent, Belgium in 1899 where a school was established that trained dogs especially for law enforcement work. In England, the North Eastern Railway Police started using dog teams in 1908. All the early English programs were rather informal operations. After World War II the British decided to officially introduce dogs to police dog work. In 1947 the London Metropolitan Police Force spent a year training Labradors while, during the same year, the Surrey Constabulary experimented with Alsatians (Redwood, 1980). The Alsatians were found to be better suited for general-purpose dog work.

The organizer of the Surrey experiment was Chief Constable Mr J. Simpson. Six policemen were chosen to be handlers based on their record and personality. With no previous experience, they devised and developed training and operational methods that are still used today throughout the United Kingdom, as well as in many parts of the world (Salt and Salt, 1972). Surrey became the training ground for all future police dogs and police dog handlers in Great Britain.

1.1.1 ESTABLISHMENT OF THE NEW ZEALAND POLICE DOG SECTION

One of the policemen involved in setting up the Surrey Dog Training Centre was Frank Riley. He became an expert on Alastians and an authority on their training, care, characteristics and the best strains to breed for police dog work (Redwood, 1980). In 1955 the Prime Minister of New Zealand and Minister of Police Sidney Holland went to England to find out about the latest techniques in police work. He saw a police dog demonstration and decided that it would be a good idea to introduce police dogs into New Zealand. Frank Riley was asked to come to New Zealand for twelve months to set up a New Zealand Police Dog Unit. He arrived in 1956 with four dogs and established the Royal New Zealand Police Dog Training Centre in Trentham, Wellington.

Initially there was a lot of opposition to the establishment of the Police Dog Unit but soon the dogs abilities and intelligence proved the critics wrong. The Police Dog Training Centre took longer than twelve months to set up so Frank Riley ended up residing in New Zealand. After a few years, Western Samoa, Fiji and Papua New Guinea started using police dogs as well. All their handlers have been trained at Trentham. The Air Force is the only member of the New Zealand Armed Forces to use dogs. In 1967 the Police started training dogs and handlers for the Air Force where they are mainly used for guard work.

1.1.2 HISTORY OF THE GERMAN SHEPHERD BREED

The German Shepherd Dog breed, which is the most widely used breed for law enforcement work, originated from Germany in 1899. Early in the nineteenth century any breed of dog was used as a sheepdog (Willis, 1991) but as the nineteenth century drew to a close, communications became easier and in Germany a movement combined the various shepherd dogs into one breed (Bennett, 1987). Rittmeister von Stephanitz started a program of selective breeding that eventually led to the formation of the German Shepherd Dog breed (Redwood, 1980). The first German Shepherd Dogs were bred from strains of regional shepherd dogs and from interbreeding northern and southern types of shepherd dogs (Allan and Allan, 1997).

In England the German Shepherd Dog breed grew in popularity after World War I and a large number of them were imported into the country. Their name was changed to the Alastian due to the public wanting nothing to do with the German Shepherd Dogs because of their origin. At first, strict breeding was adhered to but soon demand exceeded supply and poor breeding ensued. The breed became associated with attacks on people and sheep and their popularity declined. Thereafter, the breed was bred and trained more carefully and its potential was developed. Training societies were formed and just before World War II several were used as guide dogs for the blind (Salt and Salt, 1972).

1.1.3 HISTORY OF MILITARY DOGS

During World War I dogs were trained to perform specified military duties. It was the Germans, who first demonstrated the value of dogs in a range of capacities and they used German Shepherd Dogs as messengers, guards and sentries (Salt and Salt, 1972). The British set up a war dog school as the war proceeded.

By the second World War all the major powers had obtained German Shepherd Dogs and made full use of them as messengers, detectors of mines, guards for patrolling borders and coastlines, and for scouting and lookout duties (Salt and Salt, 1972). The Germans set up a military kennel in 1934 and by 1939 had 50,000 trained dogs ready for war. The United States did not start training dogs for military duties until 1942.

1.2 POLICE DOG PRODUCTION IN NEW ZEALAND

1.2.1 BREEDING

Initially all police dogs in New Zealand, except for imported breeding stock, were born and bred at the dog kennels in Trentham, Wellington. In recent years, the Police have received dogs from the general public, as well as using dogs from their own breeding program. In the breeding program, matings between bitches and dogs are carefully planned and some puppies are rejected to keep training wastage at a minimum.

The characteristics used to assess potential stud dogs to be used for breeding are hip dysplasia score, health, fertility, temperament, prey drive, concentration and size. Brood bitches are assessed through comparison of traits between them and their male siblings during the foster program and prior to formal training. The dog's hip dysplasia score is measured at twelve to fourteen months of age. The ideal individual combined score for hip dysplasia in each parent is less than ten with a low score being more ideal then a score close to ten.

Currently the Police Dog Training Centre has five bitches that are used for breeding purposes only. Five more bitches are required to increase the breeding program so that more dogs are produced that are especially bred for police dog work. Bitches are not used for breeding until they are two years old and continue breeding until they are around seven years old. The bitches are bred once every year during that time. Artificial insemination is used if necessary. Although bitches are used for police dog work handlers prefer dogs as the bitches come into season for three weeks once or twice a year and during this time they are unable to go on patrol as they will attract other dogs.

1.2.2 FOSTERING

Prior to 1995 puppies were kept under close scrutiny at the kennels for the first five months after birth. During this time their progress and temperament were noted and the puppies that were not up to standard were rejected. After five months the puppies were sent into the districts and looked after by their future handlers. In the districts there was no back up support for the puppies or their handlers, and no control over the type of food they were receiving and the environment they lived in.

In 1995 the Police Dog Training Centre decided to set up a foster home program similar to the one established by the Guide Dog Services. The aim of the foster home program is to allow the puppies to live in a home in order to socialize them properly. The puppies are observed interacting with their littermates and are selected to go to a foster home. The police look for a puppy that is happy and confident, slightly dominant and wilful in temperament. The same criterion is used to select the bitches that have the potential to be used for breeding purposes.

Only dogs and brood bitches deemed to have potential as working dogs or for breeding go to the foster homes at eight weeks of age. The other dogs are sold to the public. Staff from the Police Dog Training Centre visit the puppies during the second week of their placement in a foster home. During the dog's time at the foster home the family is encouraged to take the puppy for walks in a wide range of areas that involves exposure to different floor surfaces and, also during the night so that the puppy is used to walking in

darkness. The police discourage strict control of the puppy, as they still want a dog that shows dominance and is wilful in temperament. Play games are recommended with an emphasis on allowing the puppy to become possessive of its play articles during retrieve and tug of war games.

The puppies are assessed continually by the family and once monthly by staff from the Police Dog Training Centre. After the first month the puppy is tested on its behaviour during a street walk. During the second month in a foster home the puppy is tested for its reactions when walking in a busy shopping mall. The ability of the puppy to walk up stairs is tested monthly. The puppy's ability to retrieve is assessed by the family.

The potential brood bitches are assessed on the same basis as the dogs while they are in the foster homes. If they are approved for breeding they stay in the foster homes until they are required. When they are going to be bred they are returned to the Police Dog Training Centre. They stay there until their puppies are ready to be sent to their own foster homes. The bitches are then returned to their own foster home.

1.2.3 ALLOCATION

At nine months of age puppies are returned to the Police Dog Training Centre and are given to their handlers and sent to the districts. Allocation of the dogs to the handlers is random as there are only a few dogs available at any one time. At this stage a lot of puppies are rejected for future police dog work. The main problem that has been encountered is that the puppies become too friendly in manner. Therefore, it has been suggested that it might be better to return the puppies to the Police Dog Training Centre and send them to their handlers earlier. The puppies are kept at the handler's home and training begins at ten months of age.

1.2.4 DONATED DOGS

Currently the Police receive dogs donated to them by the general public. These dogs usually come from breeders who have decided that they are not suitable for showing or

are not suitable for guide dog work. Although some of these dogs do become successful police dogs, the success rate is not as high as the dogs that are especially bred by the Police Dog Training Centre. The police bred dogs have a 40% success rate while the donated dogs have only a 7% success rate of becoming police dogs.

The dogs that are donated to the Police are usually twelve to eighteen months of age. They are observed in their owner's home and evaluation begins the moment the evaluator sees the dog. The evaluator looks for a dog that is dominant, with its tail up and one that is territorial on its property. The evaluator takes the dog out for a walk and observes whether the dog is confident on slippery floors, stairs, around crowds, in traffic and over heights. Their retrieval abilities are measured and ideally the dog should concentrate on its toy, and not sniff the ground even in stimulating surroundings. If the dog is selected, training commences immediately so that unproductive time is kept at its minimum.

1.2.5 TRAINING A POLICE DOG

1.2.5.1 Allocation course

The first training course the dog and its handler undertake is called the allocation course. The aim of this course is to develop an affinity between the dog and handler, test the environmental steadiness of the dog with the handler, assess the team's potential for training, teach the handler the basic skills of dog care and introduce the handler to the theory of dog training and canine behaviour. The dog and handler are taught the basic retrieve and recall, and introduced to various places, people and objects. This may occur when the dog is about 10 months of age (Gibson, 1996).

1.2.5.2 Initial course

The initial training course is undertaken when the dog is 14 months of age. In it the dog is introduced to grass tracking, formal obedience and control disciplines, agility exercises, and sleeve play. The dog is assessed for its potential to carry on with further training and the handler is also assessed on his ability (Gibson, 1996).

1.2.5.3 Intermediate course

During this course the dog learns how to follow a one-hour old track on grass, is introduced to gravel tracking, criminal work, building search, article search and sendaway. The dog and handler are also required to have their obedience, agility and control disciplines up to test standard at this stage (Gibson, 1996).

1.2.5.4 Final course

The final course covers the remainder of the necessary training which includes criminal work, building and open searches, tracking in operational environments and crowd control. The handler is required to undergo a written examination that covers the entire training syllabus. The team has to pass qualifying practical tests with all aspects of criminal work covered – apprehension of offender, control/release, recall, defending handler, firearm attack, other weapon attack and crowd control. The team has to carry out a building or open search for hidden or exposed people, track on a hard surface with a scent fifteen minutes old at night, do an article search, and undergo the commands sendaway and redirection and undergo distance control work (Gibson, 1996).

1.2.6 FINAL ASSESSMENT

After the dog and handler team have completed all the necessary courses a final selection of the dogs for police dog use is undertaken. The main areas that the Police look at are hip dysplasia score, size, temperament, prey drive and concentration, and health. The ideal size of a police dog is between 35 to 40 kg. If the dog is too small it may not be able to easily take hold of an offender, and if too large will not be agile or fit enough to climb over fences and outrun offenders. A police dog must be bold and outgoing, be well socialized and confident in all working environments, and not be outwardly aggressive but willing to respond to challenges. The trait "prey drive" is considered to be very important as it is used in all aspects of the dog's training from tracking to criminal work. Because a police dog is required to do a range of jobs an ability to concentrate is needed.

1.2.7 OPERATIONAL DOGS

On average it costs around $35,000 to train a police dog and handler team from the time the puppy is born to the time that the team graduates as 'operational'. Currently there are 120 operational dogs working in New Zealand. The Police Dog Training Centre requires twenty to thirty dogs a year to replace operational dogs that retire due to old age or for health reasons.

Dog teams are assessed twice a year in all aspects of police dog work, once by a local Regional Dog Co-ordinator and once by the Officer in Charge of the Dog Training Centre. Each year the National Police Dog Championships are held at the Police Dog Training Centre and the top seven or eight operational dog and handler teams are invited to attend. A dog is expected to work for around five years. After the dog retires it is usually kept by the handler or given to a reputable home.

1.3 BEHAVIOURAL GENETICS

Behavioural genetics is controversial as it attempts to explain differences in behaviour between individuals (Plomin *et al.*, 1990). Darwin in 1871 noticed that there was variation within species of physical and behavioural attributes and concluded that these were due to genetic effects (Grandin, 1998).

In the 1920s behaviourism promoted the possibility that the environment could explain all differences in behaviour and a number of behavioural experiments were conducted (Grandin, 1998). It wasn't until the 1970s that it was recognized that genetic and environmental influences affect behaviour (Plomin *et al.*, 1990).

1.3.1 NATURE VERSUS NURTURE DEBATE

During the 20th century there was debate about the importance of nature (genes) and nurture (experience) in the development of any behavioural trait (Fuller and Thompson, 1978a). The debate is complicated because behaviour is a complex phenotype that

reflects the functioning of the whole organism, and is dynamic and changing in response to the environment (Plomin, 1990). Behavioural events are functions of an organism and its surroundings at any one point in time (Fuller and Thompson, 1978b).

One problem in studying the inheritance of behaviour is that a behavioural trait is likely to be affected by many genes acting in concert and not just a single gene (Kelner and Benditt, 1994). The genes provide the information that allows the construction and regulation of proteins within particular environments. These proteins in turn are building blocks used in the construction and regulation of neural circuits in the brain, which ultimately stimulate and modulate behaviour (Hahn and Wright, 1998). The behaviour observed is the phenotype being expressed which is controlled by the genotype made up of the subsequent sequence of the proteins.

Quantitative genetics is ideal for behavioural genetics as it identifies genetic influence even when many genes and substantial environmental variation is involved (Plomin, 1990). The basis of quantitative genetics is the idea of heritability. Heritability measures the amount of genetic influence on a particular trait. The heritability of a trait pertains to a specific population in a particular situation in time (Fuller and Thompson, 1978b). Therefore, a different population of the same species at a different place in time may have a different heritability (Plomin *et al.*, 1997).

Applied behavioural genetics began thousands of years ago when humans began domesticating animals. These animals were then bred for their behaviour as much as for their morphology (Plomin, 1990). This selection of animals was undertaken without the knowledge of genetics. In the last 100 years there have been many studies using the techniques of selection studies, inbred strain studies, family studies, pedigree analysis, classical crosses between lines or strains and large breeding designs containing several lines and crosses (Hahn and Wright, 1998).

The ideal subject for genetic studies is a variable species, that is prolific, easily maintained, and has a small number of large-sized chromosomes so that hereditary

factors can be manipulated and directly observed (Fuller and Thompson, 1960). The fruit fly Drosophila is therefore ideal. Rats, mice, cats and dogs are also extensively used, as they are closer to humans than the fruit fly.

Selection studies in the laboratory provide the most convincing demonstrations of genetic influence on behaviour (Plomin, 1990). The basis of selection studies involves selecting animals exhibiting high or low extremes of the behaviour under study in the hope of forming separate high or low lines in subsequent generations (Ehrman and Parsons, 1981). An unselected control line is also used (Plomin *et al.*, 1997). The advantage of selection procedures is that selection is applied to relatively small numbers of breeding animals and their subsequent genetic gain is transmitted to their descendents (Faure and Mills, 1998).

Selection can be conducted on behaviours that are under polygenic control. The two genetic lines from the parents will steadily increase each generation if the behavioural trait is controlled by a large number of genes. If only one or two genes are responsible for the behaviour the two genetic lines could separate for a few generations but then will not diverge any further (Plomin *et al.*, 1997). This only occurs in a limited number of phenotypes (e.g colour). Selection is an attempt to bring about the differential reproduction of genotypes, and so change the relative proportions of alternate alleles from generation to generation (Scott and Fuller, 1965).

The first ever laboratory selection experiment on behaviour was conducted in 1924 on maze running in rats in which bright and dull rats were generated over two generations (Plomin *et al*, 1990). This was the first experiment to show that selection for a behaviour was possible. Since then there have been many studies conducted on a large range of behaviours including activity, fighting, emotional behaviour, audiogenic seizures, running speed, exploratory behaviour and learning in Drosophila and other species (Ehrman and Parsons, 1981).

1.3.2 CANINE BEHAVIORAL GENETICS

Selection studies form the basis for most of the genetic studies conducted on canine behaviour. Dogs are ideal subjects for behavioural genetic studies as they are the oldest domesticated species, they are distributed worldwide and they exist in many specialized breeds which provides a ready made source of material (Fuller and Thompson, 1960). The earliest book on dogs, written in 1576, classified breeds on the basis of behaviour (Plomin *et al.*, 1997). There are two major groups of behaviour in the canine (Stur, 1987). The first group are genetically fixed and species-specific. These behaviours are necessary for the survival of the animal. The second group are behaviours that show genetic variance within the species and this group of behaviours are of interest for the current study.

Most of the earlier work in canine behaviour tried to explain the inheritance of particular traits by a Mendelian mode of inheritance. E.C. MacDowell in 1921 was the first person to study the genetics of canine behaviour (McKenzie *et al.*, 1986). MacDowell worked with Dachshunds and concluded that responses to visual and auditory stimuli showed a dominant disposition.

1.3.3 THE BAR HARBOUR PROJECT

Scott and Fuller (1965) conducted the most comprehensive work on the genetics of canine behaviour. They chose five breeds; the basenji, beagle, cocker spaniel, Shetland sheep dog, and the wire-haired fox terrier. These breeds were selected as they showed a wide range of behavioural differences and represented the major groups of dogs. Genetic variance was the primary variable in this study as they assumed that it was the cause of the different breed specific behaviours. They analysed behaviour during puppy development and found that studying the development of an animal was one of the most meaningful ways to study the action of genetics upon behaviour as any new behaviour can be noted under constant environmental conditions (Scott, 1964).

There were two major genetic experiments in their study. One compared differences between breeds in a large number of tests, the majority of which were concerned with emotional and social behaviour. They kept the environment constant and measured the similarities and differences between breeds. From their tests they found that there were breed differences for the traits; emotional reactivity, being quiet while being weighed, crude leash training, and sitting on and jumping off a platform on command. In the tests for trainability, the effect heredity played was highly complex, both because of the number of specific basic abilities involved and because of the complicated interaction between them made possible by behavioural adaptation (Scott and Fuller, 1965).

Scott and Fuller (1965) tested the social relationships between littermates, bitches and their offspring, and dogs with humans. The course of development of the social relationships was determined by the genetic differences between the individuals and also the social environment they were in.

The human-dog relationship is an important consideration for working dogs. Home-reared dogs were compared with dogs reared in kennels on their behaviour with humans. The home-reared dogs showed more confidence in strange situations and were more affectionate to people than the dogs raised in kennels (Scott and Fuller, 1965). This study showed the importance of the early environment on the later behaviour of the dogs. Even though the dogs were of different breeds they all showed behaviour related to the environment they were raised in.

When the basenji and the cocker spaniel were crossed and the F1, backcross individuals and F2 offspring compared with the original parents the mode of inheritance for particular behavioural traits was predicted using Mendelian analysis (Scott and Fuller, 1965). However, when an analysis of variance of more specific scores was conducted the Mendelian explanation did not fit well (Scott and Fuller, 1965). A weakness of this study was the lack of a second backcross, which meant that they could not test for single factor inheritance.

Scott and Fuller (1965) predicted heritability estimates for the behavioural traits measured. Heritability estimates ranged from zero to sixty six per cent with some traits indicating a high degree of genetic influence in the pure breeds. They also considered all the tests together and conducted a factor analysis. Five major factors were found. Three of the factors "impulsiveness', "docility", and "visual observation" were considered emotional factors. One factor took into account the similarity of certain tests and the last factor focused on the tendency of a number of dogs showing position preferences (McKenzie *et al*, 1986).

Correlations in the F2 generation did not support the hypothesis that a few major genes were involved in these factors, although a high degree of genetic variation was found both within and between breeds for the majority of the tests performed. When the tests were considered as a group, Mendelian genetics could explain the results, with some indicating that dominance was an important factor. But when individual tests were evaluated it was difficult to interpret them upon simple Mendelian inheritance because of the complex interactions with the environment.

No correlations between physical and behavioural characteristics were found (Scott and Fuller, 1965) and there were relatively few behavioural traits for which any breed was actually either homozygous recessive or dominant. Therefore, there was a large amount of genetic variation both between and within breeds. This makes dogs highly responsive to selection and makes it impossible to generalize about all dog breeds.

1.3.4 TEMPERAMENT STUDIES

1.3.4.1 Behavioural tests

The most common use of behavioural tests on dogs is to test their suitability for work including guiding blind people, military and police dog work, but tests are also used to predict problem behaviour or to evaluate the suitability of a dog as a pet.

Van der Borg *et al* (1991) conducted a range of behavioural tests to predict problem behaviour in dogs that had been placed in animal shelters. Twenty-one tests were designed to test aggression, fear, obedience, separation anxiety and other miscellaneous behaviours and interviews were also conducted with the animal shelter staff. Interviews were conducted with the new owners 1-2 months after receiving the dog from the shelter to see if any problem behaviours had occurred. The tests carried out at the shelter were able to predict 75% of the 190 cases of problem behaviour and were a better predictor than the opinions of the animal shelter staff (van der Borg *et* al, 1991).

The suitability of dogs for guide dog work was evaluated in a study using seventeen test situations on Labradors, Golden Retrievers and other breeds (Goddard and Beilharz, 1983). A factor analysis was conducted which yielded four factors; general performance, sensitivity, fearfulness, and fearfulness accompanied by high activity. These factors were made up of interrelated scores derived from when correlations were conducted between the trainer's scores. These four factors explained 60% of the variance of the original scores.

The most common reasons why Guide Dog trainers rejected dogs were fearfulness, distraction and aggression. Gender differences were also seen. Females showed more fear and were more distracted by scents but less aggressive and distracted by dogs than males. No unfavourable genetic correlations were found between the traits and therefore selection should be possible to improve the types of dogs.

Wilsson and Sundgren (1997a) used similar tests to Goddard and Beilharz to select German Shepherd and Labrador Retriever dogs for different types of work. The dogs underwent seven different tests and ten behavioural characteristics were scored for each dog at each test. Marked differences in mental characteristics were seen between breeds, sexes, and dogs ideal for police dog work and dogs ideal for guide dog work. But there were also similarities between different categories of service dogs compared to dogs that were not suitable for any type of service dog work.

For both breeds four factors were found that could be summarized as mental stability, cooperation, affability and ardour. An index value was obtained for each dog, which combined the additive value of all the tests performed. This index value was useful in sorting out which German Shepherds would be ideal for police dog work and which Labrador Retrievers would be useful for guide dog work. Therefore, the use of the index value made it possible to use the same behavioural test to select dogs for different types of service, even if they were from different breeds.

The heritability obtained for the index value was 0.24 for both breeds, which is high since it included all the parameters tested. Heritability estimates of 0.15 to 0.32 were found for the four factors obtained from the factor analysis conducted. This test was shown to work as the index value increased for the German Shepherds used in this study after the new selection criterion was introduced (Wilsson and Sundgren, 1997b).

A review paper evaluating the use of behavioural tests found that the reliability and validity of the behavioural tests for guide dogs were controversial as they were often drawn up, examined and evaluated according to the personal views of one individual (Knol *et al.*, 1998). But a breeding program seems to be beneficial in improving the level of suitability of the guide dogs as dogs from the breeding program were superior to dogs donated from other sources. Therefore, the most important aspect in these types of studies is to define exactly what sort of behaviour characteristics are typical for a dog of good temperament and to have a fixed way of judging these characteristics (Stur, 1987).

1.3.4.2 Puppy behavioural tests

The effectiveness of conducting behavioural tests while the dogs are still young is debatable. If accurate, such tests would have the advantage of saving time, money and increasing genetic gain, as selection would take place before training. The first scientific study of this topic was the selection of breeding stock based on puppy tests conducted at the San Rafael Guide Dog centre between the years 1953 and 1964 (Scott and Bielfelt, 1976). Before the puppy tests were conducted the puppies were individually socialised with a strange handler for two weeks. The puppy tests started when the puppy was eight weeks old and were carried out until the puppy was twelve weeks old. The tests were grouped into three groups; performance tests, response to novel stimuli tests and simulated guide experience tests.

When the tests were evaluated it was found that sixty percent of the dogs that passed the tests became guide dogs, while those that were rated poor had only a forty five percent rate of success and only one third of those that failed the tests altogether became successful guide dogs (Scott and Bielfelt, 1976). The best predictor of success in most of the tests conducted was the result shown by the puppies during their first trials. Evaluation weights for the different tests were assigned accordingly so that a combined score for the puppy could be calculated giving a more accurate prediction. Ten percent of the variance found was attributed to genetic variance that would be available for selection. The heritability of the tests from the puppies were evaluated and the tests "Fetch" and "Come" were found to show high heritability (Scott and Bielfelt, 1976).

Goddard and Beilharz (1986) conducted a number of tests on puppies between the ages of 4 weeks and 6 months of age. They found repeatable measures of activity in the pups but they did not correlate with the activity seen when they were adults. The only tests that had a practical prediction of adult behaviour were the tests related to fearfulness. The predictive value of the tests increased with age and with more relevant, intense stimuli. The tests involving a strange person, walking on a leash in a frightening place and

frightening objects were the most reliable tests in predicting the puppies future performance.

Six hundred and thirty German Shepherd eight-week-old puppies were subjected to a number of behavioural tests to see if they could predict adult behaviour (Wilsson and Sundgren, 1998). The tests were not useful in predicting adult suitability for service dog work, as no correlation between the puppy test results and the performance at adult age was seen. Significant correlations were seen between the puppy score groups. A sex difference in behaviour was seen in four out of the ten tests conducted. The heritability estimates conducted ranged from medium to high and maternal effects were also seen.

Slabbert and Odendaal (1999) provide the only study on the early prediction of police dog efficiency. The South African Police Service do not foster home their pups, instead they are kept at the kennels until they are ready to start training. The puppy's stay with their mother until they are twelve weeks old and are kept in a socializing unit. The puppy's stay in the socializing unit for their first 9 months and during this time they are exposed to a wide range of activities including swimming, car rides, school visits, puppy walks, and retrieval and aggression games.

A wide range of tests on 167 puppies was conducted during the period 8 weeks to 9 months. A retrieval test was first conducted when the puppies were 8 weeks old and then retested at 12 weeks old. The puppy was scored on its interest to the command, the manner and way in which it found the object and how it retrieved and returned the object back to the handler. An obstacle test and a gunshot test were only conducted once, with the obstacle test being tested at 8 weeks of age and the gunshot test being conducted at 12 weeks of age. A startle test for temperament conducted at 12 weeks and 16 weeks of age involved a stranger jumping out of the bushes while the dog was being walked.

The last test that was carried out was an aggression test that was measured at 6 months and 9 months of age. A stranger provoked the dogs by striking them with an old rag. If the dog hid, it scored zero, if it showed no fear but did not attack it scored five and if the

dog moved forward, bit the rag and held on it scored ten. The three tests, retrieve at 8 weeks old, aggression at 9 months of age and aggression at 6 months when used together were the most effective in predicting adult police dog efficiency although all the other tests except the gunshot test were significant. These three tests were able to accurately predict 81.7% of unsuccessful dogs and 91.7% successful dogs and should be utilised in the future.

1.3.5 TEMPERAMENT CATEGORIES

A recent study on Guide Dogs in Australia tried to describe categories of temperament in potential guide dogs for the blind (Murphy, 1998). It is the trainer's job to assess a twelve-month old dog on twenty categories of temperament but it has been shown that temperament scores are not usually consistent between trainers. In this study the dogs and their trainers were videotaped on their final assessment walk. Trainers that had no prior knowledge of the dog observed the tapes and the elements of behaviour in one hundred and twenty segments of the videotape were noted. The behavioural elements for nine temperament categories that were observed at high frequencies were noted. It was found that some elements of behaviour were common to more than one set and it is suggested that it is better to use a number of elements of behaviour to interpret temperament categories than just using a single aspect of behaviour (Murphy, 1998).

Serpell and Hsu (2001) evaluated behaviour and temperament in guide dogs using a questionnaire aimed at the volunteer puppy-raisers. Volunteer puppy-raisers look after the puppy from 8 weeks to 12 months old and would most likely know more about its typical behaviour than evaluators in a test situation would. The questionnaire used a five-point semantic differential-type rating scale, which is a format similar to that used in temperament studies in children. The questionnaire was constructed of 40 questions covering aggression, fear and anxiety, training and obedience, attachment and separation distress and 'general behaviour' items.

The results of the questionnaire were compared to The Seeing Eye Inc. (TSE)'s pre-existing classifying system, which involves continuous assessment of the dog from

veterinarians, training instructors and their supervisors to estimate the construct validity of the questionnaires. The surveys were randomly divided into three groups. Two of the groups were compared to identify any common factors. The last group was used to test the stability of the factors that were identified. Dogs that had similar parentage were randomly distributed among the three groups and there was no bias in the gender ratios among the groups.

Eight factors covering stranger-directed fear/aggression, non-social fear, energy level, owner-directed aggression, chasing, trainability, attachment, and dog-directed fear/aggression were found. These factors were stable between the male and female sub-groups, and among the three breeds of dogs (Serpell and Hsu, 2001). Three out of the eight factors had a moderate reliability, while the other five had relatively low reliabilities. Therefore, it is suggested that additional questions should be added to the questionnaire to improve the reliabilities. All the factors had good validities when measured against the guide dog school's criteria for rejecting dogs. The questionnaire provided an accurate means of predicting a dog's suitability for guide dog work. Therefore, the questionnaire can be used as an aid in the selection process as it can give a good indication of the temperament of the dog.

1.4 PHYSICAL PROBLEMS

1.4.1 HIP DYSPLASIA

Although hip dysplasia is not a behavioural trait it is a common occurrence in German Shepherd Dogs and will shorten the operational lifespan of that particular dog and eliminate the dog's potential for breeding purposes. Two thousand four hundred and four German Shepherd dogs were radiographically evaluated for hip dysplasia at the Armed Forces Dog Training Centre in Sweden during the period 1965 to 1973 (Hedhammer *et al.*, 1979). The heritability of hip dysplasia was estimated to be around 0.4 to 0.5

A grading system indicating the severity of hip dysplasia from borderline to severity has proved useful in the selection of dogs for breeding. In one study it was found that parents that had grade I hip dysplasia were not significantly greater risks than those classified as normal (Hutt, 1969). This result provides breeders with a larger number of dogs to breed from and allows them to concentrate on selecting dogs for other favourable traits.

In the first study to test the relationship between temperament and hip dysplasia in 1975 a negative genetic correlation of –0.25 was found between them (Willis, 1989). Bartlett (In Mackenzie *et al.*, 1986) found the four traits; nose, energy, self-right and confidence to be negatively correlated with hip dysplasia but only the correlation between hip dysplasia and ear sensitivity was found to be significant. In an army dog population Mackenzie *et al.* (1986) estimated a heritability of 51% for temperament and a 26% for hip dysplasia with a negative correlation of –0.33.

1.4.2 BEHAVIOURAL AND PHYSIOLOGICAL TRAITS

It is also important to consider correlations between different characteristics, whether they are behavioural or physiological in nature. Because temperament is a characteristic that is hard to judge objectively it is necessary to find parameters, correlated with important temperament traits, which can be classified objectively and in a simple way (Stur, 1987). Once favourable correlations are found the breeder can select for these parameters and will be confident in getting the desired temperament traits as well. In the same token the breeder can also prevent unfavourable characteristics emerging in the population. This is the basis of factor analyse that are often used in the behavioural tests mentioned above.

1.5 DRIVE

1.5.1 INTRODUCTION TO DRIVE

The precise definition of behavioural traits is crucial in enabling behavioural tests on temperament to be useful in the selection of service dogs. In the New Zealand Police Dog

service the trait "prey drive" is considered to be the most important behavioural trait as it is required for all areas of police dog work from tracking to criminal work. Therefore, it is necessary to try and define this trait accurately so that prey drive can be precisely measured in any potential police dog.

The concept of drive was introduced to account for the fact that animals "worked" only in certain biological states (Bindra, 1968). Drive has been defined as "a bodily state that prompts behaviour to the extent to which it makes the animal reinforcible" (Smith, 1984). However, many other psychologists have theories on what drive is and there are a number of definitions (Bolles, 1958). One common definition is that drives are innate capacities that organise sensory stimulation and with appropriate rewards perform a selector function resulting in a specific response (Wayner and Carey, 1973).

Drive is considered an energiser, an engine that powers an animal to undergo a certain type of behaviour. It is synonymous with the term arousal, which powers the cue function that guides a behaviour (Hebb, 1955). The general view is that there are certain principle functional properties of drives. The first property is to activate or energise latent reaction (associative) tendencies (Brown, 1953). The second is to reinforce responses whose elicitation is followed by a reduction in drive and to function as punishment whenever abrupt increases in drive occur following a response (Brown, 1953).

1.5.2 LEARNING AND DRIVE

Learning is dependent on drive. Efficient learning is possible only in the waking, alert, responsive animal, in which the level of arousal is high (Hebb, 1955). Learning occurs through reinforcement, so reinforcement plays a part in drive. An observed increase in general activity is the outcome of strengthening by reinforcement of locomotory and other acts that spontaneously occur in the experimental situation. Specific situational cues become instrumentally conditioned to certain specific "activity responses" by virtue of the reinforcement provided (Bindra, 1968).

Some psychologists believe that there must be a multiplicity of drives, each produced by a specific physiological disequilibrium or need, and each characterised by the suitability of specific goal objects (Bolles, 1958). Others believe that drive is a generalised activating process rather than a specific force for a specific behaviour (Remley *et al*, 1980). Another suggestion is that instead of a common energising factor that operates all drive manipulations, the relationship between each drive manipulation and activity level is a specific one. Exact changes in the level and form of activity are dependent upon the particular neuro - physiological mechanisms involved (Bindra, 1968).

1.5.3 INNATE DRIVES AND ACQUIRED DRIVES

Researchers believing in more than one drive suggest that drive includes both acquired drives as well as innate drives. In humans the original sources of drive are thought to be the three innate emotions: rage, fear, and love (Remley *et al*, 1980). Acquired drives can be obtained by classical conditioning, as an event will be reinforcing if it reduces a drive state (Wayner and Carey, 1973). One view is that individuals acquire numerous habits or modes of reacting to complex situations made up of both external and internal stimulus components (Brown, 1953).

1.5.4 MEASUREMENT OF DRIVE

The measurement of drive has been a major problem in psychology. Measuring the strength of drive from the intensity of the stimulation has been used but is not reliable. Habituation combined with positive reinforcement may completely remove the effectiveness of even highly painful stimulation (Malmo, 1958). Measuring the hours of deprivation as a measure of drive can also be misleading. The difficulty of measuring drive is that there are always uncontrolled determinants of drive combining to produce an unknown level of drive (Malmo, 1958).

It is thought that the endocrine system is the physiological mechanism of drive. The hormones secreted by the endocrine glands provide the basis for the drive of all behaviours (Remley *et al*, 1980). Therefore, there is the possibility of using physiological

measures to give an indication of the level of drive. This offers the possibility of measuring the combined effects of all the various and sundry antecedent conditions which, at any moment in time, determine the level of drive (Malmo, 1958).

1.5.5 DRIVE, INSTINCT AND MOTIVATION

The term's instinct, drive and motivation are closely connected. Many use these terms interchangeably but they are quite distinct. Instinct is behaviour that is sensitive to the environment at a moment in time and which works within it to realise some special effect even in the absence of learning (Smith, 1984). Drive is thought to be acquired by learning. Without learning, drive has little or no direction and only through learning is a stronger directive influence produced. An animal in the drive state starts out with a behaviour that is unformed and that an encounter with a repeated reinforcer gradually produces a behaviour that has a high level of efficiency (Smith, 1984).

Motivation includes the anticipation of goals, and the expression of affect (emotion) while instinct is thought to be species-specific, nonaffective, and its appetitive phase is unmodified by expectancy (Colgan, 1989). The use of drive seems essential in order to comprehend the diversity of motivated behaviour that animals exhibit. Therefore, drive is considered to be the underlying force for motivation with different drives producing different types of motivation (Colgan, 1989).

1.5.6 IS THE TERM DRIVE MEANINGLESS?

Some theorists believe that drive has nothing to do with general activity. The activity that does occur is held to be a consequence of the behaviour-energising effect of an anticipatory response, and these responses are assumed to be conditioned to environmental stimuli (Bolles, 1958). In one study it was proposed that one effect of deprivation might be a sensitisation of the reticular system, which in turn sensitises the animal to environmental stimuli. What is meant by drive may turn out to be just the arousal function of this system (Bolles, 1958). The term drive may have been bandied

about to the point where it is not only useless but is actually meaningless and confusing in the literature. The term may serve no scientific purpose and could be abandoned (Wayner and Carey, 1973).

1.6 DEVELOPMENT OF BEHAVIOUR

Knowledge of the development of behaviour is essential for any service organization so that they can best utilise the key stages of development to increase the chance of success of the dog. The study of the genetic and social behaviour of the dog by Scott and Fuller (1965) provided the first comprehensive research on the development of behaviour. Scott and Fuller defined four stages in the development of behaviour: the neonatal period, the transition period, the socialization period, and the juvenile period. The prenatal period is also thought to be a crucial stage of development.

1.6.1 THE PRENATAL PERIOD

The importance of this period has been largely overlooked in canine development. Studies conducted on rodents indicate that transplacental maternal influences may affect the subsequent behaviour of the offspring (Serpell and Jagoe, 1995). If the mother rat is stressed during the third term of her pregnancy, her pups will have reduced learning ability, extremes of behaviour and increased emotional states (Fogle, 1990). It is likely that similar influences occur in dogs.

1.6.2 THE NEONATAL PERIOD

This period of the dog's life covers the first two weeks of its life. At this stage the eyes are closed and it is unable to hear, but the sense of taste and smell is present. During this time the puppy has an infantile pattern of investigative behaviour, which is based entirely on the sense of touch (Scott and Fuller, 1965). The pup is wholly under the care of the mother and the way she behaves with her pups will influence their behaviour in later life (Fogle, 1990). Anything that disturbs the bitch or interferes with the smooth operation of her instinctive behaviour may have a detrimental effect on the puppies (O'Farrell, 1986). The young puppy is shielded from the effects of the external environment, both by

maternal care and its own limited sensory, motor, and intellectual capacities (Scott and Fuller, 1965).

It has been assumed that at this stage the puppies are incapable of associative learning. Behaviour can change due to learning or because of maturational changes in the organization of the animal, which can include learning itself (Scott and Nagy, 1980). Therefore, it is difficult to distinguish between the two effects. But it has been shown that neonatal puppies can learn simple associations, although slowly compared with older pups, and only within the limits of their own rather specialized sensory and behavioural capacities (Serpell and Jagoe, 1995). The handling of puppies by humans at this stage of development has been found to be advantageous.

1.6.3 THE TRANSITION PERIOD

This period lasts less than a week and starts with the opening of the eyes and ends when a startle response to loud noises occurs. The patterns of neonatal existence disappear and are replaced by those more typical of later puppyhood and adult life (Serpell and Jagoe, 1995). The pup's world opens up and suddenly it's littermates and the rest of its environment have a dramatic effect on its developing mind (Fogle, 1990).

This is considered to be a crucial period in which daily handling is desirable and when the pup is extremely and increasingly responsive to it's surroundings (Willis, 1989). The relationship with its mother changes from ingestive behaviour to a more complex behaviour indicating that one sort of environmental stimulation has a very different effect on the behaviour of the puppy at different ages (Scott and Fuller, 1965). The end of this period occurs at approximately three weeks of age. By this time puppies are capable of associative learning in a variety of ways and can be conditioned with a speed reaching that of adults (Scott and Nagy, 1980).

1.6.4 THE EFFECTS OF EARLY HANDLING

The importance of early handling has been shown in a variety of animals. Puppies exposed to early handling showed superior performance in problem solving situations, showed less emotional arousal, showed the greatest attraction to man, and were frequently the dominant individuals in group situations (Fox and Stelzner, 1966a). If puppies had been handled daily in their first five weeks of life they developed into more confident, exploratory and socially dominant adolescents compared to those that had not been handled (Case, 1999). Canine neonates exposed to varied stimulation from birth to five weeks of age were found to be more confident, exploratory and socially dominant when tested later in strange situations than unstimulated controls (Fox, 1978). There is also evidence that mild stresses even in the neonatal period are good for the development of the pup's mind. Mild stresses will accelerate body growth, reduce emotionality and possibly increase resistance to certain diseases (Fogle, 1990).

In rats, handling for 10-20 days after birth reduced adrenocortical steroids in the plasma at weaning after pups were exposed to novel stimuli compared with controls (Levine, 1967). The early handling counteracted the influence of the experience of the mother during her infancy. Early handling by humans of kittens produced kittens that were more precocious, opened their eyes and emerged from their nesting boxes earlier, and showed synchrony in their EEGs (Meir, 1961). The visual exploratory behaviour in human infants that received earlier handling in the first five weeks of life were found to be significantly higher than non-handled controls (White and Castle, 1964). These studies on different species show the benefits of early handling.

1.6.5 THE SOCIALISATION PERIOD

This period of socialization is thought to be the most 'sensitive period' of the puppy's development. During this stage most of the new patterns of behaviour are directly connected with the mother and littermates and form a part of the animal's rapidly developing social relationships (Scott and Fuller, 1965). The relationship with its mother becomes less important as the mother spends time away from the nest and a strong relationship with its littermates develops. Play fighting with its littermates begins, which

stimulates communal behaviour that creates the social bonds with other dogs, affects and moulds its future adult behaviour and establishes the future dominance relationships in the pack (Fogle, 1990). The puppy also starts exploring outside the environment where they have spent most of their life (Scott and Nagy, 1980).

For domestic dogs, this period enables puppies to form non-conspecific attachments for humans or other animals encountered socially during this period (Serpell and Jagoe, 1995). The experience of other species or environments can be relatively small during this time but can have a long-lasting effect on the dog's behaviour (Seksel, 1997). A relationship with humans can develop with just two 20-minute periods a week of being exposed to them (Fuller, 1967).

At first, a puppy will be limited in the positive responses it can make to a passive and non-fighting individual because of its motor capacities. As the puppy develops, the attraction to a handler increases and reaches its peak at around five weeks of age. At this stage the puppy is in the socialization period of its development. After five weeks of age a fear response to new and active individuals develops which affects the previous attraction response. A rapid recovery from initial fears also occurs between 3 to 5 weeks of age. As a result, the relatively short period from 3 to 5 weeks of age is the time when a puppy makes the most rapid connection with a completely strange individual (Scott and Fuller, 1965).

1.6.6 CRITICAL PERIOD EXPERIMENTS

A puppy will have an increased tendency to withdraw from human beings after five weeks of age and unless socialization occurred before 14 weeks of age, withdrawal reactions from humans will become so intense that normal relationships could not thereafter be established (Freedman *et al*, 1961). Fox and Stelzner (1966b) tested the approach responses to a human in dog's aged 5-6, 8-9 and 12-13 weeks of age. The slowest approaches were found in the 8-9 week age group. A traumatic experience had the greatest effect in this age group as well, with no effect in the 12-13 week age group and a temporary effect in the 5-6 week age group.

A similar experiment was conducted on the white rat. Infant shock experiences can produce a conditional fear response to a conditioned stimulus and simultaneously reduce susceptibility to later emotional disturbances aroused by other stressful stimuli. There are critical periods when an electric shock had a greater influence upon emotional behaviour than at other times (Lindholm, 1963).

1.6.7 RESTRICTED ENVIRONMENT EXPERIMENTS

Rhesus monkeys raised in restricted conditions preferred non-social activities when given a choice compared to monkeys raised in the field that preferred social activities. Females preferred the monkeys raised in the field than the restricted monkeys (Mason, 1961). Rats raised in a complex free environment had a significant reduction in emotionality compared to rats raised in laboratory cages (Deneberg and Morton, 1962).

1.6.8 ISOLATION EXPERIMENTS

When dogs have been isolated for a long period of time they develop post-isolation behavioural disturbances (Fuller and Clark, 1966). It has been shown that puppies kept in isolation for only a relatively short time between the ages of 4 to 5 weeks behaved similarly to pups reared for much longer periods in social deprivation. The behaviours included hyperactivity, diffused reactions to novel objects, and increased attention to their physical environment. These puppies also had the lowest emotional attachment to man and showed the most inferior problem solving abilities (Fox and Stelzner, 1966a).

Fuller (1967) conducted a comprehensive study of the effects of experimental deprivation on later behaviour. He found that biweekly breaks of less than ten minutes each largely counteracted the effects of isolation. Also puppies that had specialized handling and were administered a tranquillising drug had reduced post-isolation symptoms. The effect of isolation can also be reduced if the dogs are given visual exposure to the environment through a window showing toys, people or other animals. Providing the dogs with stimuli

in the environment had no effect in modifying the behaviour that had developed from isolation (Fuller and Clark, 1966).

1.6.9 NORMALLY REARED CONDITIONS EXPERIMENTS

Most of the studies conducted on early development in animals involve isolation, depriving the animals from certain types of environments, or exposing them to some aversive stimuli. But in reality, most animals will not be exposed to such extremes in their social environments. Although these studies are useful in distinguishing the critical periods of development and the effects of such extreme environments, it does not give much insight into the development of the animal in normal social settings.

One study has been conducted on the effects of puppy socialization classes. These classes originated to help owners understand their dogs and to achieve a much larger percentage of manageable and sociable animals in the community (Seksel, 1997). The classes are usually run by a veterinarian or animal behaviouralist and involve four weekly one-hour sessions. The puppies are around 7 to 16 weeks of age when they undergo this course. By the end of the four weeks the puppies have learnt how to sit, come, wait, lie down, stay, and to walk on a loose lead without pulling. They are also exposed to a wide range of novel stimuli in a non threatening manner, and are frequently handled by a number of owners. The owners are also taught about the importance of showing dominance to the puppy, and how to discourage unacceptable behaviour.

It is thought that these classes will help identify any behavioural problems that are starting to develop, create better behaved dogs, and to educate the clients on puppy care (Seksel, 1997). But it was found that the benefits of the socialization and training program were primarily based on improvement in commands. Therefore, it was concluded that at least with responses to novel, social, and handling stimuli, that the puppy's exposure to these stimuli in a house environment is sufficient and that additional exposure at a class does not significantly improve upon it (Seksel, 1997).

This suggests that there is a minimum level of social interaction that is needed at an early age, but any above that level will not necessarily improve social behaviour. This conclusion is supported by the other studies that have been conducted as they alter the environment dramatically, thus not providing the animal with the minimum level of social interaction that may be needed to produce a normally developed dog. As a result, the animals develop post-isolation syndrome, are more fearful and distrustful and do not undergo normal sorts of behaviours.

1.6.10 JUVENILE PERIOD

This period runs from 12 weeks of age up to 6 months. The puppy has established the foundation for what he will learn in the future, and becomes mature enough to form complete sexual relationships. They begin to explore more and this is probably the time when they make the easiest transition from one physical environment into another (Scott and Fuller, 1965). It has been found that guide dog puppies successfully adapt to their new homes at 12 weeks of age but if they are kept in the kennels after 14 weeks of age their later training will be affected (Pfaffenberger *et al*, 1976). German Shepherd puppies that were removed from their mother at six weeks of age exhibited loss of appetite and weight, and increased distress, mortality and susceptibility to disease compared with pups that remained at home with their mothers until twelve weeks of age (Slabbert and Rasa, 1993).

1.7 AREAS OF CONCERN

There are currently two major areas of concern for the Royal New Zealand Police Dog Training Centre.

The first is how the Royal New Zealand Police Dog Training Centre selects the dogs that are going to become operational and how they select dogs and brood bitches for breeding. Currently there is no standard selection criteria set for what makes a good police dog and this has led to dogs that should not become police dogs becoming operational.

The Police Dog Training Centre have a very broad idea of the characteristics they believe are important but they have not developed clear definitions of these characteristics. The characteristics may be less than optimal in a selection process. The characteristics are not ranked in their level of importance. This leaves it up to the evaluator to decide on which characteristics they believe are more important. This makes improving the standard of the police dogs difficult.

The other area of concern is that the breeding program that is currently undertaken at the Police Dog Training Centre is very limited. Selection is heavily based on the individual merit of the dogs. The performance of each operational dog is evaluated by reports that are undertaken every year by the Senior Constable at the Police Dog Training Centre. These reports measure a wide range of disciplines including criminal work, obedience and tracking. If the dog performs well operationally and shows the right characteristics it is accepted for breeding. Even if the pedigree of the dog is not known it will still be bred from.

The disadvantage of such selection is that as there is no clearly defined selection criterion so the selection does not remain consistent from generation to generation. Ideally a selection index should be designed that grades each character upon a numerical scale of merit (Robinson, 1982). Then the characters are ordered in level of importance and different weighting coefficients assigned to each character. The dog's overall selection

index is the sum of all the characters multiplied by their respective weighting coefficients. This same selection index can be used to select the dog's potential for police dog work before it is even considered for breeding.

It will also be advantageous for the Royal New Zealand Police Dog Training Centre to use pedigree information, as well as conducting progeny testing and utilising family data from full sib and half sib families.

1.8 AIM OF THE RESEARCH

The aim of this current research is to identify the traits that are considered to be vital in making a dog an effective operational police dog in New Zealand. Since there is only one paper on police dogs this will be a first attempt in identifying important behavioural traits.

A questionnaire sent to police dog handlers will get their views on different behavioural traits in a police dog. The questionnaire will contain questions on their current police dog and their ideal police dog to get an indication of whether the dogs that are currently operational are up to the standard that is required of them. Questions on aspects of the development of the police dog ranging from training to foster homes will also be included. This questionnaire will allow an evaluation of behavioural characteristics in police dogs. This will help in developing selection criteria that can be used to identify potential dogs for police dog work and potential stud dogs and brood bitches.

An analysis of the annual trial reports conducted on operational police dogs will be carried out. The aim of the analysis is to measure the repeatability of the annual assessments in police dogs that are currently operational. Correlations between the traits will also be investigated. If favourable correlations are found then the number of traits measured can be reduced so a more focused trial system and breeding programme can be used.

Combining these annual reports with available genetic information will allow an estimate of the heritability of the traits to be calculated. The analysis of the annual reports will also be useful in evaluating the usefulness of the traits currently being used to identify potential stud dogs and brood bitches. It will also identify the traits that are more reliable then others and which ones have the highest heritability.

From the results obtained by analysing of the data, genetic information and the questionnaire, a basis for starting a selection criterion for the breeding and the selection of the Police Dogs in New Zealand will be developed.

2 A SURVEY OF THE OPINIONS OF POLICE DOG HANDLERS ON THE BEHAVOUR, BREEDING, TRAINING AND QUALITY OF POLICE DOGS.

2.1 INTRODUCTION

The Royal New Zealand Police Dog Training Centre is responsible for breeding, selecting and training all the operational general-purpose police dogs used in New Zealand. Currently there are 120 operational general-purpose police dogs in service in 12 regions around the country. These dogs were either bred by the Police or donated to them from a number of sources. At present the Police Dog Training Centre uses the international German Shepherd breed standard to assess potential breeding stock to suit New Zealand Police requirements.

To improve the standard of police dogs a protocol for selecting and breeding animals needs to be designed. This protocol should include the traits that are essential in a good police dog and these traits should be ranked in order of importance. The protocol should ensure that no unsuitable dogs are used for breeding. Determining what traits are important is vital, as only dogs that have the right traits should be used for breeding. If traits are ranked in importance the breeders can select dogs having the best performance in the important traits and breed from them.

This survey of police dog handlers was used to rank a number of traits, which were thought to make a good police dog. A questionnaire such as this generates useful information as it focuses on a topic that is of interest to the respondents, and the majority of the questions are not concerned with the respondents themselves. These two elements have been shown to increase the response rate to questionnaires and they provide a means to address a new area of interest (Heberlein and Baumgartner, 1978).

This survey asked police dog handlers:

1. To evaluate a number of traits that are thought to make a good police dog
2. Determine if dogs currently operational are up to the standard that is required of them
3. Identify how to improve the standard of police dogs.

2.2 METHOD

2.2.1 QUESTIONNAIRE

A questionnaire (Appendix 1) was developed to determine what police dog handlers thought about the breeding, training and selection of police dogs. A mail questionnaire was used as it was cost effective, the respondents were easy to contact, the results could be obtained quickly, and answers to personal questions were more likely to be addressed than if telephone or personal interview questionnaires were used.

A cover letter (Appendix 1) was enclosed with each questionnaire. It explained the aims of the study, the purpose of the questionnaire, and included an expression of appreciation from the researcher. It also stated that the respondent's answers would be completely confidential. The confidentiality of the process was reinforced by the fact that the questionnaire did not ask the respondent's name. It was felt that more handlers would be willing to answer the questionnaire and answer the questions more accurately if their identity was not known.

The questionnaire was mailed out to all the district leaders of the Royal New Zealand Police Dog Section via the internal mail system. The questionnaire was then distributed to all the police dog handlers in the districts. Overall, 120 questionnaires were sent out. A freepost envelope with a return address was enclosed so that the police dog handlers could send the questionnaire back without any cost. The date of the stamp on the freepost envelope that was returned was noted so that the response rate could be recorded.

The questionnaire consisted of four main sections.

In section one respondents were given a list of behavioural and physical traits of dogs and asked to rank the importance of the traits on a scale from 1 to 5 with 1 being the least and 5 being the most important. Respondents were asked to rate their own police dog and

describe an ideal police dog to determine whether the standard of the police dogs that are currently operational are similar to the handler's idea of the ideal police dog.

The second section had a series of questions on methods to improve police dogs. All of these questions had answers with a numerical rating scale.

The third section had open-ended questions and numerical rating scale questions about the matching of dogs with handlers and the use of foster homes.

The fourth section had open-ended questions about the trait 'prey drive', training, and improvement in the owner's police dog.

Many of the questions were in a format where there was a set of statements accompanied by a numerical rating scale of 1 to 5. The Likert Coding scale ratings for specific questions are shown in Appendix 2. In this system of rating the values from one to five vary according to the question asked. This system of rating allowed us to measure the strength of the respondent's opinion and to measure a dog's ability in certain areas.

2.2.2 COLLATION

The data from the questionnaires were adjusted where necessary so that quantitative analysis could be conducted. The answers that were not in a numerical scale were coded. The demographic data 'years of experience of the handler' and 'number of dogs' that were to be used as fixed effects in the statistical analysis were grouped into three categories (Table 2.1.) Numerical values were assigned to the answers of Question 16 (Do you think your dog tracks as a player in a game or as a predator?) and Question 19 (Which dogs do you think are the best for Police dog work - those bred at Trentham, those donated from the public or both?) (Table 2.2). For the definition of the trait 'prey drive' and how it is measured the answers were grouped into categories according to the words used in the definition. Answers that could not be categorised were summarised.

2.2.3 STATISTICAL ANALYSIS

Statistical analysis was conducted using the Statistical Analysis System (SAS) package. Descriptive procedures were carried out to show frequencies and central tendencies. The chi-square test was conducted on the data with the fixed effects 'source of dog', 'years of experience of the handler', and 'the number of dogs' being taken into account separately for each answer. The chi-square test was also done on the behavioural traits listed for the ideal dog so that the traits could be ranked in importance from most important to least important. A paired t-test was used to compare the values for the handler's own dog and their ideal dog. Where the paired t-test showed a non-significant result an analysis of variance was conducted taking into account the fixed effect 'years of experience of the handler' in order to reduce the variance that cannot be accounted for in the paired t-test analysis.

Table 2.1 Coding values for demographic data

2.2.3.1 Category	2.2.3.2 Range of answers	2.2.3.3 Code
Years of exp. of handler	1 – 4 yrs	1
	5 – 10 yrs	2
	> 11 yrs	3
Number of dogs	1 – 2 dogs	1
	3 – 4 dogs	2
	5 – 6 dogs	3
Source of dog	Bred by Police	1
	Donated from other source	2
Body length of dog	Short	1
	Med	2
	Long	3
Hair type of dog	Short	1
	Med	2
	Long	3
Coat colour of dog	Sable	1
	Black/Tan	2
	Black/Gold	3
	Other	4

Table 2.2 Coding scale for categorical questions

2.2.3.4 Category	2.2.3.5 Range of answers	2.2.3.6 Coding
How their dog tracks	As a player in a game	1
	As a predator	2
	Both	3
Type of ideal dog	Dogs bred in Trentham	1
	Dogs donated	2
	Both	3

2.3 RESULTS

2.3.1 RESPONSE RATE

Seventy-four questionnaires (67%) were returned from one hundred and twenty police dog handlers. The first were received on the 28th of March 2001. The majority arrived between the 28th of March 2001 and the 29th of April 2001. The last was received on the 27th of May 2001.

2.3.2 EXPERIENCE OF RESPONDENTS

The average number of years of experience as a dog handler was 7.6 years (± 5.6). There was a wide distribution of experience, the shortest time in the Police Dog Service being 8 weeks and the longest time being 28 years. Around twenty percent of the police dog handlers had 3 to 4 years experience (Table 2.3).

2.3.3 NUMBER OF DOGS HANDLED BY RESPONDENTS

Thirty four percent of the police dog handlers had had only one police dog during their career in the Police Dog Section. The highest number of police dogs a handler had worked with was six. The majority of the handlers had between one to three dogs during their time in the Police Dog Section (Table 2.4). The mean number of dogs handled by the respondents was 2.3 (± 1.3).

2.3.4 POLICE DOGS USED BY RESPONDENTS

All the participants used male German Shepherd dogs. The most frequent type of body length for the dogs in this study was medium with fifty seven percent having this type of body. Only seven percent had a short body type (Table 2.5). The majority of the dogs had

either a short or medium length coat and five percent had a long coat (Table 2.6). The majority of the dogs (66%) had the coat colour black and tan and only two dogs had a coat colour that was not either sable, black & tan or black and gold. About fifteen percent of the working dogs were either sable or black and gold (Table 2.7).

2.3.5 RANKING OF TRAITS AND ACTIVITIES

The police dog handlers described their own dog according to the traits given to them in the questionnaire. They scored these traits from highest to lowest as 'prey drive', 'playfulness', 'trainability', 'general activity', 'independence', 'obedience', and 'aggression' (Table 2.8). Their own dogs had very high 'prey drive' (4.36) but much lower aggression (3.35).

Their description of the ideal dog using the same traits scored from highest to lowest 'prey drive', 'trainability', 'general activity', 'obedience', 'playfulness', 'independence' and 'aggression' (Table 2.9). The ideal dog would have a higher prey drive then their own dog (4.88) and would also have a low aggression with the value being slightly higher then the aggression rate obtained for their own dog (3.85).

The police dog handlers ranked their own dog highest for criminal work (4.08) and lowest for general obedience (3.71) (Table 2.10). The most important activity of their ideal dog was track and search (4.99) while general obedience was considered the least important (4.34) (Table 2.11).

2.3.6 THE IDEAL DOG VERSUS THE REAL DOG

The majority of the police dog handlers rated their dogs high or very high and the ideal dog very high for the traits 'trainability' (Figure 2.1), 'general activity' (Figure 2.4), 'obedience' (Figure 2.5) and 'playfulness' (Figure 2.7).

For the trait 'prey drive' 51% of the handlers rated their dog very high with 89% rating the ideal dog very high (Figure 2.3). 36% of respondents rated their own dog average for the trait 'aggression' while 47% rated the ideal dog high (Figure 2.2). 61% of handlers rated their dog high or very high for the trait 'independence' and 75% of handlers rated the ideal dog high or very high for 'independence' (Figure 2.6) (Table 2.12 – 2.13).

About half of the handlers rated their dog's general obedience and track and search as high (Table 2.14). Their ideal dog rated very high in these characteristics (Table 2.15). 46% of handlers rated their dog's criminal work as very high with 80% rating the ideal dog as very high (Table 2.14, Figure 2.9). The rating of overall is how the dog scores in all the activities combined. The majority of the handlers rated their dog high for overall activity while the ideal dog rated very high (Table 2.15, Figure 2.11).

2.3.7 LEVEL OF IMPORTANCE OF CHARACTERISTICS

In question three the participants were asked to circle five characteristics they believed were the most important in police dogs. The characteristics listed were height, weight, size, sex, colour, source of dog, 'trainability', 'prey drive', 'aggressiveness', 'obedience' and 'general activity'. The majority of respondents either gave a score from one to five for each of the characteristics listed or rated the top five characteristics on a score they thought was suitable, not an actual ranking scale of one to five as asked.

Therefore, instead of being able to summarize the results on which characteristics were considered most important and ranking them on a scale of one to five the characteristics given the highest scores in total were added up. The trait 'prey drive' had the highest total score of 333. The next highest score of 326 was for the trait 'trainability'. 'activity'(244), 'aggressiveness'(239), 'obedience'(233) and size (62) in order of highest to lowest were the next four highest scores.

2.3.8 METHODS FOR IMPROVEMENT

In question nine police dog handlers were asked to rank a number of actions which might improve the standard of police dogs (Table 2.17). Improving the stud and brood bitch selection process was considered to be the most important with 47% and 44% of respondents respectively rating these methods as very important (Table 2.16). 63% of the police dog handlers considered that reducing the number of donated dogs was not important and 59% considered changing breed was not important (Table 2.16). More focus on training, stricter assessment measures and improving the puppy testing all had an average rating value of 3.7, which indicated an average to high level of importance (Table 2.17).

2.3.9 FEMALE GERMAN SHEPHERDS

When asked why bitch dogs were not used for operational work thirteen participants chose not to answer this question as they had not had any experience working with them or did not know why bitches were not used. The reasons considered most important were 'not aggressive enough' and 'more important for breeding' (2.44) (Table 2.18). Many dog handlers disagreed with the statement that female German Shepherds had 'low trainability' (49%) and 'low prey drive' (46%) (Table 2.19).

2.3.10 REASONS TO USE THE GERMAN SHEPHERD BREED

Police dog handlers thought that German Shepherd Dogs were the ideal police dog because of 'public perception' (4.22) and few thought they were ideal because of aggression (2.93) (Table 2.20). Most agreed that they had a high 'prey drive' (58%) and 30% strongly agreed with a statement that German Shepherds were the 'right size' (Table 2.21). Many handlers considered the German Shepherd dog characteristics 'high trainability', 'right size', and 'active' important. No handler strongly disagreed with the

statement that German Shepherd dogs were 'easily trainable' and had high 'prey drive'(Table 2.21).

2.3.11 TRAINING

Forty three percent of participants believed that training was adequate at the Royal Police Dog Training Centre. Overall, fifty six percent of participants found that the training at the Training Centre was adequate or very adequate, with fifty six percent of participants also rating training in their own regions as adequate or very adequate (Table 2.22). At the Training Centre an average rating of 3.51 was found while the average rating for training in the region was 3.64 (Table 2.26).

The main weakness in training stated by the handlers was a lack of consistency between training at the training centre and training in the regions with twelve handlers stating this. Some of them stated that the lack of consistency was due to a lack of ability or experience in the instructors or due to a high turnover in staff. Seven handlers thought that there was not enough training in real life situations. Six handlers believe that unsuitable dogs are being kept in the training program longer than they should be. A reluctance to try new training methods was mentioned by four handlers.

Weaknesses in training that were mentioned included; dogs should have a pass/fail rating instead of being assessed, training was too long, training was too short, training did not contain enough fun activities, some regions did not have a trainer in their area, there were too many handlers on the same course, and that there was too much obedience. Some handlers thought that handlers should also undergo a selection criteria.

2.3.12 HANDLER AND DOG MATCHINGS

A very small number of handlers (1%) thought that dogs were matched very well with their handlers and thirty four percent thought that they were personally very well matched

with their dog (Table 2.23). Nineteen percent of handlers believed that dogs and handlers were not matched up well at all (Table 2.23). The main reason stated on why dogs and handlers were not matched well was because there was not enough choice in the dog that they could be matched up with.

2.3.13 HOW THE HANDLER'S DOG TRACKS

Half of the participants thought that their dog tracked as a predator while forty three percent believed that their dog tracked as if in a game. The rest believed that their dog tracked both as a predator and thought of it as a game (Table 2.24).

2.3.14 DEFINITION OF PREY DRIVE

Sixty-one respondents answered the question on what they thought the definition of 'prey drive' was. The most common comments were 'the will to', 'its enthusiasm to', 'the desire to', 'it's motivation to', 'it's determination to', 'it's instinct to', and 'its keenness' to retrieve, chase, and hunt an object, prey, article or offender. The definitions were grouped depending on which descriptive words they used. There was also a group of miscellaneous responses that were not similar to any of the other groups.

The comment 'the desire to' was the most common response with 13 participants using that word. Nine people used the word 'determination', the words 'willingness' and 'motivation' was used by seven participants each, 'drive' was used by six people, four people used 'keenness', 'hunt' was used three times and 'the instinct to' was used by two people. Other words used were 'focus', 'fanatical', 'propensity to', 'aggressive', a 'sight activated chase reflex', and 'strong'.

2.3.15 HOW PREY DRIVE IS MEASURED

When asked how the Police measure 'prey drive' fifty-nine responses were received. Most of the respondents thought that the Police measure prey drive by retrieve games, whether it be with an object, prey, or sleeve. Others mentioned tracking ability as the main way that prey drive was measured while others thought that retrieve was used initially and then tracking ability when the dog was more experienced.

2.3.16 FOSTER HOMES

The highest percentage of participants (35%) agreed that foster homes were good. Only five percent of handlers thought that foster homes were not a good idea at all (Table 2.25). The mean score was a value of 3.46 indicating that foster homes were an average to a good idea (Table 2.26). Thirty-one handlers commented on the foster home program. Out of the thirty-one handlers, four mentioned that the handlers should raise the puppies themselves while two thought that puppies should be removed from the foster home earlier. The main comments were that foster homes were a good idea but the families need to be monitored more closely as some of them were making the dogs too soft, not encouraging them on their exercises enough, and overprotecting the dogs.

2.3.17 SOURCE OF DOG

Sixty percent of handlers believe that donated dogs are better for police dog work while only nine percent believed that bred dogs were better. Thirty percent were undecided.

2.3.18 PROBLEMS IN A HANDLER'S OWN DOG

Twenty out of the seventy-two police dog handlers (28%) stated that there was a problem with their own police dog. Three handlers mentioned that their dog was getting old, two had dogs with hip dysplasia and two thought that their dog was not aggressive enough.

Other problems were temperament, lack of concentration, 'perving', fear of slippery floors, lameness, enlarged prostate gland, ear problems, skin problems, back degeneration and noisiness.

2.3.19 IMPROVEMENT IN THE HANDLER'S OWN DOG

When police dog handlers were asked whether there had been an improvement in the dogs that they had used twenty-two said no while nineteen said yes. For twenty-five of the police dog handlers this question was not applicable as they had only worked with one dog. Of the remaining six handlers, four of them said that each dog was different and that they could not compare them, one said that both of his dogs were exceptional and one said that there were fewer genuine hard/aggressive dogs at present.

2.3.20 CHI-SQUARE ANALYSIS OF DATA

(See Appendix Three for details)

2.3.20.1 Question One Traits with Source of Dog

A chi-square analysis conducted on the traits 'trainability', 'aggressiveness', 'prey drive', 'general activity', 'obedience', 'independence', and 'playfulness' (Question one), which took into account whether the dog was bred at the Police Dog Training Centre or donated to them from other sources was conducted with all five values from very low to very high recorded. There were only a few responses in the lower half of the rating scale and a further chi-square analysis was conducted with the responses ranked as very low, low and average combined. None of the chi-squares showed a significant difference between the dogs bred at the Police Dog Training Centre and those donated to them for the traits in question one (Table 2.27).

2.3.20.2 Question Four Activities with Source of Dog

A chi-square analysis was conducted for the activities general obedience, criminal work, tracking and searching, and the overall rating for the three activities taking into account the source of the dog. Due to the fact that there were few responses in the lower half of the scales the scores very low, low and average were combined. No significant difference was found between the source of dog and the scores recorded for Question Four (Table 2.28).

2.3.20.3 The traits asked in Question One: How would you personally describe your police dog? and Question Two: How would you personally describe the ideal police dog? with years of experience of handler

To test whether the years of experience of the handler had an effect on the scoring of the dogs for the traits in question one and the ideal dog in question two a chi-square analysis procedure was conducted. No significant differences were found (Tables 2.29 and 2.30). The scores very low, low and average were combined before analysis.

2.3.20.4 Question Nine: Methods for Improvement with Years of Experience of Handler

Question nine was concerned with methods for improving the standard of the police dogs. For the methods more focus on training, improved stud selection, improved brood bitch selection, stricter assessment measures, and improved puppy testing the scores very low, low and average were combined before analysis of these methods were conducted. For reducing the number of donated dogs and changing breed the scores average, high and very high were combined. The scores high and very high were combined for the method having better food. The years of experience of the handler had no significant effect on the responses to seven of the eight methods for improving the standard of the police dogs.

For the method 'reducing the number of donated dogs' the years of experience of the handler did have an effect (Table 2.31) . Seven handlers that had been in the Police Dog Section for more then 11 years rated the method 'reducing the number of donated dogs' as average or above average in level of importance while the expected frequency was only three. It was expected that 5 handlers with 5 to 10 years of experience would rate reducing the number of donated dogs as average or above average in level of importance but only one handler did.

2.3.20.5 Question Nine: Methods for improvement with number of dogs

The number of dogs worked by the handlers was taken into account for the scores of the eight methods for improving the standard of the police dogs. As there were only a small number of handlers that had five or six dogs, when the methods reducing the number of donated dogs, better food and changing the breed were analysed the groupings of the number of dogs was changed from three groups to two. The group of participants that had three or four dogs and the group of participants who had five or six dogs were combined before analysis was conducted. No significant differences were found between the ratings of the participants who had only one or two dogs scored with the participants who had had three or more dogs (Table 2.32).

2.3.20.6 The frequencies for the traits for the 'ideal' dog

A chi-square analysis was conducted on the frequencies given by the police dog handlers on the traits for the 'ideal' dog. It is expected that the most important trait will have large chi-square values due to a larger number of handlers scoring the value 'very high' than the expected frequency and a smaller number of handlers scoring 'very low/average' than expected.

The analysis shows that the trait 'prey drive' was considered the most important trait by the police dog handlers as the trait had the highest chi squared value in the cell for a score of very high. As shown in the observed frequency value and the expected frequency value

the large chi square value was due to a larger number of handlers rating the ideal dog as very high for the trait than expected. A large chi square value was also seen in the very low/average score and was due to a smaller number of handlers scoring this value than the expected value.

The ranking of the ideal traits from most important to least important was obtained from the chi square values in the cells for the score of 'very high' and 'very low/average' for each trait and the differences between the observed frequency value and the expected frequency value. The ideal traits from most important to least important were 'prey drive', 'trainability', 'general activity', 'obedience', 'playfulness', 'independence', and 'aggressiveness'.

2.3.20.7 The frequencies of the activities for the 'ideal' dog

A chi-square analysis on the activities involved in police dog work was conducted to find out what activity was thought to be the most important by the police dog handlers. From the values obtained for the chi-square the activity track/search was considered the most important. This activity had a chi-square value of 5.48 for the score very high with the score average/high having a value of 16.36. From the differences in values obtained for the observed frequency and the expected frequency track/search had a higher number of handlers rating this activity as very high then expected and a lower number scoring this activity as average/high.

The least important activity considered by the handlers was general obedience. This activity had high chi-square values for the scores average/high and very high but this was due to a higher number of handlers rating general obedience as average/high than expected and a smaller number rating this activity as very high than what was expected.

2.3.21 IDEAL VERSUS REAL POLICE DOGS

Paired t-tests were conducted for the traits 'trainability', 'aggressiveness', 'prey drive', 'activity', 'obedience', 'independence' and 'playfulness' to see if the scores that were recorded for the personal dog (Question One) were significantly different from the ideal dog (Question Two). Significant differences were found for all the traits except for the trait playfulness (Table 2.34). All the differences between the means had positive values, therefore the ideal mean for the trait was higher than the mean for the handler's own dog. As the trait 'playfulness' showed a non-significant difference an analysis of variance was conducted with the fixed effect 'years of experience' also taken into account. The analysis of variance showed that there was no significant difference between the dog handler's personal dog and the ideal dog for the trait 'playfulness' (Table 2.35).

Paired t-tests were also conducted for the activities general obedience, criminal work, track/search and the overall scores obtained for all the activities combined to see if there was a difference between the personal dog scores (Question Four) and the ideal dog scores (Question Five). All the results were significant so there was a difference in the values obtained for the personal dog and the values obtained for the ideal dog for the activities general obedience, criminal work, track/search and overall activity (Table 2.36). The values for the difference between the means were all positive indicating that the ideal dog rated higher on average than the personal dog on the activities. As all the results were significant no further analysis was conducted.

Table 2.3 The years of experience as a dog handler of the respondents

Years of Experience	Frequency	Percent	Cumulative Frequency	Cumulative Percent
0	1	1.41	1	1.41
0.3	1	1.41	2	2.82
0.5	2	2.82	4	5.63
0.67	1	1.41	5	7.04
1	4	5.63	9	12.68
1.5	1	1.41	10	14.08
2	3	4.23	13	18.31
3	7	9.86	20	28.17
4	7	9.86	27	38.03
5	5	7.04	32	45.07
5.5	1	1.41	33	46.48
6	5	7.04	38	53.52
7	4	5.63	42	59.15
8	3	4.23	45	63.38
9	4	5.63	49	69.01
10	5	7.04	54	76.06
11	3	4.23	57	80.28
12	3	4.23	60	84.51
13	1	1.41	61	85.92
14	3	4.23	64	90.14
15	2	2.82	66	92.96
17	1	1.41	67	94.37
18	1	1.41	68	95.77
21	1	1.41	69	97.18
24	1	1.41	70	98.59
28	1	1.41	71	100

Table 2.4 Frequency table for the number of dogs respondents had worked with during their time in the Police Dog section

Number of Dogs	Frequency	Percent	Cumulative Frequency	Cumulative Percent
1	25	34.72	25	34.72
2	18	25	43	59.72
3	16	22.22	59	81.94
4	7	9.72	66	91.67
5	5	6.94	71	98.61
6	1	1.39	72	100

Table 2.5 Frequency table for the body length of the respondent's police dogs

Body	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Short	5	7.14	5	7.14
Medium	40	57.14	45	64.29
Long	25	35.71	70	100

Table 2.6 Frequency table for the hair length of the respondent's police dogs

Hair	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Short	27	46.55	27	46.55
Medium	28	48.28	55	94.83
Long	3	5.17	58	100

Table 2.7 Frequency table for the coat colour of the respondent's police dogs

Colour	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Sable	11	15.49	11	15.49
Black/Tan	47	66.2	58	81.69
Black/Gold	11	15.49	69	97.18
Other	2	2.82	71	100

Table 2.8 Descriptive statistics for Question 1.

How would you personally describe your police dog on a scale of 1 – 5 (1 – very low, 5 – very high)?

QUESTION	TRAIT	MEAN	STD	CONF.	MODE
One	Prey drive	4.36	0.73	0.17	5
One	Playfulness	4.23	0.71	0.16	4
One	Trainability	4.16	0.78	0.18	4
One	General activity	3.97	0.8	0.18	4
One	Independence	3.73	1.04	0.24	4
One	Obedience	3.72	0.88	0.2	4
One	Aggressiveness	3.35	1.07	0.24	3

Table 2.9 Descriptive Statistics for Question 2.

How would you personally describe the ideal police dog on a scale of 1 – 5 (1 – very low, 5 – very high)?

QUESTION	TRAIT	MEAN	STD	CONF.	MODE
Two	Prey drive	4.88	0.37	0.08	5
Two	Trainability	4.8	0.5	0.11	5
Two	General activity	4.49	0.56	0.13	5
Two	Playfulness	4.3	0.72	0.16	5
Two	Obedience	4.3	0.81	0.19	5
Two	Independence	4.03	0.91	0.21	4
Two	Aggressiveness	3.85	0.82	0.19	4

Table 2.10 Descriptive Statistics for Question 4.

How would you rate your dog on the activities below on a scale of 1 – 5 (1 – very low, 5 – very high)?

QUESTION	ACTIVITY	MEAN	STD	CONF.	MODE
Four	Criminal work	4.08	1.05	0.24	5
Four	Tracking & searching	4.06	0.75	0.17	4
Four	Overall	3.96	0.67	0.15	4
Four	General obedience	3.71	0.8	0.18	4

Table 2.11 Descriptive Statistics for Question Five.

How would you rate the ideal police dog on these activities on a scale of 1 – 5 (1 – very low, 5 – very high)?

QUESTION	ACTIVITY	MEAN	STD	CONF.	MODE
Five	Tracking & searching	4.99	0.12	0.03	5
Five	Criminal work	4.78	0.45	0.1	5
Five	Overall	4.72	0.45	0.1	5
Five	General obedience	4.34	0.75	0.17	5

Table 2.12 Frequency table for Question 1.

How would you personally describe your police dog?

Trait	Score level	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Trainability	low (2)	2	2.7	2	2.7
	average (3)	11	14.86	13	17.57
	high (4)	34	45.95	47	63.51
	very high (5)	27	36.49	74	100
Aggression	very low (1)	4	5.41	4	5.41
	low (2)	10	13.51	14	18.92
	average (3)	27	36.49	41	55.41
	high (4)	22	29.73	63	85.14
	very high (5)	11	14.86	74	100
Prey Drive	average (3)	11	14.86	11	14.86
	high (4)	25	33.78	36	48.65
	very high (5)	38	51.35	74	100
General Activity	low (2)	3	4.05	3	4.05
	average (3)	16	21.62	19	25.68
	high (4)	36	48.65	55	74.32
	very high (5)	19	25.68	74	100
Obedience	very low (1)	1	1.35	1	1.35
	low (2)	5	6.76	6	8.11
	average (3)	22	29.73	28	37.84
	high (4)	33	44.59	61	82.43
	very high (5)	13	17.57	74	100
Independence	very low (1)	1	1.35	1	1.35
	low (2)	9	12.16	10	13.51
	average (3)	19	25.68	29	39.19
	high (4)	25	33.78	54	72.97
	very high (5)	20	27.03	74	100
Playfulness	average (3)	12	16.22	12	16.22
	high (4)	33	44.59	45	60.81
	very high (5)	29	39.19	74	100

Table 2.13 Frequency table for Question 2.

How would you personally describe the ideal police dog?

Trait	Score level	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Trainability	average (3)	3	4.05	3	4.05
	high (4)	9	12.16	12	16.22
	very high (5)	62	83.78	74	100
Aggression	low (2)	4	5.41	4	5.41
	average (3)	19	25.68	23	31.08
	high (4)	35	47.3	58	78.38
	very high (5)	16	21.62	74	100
Prey Drive	average (3)	1	1.35	1	1.35
	high (4)	7	9.46	8	10.81
	very high (5)	66	89.19	74	100
General Activity	average (3)	2	2.7	2	2.7
	high (4)	34	45.95	36	48.65
	very high (5)	38	51.35	74	100
Obedience	very low (1)	1	1.35	1	1.35
	average (3)	11	14.86	12	16.22
	high (4)	26	35.14	38	51.35
	very high (5)	36	48.65	74	100
Independence	very low (1)	1	1.37	1	1.37
	low (2)	3	4.11	4	5.48
	average (3)	14	19.18	18	24.66
	high (4)	30	41.1	48	65.75
	very high (5)	25	34.25	73	100
Playfulness	average (3)	11	14.86	11	14.86
	high (4)	30	40.54	41	55.41
	very high (5)	33	44.59	74	100

Figure 2.1 The ranking by respondents of the Trainability of their own and an ideal police dog

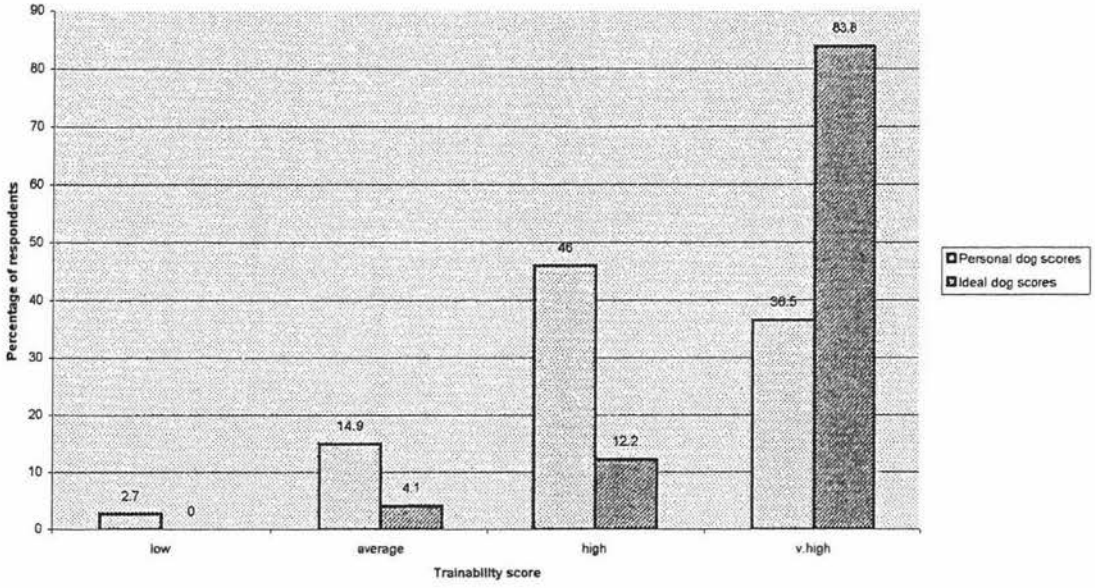

Figure 2.2 The ranking by respondents of the Aggressiveness of their own and an ideal police dog

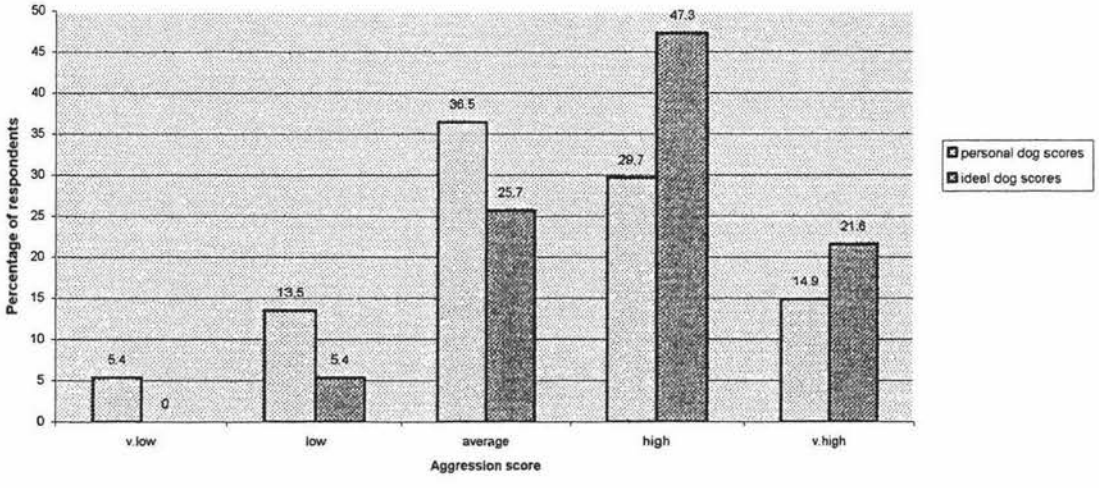

Figure 2.3 The ranking by respondents of the Prey Drive of their own and an ideal police dog

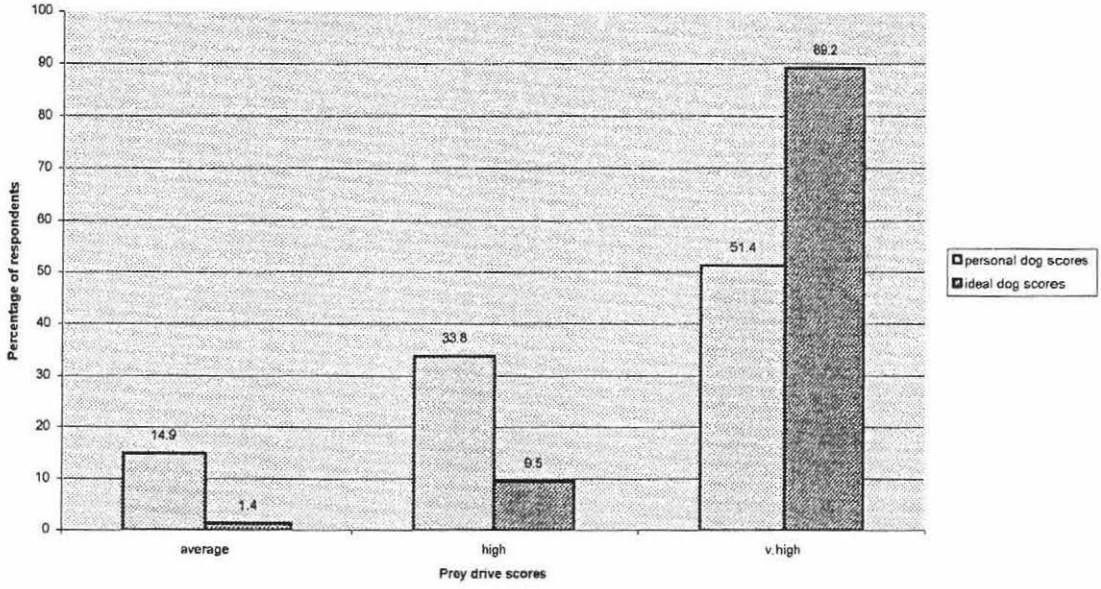

Figure 2.4 The ranking by respondents of the General Activity of their own and an ideal police dog

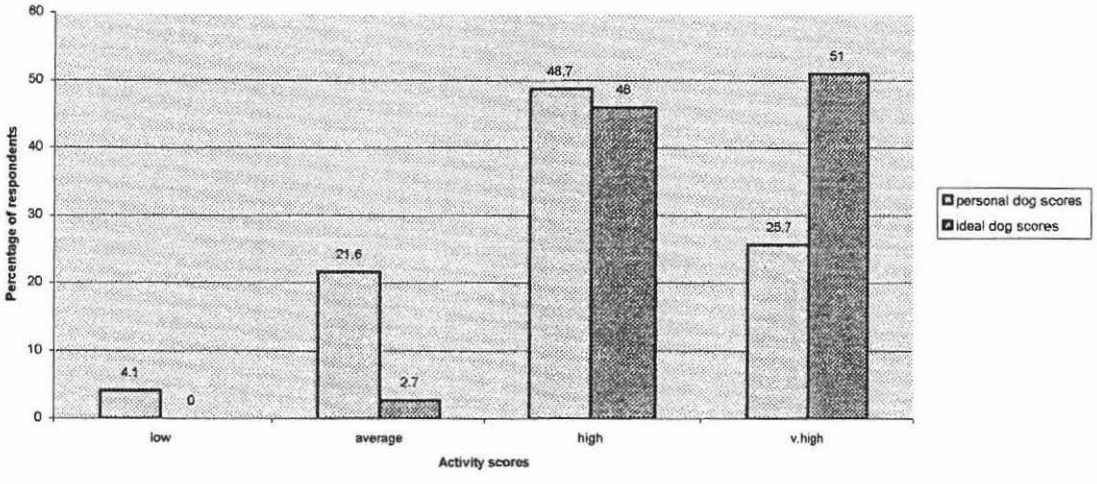

Figure 2.5 The ranking by respondents of Obedience of their own and an ideal police dog

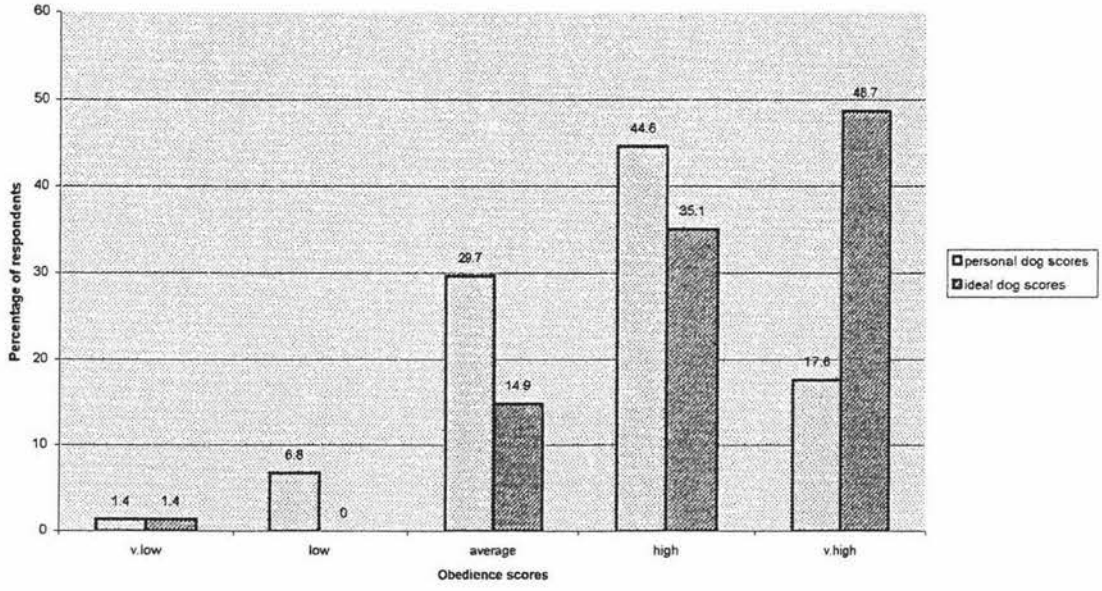

Figure 2.6 The ranking by respondents of the Independence of their own and an ideal police dog

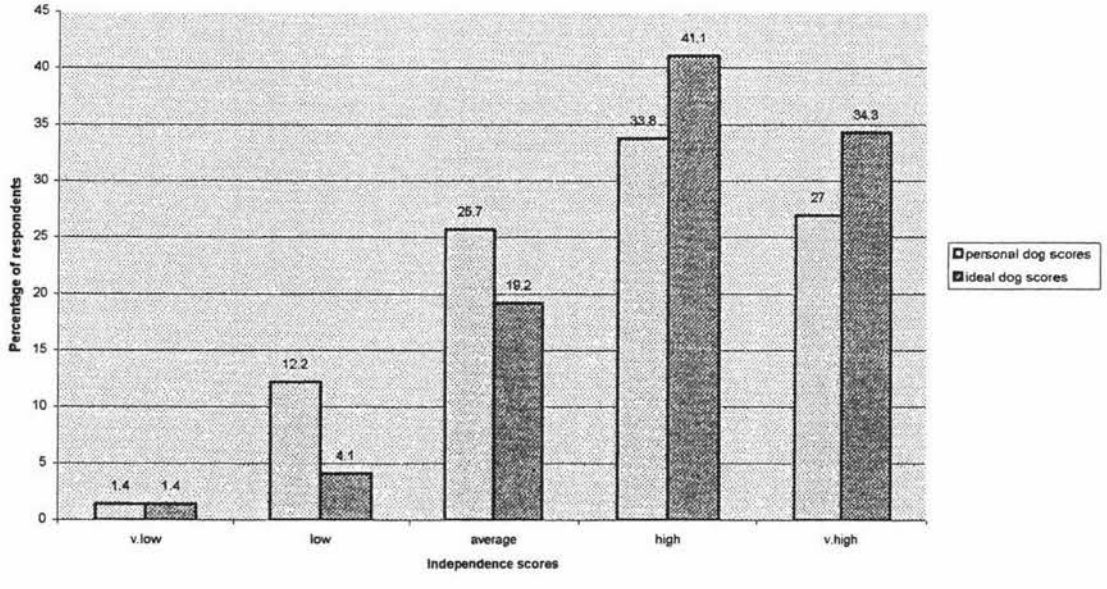

Figure 2.7 The ranking by respondents of the Playfulness of their own and an ideal police dog

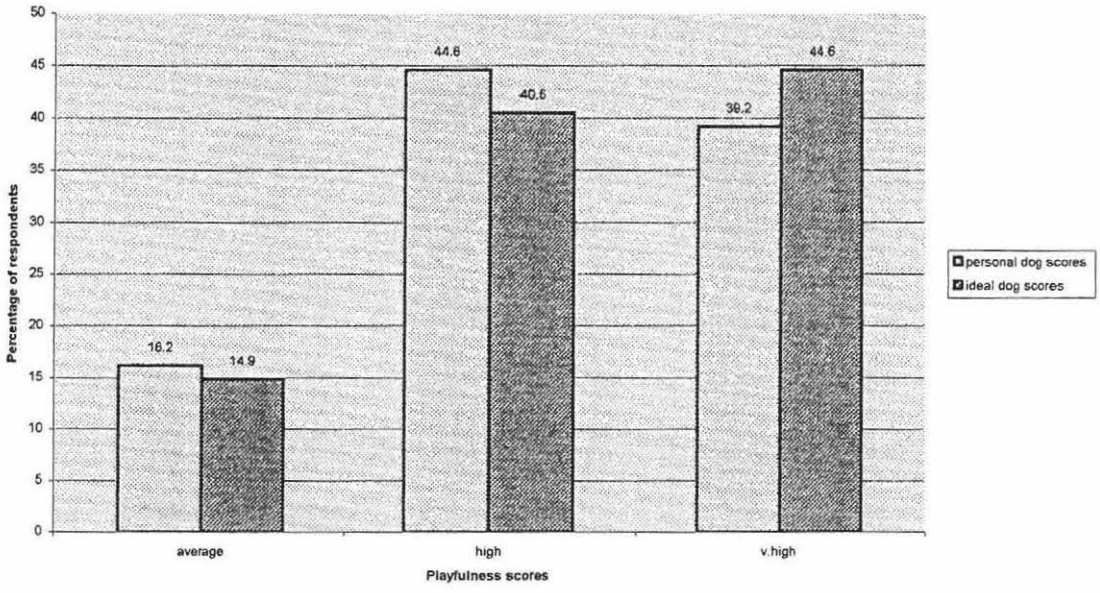

Table 2.14 Frequency table for Question 4.

How would you rate your personal police dog on the activities below on the scale of 1 – 5 (1 – very low, 5 – very high)?

Activity	Score level	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Obedience	very low (1)	1	1.39	1	1.39
	low (2)	3	4.17	4	5.56
	average (3)	21	29.17	25	34.72
	high (4)	38	52.78	63	87.5
	very high (5)	9	12.5	72	100
Criminal Work	very low (1)	1	1.39	1	1.39
	low (2)	6	8.33	7	9.72
	average (3)	13	18.06	20	27.78
	high (4)	19	26.39	39	54.17
	very high (5)	33	45.83	72	100
Track/Search	low (2)	1	1.39	1	1.39
	average (3)	15	20.83	16	22.22
	high (4)	35	48.61	51	70.83
	very high (5)	21	29.17	72	100
Overall	low (2)	2	2.82	2	2.82
	average (3)	11	15.49	13	18.31
	high (4)	46	64.79	59	83.1
	very high (5)	12	16.9	71	100

Table 2.15 Frequency table for Question 5.

How would you rate the ideal police dog on these activities on a scale of 1- 5 (1 – very low, 5 – very high)?

Activity	Score level	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Obedience	average (3)	12	16.22	12	16.22
	high (4)	25	33.78	37	50
	very high (5)	37	50	74	100
Criminal Work	average (3)	1	1.35	1	1.35
	high (4)	14	18.92	15	20.27
	very high (5)	59	79.73	74	100
Track/Search	high (4)	1	1.37	1	1.37
	very high (5)	72	98.63	73	100
Overall	high (4)	21	28.38	21	28.38
	very high (5)	53	71.62	74	100

Figure 2.8 The percentage of ratings for the police dog handler's dog and their ideal dog on the activity General Obedience

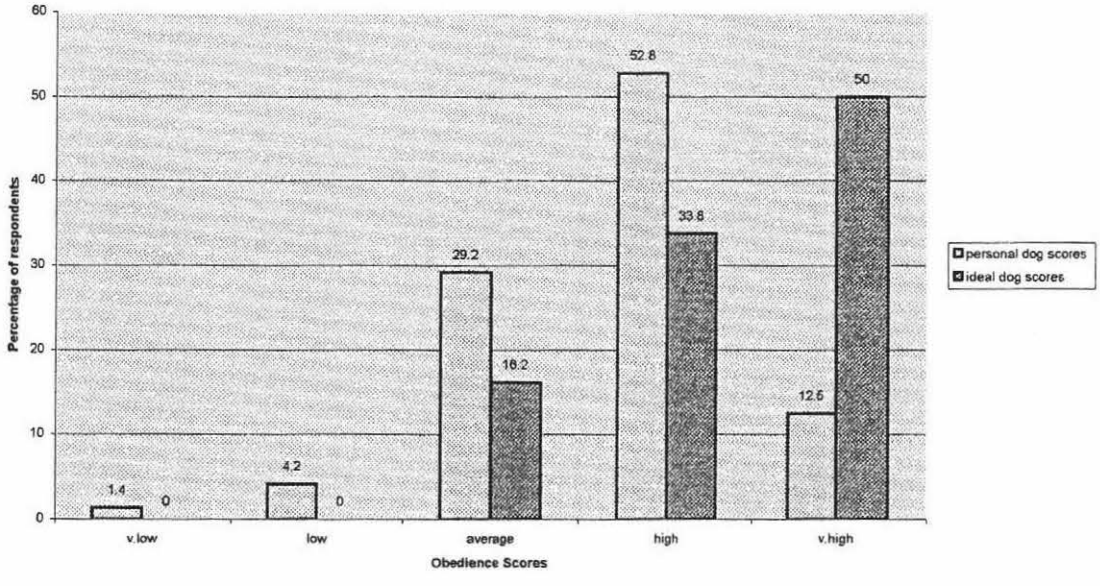

Figure 2.9 The percentage of ratings for the police dog handler's dog and their ideal dog on the activity Criminal Work

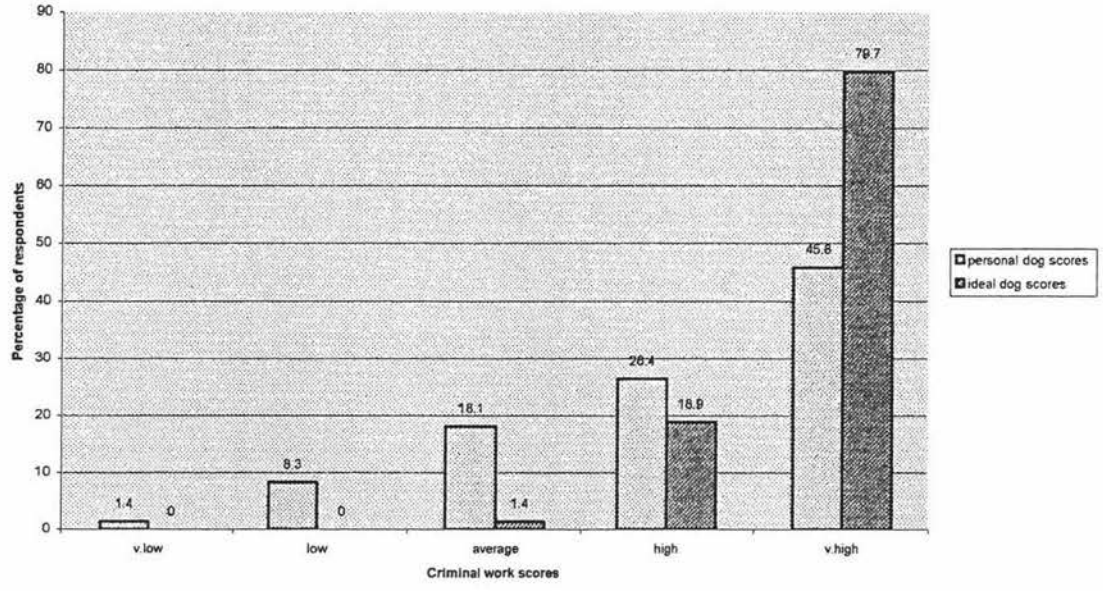

Figure 2.10 The percentage of ratings for the police dog handler's dog and their ideal dog on the activity Track/Search

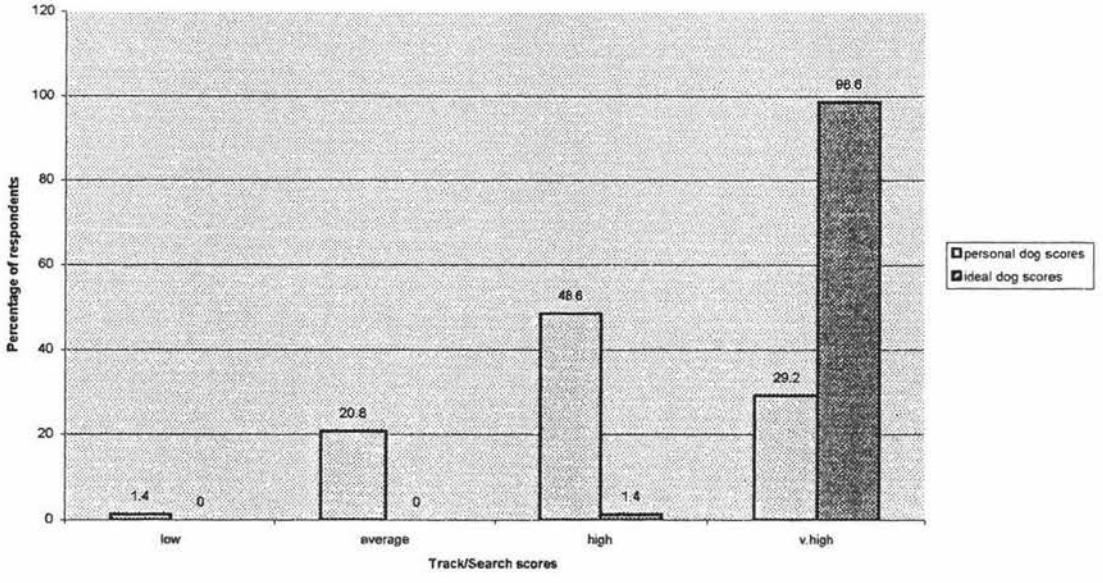

Figure 2.11 The percentage of ratings for the police dog handler's dog and their ideal dog on Overall activity

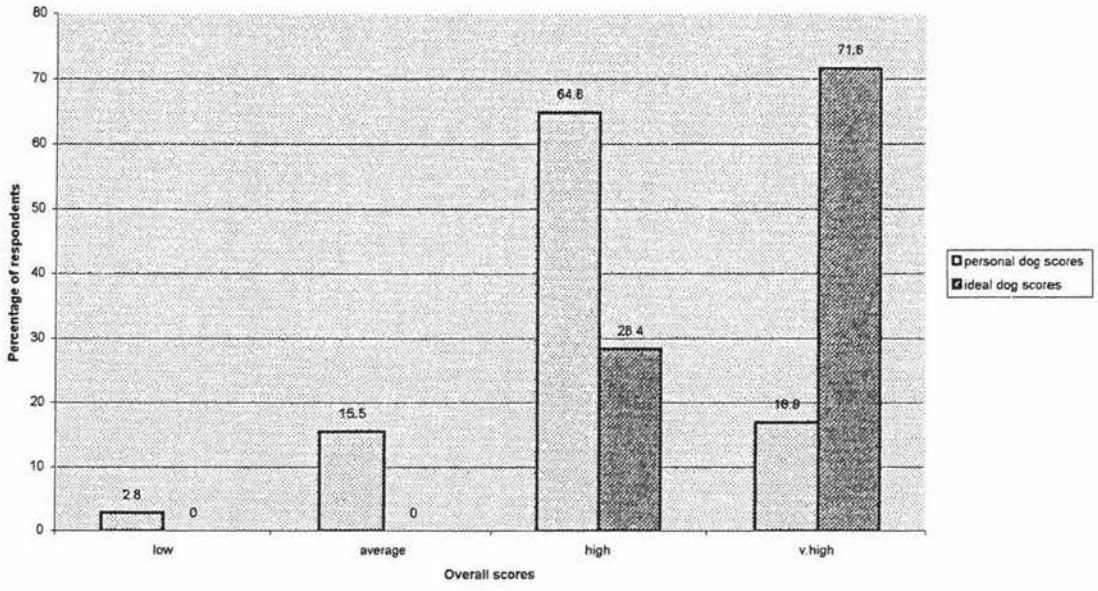

Table 2.16 Frequency table for Question 9.

Rank the importance of these 8 methods for improving the standard of police dogs

Method	Score level	Frequency	Percent	Cumulative Frequency	Cumulative Percent
More focus on training	not impt.(1)	2	2.86	2	2.86
	slightly impt. (2)	3	4.29	5	7.14
	average (3)	19	27.14	24	34.29
	impt. (4)	30	42.86	54	77.14
	very impt. (5)	16	22.86	70	100
Improved stud selection	not impt.(1)	3	4.11	3	4.11
	slightly impt. (2)	3	4.11	6	8.22
	average (3)	12	16.4	18	24.66
	impt. (4)	21	28.77	39	53.42
	very impt. (5)	34	46.58	73	100
Improved brood bitch selection	not impt.(1)	3	4.17	3	4.17
	slightly impt. (2)	4	5.56	7	9.72
	average (3)	10	13.89	17	23.61
	impt. (4)	23	31.94	40	55.56
	very impt. (5)	32	44.44	72	100
Stricter assessment measures	not impt.(1)	2	2.78	2	2.78
	slightly impt. (2)	1	1.39	3	4.17
	average (3)	24	33.33	27	37.5
	impt. (4)	29	40.28	56	77.78
	very impt. (5)	16	22.22	72	100
Reduce number of donated dogs	not impt.(1)	45	63.38	45	63.38
	slightly impt. (2)	12	16.9	57	80.28
	average (3)	10	14.08	67	94.37
	impt. (4)	3	4.23	70	98.59
	very impt. (5)	1	1.41	71	100
Improve puppy testing	not impt.(1)	1	1.43	1	1.43
	slightly impt. (2)	6	8.57	7	10
	average (3)	22	31.43	29	41.43
	impt. (4)	23	32.86	52	74.29
	very impt. (5)	18	25.71	70	100
Better food	not impt.(1)	20	28.17	20	28.17
	slightly impt. (2)	15	21.13	35	49.3
	average (3)	25	35.21	60	84.51
	impt. (4)	9	12.68	69	97.18
	very impt. (5)	2	2.82	71	100
Changing breed	not impt.(1)	41	58.57	41	58.57
	slightly impt. (2)	17	24.29	58	82.86
	average (3)	8	11.43	66	94.29
	impt. (4)	3	4.29	69	98.57
	very impt. (5)	1	1.43	70	100

Table 2.17 Descriptive Statistics for Question 9.

Rank the importance of these 8 methods for improving the standard of police dogs

QUESTION	TRAIT	MEAN	STD	CONF.	MODE
Nine	Stud selection	4.1	1.08	0.25	5
Nine	Brood selection	4.08	1.09	0.25	5
Nine	Focus on training	3.79	0.95	0.22	4
Nine	Stricter assessment	3.78	0.91	0.21	4
Nine	Improved puppy testing	3.73	0.99	0.23	4
Nine	Better food	2.41	1.12	0.25	3
Nine	Changing breed	1.66	0.95	0.22	1
Nine	Reducing donated dogs	1.63	0.97	0.22	1

Table 2.18 Descriptive Statistics for Question 10.

What do you think is wrong with female German Shepherds?

QUESTION	TRAIT	MEAN	STD	CONF.	MODE
Ten	Not aggressive enough	2.44	1.22	0.28	1
Ten	More impt for breeding	2.44	1.22	0.28	1
Ten	Too easily distracted	2.22	1.09	0.25	1
Ten	Low prey drive	1.98	1.06	0.24	1
Ten	Lower trainability	1.79	0.91	0.21	1

Table 2.19 Frequency table for Question 10.

What do you think is wrong with female German Shepherds?

Reason	Score level	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Not aggressive enough	strongly disagree (1)	19	31.15	19	31.15
	disagree (2)	12	19.67	31	50.82
	neutral (3)	16	26.23	47	77.05
	agree (4)	12	19.67	59	96.72
	strongly agree (5)	2	3.28	61	100
Lower trainability	strongly disagree (1)	30	49.18	30	49.18
	disagree (2)	17	27.87	47	77.05
	neutral (3)	11	18.03	58	95.08
	agree (4)	3	4.92	61	100
Too easily distracted	strongly disagree (1)	21	35	21	35
	disagree (2)	13	21.67	34	56.67
	neutral (3)	19	31.67	53	88.33
	agree (4)	6	10	59	98.33
	strongly agree (5)	1	1.67	60	100
More important for breeding	strongly disagree (1)	19	31.15	19	31.15
	disagree (2)	11	18.03	30	49.18
	neutral (3)	19	31.15	49	80.33
	agree (4)	9	14.75	58	95.08
	strongly agree (5)	3	4.92	61	100
Low prey drive	strongly disagree (1)	28	45.9	28	45.9
	disagree (2)	11	18.03	39	63.93
	neutral (3)	18	29.51	57	93.44
	agree (4)	3	4.92	60	98.36
	strongly agree (5)	1	1.64	61	100

Table 2.20 Descriptive Statistics for Question 11.

German Shepherds are ideal police dogs because they are:

QUESTION	TRAIT	MEAN	STD	CONF.	MODE
Eleven	Public perception	4.22	0.82	0.19	5
Eleven	Easily trainable	4.1	0.65	0.15	4
Eleven	Right size	4.01	0.84	0.19	4
Eleven	High prey drive	3.97	0.65	0.15	4
Eleven	Active	3.79	0.78	0.18	4
Eleven	Protective	3.58	0.96	0.22	3
Eleven	Right weight	3.49	0.88	0.2	3
Eleven	Highly aggressive	2.93	0.95	0.22	3

Table 2.21 Frequency table for Question 11.

German Shepherds are ideal police dogs because they are:

Reasons	Score level	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Highly aggressive	strongly disagree (1)	7	9.59	7	9.59
	disagree (2)	12	16.44	19	26.03
	neutral (3)	35	47.95	54	73.97
	agree (4)	17	23.29	71	97.26
	strongly agree (5)	2	2.74	73	100
Protective	strongly disagree (1)	3	4.17	3	4.17
	disagree (2)	3	4.17	6	8.33
	neutral (3)	27	37.5	33	45.83
	agree (4)	27	37.5	60	83.33
	strongly agree (5)	12	16.67	72	100
Easily trainable	neutral (3)	12	16.44	12	16.44
	agree (4)	42	57.53	54	73.97
	strongly agree (5)	19	26.03	73	100
Right size	strongly disagree (1)	1	1.37	1	1.37
	disagree (2)	1	1.37	2	2.74
	neutral (3)	16	21.92	18	24.66
	agree (4)	33	45.21	51	69.86
	strongly agree (5)	22	30.14	73	100
High prey drive	neutral (3)	16	22.22	16	22.22
	agree (4)	42	58.33	58	80.56
	strongly agree (5)	14	19.44	72	100
Public perception	disagree (2)	2	2.74	2	2.74
	neutral (3)	12	16.44	14	19.18
	agree (4)	27	36.99	41	56.16
	strongly agree (5)	32	43.84	73	100
Active	disagree (2)	4	5.48	4	5.48
	neutral (3)	19	26.03	23	31.51
	agree (4)	38	52.05	61	83.56
	strongly agree (5)	12	16.44	73	100
Right weight	strongly disagree (1)	1	1.37	1	1.37
	disagree (2)	7	9.59	8	10.96
	neutral (3)	29	39.73	37	50.68
	agree (4)	27	36.99	64	87.67
	strongly agree (5)	9	12.33	73	100

Table 2.22 Frequency table for Question 12.

Do you think training is adequate in:

Area	Score level	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Trentham	very inadequate (1)	2	2.74	2	2.74
	inadequate (2)	9	12.33	11	15.07
	neutral (3)	21	28.77	32	43.84
	adequate (4)	32	43.84	64	87.67
	very adequate (5)	9	12.33	73	100
Region	very inadequate (1)	2	2.82	2	2.82
	inadequate (2)	10	14.08	12	16.9
	neutral (3)	19	26.76	31	43.66
	adequate (4)	21	29.58	52	73.24
	very adequate (5)	19	26.76	71	100

Table 2.23 Frequency table for Question 14.

Do you think that the dogs are matched well with their handlers on a scale of 1 – 5 (1 – not at all, 5 – very well)?

Dogs matched well	Score level	Frequency	Percent	Cumulative Frequency	Cumulative Percent
In general	not at all (1)	14	19.72	14	19.72
	below average (2)	12	16.9	26	36.62
	average (3)	24	33.8	50	70.42
	well (4)	20	28.17	70	98.59
	very well (5)	1	1.41	71	100
You personally	not at all (1)	3	4.11	3	4.11
	below average (2)	5	6.85	8	10.96
	average (3)	15	20.55	23	31.51
	well (4)	25	34.25	48	65.75
	very well (5)	25	34.25	73	100

Table 2.24 Frequency table for Question 16.

Do you think your dog tracks:

How your dog tracks	Frequency	Percent	Cumulative Frequency	Cumulative Percent
As a player in a game	31	43.66	31	43.66
As a predator	36	50.7	67	94.37
Both	4	5.63	71	100

Table 2.25 Frequency table for Question 17.

Do you think foster homes are a good idea?

Are foster homes a good idea?	Frequency	Percent	Cumulative Frequency	Cumulative Percent
not at all (1)	4	5.41	4	5.41
bad idea (2)	12	16.22	16	21.62
average (3)	18	24.32	34	45.95
good idea (4)	26	35.14	60	81.08
great idea (5)	14	18.92	74	100

Table 2.26 Descriptive Statistics for

Question 12. Is training adequate?,

Question 14. Do you think dogs and handlers are matched well?

Question 17. Do you think foster homes are a good idea?

QUESTION	TRAIT	MEAN	STD	CONF.	MODE
12	Trentham	3.51	0.96	0.22	4
12	Your region	3.64	1.12	0.25	4
14	In general	2.75	1.12	0.25	3
14	You personally	3.88	1.09	0.25	5
17	Foster homes	3.46	1.13	0.26	4

Table 2.27 Chi-square results for the traits asked in Question 1. How would you personally describe your police dog? with source of dog

Trait	χ^2 Value	P Value
Trainability	3.78	0.15
Aggressiveness	0.14	0.71
Prey drive	2.92	0.23
General activity	3.72	0.16
Obedience	0.57	0.75
Independence	0.71	0.70
Playfulness	4.00	0.14

Table 2.28 Chi-square analysis results of the dog handler's personal dog for the activities General Obedience, Criminal Work, Track/Search & Overall with source of dog

Activity	χ^2 Value	P Value
General Obedience	0.30	0.86
Criminal Work	0.65	0.72
Track/Search	0.86	0.65
Overall	0.29	0.86

Table 2.29 Chi-square analysis results for the dog handler's personal dog for the traits asked in Question 1 with years of experience of the handler

Trait	χ^2 Value	P Value
Trainability	2.91	0.57
Aggressiveness	7.84	0.10
Prey drive	1.54	0.82
General activity	0.98	0.91
Obedience	0.99	0.91
Independence	4.72	0.32
Playfulness	6.20	0.18

Table 2.30 Chi-square analysis results of the ideal dog for the traits asked in Question 2 with years of experience of the handler

Trait	χ^2 Value	P Value
Trainability	5.72	0.06
Aggressiveness	3.62	0.46
Prey drive	0.75	0.69
General activity	2.26	0.32
Obedience	7.69	0.10
Independence	6.86	0.14
Playfulness	7.02	0.135

Table 2.31 Chi-square analysis results for the different methods for improvement with years of experience of the handler

Methods	χ^2 Value	P Value
More focus on training	3.76	0.44
Improved stud selection	0.61	0.96
Improved bitch selection	0.56	0.97
Stricter assessment measures	4.50	0.34
Reducing number of donated dogs	9.81	0.01
Improved puppy testing	7.10	0.13
Better food	5.98	0.43
Changing breed	1.85	0.76

Table 2.32 Chi-square analysis results for the different methods for improvement with number of dogs

Methods	χ^2 Value	P Value
More focus on training	1.70	0.79
Improved stud selection	3.84	0.43
Improved bitch selection	6.38	0.17
Stricter assessment measures	1.13	0.89
Reducing number of donated dogs	0.67	0.72
Improved puppy testing	2.00	0.74
Better food	0.62	0.89
Changing breed	1.90	0.39

Table 2.33 Chi - square table for the frequencies for the traits of the 'ideal' dog

		Score		
Trait		Very Low - Average	High	Very High
Trainability	Observed Frequency	3	9	62
	Expected Frequency	10	24.5	39.5
	Chi -square Value	1.6	9.8	12.8
Aggressiveness	Observed Frequency	23	35	16
	Expected Frequency	10	24.5	39.5
	Chi -square Value	16.9	4.5	14
Prey drive	Observed Frequency	1	7	66
	Expected Frequency	10	24.5	39.5
	Chi -square Value	8.1	12.5	17.8
General activity	Observed Frequency	2	34	38
	Expected Frequency	10	24.5	39.5
	Chi -square Value	6.4	3.7	0.06
Obedience	Observed Frequency	12	26	36
	Expected Frequency	10	24.5	39.5
	Chi -square Value	0.4	0.1	0.3
Independence	Observed Frequency	18	30	25
	Expected Frequency	10	24.1	39
	Chi -square Value	6.4	1.4	5
Playfulness	Observed Frequency	11	30	33
	Expected Frequency	10	24.5	39.5
	Chi -square Value	0.1	1.2	1.7

Table 2.34 Chi-square table for the frequencies for the activities of the 'ideal' dog.

		Score	
Activity		Avge/High	Very High
General obedience	Observed Frequency	37	37
	Expected Frequency	18.56	55.44
	Chi -square Value	18.32	6.13
Criminal work	Observed Frequency	15	59
	Expected Frequency	18.56	55.44
	Chi -square Value	0.68	0.23
Track/search	Observed Frequency	1	72
	Expected Frequency	18.31	54.69
	Chi -square Value	16.36	5.48
Overall	Observed Frequency	21	53
	Expected Frequency	18.56	55.44
	Chi -square Value	0.32	0.11

Table 2.35 Paired t-test analysis for traits asked in Question One and Two comparing the personal dog with the ideal dog

Trait	Number	Difference between means	Std. Err	P value
Trainability	74	0.64	0.08	<.0001
Aggressiveness	74	0.5	0.12	<.0001
Prey drive	74	0.51	0.09	<.0001
General activity	74	0.53	0.10	<.0001
Obedience	74	0.59	0.10	<.0001
Independence	73	0.29	0.10	0.00
Playfulness	74	0.07	0.09	0.45

Table 2.36 Analysis of variance for the trait Playfulness comparing the personal dog with the ideal dog

Trait	F Value	P Value
Playfulness	0.38	0.77

Table 2.37 Paired t-test analysis for activities asked in Question Four and Five comparing the personal dog with the ideal dog

Activity	Number	Difference between means	Std. Err	P value
General obedience	72	0.63	0.10	<.0001
Criminal Work	72	0.71	0.13	<.0001
Track/Search	71	0.92	0.09	<.0001
Overall	71	0.75	0.08	<.0001

2.4 DISCUSSION

The major findings of this study were:

1. The traits of an ideal dog in order of importance were 'prey drive', 'trainability', 'general activity', 'obedience', 'playfulness', 'independence', and 'aggressiveness'. The activities in order of importance were track/search, criminal work, overall activity and general obedience.
2. There was a significant difference between the police dog handler's own dog and their ideal dog. However, although the current police dogs are less than ideal, for the majority of the traits they were rated high or very high.
3. The definition of 'prey drive' used by the Police Dog Training Centre is similar to the definitions given by the police dog handlers and the definition of the term 'drive'.
4. The Police did not breed the majority of the operational police dogs and the majority of the police dog handlers believe that donated dogs are better for police dog work.
5. Respondents suggested that the dogs can be improved by stricter stud and brood bitch selection, by monitoring the foster homes and having the dogs allocated to the handlers earlier, having a defined structure for training and more contact between the Dog Training Centre and the regions, and having more dogs available so that dogs can be better matched with the handlers.
6. The years of experience of the handler, the number of dogs handled or the source of the handler's dog did not have an effect on the responses obtained in the questionnaire.

2.4.1 DEFINITION OF THE IDEAL POLICE DOG

The ideal police dog would have a high 'prey drive' and be very good at 'track and search' and 'criminal work'. The trait 'aggression' and the activity general obedience are not considered as important.

The majority of the police dog handlers rated their dogs quite highly for each of the traits listed and the handler's own dog and the ideal dog were rated the same for 'playfulness'. This suggests that the majority of the operational police dogs are up to the standard required of them for this trait.

For most traits the ideal dog and the operational dog were significantly different. This indicates that the current operational dogs need to be improved in the traits 'prey drive', 'trainability', 'aggressiveness', 'general activity', 'obedience', and 'independence'. Therefore, although the police dog handler's own dog scored high or very high for the majority of the traits the respondents did not think that they were ideal.

The ideal dog and the operational dog were significantly different for all of the activities. Therefore, the operational dog needs improvement in all areas of police dog work according to the handlers.

It is likely that the police dog handlers rate their own dog very highly and the differences between reality and ideal dogs may be even greater than the questionnaire indicates. As a numeric rating scale was used in questions one and two there were only five possible ratings. It is possible that the handlers wanted to rate their dog somewhere in between the ratings stated, did not want to rate their own dog badly or did not give the question much thought so answered what they thought would be a good answer and not the true rating of the dog.

2.4.2 RANKING OF TRAITS

The traits ranked from most important to least were 'prey drive', 'trainability', 'general activity', obedience', 'playfulness', 'independence', and 'aggressiveness'. This gives a good indication of the importance placed on these traits by the respondents. The handlers rated all of the traits as important or very important which shows that they are all considered crucial traits in a police dog.

The activities ranked in order of importance were track/search, criminal work, overall activity and general obedience. The ranking of the activities coincides with the ranking of the traits as the traits 'prey drive', and 'trainability' are crucial in a dog becoming good in the activity track/search.

The breeding stock assessment that is currently being used by the Dog Training Centre addresses the character traits self-confidence, fearlessness, hostile/aggressiveness, aloofness, approachable, eagerness, alertness, timidness, nervousness and submissiveness. They also look at the dog's motivation to learn, it's drive (retrieve/play), it's general drive, it's trainability, and how easily it is distracted. A rating of 1 to 4 is assigned with 1 assigned as the dog having a very low amount of the trait and 4 as the dog having a high score for the trait (International breed standard).

The Police will reject dogs that are moderate to high in aggressiveness, timidness or nervousness, scoring either 1 or 4 in aloofness and approachability, and scoring high for submissiveness. These traits are listed by the international breed standard for the German Shepherd dog. The rejection criterion was set by the Police Dog Training Centre for selecting the dogs to be used as breeding stock.

One of the main problems of the questionnaire was that it did not use the Police standard in asking the handlers what they thought was important. As the traits used in the International Breed Standard were not specifically chosen to measure the ability of a

police dog only some of these traits were asked in the questionnaire. A large number of their traits were undesirable. As the aim of this study was trying to find the ideal traits only favourable traits were used in the questionnaire. In a breeding programme it would be useful to combine the breed standard and the criteria identified as important by the police dog handlers.

2.4.3 DEFINING AND MEASURING PREY DRIVE

An important part of a selection programme is to define the traits to be used in the selection objective. The trait 'prey drive' was considered the most important of the traits listed in the questionnaire. Therefore, two questions were placed in the questionnaire that asked the handlers to write down what they thought the definition of 'prey drive' was, and how they thought the Police measured this trait to see how varied the responses would be, and how close they were to the definition used at the Police Dog Training Centre.

The majority of the respondents answered these two questions on 'prey drive'. The definitions were grouped into eight major categories. The main differences in the definitions were the descriptive words used. But the majority of the words used were very similar and could be interchanged easily. The general definition of 'prey drive' is the 'dog's desire to retrieve/chase an object/person'. The majority of the respondents had a similar idea in mind on what the word 'prey drive' meant.

Quite a few respondents did not distinguish between the definition of 'prey drive' and the measurement of 'prey drive'. But the majority of the answers used 'retrieve' as the way in which 'prey drive' was measured at the beginning and 'track' when the dog was more experienced. Some handlers thought the chase was more important, while others thought the retrieval of the object was the main measurement.

The staff at the Police Dog Training Centre believes that 'prey drive' and 'retrieve drive' are the same thing. Drive is considered to be an energiser, an engine that powers an animal to undergo a certain type of behaviour (Hebb, 1955) and has been closely associated with 'instinct' and 'motivation'. Drive is thought to be biological in nature and is reinforced by learning (Bindra, 1968; Smith, 1984). The general definition used by the Police classifies 'prey drive' to be the dog's natural willingness to hunt, attack and kill prey.

Physiological measures can be used to measure the combined effects of all the various conditions that determine the level of drive (Malmo, 1958). But physiological measures are not practical in a dog selection program. In South Africa, the police dog service perceive prey drive to be equivalent to retrieving (Slabbert and Odendaal, 1999). They measured prey drive by a retrieval test, where the dog had to retrieve a favourite toy. The interest the dog showed, the manner in which it approached the object, the way in which it found the object, how it retrieved the object if found, and whether the puppy carried it back to the owner was measured.

Currently the Police Dog Training Centre uses the test 'retrieve' in their annual reports under the section of obedience work. In this test emphasis is placed on heel and throw, pick up and return to sit, and delivery and heel. The test places more emphasis on the obedience of the dog rather than the dog's manner in which it retrieves the object (see Chapter 3).

A more precise test of 'retrieve', that accurately assesses the dog's interest in the object, the manner in which it approaches the object, the way in which it finds the object, how it retrieves the object, and if it returns the object back to the handler, is needed. This test will more accurately measure the dog's ability in the trait 'prey drive'. Using the test 'track' (see Chapter 3) would not be ideal as a lot of the performance of the team in this task is due to the handler's ability to cast a line, pick up on the indications of the dog and to control the dog. As drive seems to be reinforced by learning, early exposure to the

basic retrieve exercise and positive reinforcement will help the dog to develop 'prey drive'.

2.4.4 NUMBER OF DONATED DOGS

The majority of respondents thought that donated dogs were better for police dog work and rated reducing the number of donated dogs as unimportant. This answer might have been biased because of the large number of handlers who had dogs that were not bred by the Police Dog Training Centre.

The large percentage of operational dogs that are donated is a concern. It indicates that the Police Dog Training Centre is not producing enough suitable dogs in their breeding programme either because too few litters are produced or the dogs produced are not suitable for Police work. A larger or more effective dog-breeding programme is required. Reinforcing this view is the fact that handlers thought the most important methods for improvement of police dogs were improved stud and brood bitch selection even though reducing the number of donated dogs was considered unimportant.

To achieve a consistent standard of police dogs the Police should produce the majority of the dogs that become operational. If effective selective breeding is taking place then only dogs that have the desired behavioural and physical traits are bred from. These matings will produce litters with some dogs exhibiting many of these favourable traits. In successive generations the important traits should be continuously improved so that a higher standard of dogs are produced. Producing dogs that are up to a higher standard than the dogs that are currently being utilised now will provide a number of benefits. The time and cost involved in fostering unsuitable dogs, training dogs that are not suitable and continued training and assessment of the dog once operational will be reduced.

2.4.5 IMPROVEMENT IN ENVIRONMENTAL EFFECTS

A knowledge of the development of dog behaviour is essential for service dog organizations so that they can use the key stages of development to increase the chance of the dog succeeding. The environment that a dog experiences when it is young effects the later behaviour of the dog (Scott and Fuller, 1965). Although breeding the right dogs is essential in creating a dog that will be up to the standard required for police dog work, the environment also plays a crucial role (Willis, 1989). Without the right environment the dog will not reach it's full potential and as a result may not become operational (Serpell and Jagoe, 1995). Therefore, it is important to assess the environments that affect whether a dog becomes operational. Environments include foster homes, training, and handler and dog matchings.

A puppy selection performance test conducted when the dog is young could reduce the time and money spent on the dog before training begins. If a performance test was conducted when the dog was 8 weeks old the experiences of the dog at this stage would be highly standardised as each dog would have been subjected to the same environment. Therefore, any differences in the performances measured would be largely due to genetic differences in the dogs.

A number of studies have tried to develop puppy-testing assessments that accurately predict the success of the puppy in adult life (Slabbert and Odendaal, 1999; Wilsson and Sundgren, 1998; Goddard and Beilharz, 1986; Scott and Bielfelt, 1976). The majority of these tests were not useful in predicting adult performance. The most successful tests were conducted by the San Rafael Guide Dog centre (Scott and Bielfelt, 1976) and the South African Police Service Dog Breeding Centre (Slabbert and Odendaal, 1999).

At the South African Police Service Dog Breeding Centre a number of tests were designed that exposed the dogs to situations they would encounter as police dogs. The tests were conducted from the ages of eight weeks to 9 months. All the tests were found to be statistically significant except for the gunshot test. Three of the tests, the retrieval

test at eight weeks and the aggression test at 6 months and 9 months were the most significant. When the three tests were combined together they were able to predict 81.7% of unsuccessful dogs and 91.7% of the successful dogs (Slabbert and Odendaal, 1999).

Although a puppy testing programme could be designed for the Police Dog Training Centre based on the study conducted by Slabbert and Odendall (1999) it is probably more viable now to start conducting the performance testing when the dog returns to the training centre after it has been in a foster home. The dog will be 9 months of age and may portray the behavioural characteristics it will possess when operational. At this stage it will not be attached to a certain handler so will more accurately perform on the basis of it's own performance alone. Once a selection criteria and a standard breeding program are up and running more research on designing a puppy-testing program would be advisable.

2.4.5.1 Foster homes

Foster homes play an important part in whether a dog becomes operational or not as they are in charge of the dog when it goes through its socialisation period between 3 and 13 weeks (Scott and Fuller, 1965). A number of studies have shown that certain events or experiences at this time can have a long lasting effect on the behaviour of the dog (O'Farrell, 1986; Willis, 1989; Scott and Nagy, 1980; Fogle, 1990; Case, 1999; Fox and Stelzner(a), 1966; Levine, 1967; Fuller, 1967; Freedman *et al*, 1961; Fuller and Clark, 1966; Slabbert and Rasa, 1993; Pfaffenberger *et al*, 1976).

Although a large number of police dog handlers believe that foster homes are a good idea the majority suggested that dogs should be removed from the foster homes earlier than 9 months of age and then raised by the handler before training begins. These suggestions may be valid as they might reduce problems that have arisen in the past with dogs. These undesirable habits include reduced retrieval abilities due to a lack of practice in the foster home and dogs being submissive to humans. Earlier matching could increase the chance

of mismatching. If there was a larger number of dogs in foster homes programme this could reduce the chance of mismatching of dogs and handlers due to the larger number of choices.

2.4.5.2 Improvements in training

Training a dog and handler team is a very important part in determining the subsequent success of the team once operational. Therefore, it is important to rectify any problems in the current training procedure. Currently the Dog Training Centre is the main training centre but training in between the courses at the Dog Training Centre is also conducted in the regions. More than half the handlers thought that training was adequate at the Dog Training Centre and the regions. A number of issues were raised when they were asked what the weaknesses in training were. These included a lack of consistency due to staff problems, not enough exposure to real life situations, using unsuitable dogs and a reluctance to try new training methods.

The largest concern was a lack of consistency in the training received at the two different locations. A way to rectify this is to have the Dog Training Centre as the main training place for all the dog and handler teams with the regions only reinforcing the training gained at the centre after each course. A strict guideline on what the training procedures are will also help to provide consistency in training. If regular contact is maintained between the instructors at the Dog Training Centre and the head staff in each region then the instructors at the Dog Training Centre can monitor what each region is teaching the dog and handler team in between courses. This will help in decreasing any confusion that might arise with different training procedures.

2.4.5.3 Handler and dog matchings

Only 1% of handlers thought that dogs were matched very well with their handlers while 34% thought that they were personally well matched. This suggests that the handlers are biased towards their relationship with their current dog believing that they are well

matched while thinking that other teams are not matched well. Currently the police dog handlers do not get a choice on the dog that they are assigned to work with due to a lack of dogs available. As each handler and each dog has distinct personalities there is the potential for problems to arise. The handler and the dog will form a team and will work long hours together. For a team to work to the best of their abilities the dog and handler should be able to understand each other's signals and work together to achieve the desired result. If misunderstandings arise due to personality clashes the working ability of the team will be affected. The majority of behavioural problems in dogs stems from poor communication between the handler and the dog.

The only way that handlers and dogs will be well matched with each other is to have more dogs available to choose from and this can only be accomplished by improving the breeding program so that a higher number of dogs with the right characteristics are available.

2.4.6 EFFECTS OF EXPERIENCE

It is logical to assume that a handler who had been in the Police Dog Section for a long time or had worked with a number of dogs might answer the questionnaire differently to a handler who was new to the Police Dog Section or who had only worked with one dog. The age of the dog might have had an effect on the responses received to questions on the handler's own dog as a young dog might not have mastered all the skills yet, or an older dog might be slowing down and not performing as well as it did when it was younger. The source of the dog was also expected to be significant as the dogs especially bred by the Police are assumed to be better then the donated dogs.

Chi-square analysis was conducted on the responses to Question One that asked the police dog handler's to rate their dogs on a number of traits and on Question Four that asked the handler's to rate their dog on the activities used in police dog work. There was no difference in the scores obtained for the dogs bred by the Police and the donated dogs.

Therefore, the scores obtained for each dog is a true indication of how the dog rates on certain traits and activities and were not due to any handler experience, age of dog, or the source of dog.. This reinforces the observation that the breeding programme currently being used by the Police is not achieving significantly better results than donated dogs.

Chi-square analysis was also conducted on the responses to Question Nine, which asked which methods for improvement were important. The years of experience of the handler and the number of dogs a police dog handler had did not affect the responses to this question except for the method 'reducing the number of dogs' where years of experience did have an effect. This result indicates that the most important methods found in the analysis are the two methods that most likely need to be addressed. These two methods were 'improved stud and brood bitch selection'.

2.4.7 ARE THE POLICE DOG HANDLERS WORTH LISTENING TO?

The questionnaire was aimed at getting the opinions of the police dog handlers. As this was an initial study the questionnaire had to be designed so that a wide range of topics were addressed. The majority of the questions were structured around a general question and a list of options provided. Therefore, the researcher guided the opinions of the dog handlers to some extent. Also, the questionnaire did not ask the handlers the exact characteristics currently being used by the Police Dog Section. The characteristics currently being used by the Police are based on the kennel club characteristics and therefore, other traits were used in the questionnaire to see if those traits were also considered important in police dogs.

The majority of the handlers gave their opinions when it was asked and a lot of good ideas were presented. A lot of the handlers gave the same opinions and scored the ideal dog in a similar manner so they are reasonably consistent. The opinions of the handlers and their ideas or areas of concern are worth listening to. But there is a possibility that the handlers rated their dogs higher than their true worth. This is seen in the contradiction in

the answer to the question about the dog and handler matchings. The majority of the handlers did not think that dogs and handlers were well matched but a high percentage thought that they were personally well matched with their current dog.

The police dog handlers have evaluated the traits, activities and environmental effects that they believe are important or need to be improved on. In the next chapter we investigate the annual trial results to see if the areas of concern addressed by the handlers in the questionnaire are the areas that the dog and handler team are scoring low in. The analysis of the results will also give an idea on the rating of the dog and handler team in real life situations and will give an indication of the traits that the Police Dog Training Centre look for in a scoring situation. It will be of interest to see if there are any similarities in the scores received by the dog and handler teams in the annual trials and the scores given to the dogs in the questionnaire.

3 ANALYSIS OF THE ANNUAL REPORTS FROM POLICE DOG TRIALS

3.1 ABSTRACT

The Police Service conducts annual trials on operational dog and handler teams which are assessed by the Senior Constable at the Royal New Zealand Police Dog Training Centre. No scientific analysis has been conducted on the data obtained from these trials and in this study the repeatability of the results were assessed. The activities measured during the trials included 'heel free', 'retrieve', 'down stay', 'sendaway', 'recall and redirection', 'distance control', 'speak on command', 'track', 'article search', 'passive attack', 'chase and recall', 'chase and attack', 'control', and 'search and escort'. Data were available for the years 1997 to 2000. The data were transformed by performing the cube function, and an analysis of variance was conducted with dog and year effects. Repeatabilities were calculated based on the mean squares from the dog effect and the error variance terms. The highest repeatability value (0.48) was obtained for 'speak on command' while 'track' had the lowest repeatability value (0.03). 'Heel free', 'retrieve', and 'chase and recall' showed repeatabilities between 0.3 and 0.4 while 'down stay', 'distance control' and 'passive attack' were between 0.2 and 0.3. All other activities had repeatabilities less than 0.2. The generally low repeatabilities are indicative of low heritabilities and also low permanent environmental effects which would suggest the carryover effects of training are generally poor. Insufficient data were available to enable the estimation of heritability values. However, repeatability values give an upper limit to the possible heritability values for the activities. A better description of the activities could be obtained if they were split into handler and dog components. The traits a dog needs to perform well for each activity should be identified and scored during assessment. A scoring system of 1 to 5 utilising the scores of the dog traits and handler performance should be used for an overall activity score instead of the scoring systems currently used.

3.2 INTRODUCTION

The Royal New Zealand Police Dog Service currently has one hundred and twenty operational police dogs. The Senior Constable at the Dog Training Centre in Trentham, Wellington assesses each dog and handler team once a year. They are tested on all areas of general-purpose dog work. This includes criminal work, track and search, and obedience. The main purpose of the annual trial and report is to make sure that the dog and handler teams are competent in all areas of police dog work and to find out specific exercises that the team needs to improve on.

The results of these annual trials also determine the top eight dog and handler teams which then compete at the National Police Dog Championships held every year in June. The championship is a week-long competition where the dog and handler team is subjected to a wide range of tests that are more complicated and difficult than the annual trials. The dog and handler team that has the highest overall score is invited to compete at the Australasian Police Dog Championships.

No scientific analysis has been conducted on the data gathered at the annual trials. The annual reports are one important measure of how the dog and handler team are operating after graduating from training. A repeatability analysis will give us an indication of the performance of the team and the consistency of the assessor. If the repeatability value is high then both the team and the assessor are consistent. If the repeatability value is low then either the assessor is inaccurate or the team is not consistent.

As the majority of the activities tested in the annual trials are also scored in training a high level of competency for each of the activities is expected as only the teams that reach a specific level become operational. The dog and handler teams that do not make the initial grade in their final course of training are disbanded. As the dog and handler team remain consistent from year to year it is expected that there will be an initial improvement in the values obtained for each activity during the first few years after the

team has become operational. This is because the new team will master the skills required and will be more used to using these activities in a practical environment. Once the team has mastered all the activities a measure of consistency is expected in the values obtained for each activity year after year and a plateau will probably be reached where the team has reached their full potential in a working and test environment.

The coefficient of repeatability is an estimate of the genetic and permanent environmental effects that determine a characteristic. It is the correlation between the measurements of a character taken from the same animal at different times. Successive records of the same animal tend to be more alike than those of different animals because an animal's genotype and permanent environmental effects remain largely unaltered throughout it's lifetime.

The coefficient of repeatability is closely related to heritability. Heritability measures the additive variance as a proportion of the total phenotypic variance. The environmental variance is taken into account in the calculation of the repeatability value (Willis, 1998). Therefore, repeatability values will always be higher than heritability values as they will be influenced by the permanent environmental factors. Repeatability sets an upper limit for heritability.

In this chapter data from the annual trials of operational dog and handler teams over the period 1997 to 2000 are analysed. The analysis will include correlational studies, a consideration of fixed effects, a repeatability analysis and a calculation of heritability estimates.

3.3 METHOD

3.3.1 DATA COLLECTION

Data from the annual trial reports of all operational teams that had been assessed for at least two years from the years 1997 to 2000 were collected. During these four years the evaluator Senior Constable Brendon Gibson designed the annual reports and assessed all the operational dog and handler teams.

The activities scored in each of the annual reports were 'heel free', 'retrieve', 'down stay', 'sendaway', 'recall and redirection', 'distance control', 'speak on command', 'track', 'article search', 'passive attack', 'chase and recall', 'chase and attack', and 'control'. 'Search and escort' was only scored in the 1999 and the 2000 annual reports. Details on how the activities were scored for each of the annual reports and the scoring system used are shown in Appendix Four.

3.3.2 FIXED EFFECTS

The years of experience of the handler and the age of the dog were also recorded as of the year 1999. The years of experience of the handler were grouped into three groups; inexperienced (0-4 yrs), experienced (5 – 10 yrs), and very experienced (>11yrs). Three groups were assigned for the age of the dog; young (1 – 2 yrs), middle age (3 – 5 yrs) and old (>6 yrs).

3.3.3 DATA RECORDING

The data were not normally distributed and were transformed. The transformation also balanced out the fact that the maximum score for the traits varied in some years. In the repeatability analysis the effect of the year was taken into account which would also have accounted for the variation in the maximum scores given for each activity.

3.3.4 TRANSFORMATIONS

An analysis of variance, with the effect of the year, was performed on all the activities using the original values. However, the original data were not normally distributed and were skewed to the right side of the distribution. The repeatability analysis test works on the assumption that the data used in the analysis follows a normal distribution. As the data were not normally distributed it was transformed by the cubed function to make it more normally distributed before analysis began. Each year of every activity was transformed separately due to the fact that in some years the activities were scored differently.

All the scores that had a value of 0 was converted to a value of 1 before further analysis was conducted due to the fact that a value of 0 might be recognised by SAS as an invalid result.

3.3.5 ALLOWING FOR UNBALANCED DATA

The number of records per handler and dog team varied because not all teams were evaluated in every year. Therefore, to enable the repeatability to be calculated it was necessary to devise a coefficient (k_1) which represented the average number of observations per handler and dog team. The k_1 coefficient was calculated by:

$$k_1 = \frac{1}{N-1}\left(m. - \frac{\Sigma m_k^2}{m.}\right)$$

Where m. = total number of measurements
m_k = the number of measurements taken on the k^{th} individual
N = number of dogs

3.3.6 REPEATABILITY ANALYSIS

A repeatability analysis was conducted with the model:

Activity = μ + year + age + exp + dog + e_{ij}

where year = the effect of year

age = age of the dog

exp = years of experience of the handler

dog = the effect of dog

An analysis of variance was conducted in SAS with the effects of year, age of the dog, years of experience of the handler and the effect of dog taken into account. The age of the dog and the years of experience of the handler were grouped into three categories before analysis was carried out. A repeatability was calculated in Excel for each activity using the mean square from the value for the dog effect and the error term.

3.4 RESULTS

3.4.1 RAW DATA

The data from the years 1997 to 2000 were collected for each of the activities; 'heel free', 'retrieve', 'down stay', 'sendaway', 'recall and redirection', 'distance control', 'speak on command', 'track', 'article search', 'passive attack', 'chase and recall', 'chase and attack', and 'control'. The activity 'search and escort' was only scored in 1999 and 2000 so only the data obtained from those years was available for analysis. In total, records from 59 dogs were collected for all the activities except for the activities 'passive attack', 'chase and recall' and 'chase and attack' where records from 58 dogs were available. The mean scores and standard deviations for each activity is shown in Table 3.1.

3.4.2 DESCRIPTIVE STATISTICS

The descriptive summary statistics for each year of each activity shows the number of dogs tested in each year, the maximum score for each activity per year, the mean score for the activity, it's standard deviation, the original data's skewness and kurtosis, and the skewness and kurtosis for the transformed data (Tables 3.2 – 3.15).

3.4.2.1 Heel free

In the year 1999 fifty three dog and handler teams were scored compared to forty two in the year 2000, thirty nine in the year 1998 and thirty three in the year 1997. The highest mean value of 63.6 for the annual reports was obtained in the year 1999. Eight dog and handler teams scored a value of sixty three points out of the possible seventy points in the 1998 annual report. Only two dog and handler teams scored 100% for the activity Heel Free in all of the annual reports.

3.4.2.2 Retrieve

The highest mean score of 34.12 out of a possible 40 was obtained in the 2000 annual report. In 1997 and 1998 one dog and handler team scored the lowest value of twenty out of a possible sixty points. The most common score was a value of fifty five points. This occurred in 1999 when thirteen dog and handler teams reached this score. In 2000 and 1999 seven dog and handler teams scored 100%, and two teams scored 100% in 1998 and in 1997.

3.4.2.3 Down stay

The activity Down Stay was scored out of thirty points in the year 2000. In the earlier years Down Stay was scored out of twenty. The highest mean score of 18.64 was obtained in 1999. In 2000 six different scores were obtained from all the dog and handler teams. Thirty four teams scored 100% in 2000, forty two teams in 1999, thirty in 1998 and twenty nine in 1997. The median scores obtained for all the annual reports was the value equivalent to a percentage of 100%.

3.4.2.4 Sendaway

In all of the annual reports the activity Sendaway was scored out of fifty points. The lowest mean score of 29.64 was obtained in 1997 with the year 1999 scoring the highest mean score of 40.93. A total of seventeen teams scored zero in all the annual reports. The highest and most common score obtained was fifty with eleven teams obtaining this in 2000, thirty two in 1999, fifteen in 1998 and five in 1997.

3.4.2.5 Recall and redirection

The Recall and Redirection activities were scored out of fifty except in 1999 where it was scored out of sixty. The highest mean score was in the year 1999 with the lowest mean score in 1998. In all of the annual reports there was a wide range of scores obtained with

at least one team scoring zero in each year. In 1999 twenty nine teams scored fifty, while only five scored fifty in 2000, seven in 1998 and three in 1997. Two teams scored fifty twice, one of them in 1997 and again in 1999, and one in 1999 and again in 2000.

3.4.2.6 Distance control

In 1997 Distance Control was scored out of sixty, in 1998 and 1999 it was scored out of seventy and in 2000 it was scored out of forty. The most common score occurred in 2000 with six teams obtaining a value of forty out of forty. The lowest score of seventeen was in 1999.

3.4.2.7 Speak on Command

Speak on Command was scored out of forty for all the annual reports. The highest mean score of 32.77 was obtained in 1999 with the next highest mean score of 32.59 obtained in 1998. In 1999 and 1998 twenty three teams scored 100% with a total of fourteen teams scoring zero in all four annual reports.

3.4.2.8 Track

All of the Track activities were scored out of three hundred. One team scored zero in 1997 with the next lowest score of thirty in 1998. The highest mean value of 262.64 was obtained in 1999. One team scored 100% in 1997, none in 1998 or in 1999 and six in 2000. The majority of the scores had a value of 200 or over in all the annual reports.

3.4.2.9 Article Search

Article Search was scored out of 60 for the years 1997 and 1998. In 1999 and 2000 Article Search was scored out of seventy. In all of the annual reports the most common score was 100% with eleven teams scoring 60 in 1997, sixteen in 1998, twenty seven in 1999 and in 2000 sixteen teams scoring 70. In 1997 two teams scored 0.

3.4.2.10 Passive Attack

Passive Attack was scored out of 100 points in the years 1997, 1998 and 2000. In 1999 Passive Attack was scored out of eighty. The highest mean score of 95.27 was obtained in 2000. The most common score was 100% with fifteen scoring one hundred points in 1997, fourteen in 1998, and twenty four in 2000. In 1999 twenty six teams scored eighty points. Only one team scored zero and that was in 1997.

3.4.2.11 Chase and Recall

Chase and Recall was scored out of 100 in all the annual reports except in 2000 where it was scored out of 110. The highest mean score of 91.82 was in 1997. Only four different scores occurd in 1997, the values 0, 50, 80 and 100 with twenty nine teams scoring 100. In all the annual reports 100% was the most common score obtained. The only year where a team scored zero was in 1997 with two teams achieving this score.

3.4.2.12 Chase and Attack

A maximum value of 100 points was allocated to Chase and Attack in the years 1997 and 1998. In 1999 Chase and Attack was scored out of 90 and in 2000 it was scored out of 120. In 2000 the lowest score which was obtained by four teams was 100 points. The most common score was 100% in all the annual reports.

3.4.2.13 Control

Control was scored out of fifty points in the years 1997 and 1998. In 1999 and 2000 Control was scored out of seventy. Only thirty three teams were tested for the activity Control in 1997. The most common score was 100% in all the annual reports with sixty percent receiving this score in 1997, 1998 and 1997 and sixty four percent in 2000.

3.4.2.14 Search and Escort

Search and Escort was only scored in 1999 and 2000 and was scored out of sixty. The highest mean score of 56.05 occurred in 2000. Only thirty eight teams were scored in both years. The most common score was fifty in both years with twenty nine percent scoring fifty in 1999 and sixty eight percent in 2000. The lowest score of seventeen was scored in 1999.

3.4.3 SKEWNESS AND KURTOSIS

All the transformations conducted reduced the skewness of the original data. The majority of the activities also showed reduced kurtosis after transformation.

3.4.4 REPEATABILITY ANALYSIS

The analysis of variance was conducted in SAS with the effects of year, age of the dog, years of experience of the handler and the effect of dog taken into account. The output could not be used to conduct any further statistical analysis as there was not enough data for SAS to produce the least square mean values. Therefore, an analysis of variance was conducted with the two effects; year and dog. Then the repeatability analysis was conducted on the data obtained.

The repeatability analysis was repeated with the new model:

$$\text{Activity} = \mu + \text{year} + \text{dog} + e_{ij}$$

where activity = the activity being measured

year = year the team was measured

dog = the effect of the dog

e_{ij} = the error term

The highest repeatability with a value of 0.48 was obtained for the activity 'speak on command'. The activity 'track' had the lowest repeatability with a value of 0.03. The activity 'speak on command' was the only activity that had a repeatability value above 0.4. 'Retrieve', 'chase and recall' and 'heel free' all had repeatability values between 0.3 and 0.4. Values between 0.2 and 0.3 were obtained for the activities 'passive attack', 'down stay' and 'distance control'. All the other activities had repeatability values less than 0.2.

In all of the activities the fixed effects year and dog were significant except the activities 'track', 'control' and 'search and escort' where the fixed effect dog was not significant. The k_1 values obtained for each activity ranged from 2 to 2.88. The k_1 value gives an average number of observations of each team on the activities. Therefore, two to three observations were available for each team.

The repeatability values obtained, the k_1 values and the significance of the year and dog effects are shown in Table 3.16.

3.4.5 CORRELATIONS BY YEAR

To verify the repeatability measures the data was plotted year against year for all the four years of data collection. The graphs of 'chase and attack' are shown in full with a complete description of the methodology (see below). The R value of each graph was calculated and the average R values of the six graphs were obtained for each activity. There were slight discrepancies in the values obtained from the calculations using the SAS output and from the graphs. The repeatabilities for each activity, and the average of the R values for each activity are shown in Table 3.17.

3.4.6 PROBABILITY TABLES

A probability table was conducted on the activity 'chase and attack'. Probability tables are useful in obtaining the number of teams that scored a particular value in one year and

the number of teams that scored the same value in another year. If the teams are repeatable then it is expected that a large number of teams will score a particular value year after year.

The probability tables obtained for the activity 'chase and attack' are shown in Table 3.18 – 3.23. The probability table comparing the values obtained in 2000 and the values in 1999 shows that 36% of teams scored the highest possible score in 1999 and in 2000. 64% of the teams that scored 90 in 1999 scored 120 in 2000 while 61% of the teams that scored 120 scored 90 in 1999. The majority of the tables show that there is a higher probability of scoring highly in one year if it scored high in another year. But scoring the exact score year after year is rare.

A full detailed description of the method used to measure the repeatability of the activity 'chase and attack' is shown below.

3.5 CHASE AND ATTACK

Overall 168 observations from 58 dogs for the activity 'chase and attack' were collected. In the year 2000 41 observations were collected, in 1999 53 observations were collected, in year 1998 41 observations were collected and in 1997 33 observations were collected. All data collected for the activity 'chase and attack' were not normally distributed. Therefore, a cube transformation was conducted to reduce the negative skewness of the data. As the data were unbalanced a k_1 value was calculated to estimate the average number of observations per handler and dog team before analysis of the data was conducted. The k_1 coefficient was calculated by:

$$k_1 = \frac{1}{N-1}\left(m. - \frac{\Sigma m_k^2}{m.}\right)$$

Where m. = total number of measurements
m_k = the number of measurements taken on the k^{th} individual
N = number of dogs

For the activity 'chase and attack' the k_1 coefficient was:

$$k_1 = \frac{1}{58-1}\left(167 - \frac{521}{167}\right) = 2.88$$

Therefore, the average number of observations collected from each dog for the activity 'chase and attack' was 2.88.

An analysis of variance was conducted using SAS with the effect of year and then dog taken into account. The analysis of variance was significant at the 5% level. Both year and dog were significant at the 5% level.

A repeatability analysis with the model:

Chase and Attack = μ + year + dog + e_{ij}

was used to work out the repeatability of the activity 'chase and attack'.

As the Model values on the ANOVA table consisted of both the year and the dog effect the value used for calculating the repeatability was the Mean Square value from the dog effect alone. The repeatability analysis was conducted as follows:

Anova

Source	DF	SS	MS
Dog	57	4.43E+12	7.77E+10
Error	106	5.20E+12	4.9E+10

$k_1 =$ 2.88

$\delta^2_e =$ 4.9E+10

$$\delta^2_w = \frac{MSw - Mse}{k_1}$$

$\delta^2_w =$ 9.97E+09

$$R = \frac{\delta^2_w}{\delta^2_w + \delta^2_e}$$

$R =$ 0.17

The data were then plotted year against year for all the four years of data that were collected (Figures 3.1 – 3.6)

The R value was calculated for each year combination.

R value for 2000 vs. 1999 = 0.07
R value for 2000 vs. 1998 = 0.27
R value for 2000 vs. 1997 = 0.18
R value for 1999 vs. 1998 = 0.28
R value for 1999 vs. 1997 = 0.28
R^2 value for 1998 vs. 1997 = 0.28

Therefore, the average value for R was calculated as 0.23.

The repeatability calculated from the ANOVA was 0.17 and the average correlation from the graphs was 0.23. The slight discrepancy in the values obtained were probably due to the fact that the year by year correlations did not adjust for the effect that in 1997 and in 1998 'chase and attack' had a maximum value of 100, in 1999 it had a maximum value of 90 and in 2000 it had a maximum value of 120. The year by year correlations also did not take into account the dog effect while the ANOVA took both of these factors into account.

Probability tables for each year against another year for all of the four years collected was conducted for the activity 'chase and attack' (Tables 3.18 – 3.23)

Table 3.1 Original data for the activities tested in the annual trials

Activity	1997 Maximum Score	1997 (Mean±Std)	1998 Maximum Score	1998 (Mean±Std)	1999 Maximum Score	1999 (Mean±Std))	2000 Maximum Score	2000 (Mean±Std)
Heel free	70	56.61 ± 7.24	70	60.56 ± 4.41	70	63.60 ± 3.95	60	53.31 ± 4.0
Retrieve	60	47.24 ± 8.44	60	49.08 ± 7.65	60	50.53 ± 8.28	40	34.12 ± 5.03
Down stay	20	18.70 ± 3.75	20	17.17 ± 5.68	20	18.64 ±3.87	30	27. 05 ± 7.55
Sendaway	50	29.64 ± 19.19	50	34.61 ± 19.63	50	40.93 ± 13.81	50	36.19 ± 13.20
Recall and redirection	50	34.91 ± 13.94	50	29.61 ± 18.19	60	49.60 ± 16.85	50	39.57 ± 10.94
Distance control	60	49.27 ± 7.30	70	51.93 ± 8.78	70	59.00 ± 9.82	40	32.93 ± 5.07
Speak on command	40	26.21 ± 14.31	40	32.59 ± 12.24	40	32.77 ± 10.23	40	27.17 ± 13.08
Track	300	233.73 ± 60.07	300	227.12 ± 71.28	300	262.64 ± 29.14	300	248.29 ± 49.11
Article search	60	40.61 ± 18.91	60	47.56 ± 13.38	70	57.60 ± 15.70	70	57.88 ± 14.15
Passive attack	100	86.82 ± 19.44	100	85.24 ± 15.73	80	72.83 ± 11.12	100	95.27 ± 7.63
Chase and recall	100	91.82 ± 25.43	100	83.54 ± 18.41	100	90.19 ± 12.71	110	95.51 ± 20.23
Chase and attack	100	83.94 ± 18.40	100	89.02 ± 13.05	90	82.26 ± 11.29	120	115.15 ± 6.62
Control	50	45.61 ± 6.22	50	45.83 ± 7.16	70	65.38 ± 9.03	70	64.52 ± 13.06
Search and escort	n/a	n/a	n/a	n/a	60	41.56 ± 8.59	60	56.05 ± 7.46

Table 3.2 Descriptive statistics for the activity Heel Free

Year	No. of dogs	Possible Score	Mean (original)	Standard Deviation (original)	Skewness (original)	Skewness (transformed)	Kurtosis (original)	Kurtosis (transformed)
2000	42	60	53.31	4	-1.19	-0.74	1.65	0.43
1999	53	70	63.6	3.95	-0.39	-0.15	-0.4	-0.71
1998	39	70	60.56	4.41	-0.55	-0.25	-0.25	-0.65
1997	33	70	56.61	7.24	-0.62	0.18	0.86	-0.13

Table 3.3 Descriptive statistics for the activity Retrieve

Year	No. of dogs	Possible Score	Mean (original)	Standard Deviation (original)	Skewness (original)	Skewness (transformed)	Kurtosis (original)	Kurtosis (transformed)
2000	42	40	34.12	5.03	-0.98	-0.25	1.09	-0.89
1999	53	60	50.53	8.28	-1.28	-0.5	1.36	-0.41
1998	39	60	49.08	7.65	-1.57	-0.25	4.25	-0.1
1997	33	60	47.24	8.44	-1.27	-0.09	2.3	-0.03

Table 3.4 Descriptive statistics for the activity Down Stay

Year	No. of dogs	Possible Score	Mean (original)	Standard Deviation (original)	Skewness (original)	Skewness (transformed)	Kurtosis (original)	Kurtosis (transformed)
2000	41	30	27.05	7.55	-2.54	-2.11	5.28	2.74
1999	53	20	18.64	3.87	-3.56	-2.54	12.99	5.52
1998	41	20	17.17	5.68	-2.03	-1.4	3.1	0.22
1997	33	20	18.7	3.75	-2.84	-2.53	7.15	4.89

Table 3.5 Descriptive statistics for the activity Sendaway

Year	No. of dogs	Possible Score	Mean (original)	Standard Deviation (original)	Skewness (original)	Skewness (transformed)	Kurtosis (original)	Kurtosis (transformed)
2000	42	50	36.19	13.2	-0.68	0.03	-0.48	-1.61
1999	54	50	40.93	13.81	-1.45	-0.77	1.1	-1.18
1998	41	50	34.61	19.63	-1.02	-0.4	-0.68	-1.52
1997	33	50	29.64	19.19	-0.55	0.22	-1.26	-1.72

Table 3.6 Descriptive statistics for the activity Recall and Redirection

Year	No. of dogs	Possible Score	Mean (original)	Standard Deviation (original)	Skewness (original)	Skewness (transformed)	Kurtosis (original)	Kurtosis (transformed)
2000	42	50	39.57	10.94	-1.61	-0.41	2.98	-1.14
1999	53	60	49.60	16.85	-1.66	-0.94	1.77	-0.78
1998	41	50	29.61	18.19	-0.37	0.28	-1.39	-1.66
1997	33	50	34.91	13.94	-0.26	0.04	-1.38	-1.54

Table 3.7 Descriptive statistics for the activity Distance Control

Year	No. of dogs	Possible Score	Mean (original)	Standard Deviation (original)	Skewness (original)	Skewness (transformed)	Kurtosis (original)	Kurtosis (transformed)
2000	42	40	32.93	5.07	-0.57	0.05	-0.29	-0.7
1999	53	70	59	9.82	-2.01	-0.55	5.9	0.04
1998	41	70	51.93	8.78	-0.73	0.17	0.77	-0.57
1997	33	60	49.27	7.3	-0.61	-0.19	-0.66	-1.11

Table 3.8 Descriptive statistics for the activity Speak on Command

Year	No. of dogs	Possible Score	Mean (original)	Standard Deviation (original)	Skewness (original)	Skewness (transformed)	Kurtosis (original)	Kurtosis (transformed)
2000	42	40	27.17	13.08	-0.9	0.1	-0.34	-1.53
1999	53	40	32.77	10.23	-1.8	-0.67	2.88	-0.97
1998	41	40	32.59	12.24	-1.73	-0.97	1.88	-0.67
1997	33	40	26.21	14.31	-0.9	-0.04	-0.7	-1.41

Table 3.9 Descriptive statistics for the activity Track

Year	No. of dogs	Possible Score	Mean (original)	Standard Deviation (original)	Skewness (original)	Skewness (transformed)	Kurtosis (original)	Kurtosis (transformed)
2000	42	300	248.29	49.11	-0.98	-0.34	0.33	-1.18
1999	53	300	262.64	29.14	-1.2	-0.63	1.43	-0.29
1998	41	300	227.12	71.28	-1.21	-0.35	0.65	-1.25
1997	33	300	233.73	60.07	-2.33	-0.46	6.85	-0.35

Table 3.10 Descriptive statistics for the activity Article Search

Year	No. of dogs	Possible Score	Mean (original)	Standard Deviation (original)	Skewness (original)	Skewness (transformed)	Kurtosis (original)	Kurtosis (transformed)
2000	42	70	57.88	14.15	-1.1	-0.44	0.3	-1.28
1999	53	70	57.60	15.70	-1.12	-0.44	0.28	-1.45
1998	41	60	47.56	13.38	-1.05	-0.08	0.69	-1.52
1997	33	60	40.61	18.91	-0.83	0.38	-0.15	-1.5

Table 3.11 Descriptive statistics for the activity Passive Attack

Year	No. of dogs	Possible Score	Mean (original)	Std. Dev (original)	Skewness (original)	Skewness (transformed)	Kurtosis (original)	Kurtosis (transformed)
2000	41	100	95.27	7.63	-2.22	-1.65	5.81	2.63
1999	53	80	72.83	11.12	-2.62	-1.22	9.23	0.8
1998	41	100	85.24	15.73	-0.99	-0.39	0.4	-1.21
1997	33	100	86.82	19.44	-2.94	-0.64	11.95	-0.67

Table 3.12 Descriptive statistics for the activity Chase and Recall

Year	No. of dogs	Possible Score	Mean (original)	Standard Deviation (original)	Skewness (original)	Skewness (transformed)	Kurtosis (original)	Kurtosis (transformed)
2000	41	110	95.51	20.23	-1.82	-0.94	2.85	-0.16
1999	53	100	90.19	12.71	-1.84	-0.78	4.67	-0.16
1998	41	100	83.54	18.41	-2.03	-0.52	4.6	-0.16
1997	33	100	91.82	25.43	-3.25	-2.69	9.8	5.88

Table 3.13 Descriptive statistics for the activity Chase and Attack

Year	No. of dogs	Possible Score	Mean (original)	Standard Deviation (original)	Skewness (original)	Skewness (transformed)	Kurtosis (original)	Kurtosis (transformed)
2000	41	120	115.15	6.62	-1.19	-1.04	0.32	-0.13
1999	53	90	82.26	11.29	-1.48	-1.01	1.55	-0.24
1998	41	100	89.02	13.05	-1.94	-0.93	4.59	0.42
1997	33	100	83.94	18.4	-1.59	-0.46	2.71	-0.85

Table 3.14 Descriptive statistics for the activity Control

Year	No. of dogs	Possible Score	Mean (original)	Standard Deviation (original)	Skewness (original)	Skewness (transformed)	Kurtosis (original)	Kurtosis (transformed)
2000	42	70	64.52	13.06	-3.7	-2.15	13.97	4.96
1999	53	70	65.38	9.03	-2.86	-1.97	8.78	3.49
1998	41	50	45.83	7.16	-2.19	-1.43	4.76	1.16
1997	33	50	45.61	6.22	-1.18	-0.85	0.39	-0.82

Table 3.15 Descriptive statistics for the activity Search and Escort

Year	No. of dogs	Possible Score	Mean (original)	Standard Deviation (original)	Skewness (original)	Skewness (transformed)	Kurtosis (original)	Kurtosis (transformed)
2000	38	60	56.05	7.46	-2.19	-1.66	4.45	1.75
1999	38	60	41.56	8.59	-1.14	-0.33	0.77	-0.93

Table 3.16 The k values and the repeatability values calculated for the activities in the annual trials with the effects of the year and the dog taken into account

Activity	k_1 value	Year effect	Dog effect	Repeatability value
Speak on command	2.86	<.0001	<.0001	0.48
Retrieve	2.84	<.0001	<.0001	0.33
Chase and recall	2.88	<.0001	<.0001	0.33
Heel free	2.84	<.0001	0.0001	0.31
Passive attack	2.88	<.0001	0.0016	0.25
Down stay	2.84	<.0001	0.002	0.24
Distance control	2.86	<.0001	0.0043	0.22
Chase and attack	2.88	<.0001	0.0207	0.17
Sendaway	2.86	0.0031	0.0197	0.17
Article search	2.86	<.0001	0.0249	0.16
Recall and redirection	2.86	<.0001	0.0395	0.14
Search and escort	2	0.0289	0.2535	0.11
Control	2.86	<.0001	0.1025	0.1
Track	2.86	0.0215	0.3565	0.03

Table 3.17 The calculated repeatability values for the activities and the repeatability values obtained from the graphs

Activity	Repeatability	R value from graphs
Heel free	0.31	0.29
Retrieve	0.36	0.37
Down stay	0.33	0.38
Sendaway	0.17	0.18
Recall and redirection	0.19	0.20
Distance control	0.22	0.24
Speak on command	0.48	0.48
Track	0.03	0.13
Article search	0.16	0.17
Passive attack	0.25	0.23
Chase and Recall	0.33	0.28
Chase and Attack	0.17	0.23
Control	0.10	0.19

Figure 3.1 The dog and handler team scores for the activity Chase and attack in 2000 versus the dog and handler team scores for the activity Chase and attack in 1999

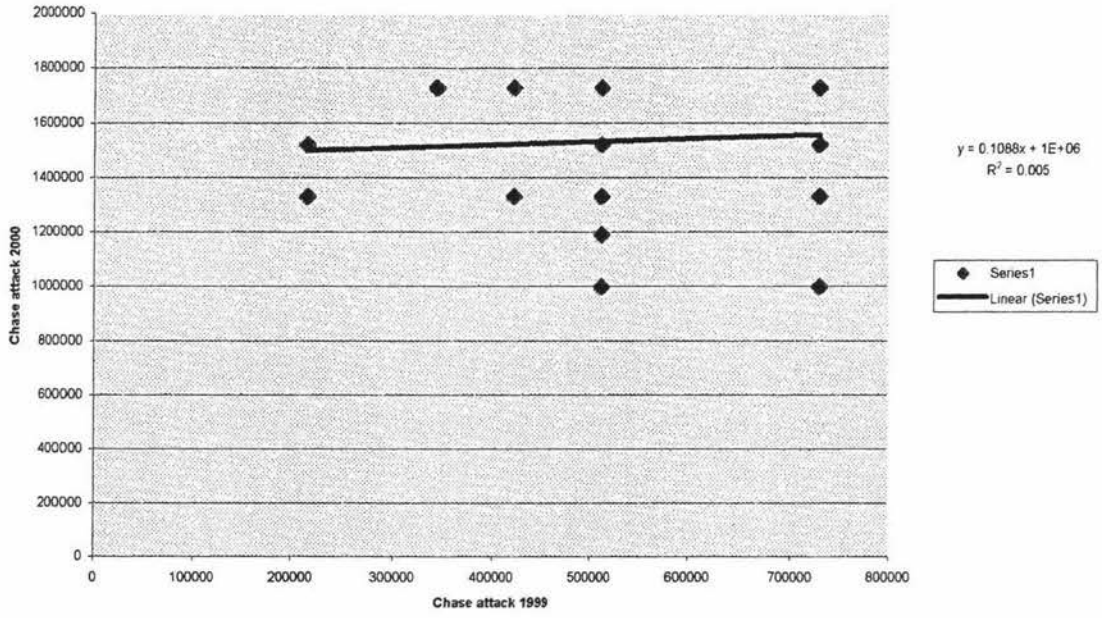

Figure 3.2 The dog and handler team scores for the activity Chase and attack in 2000 versus the dog and handler team scores for the activity Chase and attack in 1998

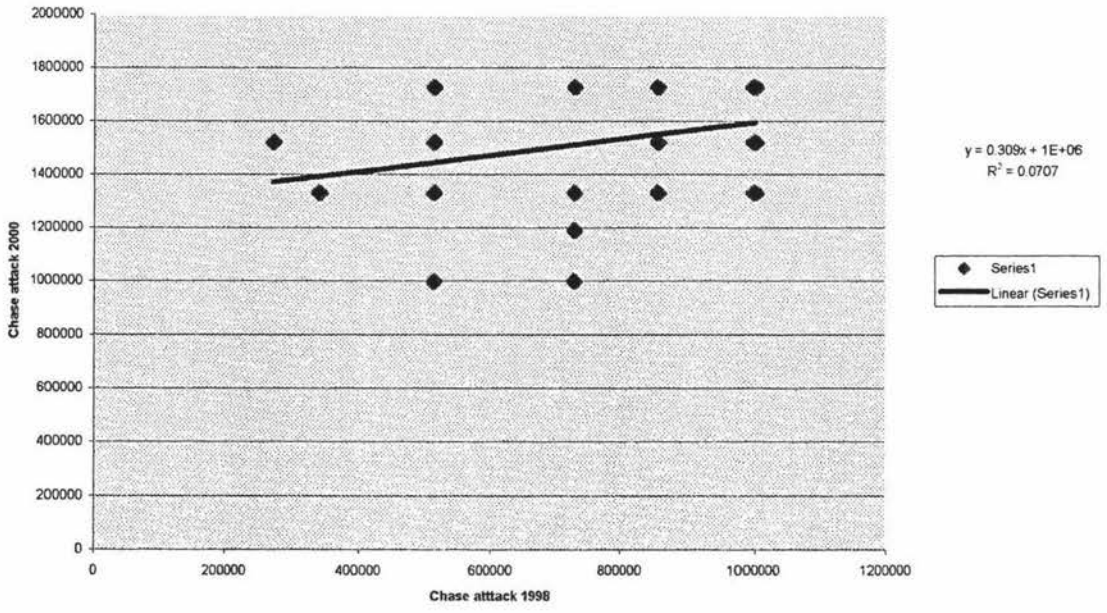

Figure 3.3. The dog and handler team scores for the activity Chase and attack in 2000 versus the dog and handler team scores for the activity Chase and attack in 1997

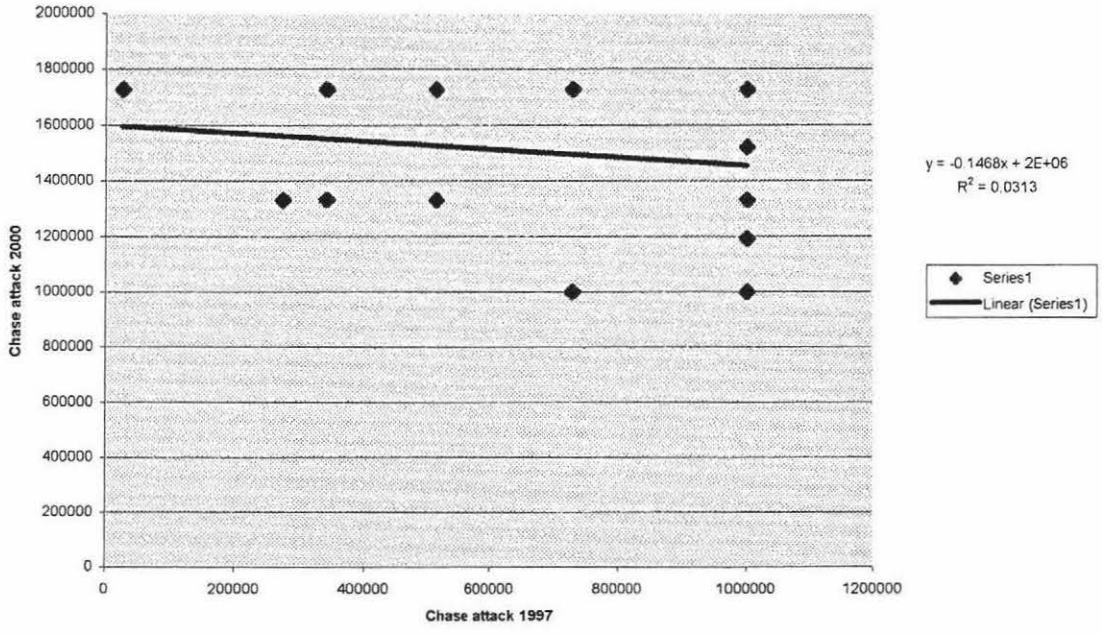

Figure 3.4 The dog and handler team scores for the activity Chase and attack in 1999 versus the dog and handler team scores for the activity Chase and attack in 1998

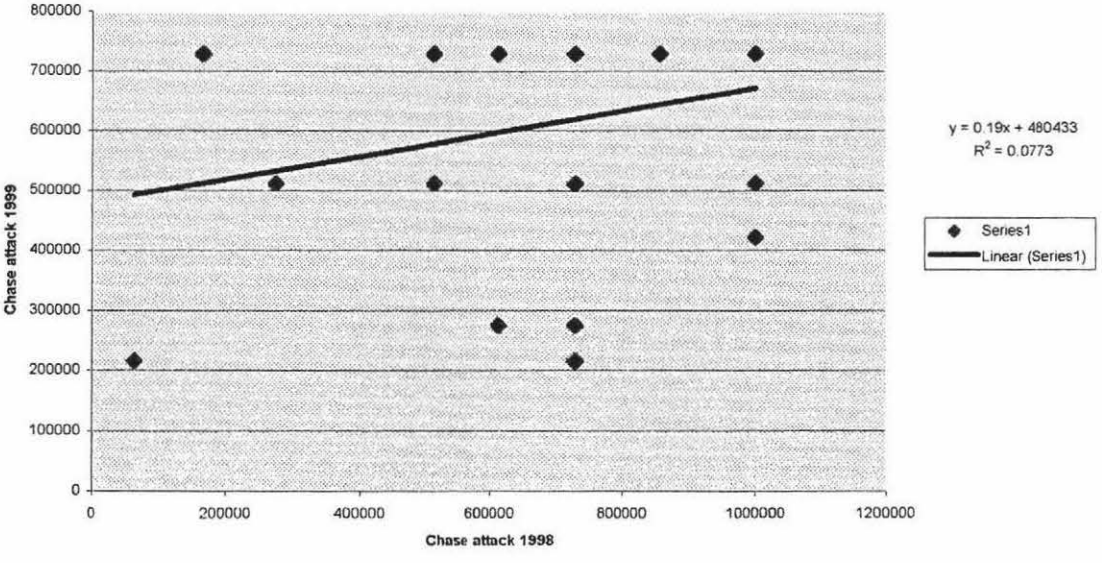

Figure 3.5. The dog and handler team scores for the activity Chase and attack in 1999 versus the dog and handler team scores for the activity Chase and attack in 1997

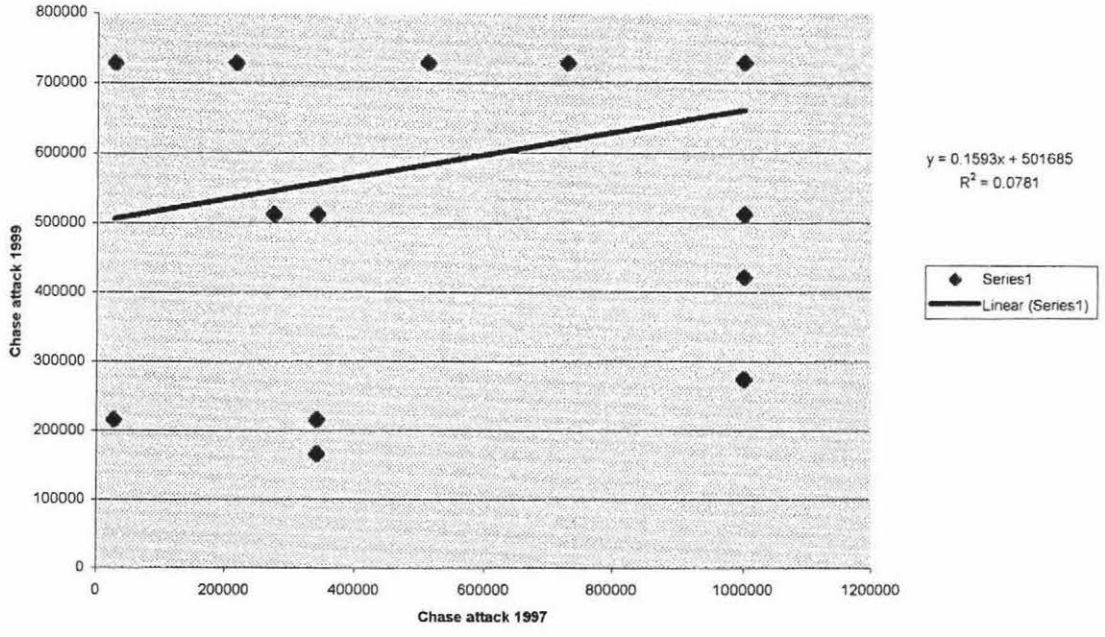

Figure 3.6. The dog and handler team scores for the activity Chase and attack in 1998 versus the dog and handler team scores for the activity Chase and attack in 1997

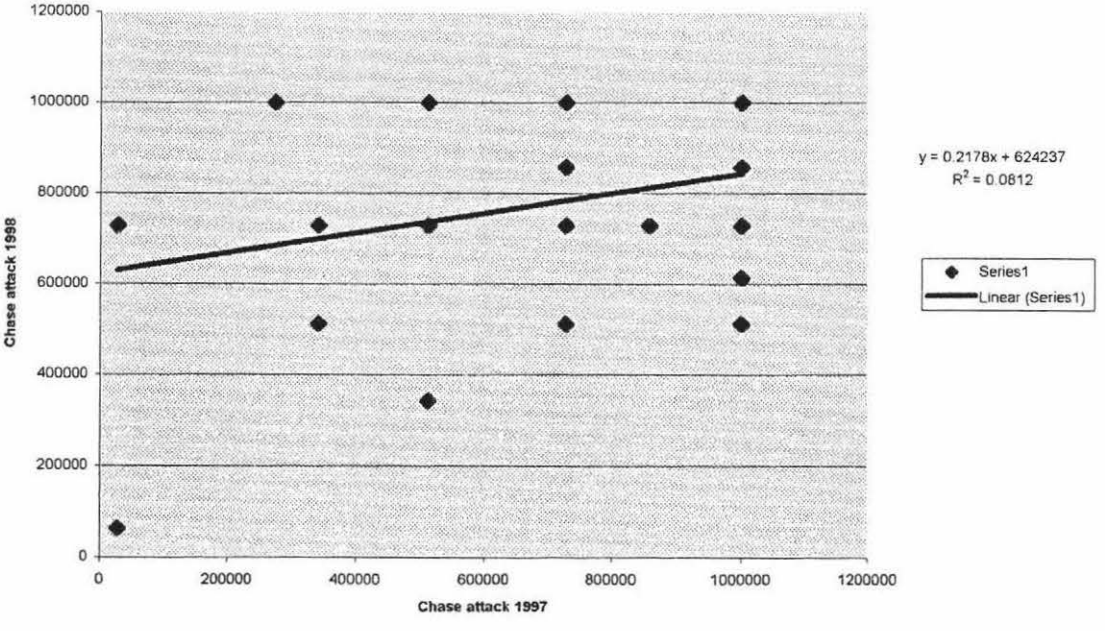

Table 3.18 Probability table of 2000 vs. 1999 for the activity Chase and Attack

		1999								
	Freq. Percent Row Percent Column Percent	90	80	75	70	65	60	55	45	
2000	120	14	3	3	2	0	0	0	0	22
		35.9	7.69	7.69	5.13	0	0	0	0	56.41
		63.64	13.64	13.64	9.09	0	0	0	0	
		60.87	37.5	75	100	0	0	0	0	
	115	3	1	0	0	0	1	0	0	5
		7.69	2.56	0	0	0	2.56	0	0	12.82
		60	20	0	0	0	20	0	0	
		13.04	12.5	0	0	0	50	0	0	
	110	4	1	1	0	0	1	0	0	7
		10.26	2.56	2.56	0	0	2.56	0	0	17.95
		57.14	14.29	14.29	0	0	14.3	0	0	
		17.39	12.5	25	0	0	50	0	0	
	106	0	1	0	0	0	0	0	0	1
		0	2.56	0	0	0	0	0	0	2.56
		0	100	0	0	0	0	0	0	
		0	12.5	0	0	0	0	0	0	
	100	2	2	0	0	0	0	0	0	4
		5.13	5.13	0	0	0	0	0	0	10.26
		50	50	0	0	0	0	0	0	
		8.7	25	0	0	0	0	0	0	
	Total	23	8	4	2	0	2	0	0	39
		58.97	20.51	10.26	5.13	0	5.13	0	0	100

Table 3.19 Probability table of 2000 vs. 1998 for the activity Chase and Attack

		1998									
	Freq. Percent Row Percent Column Percent	100	95	90	85	80	70	65	55	40	
2000	120	5	3	2	0	3	0	0	0	0	13
		19.23	11.54	7.69	0	11.54	0	0	0	0	50
		38.46	23.08	15.38	0	23.08	0	0	0	0	
		71.43	60	33.33	0	50	0	0	0	0	
	115	1	1	0	0	1	0	1	0	0	4
		3.85	3.85	0	0	3.85	0	3.85	0	0	15.38
		25	25	0	0	25	0	25	0	0	
		14.29	20	0	0	16.67	0	100	0	0	
	110	1	1	1	0	1	1	0	0	0	5
		3.85	3.85	3.85	0	3.85	3.85	0	0	0	19.23
		20	20	20	0	20	20	0	0	0	
		14.29	20	16.67	0	16.67	100	0	0	0	
	106	0	0	1	0	0	0	0	0	0	1
		0	0	3.85	0	0	0	0	0	0	3.85
		0	0	100	0	0	0	0	0	0	
		0	0	16.67	0	0	0	0	0	0	
	100	0	0	2	0	1	0	0	0	0	3
		0	0	7.69	0	3.85	0	0	0	0	11.54
		0	0	66.67	0	33.33	0	0	0	0	
		0	0	33.33	0	16.67	0	0	0	0	
	Total	7	5	6	0	6	1	1	0	0	26
		26.92	19.23	23.08	0	23.08	3.85	3.85	0	0	100

Table 3.20 Probability table of 2000 vs. 1997 for the activity Chase and Attack

		1997							
	Freq. Percent Row Percent Column Percent	100	95	90	80	70	65	60	30	
2000	120	2	0	3	2	1	0	0	1	9
		10	0	15	10	5	0	0	5	45
		22.22	0	33.33	22.22	11.11	0	0	11.11	
		25	0	75	50	50	0	0	100	
	115	3	0	0	0	0	0	0	0	3
		15	0	0	0	0	0	0	0	15
		100	0	0	0	0	0	0	0	
		37.5	0	0	0	0	0	0	0	
	110	1	0	0	2	1	1	0	0	5
		5	0	0	10	5	5	0	0	25
		20	0	0	40	20	20	0	0	
		12.5	0	0	50	50	100	0	0	
	106	1	0	0	0	0	0	0	0	1
		5	0	0	0	0	0	0	0	5
		100	0	0	0	0	0	0	0	
		12.5	0	0	0	0	0	0	0	
	100	1	0	1	0	0	0	0	0	2
		5	0	5	0	0	0	0	0	10
		50	0	50	0	0	0	0	0	
		12.5	0	25	0	0	0	0	0	
	Total	1	0	1	2	4	4	0	8	20
		5	0	5	10	20	20	0	40	100

Table 3.21 Probability table of 1999 vs. 1998 for the activity Chase and Attack

		1998									
	Freq. Percent Row Percent Column Percent	100	95	90	85	80	70	65	55	40	
1999	90	7	6	4	1	4	0	0	1	0	23
		20	17.14	11.43	2.86	11.43	0	0	2.86	0	65.71
		30.43	26.09	17.39	4.35	17.39	0	0	4.35	0	
		70	100	44.44	50	80	0	0	100	0	
	80	2	0	3	0	1	0	1	0	0	7
		5.71	0	8.57	0	2.86	0	2.86	0	0	20
		28.57	0	42.86	0	14.29	0	14.29	0	0	
		20	0	33.33	0	20	0	100	0	0	
	75	1	0	0	0	0	0	0	0	0	1
		2.86	0	0	0	0	0	0	0	0	2.86
		100	0	0	0	0	0	0	0	0	
		10	0	0	0	0	0	0	0	0	
	70	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	
		0	0	0	0	0	0	0	0	0	
	65	0	0	1	1	0	0	0	0	0	2
		0	0	2.86	2.86	0	0	0	0	0	5.71
		0	0	50	50	0	0	0	0	0	
		0	0	11.11	50	0	0	0	0	0	
	60	0	0	1	0	0	0	0	0	1	2
		0	0	2.86	0	0	0	0	0	2.86	5.71
		0	0	50	0	0	0	0	0	50	
		0	0	11.11	0	0	0	0	0	100	
	55	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	
		0	0	0	0	0	0	0	0	0	
	45	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	
		0	0	0	0	0	0	0	0	0	
	Total	10	6	9	2	5	0	1	1	1	35
		28.57	17.14	25.71	5.71	14.29	0	2.86	2.86	2.86	100

Table 3.22 Probability table of 1999 vs. 1997 for the activity Chase and Attack

		1997								
	Freq. Percent Row Percent Column Percent	100	95	90	80	70	65	60	30	
1999	90	7	0	4	5	0	0	1	1	18
		25	0	14.29	17.86	0	0	3.57	3.57	64.29
		38.89	0	22.22	27.78	0	0	5.56	5.56	
		63.64	0	100	100	0	0	100	50	
	80	2	0	0	0	2	1	0	0	5
		7.14	0	0	0	7.14	3.57	0	0	17.86
		40	0	0	0	40	20	0	0	
		18.18	0	0	0	50	100	0	0	
	75	1	0	0	0	0	0	0	0	1
		3.57	0	0	0	0	0	0	0	3.57
		100	0	0	0	0	0	0	0	
		9.09	0	0	0	0	0	0	0	
	70	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	
		0	0	0	0	0	0	0	0	
	65	1	0	0	0	0	0	0	0	1
		3.57	0	0	0	0	0	0	0	3.57
		100	0	0	0	0	0	0	0	
		9.09	0	0	0	0	0	0	0	
	60	0	0	0	0	1	0	0	1	2
		0	0	0	0	3.57	0	0	3.57	7.14
		0	0	0	0	50	0	0	50	
		0	0	0	0	20	0	0	50	
	55	0	0	0	0	1	0	0	0	1
		0	0	0	0	3.57	0	0	0	3.57
		0	0	0	0	100	0	0	0	
		0	0	0	0	25	0	0	0	
	45	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	
		0	0	0	0	0	0	0	0	
	Total	11	0	4	5	4	1	1	2	28
		39.29	0	14.29	17.86	14.29	3.57	3.57	7.14	100

Table 3.23 Probability table of 1998 vs. 1997 for the activity Chase and Attack

		1997								
	Freq. Percent Row Percent Column Percent	100	95	90	80	70	65	60	30	
1998	100	3	0	3	3	0	1	0	0	10
		10.34	0	10.34	10.34	0	3.45	0	0	34.48
		30	0	30	30	0	10	0	0	
		30	0	42.86	60	0	100	0	0	
	95	2	0	2	0	0	0	0	0	4
		6.9	0	6.9	0	0	0	0	0	13.79
		50	0	50	0	0	0	0	0	
		20	0	28.57	0	0	0	0	0	
	90	2	1	1	1	2	0	0	1	8
		6.9	3.45	3.45	3.45	6.9	0	0	3.45	27.59
		25	12.5	12.5	12.5	25	0	0	12.5	
		20	100	14.29	20	66.67	0	0	50	
	85	2	0	0	0	0	0	0	0	2
		6.9	0	0	0	0	0	0	0	6.9
		100	0	0	0	0	0	0	0	
		20	0	0	0	0	0	0	0	
	80	1	0	1	0	1	0	0	0	3
		3.45	0	3.45	0	3.45	0	0	0	10.34
		33.33	0	33.33	0	33.33	0	0	0	
		10	0	14.29	0	33.33	0	0	0	
	70	0	0	0	1	0	0	0	0	1
		0	0	0	3.45	0	0	0	0	3.45
		0	0	0	100	0	0	0	0	
		0	0	0	20	0	0	0	0	
	65	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	
		0	0	0	0	0	0	0	0	
	55	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	
		0	0	0	0	0	0	0	0	
	40	0	0	0	0	0	0	0	1	1
		0	0	0	0	0	0	0	3.45	3.45
		0	0	0	0	0	0	0	100	
		0	0	0	0	0	0	0	50	
		10	1	7	5	3	1	0	2	29
		34.48	3.45	24.14	17.24	10.34	3.45	0	6.9	100

3.6 DISCUSSION

The major findings from the statistical analysis of the annual reports were:

1. The highest repeatability of 0.48 was calculated for the activity 'speak on command', a relatively simple activity. The lowest value of 0.03 calculated for the activity 'track' was probably influenced by the large handler component being assessed in the scoring system.
2. The annual reports varied in how marks were allocated, scoring of activities, the environment and the emphasis of the trials.
3. The results were heavily skewed to the upper end of the scale for the majority of the activities which made it difficult to conduct a satisfactory statistical analysis.
4. Only about 58 dog and handler teams were available for analysis. The small number of teams made it impossible to conduct a comprehensive repeatability analysis.
5. The majority of the activities measured in the trials were complex and the values given were dependent on both the handler and the dog.

The data set collected from the annual reports was the most reliable available from the Royal New Zealand Police Dog Training Centre on measuring the ability of the operational dog and handler teams. Therefore, it was anticipated that the data would be fairly repeatable and produce high repeatability values when statistically analysed.

The highest repeatability value of 0.48 was obtained for the activity 'speak on command'. This activity involved the handler commanding the dog to speak and it was one of the simpler activity tests measured. Therefore, it would be more likely to be repeatable then some other activities.

On the other end of the scale, the activity 'track' had the lowest repeatability. This was attributed to the fact that this activity involved a lot of different abilities from both the handler and the dog. Also, a large component of the marks given was based on the behaviour of the handler. The handler made the final decision on following a trial, casting the line efficiently and in reading the action of the dog.

The activities 'heel free', 'retrieve', and 'chase and recall' all had repeatabilities between 0.3 and 0.4. The activities 'heel free' and 'retrieve' are simple activities and are learnt at the beginning of a team's training. In addition, they are the basis of many of the other activities and the majority of the teams would have mastered these activities well. Therefore, the teams would have scored highly in these activities with a number of teams scoring the same value year after year which would have resulted in the high repeatability value obtained. 'Chase and recall' is an activity that combines the heel free and retrieve disciplines. As 'heel free' and 'retrieve' were highly repeatable it follows that the activity 'chase and recall' would also have a high repeatability value.

The activities that had repeatabilities between 0.2 and 0.3 were 'down stay', 'distance control', and 'passive attack'. Down stay had a relatively low repeatability as the teams either scored 100% each year or scored 100% for the majority of the years except for one or two years where they scored very low. This was probably attributable to the scoring system used where marks were deducted easily. 'Distance control' required a down stay component so it was understandable that the repeatability was low due to a low value for the 'down stay' discipline. All the other activities had repeatabilities below 0.2.

The coefficient of repeatability is a measure of the genetic determination of a character and is the correlation between the measurements of a character taken from the same animal in different environments (Maciejowski and Zieba, 1982). It is likely that if a desired trait has a large genetic component the animal will generally perform well each year despite variations in the environment (Dalton, 1985). The advantage of a repeatability analysis is that it reduces the importance of the specific environmental

variance (Willis, 1998). Another advantage of calculating a repeatability value is to add precision to a heritability value calculated from one record (Maciejowski and Zieba, 1982).

If a repeatability value is low then the heritability of the trait will also be low. With more records the heritability value will increase due to a decrease in the environmental variance but will still remain relatively low . On the other hand, if the repeatability is high then multiple records will not be useful as the first record is already a good indication of the performance of the animal on the trait of interest (Willis, 1998).

If a high repeatability value is found then this indicates that the Police would only need to measure the trait once during the working dog's lifetime as the first record will give a good indication of it's performance. On the other hand if a low repeatability value is obtained then this indicates that the trait may not be worth selecting for in a breeding programme as the trait will have a low chance of being passed on to the animal's offspring.

The majority of repeatability analysis studies have been conducted in the livestock industries. These have the advantage of having a large number of animals to breed from each year under the same environmental conditions which makes it easier to determine genetic effects and undergo performance and progeny testing. Also, the aims of livestock industries differs from a dog breeders aims. Dog breeders want a dog that exhibits a uniform standard on a number of traits while the livestock breeder aims to achieve an extreme of the phenotype of interest which makes it easier to measure (Famula, 2001).

In a study of American Quarter horses an ANOVA method similar to the one used in this study was conducted in conjuction with two other methods, the Henderson's simple method (IHSM) and the Tilde–Hat method (THM) to estimate heritability and repeatability for racing time (Buttram *et al.*, 1988). The ANOVA method was found to yield higher heritability estimates and lower repeatability estimates then the other two

methods used. Using the ANOVA method they found that records obtained from the 2 year old horses produced higher estimates of heritability (0.28 vs 0.22) than those of the older horses.

A small number of studies have been conducted on behaviour tests in dogs where repeatability and heritability estimates were made. A study on mental characteristics in Alsatian dogs at the Army Dog Training Centre in Sweden used data from over 900 dogs (Reuterwall and Ryman, 1973). Willis (1989) calculated heritability values from the data obtained. The heritabilities calculated were low, with the highest value of 0.26 obtained for the trait 'self defence' in the female dogs. The low heritability values obtained were thought to be due to a poor scoring system (Willis, 1989).

Goddard and Beilharz (1983) estimated heritability values for the traits used to test the suitability of dogs as Guide dogs in Australia. They took into account the effects of year, sex, sire, dam, residual between-litter variation and within-litter error. The highest heritability value of 0.58 was obtained for the trait 'nervousness' with the traits 'body sensitivity', 'concentration', 'dog distraction' and 'willingness' having heritability values above 0.22.

A behaviour test for the selection of service dogs was conducted in Sweden using 1310 German Shepherds and 797 Labrador Retrievers (Wilsson and Sundgren, 1997b). An index value was formed that summarised all the characteristics utilised. A heritability value of 0.24 was obtained for the index value in both breeds, and values of 0.15 to 0.32 were also obtained from four factors derived from a factor analysis of the results. The study showed that only a small number of characteristics needed to be measured in order to be able to predict the suitability of the dog for service dog work.

Heritability values of a number of behavioural traits tested on eight – week old German Shepherd dogs was also conducted a year later at the same centre (Wilsson and Sundgren 1998). The combined heritability values obtained ranged from 0.20 to 0.48 with the

highest value obtained for the test 'tug of war'. This indicates that the traits studied were under genetic influence. But the test had no predictive value on the behaviour of the dogs when they reached adulthood. It was suggested that adult behaviour and juvenile behaviour might be under the control of different genes or that different behavioural systems were measured in adults.

In this study the repeatability values obtained from the annual trials were relatively high. But the values may not give a true indication of the actual repeatability of the activities. The accuracy of the repeatability value is influenced by the accuracy of the marking process. For the repeatability value to be accurate the trials must accurately measure each activity.

The majority of the activities were quite complex and required the dog to exhibit a number of essential traits to score well. Also a large part of the score obtained came from the handler's performance in the activities. The emphasis of the trials altered each year and this has resulted in some activities being scored in a different way or in a different situation. This would have increased the environmental variance and would result in a lower repeatability. Therefore, a large number of factors may have influenced the scores used to calculate the repeatability.

A better way to examine the repeatability of police dog activities is to calculate the repeatability of the traits that the dog must possess to do well in the activity and not the activity itself. For an activity like 'article search' the dog must possess the traits 'prey drive', 'independence', 'trainability', and 'obedience'. If each activity was broken down into a number of traits and a score given for each trait while the dog is being tested then a repeatability analysis can be conducted on each trait. If this style of marking is done for each activity a number of activities will require the same traits in the dog for it to perform well. If the marks given for each of the traits were then combined once all the activities were scored then a repeatability analysis could be conducted utilising all the scores obtained for each of the traits.

This type of analysis will determine the heritability of these traits and whether there is a use for the trait in a breeding programme. If the trait has a low repeatability it is likely that it will have a slightly lower heritability value and therefore, there would be no use in using that trait to select dogs to breed from. On the other hand, if a high repeatability were calculated, then it would be worthwhile estimating a heritability value and if that value was reasonably high then the trait could be utilised in a breeding programme.

Another advantage of breaking the activity down into essential traits is that the handler performance can be measured as well. The police would then be able to assess whether it is the dog or the handler that is not performing well when the score for an activity is low. It will also help in identifying the component of the activity that can be improved by further training.

The small number of dog and handler teams in this study made it impossible to conduct an advanced repeatability analysis. When an analysis of variance was conducted with the effects of year, age of the dog, years of experience of the handler and the effect of dog taken into account there was not enough data to calculate the least squares means. Therefore, the repeatability value obtained from only considering the year and the dog effect was the only repeatability value that could be calculated for each activity.

The true value of the repeatability would take into account the effects of the number of years of experience of the handler, and the age of the dog. If these two effects were significant then the true value for the repeatability would be lower than the repeatability values predicted here. Future analysis conducted using the recommended changes above and using a larger data set over a number of years is needed. This will allow an advanced repeatability analysis to be conducted taking into account all the fixed effects.

3.6.1 HERITABILITY VALUES

The repeatability values obtained give an upper maximum level of heritability for each of the activities measured as the difference between heritability and repeatability ignoring the effects of dominance and epistasis is the proportion of the total variance attributable to permanent environmental effects (Buttram *et al.*, 1988). The repeatability indicates how the animal will exhibit a particular trait over it's lifetime while the heritability value gives an idea on how it will pass the trait on to the next generation (Dalton, 1985). Heritability measures the extent of genetic variance on the total phenotypic variance which involves both genetic variance and environmental variance (Maciejowski and Zieba, 1982).

The heritability is calculated on the population of interest and not on the individual animal. This is based on the fact that genetic selection can not be conducted unless there is genetic variation in the population. A breeder utilises the heritability value with a selection differential to get the most effective genetic gain possible in the next generation.

If the heritability value is above zero then the offspring average for the character will be higher than the average of the parental generation population (Maciejowski and Zieba, 1982). The higher the value the more different the offspring average will be from the parental average. It is defined as the amount of the superiority of the parents above their contemporaries which on average is passed on to the offspring (Dalton, 1985).

The advantage of calculating a heritability value is to distinguish whether the trait is controlled by any genetic component. The higher the genetic component the more likely that the offspring of the parents will exhibit the trait of interest. Like the repeatability value it is expressed on a scale from 0 to 1.0 or 0 to 100%. In general terms a low heritability is classed with a value of 0 to 0.1, a medium or intermediate heritability value is between 0.1 to 0.3 and a high heritability value is 0.3 or above (Dalton, 1985).

Trying to study the heritability of behavioural traits is difficult as behaviour is a very complex trait (Willis, 1989) and highly dependent on acquired and environmental influences (Famula, 2001). Behaviour is also hard to define and only when a behavioural trait is clearly outlined in detail does any selection for that particular trait become possible. Establishing the heritability of behavioural traits in dogs is very important especially for service dog organizations as one undesirable behavioural trait may prevent the dog from becoming successful (Willis, 1991).

It was hoped in this study that the heritability value for each activity would be calculated. The heritability value would have been calculated using either the regression of offspring on sire, or offspring on the mid – parents and paternal half – sibling correlations. An estimate of the heritability of the activities could not be calculated due to there being only a small number of sire and dam records on the dogs measured in the annual trials.

The majority of the dogs assessed in the annual trials were donated and the sire and dam of the dogs were not known. If the dog is bred at the Police Dog Training Centre the litters are assigned names starting with the same letter. This makes it easy to identify which litter each dog came from. However, during a police dog's working life it is sometimes handled by a number of policemen. A handler may change the name of the dog if they believe the current name is not suitable. As there is no record of the change of names there is no way to track the original source of the dog.

Therefore, only a few pedigree records were available. Only six different sires and six different dams of seventeen different dogs were available for calculating a heritability value. As the heritability value is based on the population of interest if there are only a small number of sires or siblings then the heritability value calculated becomes statistically invalid. A minimum of ten sires with at least five progeny per sire is required, but a larger number of sires is better (Willis, 1998). Thus it was not possible to determine the heritability of the activities.

3.6.2 DESIGN OF ANNUAL TRIAL REPORTS

The design of the annual reports needs to be more consistent. In the four annual reports utilised in this study the method of scoring activities varied. In some years marks were assigned for a particular part of the activity and marks were deducted if the team did not conduct that certain part or if they did not conduct it in a satisfactory manner. In other years marks were gained when the team reached a certain level or completed a certain task. In the 1997 annual report the majority of the activities did not have the marks broken down into certain parts of the activity. This may have caused more variation in the scores that were obtained for each team.

In some years the emphasis of the trials changed. If a particular activity needed addressing that particular year the marks were broken down into very specific parts so that any error was noted and marks deducted for. Sometimes, the activities were tested in different environments. In one year the activity could have been tested at a different time of day, at night or on a different surface compared to another year. This would have made it more difficult to test the repeatability of the activity for the four years of annual trials. Therefore, it is likely that the repeatability's calculated in this study are not accurate as these effects could not be taken into account.

3.6.3 DATA RECORDING AND TRANSFORMATION

One major problem with the analysis study was the data recording. There were a large number of scoring systems used with values ranging from 10 for the activity 'down stay' to a score of 300 for the activity 'track'. For some activities, the scoring system differed each year for the same activity which made it harder to compare results. That was why the data was first recorded in proportion values. But as this changed the variability of the data, the data were converted back to the original values. Also, the majority of the dog and handler teams scored in the top half of the scale. Therefore, the data had to be transformed to make it normally distributed as it had a negative skewed distribution.

All the transformations conducted reduced the skewness of the original data. For the majority of the activities the kurtosis of the data was also reduced. As the main reason for transformation was to reduce the skewness of the data the transformations on the activities that showed an increase in kurtosis was still conducted. There was a limit in the type of transformation that was conducted. The number of years that an activity was scored was four. Each year of each activity scored was transformed separately and as the data had to be able to undergo statistical analysis each of the years had to be transformed in the same way. Therefore, the type of transformation conducted on the activity was dependent on the advantages shown for the majority of the years that the activity was scored. This resulted in some years showing the increase in kurtosis.

As one of the main problems in conducting the repeatability analysis was due to the scoring systems used an improvement in the scoring values is needed. The scoring system used must remain consistent from year to year to be able to accurately measure the repeatability value. All the dog and handler teams measured in the annual reports were already considered operational. They had already passed all the training courses and received satisfactory results according to the standards currently being used by the Police Dog Training Centre. Therefore, a high level of competency was expected in the results.

As a result, the data obtained was highly skewed to the top half of the scoring systems used. The most common score used was a score out of 50. The majority of the teams scored above 40. Therefore, all the scores possible below 40 were not utilised by the examiner. A better scoring system would use the whole range of scores possible and be able to separate teams better.

It is recommended that a scoring scale of 1 to 5 could be used instead of a large numbered scoring system that is not fully utilised. A score of 1 could indicate not competent at all, 2 could indicate low competency, 3 could indicate an average level of competency, 4 could indicate high competency and 5 could indicate excellence in the activity. This would have the advantage of clearly being able to separate the teams into

competency instead of a percentage value or a score out of 50, 100 or 300. The overall rating of the team could be based on the scores obtained for the essential traits in the dog and the score for handler performance from each activity.

3.6.4 DATA NUMBERS

An average of 58 dog and handler teams were recorded for each activity in all the annual reports. For statistical analysis only the dog and handler teams that had at least two years of annual reports were utilised. The majority of the dog and handler teams used in the analysis had three years of annual reports available for analysis. The small amount of teams was due to the fact that a lot of the dogs changed handlers during their working lifespan. Also some of the 120 teams that are currently operational had only become operational in the last year or two so did not have enough data to be useful. Others had dogs that had retired during one of those years so four annual reports were not available.

3.6.5 PATTERNS OF PERFORMANCE

It was predicted that a dog and handler team in their first few years of being operational would improve in the activities measured in the annual reports. Then a plateau would be reached where the team have performed as well as their abilities allow. Towards the end of the working ability of the dog a slight decline may result due to the slowing down of the dog due to old age or health reasons. But only four years of annual reports were able to be utilised due to the fact that the Senior Officer in charge had only been in that position for four years and had only been designing and scoring the annual reports for that long. Four years of annual reports were not sufficient to distinguish whether this pattern of performance was seen.

3.6.6 PROBABILITY TABLES

The small number of dog and handler teams prevented the use of probability tables. It was hypothesised that there should be a higher probability of dogs obtaining the same or very similar values year after year or better. Therefore, the diagonal values on the table should have the highest probability with values moving away from the diagonal progressively getting smaller. There were not enough data available to show whether dogs were receiving the same value year after year as there were a number of gaps where no values were obtained.

The probability tables would have helped confirm the repeatability values obtained. It was expected that the activities that had relatively high repeatability values would have shown the predicted pattern of the table with a high probability of dogs obtaining the same values. The activities with low repeatability values would not show tables with the predicted pattern.

The probability table on the activity 'chase and attack' was useful in finding out how many teams scored a certain value in one year and how many teams scored the value in another year. But for the majority of the values except for the score of 100 only a small percentage of teams scored the same value for the two years of the probability table.

3.7 CONCLUSION

The main purpose of analysing the annual reports was to calculate a repeatability value for the activities measured. This was achieved but whether the values obtained are close to the real repeatability value is another question. The calculations were largely dependent on the scoring system used in the annual reports, and environmental effects. It was found that the purpose of the annual trials varied each year, and therefore the scoring systems and the environments where the activity was measured changed. Only a small number of dog and handler team scores were available for analysis due to teams becoming disbanded or new teams being created during the four years. This prevented an advanced repeatability analysis and probability tables to be conducted which would have confirmed the repeatability values calculated. A heritability value could not be estimated due to insufficient pedigree data. As repeatability gives an upper limit of the possible heritability values the values obtained are a good starting point in trying to establish the heritability values of the activities.

The next step would be changing the structure of the annual trials and reports so that it conforms to a standard outline and scoring system. This would make the repeatability values more accurate as the environmental variance would be reduced. Breaking down the activities into handler and dog sections would allow the actual traits from the dog to be accurately measured. Then a repeatability analysis can be conducted on the actual traits and not on the activity itself. The scoring system should be conducted on a scale from 1 to 5 from the total scores obtained from the handler and dog components. This would mean that the whole scoring system is utilised and would separate the teams into levels of competency.

The recording of pedigree data is required so that a heritability value can be calculated. Once a heritability value is estimated, then the usefulness of the trait in breeding terms can be assessed. This will be the first step in creating the breeding programme that is required to improve the overall standard of the police dog.

4 GENERAL DISCUSSION

This research project was the first study ever carried out on the New Zealand Police Dog Service. The scientific literature on police dogs worldwide is very scarce.
The research was undertaken to gather and analyse the data that were available in the records of the New Zealand Police Dog Service. Data from the annual trials were analysed to determine the repeatability of specific dog traits. An attempt was made to determine the heritability of these traits but insufficient pedigree data were available. This reduced the value of the research substantially and this paucity of pedigree data was not expected when the study began.

The objective of any Police Dog Service is to have as many successful operational dogs in their service as required. To achieve this the requirements that make a good police dog have to be identified. Guidelines on the essential behavioural and physical traits that are required in an operational police dog have to be developed. For an effective breeding programme it is crucial to have a list of the essential traits, a ranking of these traits, the heritability value of the traits and the genetic correlation between the traits. A successful breeding programme is needed to ensure that there will be a large number of dogs that have the required characteristics to select from. It is also essential to identify the best environment for young dogs to give them the best chance of reaching their potential.

A questionnaire was sent to all operational dog handlers to define the ideal dog and to collect opinions on whether the current operational dogs are up to the ideal standard, their opinions on the relative importance of a number of behavioural traits, the definition of prey drive, methods for improving dogs, foster homes and training. The opinions of the handlers were thought to be important, as they are the ones that work with the police dogs every day. The questionnaire established what they thought needs to be done to improve the quality of dogs in service.

4.1 QUESTIONNAIRE

The handlers thought that all the behavioural traits listed; 'prey drive', 'trainability', 'general activity', 'obedience', 'playfulness', 'independence', and 'aggressiveness' were important or very important suggesting that these traits have to be included in a breeding programme. There was a significant difference between scores obtained for the ideal police dog and the handler's personal dog for all the behavioural traits listed except for 'playfulness'. Therefore, the current police dogs are not up to the standard desired by the handlers.

If a breeding and selection programme is to be successful the required behavioural traits need to be defined accurately. One of the most important behavioural traits required for a dog to become operational is the trait 'prey drive'. The handlers gave a number of definitions of prey drive but they were all very similar in nature and close to the definitions used by psychologists and the Police Dog Training Centre. They believe that 'prey drive' is the desire to, the motivation to or the willingness to retrieve, chase or hunt an object, person or prey.

Improvements suggested by the handlers included stricter stud and brood bitch selection, better monitoring of foster homes, defined structures for training with more contact between the Dog Training Centre and regions, and increased number of dogs being available to reduce mismatching of dogs to handlers.

The majority of operational police dogs were donated to the Police and not bred by the Police Dog Training Centre. This may have resulted in the handlers believing that donated dogs were better police dogs than purpose - bred dogs. It also indicates that the current breeding and selection programme is not producing enough effective dogs.

A deficiency of the questionnaire was that it was necessarily general. In an attempt to increase the participation rate only one or two questions could be asked about each aspect

of the Police Dog Section. Therefore, no definitive conclusions can be made from the results obtained. Results from this questionnaire provide a good starting point for further research and analysis.

4.2 ANALYSIS OF ANNUAL REPORTS

The only reliable data that were available for statistical analysis were the annual reports on the trial performance of each operational dog and handler team. These annual reports were compiled and recorded for four years by the same evaluator. It was anticipated that these reports would be repeatable each year in scoring the operational dog and handler teams. The annual reports are the only measure of how well the dog and handler team are operating once they have completed training. The annual reports determine whether the teams are up to the standard expected.

A repeatability value was determined for each activity examined during the annual trials with the activity 'speak on command' having the highest value of 0.48 and the activity 'track' having the lowest value of 0.03. 'Heel free', 'retrieve' and 'chase and recall' showed repeatabilities between 0.3 and 0.4, 'down stay', 'distance control', and 'passive attack' were between 0.2 and 0.3, while all the other activities had repeatabilities less than 0.2. A variety of environmental effects could have affected the repeatability values obtained but since these effects are not recorded, they could not be adjusted for. The annual reports measured the same activities each year but the emphasis of the trials sometimes varied. This meant that some activities were measured in different environments, marks were allocated differently and the scoring of the activity changed. Some activities were also complex in nature and involved a strong handler component.

Only the reports for the years 1997 to the year 2000 were analysed as earlier reports were designed and scored by different evaluators which would have increased the environmental variance. Only data from a small number of dog and handler teams were analysed as teams were disbanded or were created during the four years. This prevented a

repeatability analysis with the fixed effects age of dog, years of experience of the handler, dog effect and year effect being taken into account.

The difficulty of analysing the data makes it essential that in the future the reports should be broken down into the essential traits a dog must possess to do well in each activity and the handler components. A number of activities will have overlapping traits and the combined score the dog achieved for a particular trait from each activity can be used for the repeatability analysis instead of the score for the whole activity. These repeatability values would be closer to the true repeatability value for the trait. As repeatability provides an upper limit for a possible heritability value the value obtained would predict whether the trait has a large genetic component and whether it is useful for a breeding and selection programme.

A heritability analysis using the scores obtained from the annual reports and the pedigree data was attempted. However a shortage of pedigree information on the dogs measured in the annual reports made a heritability analysis impossible.

4.3 COMPARISION OF RESULTS FROM QUESTIONNAIRE AND ANNUAL REPORTS

The annual reports measured fourteen activities which ranged from simple activities involving the dog being good in one or two traits to complex activities in which the dog had to show ability in a number of traits and the handler also had to perform well. The questionnaire asked handlers for their opinion on the importance of a number of traits and not on the actual activities measured in the annual reports. Therefore, no direct comparisons can be made on the importance the handlers placed on a number of behavioural traits and how well dog and handler teams performed for that particular trait.

If, as suggested, the activities are broken into several traits then a score would be obtained on the performance of the dog on a particular trait. Then it would be possible to

assess whether the importance the handlers' placed on a trait is shown in the score dogs obtained for the trait. These records would indicate with a greater degree of accuracy if the dog and handler teams are obtaining the values that are expected of them in the opinion of the handlers.

4.4 LIMITATIONS IN THE POLICE DOG DATA RECORDING SYSTEM

The main limitations in this preliminary study of the police dogs in New Zealand was the small amount of data available. The only information about the dogs bred at the Police Dog Training Centre are the sire and the dam and the name of the dogs in a particular litter. There is no follow through on which dogs were sent to which foster homes, which ones were sold and whether dogs became operational or not. For the donated dogs the information is even less. The majority of donated dogs do not have any pedigree data and there is no follow through on which dogs that were donated became operational.

For a reliable analysis to be conducted on any aspect of the police dogs the data on the dogs needs to be thorough and accurate. Currently there are no separate files on the dogs that have gone through the Dog Training Centre. There are files on litters bred at the Dog Training Centre and a limited amount of information on different kennels where donated dogs were donated from. The most complete files available are the handler files. These files contain training scores for the handler and the particular dog that the handler had at the time and the annual reports the handler was involved in.

Some of these files are incomplete. In some handler files, the handler has gone through a number of dogs, not all training scores are present, or annual reports are missing. It is also very common for a handler to change a dog's name when it is under his/her care. There is no record of a change of names in any of the handler files. Therefore, it is impossible to distinguish if the scores obtained for the handler and the dog are on the same dog or a different one.

At present, there is also a limited amount of data on the foster home programme. Recently a more detailed foster home report was created that will more accurately assess areas of interest. But it will be a while before a statistical analysis can be conducted on the foster home data due to the amount of time a dog spends in the home. It would also be of interest to get some demographic data on the homes to examine if any environmental elements affects the success of the dog. The foster homes also need to be monitored more often and selection criteria should be created for first time foster home candidates to predict if they would be suitable to foster a potential police dog.

No statistics on how many dogs are bred and which ones become successful and how many dogs are donated and become successful are available. The questionnaire on the handlers was a good starting point as it gave the opinions of the handlers on a number of aspects but as they are only opinions they should be treated with caution. More accurate data are required to define the limitations on certain aspects of breeding, foster homes and training.

4.5 RECOMMENDATIONS FOR POLICE DOG TRAINING CENTRE

Files need to be created for each dog that goes through the Police Dog Training Centre no matter how short a time the dog is involved in the programme.

These files need to have:

- detailed pedigree data on the sire and dam, the grandsire and grandam, and the other dogs in the litter
- the source of the dog
- its test for suitability to go to a foster home
- its progress through the foster home
- its first handler and region assigned

- its test results on all aspects of training and the final selection programme
- the annual report results once it is operational
- change of environment, name, and handler with reasons for changes, and time of retirement

For these files to be accurate the data recording system needs to be designed so that each aspect of the dog can be accurately measured. The questionnaire has shown that the traits 'prey drive', 'trainability', 'general activity', 'obedience', 'playfulness', 'independence', and 'aggressiveness' are considered important traits. A good starting point will be setting up accurate definitions of the traits before any data is recorded.

This could be conducted by looking at other studies that use the same traits, the definitions given to those traits and the current way the trait is measured by the Police Dog Training Centre. This study has attempted to achieve a definition of the trait 'prey drive' and find an accurate way to measure the trait. A definition was achieved by utilising the opinions of the handlers, definitions of the term 'drive' and the current definition currently being used by the Police. It was found that using the 'retrieve' test was the best way to measure 'prey drive'.

If the traits are defined accurately and a way to measure the trait is established then recording information on the dogs becomes straightforward Once enough data are available for analysis then it would be possible to do several statistical analyses on all aspects of police dog work.

It would be possible to establish:

- the success rate of the breeding programme being used
- the success rate of the donated dogs
- the precise areas of concern on foster homes and training
- a repeatability analysis on the essential traits needed in police dogs
- a heritability analysis to predict the genetic component of a trait.

Only when all the information becomes available and all the analyses have been conducted can we properly start creating a breeding and selection programme and providing the appropriate environment that will create the ideal police dog.

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APPENDIX ONE

13 March 2001

Dear Sir,

This questionnaire is part of a research project that is being conducted at Massey University, Palmerston North, New Zealand.

This questionnaire will identify the traits that are considered to be important in identifying a dog that has the potential to become a good police dog. The personal views of police dog handlers are considered to be crucial in identifying these traits, as you know the requirements of a police dog. Your views on other issues concerning breeding, foster homes and training are also important. Your participation in this survey will be most appreciated.

In addition to the questionnaire, an analysis of breeding lines, training and yearly assessments will be carried out to identify the important factors that are involved in a dog becoming operational and selecting dogs for the breeding program.

All the information in these questionnaires is strictly confidential.

If you would like any more information on the research project or have any questions please do not hesitate to call us.

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POLICE DOG QUESTIONNAIRE

DEMOGRAPHY

Years of experience with police dogs_____
No. of police dogs you have worked_____
Present dog's name_____ Sex M/F (circle)
Breed_____ Neutered Yes/No
Source of dog Bred by police/Donated (circle)
Body length of dog Short/Med/Long (circle) Hair type Short/Med/Long
Colour Sable Black/Tan Black/Gold Other (circle)
What happened to your previous police dogs?_____
_____
Are there any problems with your present dog? If yes, describe
_____
_____

QUESTIONS

1. How would you personally **describe** your police dog?

Trainability	very low	1	2	3	4	5	very high
Aggressiveness		1	2	3	4	5	
Prey drive		1	2	3	4	5	
General activity		1	2	3	4	5	
Obedience		1	2	3	4	5	
Independence		1	2	3	4	5	
Playfulness		1	2	3	4	5	

2. How would you personally **describe** the **ideal** police dog?

Trainability	v. low	1	2	3	4	5	v. high
Aggressiveness		1	2	3	4	5	
Prey drive		1	2	3	4	5	
General activity		1	2	3	4	5	
Obedience		1	2	3	4	5	
Independence		1	2	3	4	5	
Playfulness		1	2	3	4	5	

3. Please circle in level of importance **five** of the characteristics you believe are the **most important** in police dogs

Height	1	2	3	4	5
Weight	1	2	3	4	5
Size	1	2	3	4	5
Sex	1	2	3	4	5
Colour	1	2	3	4	5
Source of dog	1	2	3	4	5
Trainability	1	2	3	4	5
Prey drive	1	2	3	4	5
Aggressiveness	1	2	3	4	5
Obedience	1	2	3	4	5
General activity	1	2	3	4	5

4. How would you **rate** your dogs on the activities below

General obedience	v. low	1	2	3	4	5	v. high
Criminal work		1	2	3	4	5	
Tracking & searching		1	2	3	4	5	
Overall		1	2	3	4	5	

5. How would you **rate** the **ideal** police dog on these activities

General obedience	v. low	1	2	3	4	5	v. high
Criminal work		1	2	3	4	5	
Tracking & searching		1	2	3	4	5	
Overall		1	2	3	4	5	

6. What is your **definition** of prey drive (retrieve drive)?

_____

_____

_____

7. How do you think the police **measure** prey drive?

_____

_____

_____

8. Has there been an **improvement** in the dogs you have owned over the years?

_____

_____

_____

9. **Rank** the **importance** of these **8** methods for improving the **standard** of police dogs

More focus on training	not impt	1	2	3	4	5	v. impt
Improved stud selection		1	2	3	4	5	
Improved brood bitch selection		1	2	3	4	5	
Stricter assessment measures		1	2	3	4	5	
Reducing no. of donated dogs		1	2	3	4	5	
Improved puppy testing		1	2	3	4	5	
Better food		1	2	3	4	5	
Changing breed		1	2	3	4	5	

10. What do you think is **wrong** with **female** German Shepherds

Not aggressive enough	strongly	1	2	3	4	5	strongly
Lower trainability	disagree	1	2	3	4	5	agree
Too easily distracted		1	2	3	4	5	
More important for breeding		1	2	3	4	5	
Low prey drive		1	2	3	4	5	

11. German Shepherds are **ideal** police dogs because they are:

Highly aggressive	strongly	1	2	3	4	5	strongly
Protective	disagree	1	2	3	4	5	agree
Easily trainable		1	2	3	4	5	
Right size		1	2	3	4	5	
High prey drive		1	2	3	4	5	
Public perception		1	2	3	4	5	
Active		1	2	3	4	5	
Right weight		1	2	3	4	5	

12. Do you think training is **adequate** in:

Trentham	inadequate	1	2	3	4	5	v. adequate
Your Region		1	2	3	4	5	

13. What do you think are the **weaknesses** in training?

_____

_____

14. Do you think that the dogs are **matched well** with their handlers?

in general	not at all	1	2	3	4	5	v. well
you personally		1	2	3	4	5	

15. If you **do not** think you are well matched please state your reasons below

_____

_____

16. Do you think your dog **tracks**
    as a player in a game/as a predator (please circle)

17. Do you think foster homes are a **good** idea?
    not at all 1 2 3 4 5 great idea

18. If **not** please state your reasons below

    _____

    _____

19. Which dogs do you think are the **best** for police dog work?
    Those bred at Trentham/Donated from public (please circle)

20. Are there any **comments** you would like to make?

    _____

    _____

    _____

APPENDIX TWO

Likert Coding Scale for

Question 1. How would you personally describe your police dog?,

Question 2. How would you personally describe the ideal police dog?,

Question 4. How would you rate your dogs on the activities below? and

Question 5. How would you rate the ideal police dog on these activities?

Likert Scale Answer	Coding
Very high	5
High	4
Average	3
Low	2
Very low	1

Likert Coding Scale for

Question 9. Rank the importance of these 8 methods for improving the standard of police dogs

Likert Scale Answer	Coding
Very important	5
Important	4
Average	3
Slightly important	2
Not important	1

Likert Coding Scale for

Question 10. What do you think is wrong with female German Shepherds? and

Question 11. German Shepherds are ideal police dogs because they are:

Likert Scale Answer	Coding
Strongly agree	5
Agree	4
Neutral	3
Disagree	2
Strongly disagree	1

Likert Coding Scale for

Question 12. Do you think training is adequate in a) Trentham & b) your region?

Likert Scale Answer	Coding
Very adequate	5
Adequate	4
Neutral	3
Inadequate	2
Very inadequate	1

Likert Coding Scale for

Question 14. Do you think that the dogs are matched well with their handlers a) in general & b) you personally?

Likert Scale Answer	Coding
Very well	5
Well	4
Average	3
Below average	2
Not at all	1

Likert Coding Scale for

Question 17. Do you think foster homes are a good idea?

Likert Scale Answer	Coding
Great idea	5
Good idea	4
Average	3
Bad idea	2
Not at all	1

APPENDIX THREE

Chi-square table of the dog handler's personal dog for the trait 'trainability' with source of dog

	Frequency / Percent / Row Pct / Col Pct	Source of dog: bred	Source of dog: donated	Total
Trainability Score	avge/>age	5 7.14 38.46 33.33	8 11.43 61.54 14.55	13 18.57
	high	7 10.00 22.58 46.67	24 34.29 77.42 43.64	31 44.29
	very high	3 4.29 11.54 20.00	23 32.86 88.46 41.82	26 37.14
	Total	15 21.43	55 78.57	70 100.00

Chi-square table of dog handler's personal dog for the trait 'aggressiveness' with source of dog

	Frequency / Percent / Row Pct / Col Pct	Source of dog: bred	Source of dog: donated	Total
Aggression Score	avge/<avge	9 12.86 23.08 60.00	30 42.86 76.92 54.55	39 55.71
	high/v.high	6 8.57 19.35 40.00	25 35.71 80.65 45.45	31 44.29
	Total	15 21.43	55 78.57	70 100.00

Chi-square table of dog handler's personal dog for the trait 'prey drive' with source of dog

	Frequency Percent Row Pct Col Pct	Source of dog bred	 donated	 Total
Prey Drive Score	avge/<avge	3 4.29 30.00 20.00	7 10.00 70.00 12.73	10 14.29
	high	7 10.00 30.43 46.67	16 22.86 69.57 29.09	23 32.86
	very high	5 7.14 13.51 33.33	32 45.71 86.49 58.18	37 52.86
	Total	15 21.43	55 78.57	70 100.00

Chi-square table of dog handler's personal dog for the trait 'activity' with source of dog

	Frequency Percent Row Pct Col Pct	Source of dog bred	 donated	 Total
Activity Score	avge/<avge	5 7.14 29.41 33.33	12 17.14 70.59 21.82	17 24.29
	high	9 12.86 25.71 60.00	26 37.14 74.29 47.27	35 50.00
	very high	1 1.43 5.56 6.67	17 24.29 94.44 30.91	18 25.71
	Total	15 21.43	55 78.57	70 100.00

Chi-square table of dog handler's personal dog for the trait 'obedience' with source of dog

	Frequency / Percent / Row Pct / Col Pct	Source of dog: bred	Source of dog: donated	Total
Obedience Score	avge/<avge	7	20	27
		10.00	28.57	38.57
		25.93	74.07	
		46.67	36.36	
	high	6	25	31
		8.57	35.71	44.29
		19.35	80.65	
		40.00	45.45	
	very high	2	10	12
		2.86	14.29	17.14
		16.67	83.33	
		13.33	18.18	
	Total	15	55	70
		21.43	78.57	100.00

Chi-square table of dog handler's personal dog for the trait 'independence' with source of dog

	Frequency / Percent / Row Pct / Col Pct	Source of dog: bred	Source of dog: donated	Total
Independence Score	avge/<avge	6	20	26
		8.57	28.57	37.14
		23.08	76.92	
		40.00	36.36	
	high	6	18	24
		8.57	25.71	34.29
		25.00	75.00	
		40.00	32.73	
	very high	3	17	20
		4.29	24.29	28.57
		15.00	85.00	
		20.00	30.91	
	Total	15	55	70
		21.43	78.57	100.00

Chi-square table of dog handler's personal dog for the trait 'playfulness' with source of dog

	Frequency / Percent / Row Pct / Col Pct	Source of Dog: bred	Source of Dog: donated	Total
Playfulness Score	avge/<avge	1	10	11
		1.43	14.29	15.71
		9.09	90.91	
		6.67	18.18	
	high	10	21	31
		14.29	30.00	44.29
		32.26	67.74	
		66.67	38.18	
	very high	4	24	28
		5.71	34.29	40.00
		14.29	85.71	
		26.67	43.64	
	Total	15	55	70
		21.43	78.57	100.00

Chi-square table of dog handler's personal dog for the activity 'obedience' with source of dog

	Frequency / Percent / Row Pct / Col Pct	Source of dog: bred	Source of dog: donated	Total
Level of Obedience	avge/>avge	6	18	24
		8.82	26.47	35.29
		25.00	75.00	
		40.00	33.96	
	high	7	29	36
		10.29	42.65	52.94
		19.44	80.56	
		46.67	54.72	
	v.high	2	6	8
		2.94	8.82	11.76
		25.00	75.00	
		13.33	11.32	
	Total	15	53	68
		22.06	77.94	100.00

Chi-square table of dog handler's personal dog for the activity 'criminal work' with source of dog

	Frequency / Percent / Row Pct / Col Pct	Source of Dog: bred	Source of Dog: donated	Total
Level of Criminal Work	avge/>avge	4	13	17
		5.88	19.12	25.00
		23.53	76.47	
		26.67	24.53	
	high	5	13	18
		7.35	19.12	26.47
		27.78	72.22	
		33.33	24.53	
	v.high	6	27	33
		8.82	39.71	48.53
		18.18	81.82	
		40.00	50.94	
	Total	15	53	68
		22.06	77.94	100.00

Chi-square table of dog handler's personal dog for the activity 'track/search' with source of dog

	Frequency / Percent / Row Pct / Col Pct	Source of Dog: bred	Source of Dog: donated	Total
Level of Track/Search	avge/>avge	2	13	15
		2.94	19.12	22.06
		13.33	86.67	
		13.33	24.53	
	high	8	25	33
		11.76	36.76	48.53
		24.24	75.76	
		53.33	47.17	
	v.high	5	15	20
		7.35	22.06	29.41
		25.00	75.00	
		33.33	28.30	
	Total	15	53	68
		22.06	77.94	100.00

Chi-square table of dog handler's personal dog for overall activity with source of dog

	Frequency / Percent / Row Pct / Col Pct	Source of Dog: bred	donated	Total
Level of Overall Activity	avge/>avge	3	9	12
		4.48	13.43	17.91
		25.00	75.00	
		20.00	17.31	
	high	10	33	43
		14.93	49.25	64.18
		23.26	76.74	
		66.67	63.46	
	v.high	2	10	12
		2.99	14.93	17.91
		16.67	83.33	
		13.33	19.23	
	Total	15	52	67
		22.39	77.61	100.00

Chi-square table of the dog handler's personal dog for the trait 'trainability' with the fixed effect years of exp. of handler

	Frequency / Percent / Row Pct / Col Pct	Years of exp of handler: 1-4yrs	5-10yrs	>11yrs	Total
Trainability score	low/avge	3	4	5	12
		4.23	5.63	7.04	16.90
		25.00	33.33	41.67	
		11.11	14.81	29.41	
	high	14	12	6	32
		19.72	16.90	8.45	45.07
		43.75	37.50	18.75	
		51.85	44.44	35.29	
	v.high	10	11	6	27
		14.08	15.49	8.45	38.03
		37.04	40.74	22.22	
		37.04	40.74	35.29	
	Total	27	27	17	71
		38.03	38.03	23.94	100.00

Chi-square table of the dog handler's personal dog for the trait 'aggressiveness' with the effect of years of experience of the handler

Aggression Score	Frequency / Percent / Row Pct / Col Pct	Years of exp of handler: 1-4yrs	5-10yrs	>11yrs	Total
	low/avge	17	15	7	39
		23.94	21.13	9.86	54.93
		43.59	38.46	17.95	
		62.96	55.56	41.18	
	high	4	8	9	21
		5.63	11.27	12.68	29.58
		19.05	38.10	42.86	
		14.81	29.63	52.94	
	v.high	6	4	1	11
		8.45	5.63	1.41	15.49
		54.55	36.36	9.09	
		22.22	14.81	5.88	
	Total	27	27	17	71
		38.03	38.03	23.94	100.00

Chi-square table of the dog handler's personal dog for the trait 'prey drive' with effect of years of experience of the handler

Prey drive score	Frequency / Percent / Row Pct / Col Pct	Years of exp of handler: 1-4yrs	5-10yrs	>11yrs	Total
	low/avge	6	3	2	11
		8.45	4.23	2.82	15.49
		54.55	27.27	18.18	
		22.22	11.11	11.76	
	high	8	9	6	23
		11.27	12.68	8.45	32.39
		34.78	39.13	26.09	
		29.63	33.33	35.29	
	v.high	13	15	9	37
		18.31	21.13	12.68	52.11
		35.14	40.54	24.32	
		48.15	55.56	52.94	
	Total	27	27	17	71
		38.03	38.03	23.94	100.00

Chi-square table of the dog handler's personal dog for the trait 'general activity' with the effect of years of experience of the handler

	Frequency / Percent / Row Pct / Col Pct	Years of exp of handler 1-4yrs	5-10yrs	>11yrs	Total
General Activity Score	low/avge	7	7	3	17
		9.86	9.86	4.23	23.94
		41.18	41.18	17.65	
		25.93	25.93	17.65	
	high	13	12	10	35
		18.31	16.90	14.08	49.30
		37.14	34.29	28.57	
		48.15	44.44	58.82	
	v.high	7	8	4	19
		9.86	11.27	5.63	26.76
		36.84	42.11	21.05	
		25.93	29.63	23.53	
	Total	27	27	17	71
		38.03	38.03	23.94	100.00

Chi-square table of the dog handler's personal dog for the trait 'obedience' with the effect of years of experience of handler

	Frequency / Percent / Row Pct / Col Pct	Years of exp of handler 1-4yrs	5-10yrs	>11yrs	Total
Obedience Score	low/avge	9	10	7	26
		12.68	14.08	9.86	36.62
		34.62	38.46	26.92	
		33.33	37.04	41.18	
	high	13	11	8	32
		18.31	15.49	11.27	45.07
		40.63	34.38	25.00	
		48.15	40.74	47.06	
	v.high	5	6	2	13
		7.04	8.45	2.82	18.31
		38.46	46.15	15.38	
		18.52	22.22	11.76	
	Total	27	27	17	71
		38.03	38.03	23.94	100.00

Chi-square table of the dog handler's personal dog for the trait 'independence' with the effect of years of experience of the handler

	Frequency / Percent / Row Pct / Col Pct	Years of exp of handler			
		1-4yrs	5-10yrs	>11yrs	Total
Independence Score	low/avge	8	14	6	28
		11.27	19.72	8.45	39.44
		28.57	50.00	21.43	
		29.63	51.85	35.29	
	high	12	5	6	23
		16.90	7.04	8.45	32.39
		52.17	21.74	26.09	
		44.44	18.52	35.29	
	v.high	7	8	5	20
		9.86	11.27	7.04	28.17
		35.00	40.00	25.00	
		25.93	29.63	29.41	
	Total	27	27	17	71
		38.03	38.03	23.94	100.00

Chi-square table of the dog handler's personal dog for the trait 'playfulness' with the effect of years of experience of handler

Frequency / Percent / Row Pct / Col Pct	Years of exp of handler			
	1-4yrs	5-10yrs	>11yrs	Total
low/avge	7	4	1	12
	9.86	5.63	1.41	16.90
	58.33	33.33	8.33	
	25.93	14.81	5.88	
high	9	10	11	30
	12.68	14.08	15.49	42.25
	30.00	33.33	36.67	
	33.33	37.04	64.71	
v.high	11	13	5	29
	15.49	18.31	7.04	40.85
	37.93	44.83	17.24	
	40.74	48.15	29.41	
Total	27	27	17	71
	38.03	38.03	23.94	100.00

Chi-square table of the ideal dog for the trait 'trainability' with the effect of years of experience of handler

	Frequency / Percent / Row Pct / Col Pct	Years of exp of handler 1-4yrs	5-10yrs	>11yrs	Total
Trainability score	high	1	4	5	10
		1.41	5.63	7.04	14.08
		10.00	40.00	50.00	
		3.70	14.81	29.41	
	v.high	26	23	12	61
		36.62	32.39	16.90	85.92
		42.62	37.70	19.67	
		96.30	85.19	70.59	
	Total	27	27	17	71
		38.03	38.03	23.94	100.00

Chi-square table of the ideal dog for the trait 'aggressiveness' with the effect of years of experience of handler

	Frequency / Percent / Row Pct / Col Pct	Years of exp of handler 1-4yrs	5-10yrs	>11yrs	Total
	low/avge	8	8	6	22
		11.27	11.27	8.45	30.99
		36.36	36.36	27.27	
		29.63	29.63	35.29	
Aggression Score	high	12	16	6	34
		16.90	22.54	8.45	47.89
		35.29	47.06	17.65	
		44.44	59.26	35.29	
	v.high	7	3	5	15
		9.86	4.23	7.04	21.13
		46.67	20.00	33.33	
		25.93	11.11	29.41	
	Total	27	27	17	71
		38.03	38.03	23.94	100.00

Chi-square table of the ideal dog for the trait 'prey drive' with the effect of years of experience of handler

Frequency / Percent / Row Pct / Col Pct		Years of exp of handler			
		1-4yrs	5-10yrs	>11yrs	Total
Prey drive score	high	4	2	2	8
		5.63	2.82	2.82	11.27
		50.00	25.00	25.00	
		14.81	7.41	11.76	
	v.high	23	25	15	63
		32.39	35.21	21.13	88.73
		36.51	39.68	23.81	
		85.19	92.59	88.24	
	Total	27	27	17	71
		38.03	38.03	23.94	100.00

Chi-square table of the ideal dog for the trait 'activity' with the effect of years of experience of the handler

Frequency / Percent / Row Pct / Col Pct		Years of exp of handler			
		1-4yrs	5-10yrs	>11yrs	Total
Activity Score	high	10	14	10	34
		14.08	19.72	14.08	47.89
		29.41	41.18	29.41	
		37.04	51.85	58.82	
	v.high	17	13	7	37
		23.94	18.31	9.86	52.11
		45.95	35.14	18.92	
		62.96	48.15	41.18	
	Total	27	27	17	71
		38.03	38.03	23.94	100.00

Chi-square table of the ideal dog for the trait 'obedience' with the effect of years of experience of handler

	Frequency Percent Row Pct Col Pct	Years of exp of handler 1-4yrs	5-10yrs	>11yrs	Total
Obedience Score	low/avge	3 4.23 25.00 11.11	4 5.63 33.33 14.81	5 7.04 41.67 29.41	12 16.90
	high	6 8.45 25.00 22.22	13 18.31 54.17 48.15	5 7.04 20.83 29.41	24 33.80
	v.high	18 25.35 51.43 66.67	10 14.08 28.57 37.04	7 9.86 20.00 41.18	35 49.30
	Total	27 38.03	27 38.03	17 23.94	71 100.00

Chi-square table of the ideal dog for the trait 'independence' with the effect of years of experience of handler

Frequency Percent Row Pct Col Pct	1-4yrs	5-10yrs	>11yrs	Total
low/avge	6 8.57 33.33 23.08	10 14.29 55.56 37.04	2 2.86 11.11 11.76	18 25.71
high	8 11.43 28.57 30.77	12 17.14 42.86 44.44	8 11.43 28.57 47.06	28 40.00
v.high	12 17.14 50.00 46.15	5 7.14 20.83 18.52	7 10.00 29.17 41.18	24 34.29
Total	26 37.14	27 38.57	17 24.29	70 100.00

Chi-square table of the ideal dog for the trait 'playfulness' with the effect of years of experience of handler

	Frequency / Percent / Row Pct / Col Pct	Years of exp of handler: 1-4yrs	5-10yrs	>11yrs	Total
Playfulness Score	low/avge	7	3	1	11
		9.86	4.23	1.41	15.49
		63.64	27.27	9.09	
		25.93	11.11	5.88	
	high	6	13	9	28
		8.45	18.31	12.68	39.44
		21.43	46.43	32.14	
		22.22	48.15	52.94	
	v.high	14	11	7	32
		19.72	15.49	9.86	45.07
		43.75	34.38	21.88	
		51.85	40.74	41.18	
	Total	27	27	17	71
		38.03	38.03	23.94	100.00

Chi-square table for the importance of more focus on training to improve the standard of police dogs with years of experience of handler

	Frequency / Percent / Row Pct / Col Pct	Years of exp. Of handler: 1-4yrs	5-10yrs	>11yrs	Total
More focus on Training score	avge/<avge	10	6	7	23
		14.93	8.96	10.45	34.33
		43.48	26.09	30.43	
		40.00	24.00	41.18	
	high	11	10	7	28
		16.42	14.93	10.45	41.79
		39.29	35.71	25.00	
		44.00	40.00	41.18	
	very high	4	9	3	16
		5.97	13.43	4.48	23.88
		25.00	56.25	18.75	
		16.00	36.00	17.65	
	Total	25	25	17	67
		37.31	37.31	25.37	100.00

Chi-square table of the importance of improving stud selection for improving the standard of police dogs with years of experience of handler

	Frequency / Percent / Row Pct / Col Pct	Years of exp. Of handler			
		1-4yrs	5-10yrs	>11yrs	Total
Improving stud selection	avge/<avge	6	6	5	17
		8.57	8.57	7.14	24.29
		35.29	35.29	29.41	
		23.08	22.22	29.41	
	high	8	9	4	21
		11.43	12.86	5.71	30.00
		38.10	42.86	19.05	
		30.77	33.33	23.53	
	very high	12	12	8	32
		17.14	17.14	11.43	45.71
		37.50	37.50	25.00	
		46.15	44.44	47.06	
	Total	26	27	17	70
		37.14	38.57	24.29	100.00

Chi-square table of the importance of improving brood bitch selection for improving the standard of police dogs with years of experience of handler

	Frequency / Percent / Row Pct / Col Pct	Years of exp. of handler			
		1-4yrs	5-10yrs	>11yrs	Total
Improving brood Bitch selection	avge/<avge	5	6	5	16
		7.25	8.70	7.25	23.19
		31.25	37.50	31.25	
		20.00	22.22	29.41	
	high	9	9	5	23
		13.04	13.04	7.25	33.33
		39.13	39.13	21.74	
		36.00	33.33	29.41	
	very high	11	12	7	30
		15.94	17.39	10.14	43.48
		36.67	40.00	23.33	
		44.00	44.44	41.18	
	Total	25	27	17	69
		36.23	39.13	24.64	100.00

Chi-square table of the importance of stricter assessment measures for improving the standard of police dogs with years of experience of handler

	Frequency Percent Row Pct Col Pct	Years of exp. of handler 1-4yrs	5-10yrs	>11yrs	Total
Stricter assessment measures score	avge/<avge	7 10.14 25.93 28.00	10 14.49 37.04 37.04	10 14.49 37.04 58.82	27 39.13
	high	12 17.39 44.44 48.00	10 14.49 37.04 37.04	5 7.25 18.52 29.41	27 39.13
	very high	6 8.70 40.00 24.00	7 10.14 46.67 25.93	2 2.90 13.33 11.76	15 21.74
	Total	25 36.23	27 39.13	17 24.64	69 100.00

Chi-square table of the importance of reducing the number of donated dogs for improving the standard of police dogs with years of experience of handler

Frequency Percent Row Pct Col Pct	1-4yrs	5-10yrs	>11yrs	Total
v.low/low	20 29.41 37.04 76.92	25 36.76 46.30 96.15	9 13.24 16.67 56.25	54 79.41
avge/>avge	6 8.82 42.86 23.08	1 1.47 7.14 3.85	7 10.29 50.00 43.75	14 20.59
Total	26 38.24	26 38.24	16 23.53	68 100.00

Chi-square table of the importance of improved puppy testing for improving the standard of police dogs with years of experience of handler

	Frequency / Percent / Row Pct / Col Pct	Years of exp of handler 1-4yrs	5-10yrs	>11yrs	Total
Improving puppy Testing score	avge/<avge	6	13	9	28
		8.96	19.40	13.43	41.79
		21.43	46.43	32.14	
		25.00	48.15	56.25	
	high	8	10	4	22
		11.94	14.93	5.97	32.84
		36.36	45.45	18.18	
		33.33	37.04	25.00	
	very high	10	4	3	17
		14.93	5.97	4.48	25.37
		58.82	23.53	17.65	
		41.67	14.81	18.75	
	Total	24	27	16	67
		35.82	40.30	23.88	100.00

Chi-square table of the importance of better food for improving the standard of police dogs with years of experience of handler

	Frequency / Percent / Row Pct / Col Pct	Years of exp. of handler 1-4yrs	5-10yrs	>11yrs	Total
Better food score	very low	6	9	5	20
		8.70	13.04	7.25	28.99
		30.00	45.00	25.00	
		23.08	33.33	31.25	
	low	3	6	5	14
		4.35	8.70	7.25	20.29
		21.43	42.86	35.71	
		11.54	22.22	31.25	
	average	10	9	5	24
		14.49	13.04	7.25	34.78
		41.67	37.50	20.83	
		38.46	33.33	31.25	
	high/v.high	7	3	1	11
		10.14	4.35	1.45	15.94
		63.64	27.27	9.09	
		26.92	11.11	6.25	
	Total	26	27	16	69
		37.68	39.13	23.19	100.00

Chi-square table of the importance of changing breed for improving the standard of police dogs with years of experience of handler

	Frequency Percent Row Pct Col Pct	Years of exp. of handler 1-4yrs	5-10yrs	>11yrs	Total
Changing breed score	very low	17 25.00 41.46 68.00	16 23.53 39.02 59.26	8 11.76 19.51 50.00	41 60.29
	low	4 5.88 26.67 16.00	7 10.29 46.67 25.93	4 5.88 26.67 25.00	15 22.06
	avge/>avge	4 5.88 33.33 16.00	4 5.88 33.33 14.81	4 5.88 33.33 25.00	12 17.65
	Total	25 36.76	27 39.71	16 23.53	68 100.00

APPENDIX FOUR

Heel free:

1997 – Heel free was marked out of a score of 70 in a training exercise. Marks were allocated depending on whether the team mastered the sit, stand and down elements of the exercise and marks were deducted if extra commands were used or if the dog went wide.

1998 – Heel free scored in the same way as in 1997

1999 – Heel free was marked out of 70. Heel free was done at a normal pace, a double pace and a slow pace. Marks were allocated depending on whether the sit, stand and commands were used. Two marks were deducted if the dog halted, if extra commands were used in the middle of the exercise, if the dog broke or anything else was done wrong. One mark was deducted if the dog went wide, if the dog lagged, if it jumped, and if the dog perved. Two marks were deducted if the dog halted at any time during the exercise.

2000 - Heel free was marked out of 60 in a park or sports ground. Heel free was done in a normal, double and slow pace. The exercises sit, down and stand was done on the move. Marks were allocated and deducted in the same way as the 1999 annual report.

Retrieve:

1997 - Retrieve was marked out of 60. Fifteen marks were awarded for each of the actions which included; if the dog heeled at the beginning of the exercise, if the dog picked up the article, if it returned to the handler with the article and if it returned back to the heel position by the handler.

1998 - Retrieve scored in the same way as in 1997.

1999 - Retrieve was scored out of 60. A dumbbell was used and was thrown at a distance of at least 15 metres. 20 marks were awarded for the action heel and throw. 2 marks were deducted if extra commands were used and 10 marks were deducted if the dog broke out of the heel position before commanded. 20 points were awarded for the pick up and return to sit action. If commands were used 2 marks were deducted, if the dog dropped the dumbbell or broke out of the heel position 5 marks were deducted and if the dog was slow in returning or if it went wide or failed to sit 5 marks were deducted. 20 marks were allocated for the delivery of the dumbbell and the return to the heel position.

2000 - Retrieve was scored out of 40. A dumbbell was used. 15 marks were allocated to the heel and throw action. 15 marks were allocated to the pick up and return to sit action and 10 marks were allocated to the delivery and heel action. Marks were deducted in the same way as the 1999 annual reports for all the actions. The handler could not move position throughout the exercise.

Down stay:

1997 - Down stay was scored out of 20 with no marks deducted for any specific action.

1998 - Down stay scored in the same way as 1997.

1999 - Down stay was scored out of 20 marks. The dog was required to stay in the down position for 10 minutes with the handler out of sight. A distraction of people walking and talking around the dog was used. 5 marks were allocated to the team if the dog stayed in the down position for 5 minutes. 2 extra marks were allocated to the team for every 2 minutes that the dog stayed in the down position for a total of 18 points if the dog stayed in the down position for the total ten minutes. 2 marks were awarded if the handler returned to the dog without the dog breaking out of the down position until commanded.

2000 - Down stay was scored out of 30. It was conducted on a hard surface with other dogs, vans, and people moving and talking as distractions. 1 mark was given to the dog if it stayed in the down position for 5 minutes. 3 marks were given if it stayed for 6 minutes, 7 marks for 7 minutes, 11 marks for 8 minutes, 15 marks for 9 minutes and 25 marks for 10 minutes. An extra 5 marks were given if the handler returned to the dog with the dog still in the down position. If the dog moved more than 2m from the line no marks were awarded regardless of how long the dog was in the down position prior to the movement.

Sendaway:

1997 - Sendaway was scored out of 50 points. It was part of a sequence of activities that involved sendaway, recall and redirection and distance control. Points were deducted if extra commands were used.

1998 – Sendaway was also scored out of 50 and points allocated in the same way as 1997.

1999 - Sendaway was scored out of 50 across a rugby park. Only 3 commands were allowed. 5 marks were deducted for each extra command. An extra 1 mark was deducted if an extra command was used for lack of control. Marks were allocated depending on how far the dog went after 1 command and after 3 commands. If the dog ran in a straight line no marks were deducted, if the dog ran less than 45° off a straight line 5 marks were deducted and if it ran 45° to 90° off 15 marks were deducted. Space was allocated on the sheet to comment on response to command, handler technique and command/praise.

2000 - Sendaway was marked out of 50 points. The distance used was 100 metres with the sendaway point in an area of three square metres. Emphasis was placed on response to command and effective use of command/praise. Marks were allocated in the same way as in 1999.

Recall and Redirection:

1997 - Recall and Redirection was scored out of 50. Marks were allocated depending on whether the dog obeyed the commands to move to the left or to the right. Marks were deducted if extra commands were used.

1998 - Recall and redirection scored out of 50 and marks allocated as in 1997.

1999 - The dog was required to move 20 metres to the left or right for the first redirection and 40 metres in the opposite direction for the second. 3 commands were allowed for each redirection. 2 marks were deducted for each extra command used. In the recall back to halfway no marks were deducted if the dog stopped immediately, one mark if it stopped promptly and 5 marks if it stopped slowly. 1 mark was deducted if extra commands were needed. The distance the dog moved in both directions, whether the dog moved 90°, or 90° to 20 to 30m and whether the dog crept were noted for each redirection. Space for comment on response to command, handler technique and command/praise was also allocated.

2000 - Recall and redirection was scored out of 50. The recall was conducted from the sendaway point at a distance of 50 metres. The redirection to the left or right needed to be done in 3 m^2. A distance of 25 metres was done in one direction, and 50 metres in the other direction. 10 marks were allocated for the recall back to halfway and 40 marks for the redirection. Marks were deducted in the same way as the 1999 annual report.

Distance Control:

1997 - Distance control was marked out of 60. Marks were allocated for the recall to a certain distance, stop, sit, stand and down elements.

1998 - Distance control was marked out of 70. Marks were allocated in the same way as in 1997.

1999 - Distance control was marked out of 70. Distance control was done on the return from the recall and redirection exercise. Only one set voice and hand command was required. If the dog stopped immediately in the down position after returning from the recall and redirection exercise the team received 10 marks, if it stopped promptly it was allocated eight marks and if it stopped slowly it received 5 marks. The commands sit, stand and down were conducted twice and each command was allocated 20 marks.

2000 - Distance control was marked out of 40. Distance control was conducted at a recall of 22 metres. Only voice command was required. If the dog stopped immediately in the down position after returning from the recall and redirection exercise the team received ten marks, if it stopped promptly it was allocated 8 marks and if it stopped slowly it received 5 marks. The commands sit, stand and down were conducted twice with each command allocated 10 marks.

Speak on command:

1997 - Speak on command was scored out of 40 with no specific requirements for points allocated.

1998 - Speak on command was scored out of 40 as in 1997.

1999 - Speak on command was scored out of 40 at a distance of 5 metres. Emphasis was on the voice command only. Pre-emptive cueing before command was penalised. Extra commands were deducted by 5 marks each. If the dog barked before the command or the bark was weak ten marks were deducted. If the dog crept in any direction ten marks were deducted.

2000 - Speak on command was scored out of 40 and was marked in the same way as 1999.

Track:

1997 - Track was scored out of 300. Two articles were placed on the track. 50 marks were allocated if the team started on the right track, 10 marks for the right direction and 20 marks for each article obtained. 30 marks were allocated for each of the legs undertaken with a total of 5 legs. 50 marks were allocated for casting.

1998 - Track was scored out of 300. Marks were allocated in the same way as in 1997.

1999 - Track was scored out of 300. The track was started in a grass paddock that was twenty minutes old and two articles needed to be found. There was a total of four legs in the paddock, with two hard surface cross overs. The track would either cross directly from the paddock, follow the grass kerb and then cross or follow on the road and then cross. Emphasis was placed on casting, line handling and appropriate tracking speed. 20 marks were allocated for starting on the right track with 15 marks allocated for the four legs in the paddock. 20 marks were allocated for each corner conducted in the paddock. If the team successfully crossed over from grass to road twenty marks were allocated. 20 marks were awarded for each cross over completed and 30 marks for each of the two legs remaining. 10 marks were awarded for each article found and only 5 marks if the article was not found by the dog. 5 marks were deducted if the team missed an indication, or was held up by the handler. 2 marks were deducted if the dog stopped tracking. 20 marks were allocated for the working of the dog which consisted of casting, line handling, missed indications, holding dog back, speed and any other general comments.

2000 - Track was scored out of 300. Track was conducted on a hard surface at night in an industrial or rail yard area at a distance of 300 metres. The track involved a twenty minute old scent starting on a hard surface on the road within five metres of the kerb. There were right angle corners on the road with four to five legs using the environment i.e. no set pattern. An offender was at the end of the track that was passive and cooperative but did not attract the handler's attention. Once the offender was allocated the dog was placed in the down position and it's harness or tracking line unclipped. The handler then went forward, searched the offender and then escorted the offender for 20 metres. 40 marks were allocated for the start which involved the handler casting the dog effectively, reading the dog's indication, moving with the dog and the dog's drive and concentration on the track. 100 marks were allocated for tracking on the legs and focused on the drive and concentration of the dog, the stopping on the legs, the handling of the dog, and the handler being able to read the dog. 80 marks were allocated for corners depending on whether the handler read the

indication and stopped, whether casting was conducted and the dog searched actively and whether the team moved off in the right direction. Surface changes were given 50 marks if the team was able to continue tracking and the action of the team was satisfactory. 30 marks were given if the team allocated the offender depending on the handler being able to read and control the dog, and the reaction of the dog to the missing person.

Article Search:

1997 - Article search was scored out of 60. 3 articles needed to be found with 20 marks allocated to each article. The working of the dog was noted.

1998 - Article search was scored out of 60 with marks allocated as in 1997.

1999 - Article search was scored out of 70. It was conducted on a roadside or waste area in long grass or large debris with an area 75 m x 5 m. 3 articles needed to be found in a time limit of four minutes. Emphasis was on the systematic working of the dog. 10 marks were given for each article found, 10 marks for the pattern of the team, 15 for the control of the search and the working of the dog, and 15 for the drive and motivation of the dog to search.

2000 - Article search scored out of 70. It was an operational type search conducted on a road side or wasteland. Emphasis was on the handlers working and reading of their dog. Marks were allocated as in 1999 annual report.

Passive attack:

1997 - Passive attack scored out of 100 marks with no set allocation of marks

1998 - Passive attack scored in the same way as in 1997.

1999 - Passive attack scored out of 80 with a distance of 25m for the attack. The areas considered were set up and deployment of dog which included handling skills, using a single command and remaining behind cover; speed of dog with the range fast, moderate or slow and whether it took a direct line; delivery of dog with the range solid, moderate, soft, tentative and failed to engage; intensity of bite after delivery with the range strong, moderate, soft, tentative, or released and if the dog maintained the bite until taken off by handler with the range sound, re-biting, tentative or release.

2000 - Passive attack scored out of 100 with a distance of 25m. Emphasis placed on single command, speed and delivery of attack. The areas considered were the same as in 1999. Each area was allocated 20 marks each.

Chase and recall:

1997 - Chase and recall marked out of 100 with no set marks given.

1998 - Chase and recall scored out of 100 with no set marks given.

1999 - Chase and recall scored out of 100. Control began at start of heel free. Challenge given when offender was seen involving a short chase with the offender at a distance of 10m when first seen. When dog was in full stride the recall was called for. Emphasis given on dog being at full stride and the dog's response to the recall and return to handler. Heel free was allocated 10 marks. The speed and nature of chase given 20 marks with anticipation or hesitation given a maximum penalty of 10 marks. The response to recall was worth 60 marks. Any extra commands had a penalty of 5 marks.

2000 - Chase and recall was worth 110 marks. Recall given on either the first or second occasion of the chase and attack exercise. Emphasis on control at start, determined chase as if in an attack, response to recall command, stopping dog before reaching offender, and not giving recall until the dog was in full stride. Dogs that did not 'chase' were given recall in night exercise. Heel free and challenge allocated 20 marks with volume and wording crucial. Speed and nature of chase given 20 marks with the response to command in the ranges determined, hesitant or anticipated. Response to recall command allocated 60 marks with comments stops immediately, extra commands, and failed bite. If the dog runs on and reaches offender or runs around offender 20 marks were deducted. Recovery allocated 10 marks with the comments dog returns directly on command and extra commands.

Chase and attack:

1997 - Chase and attack was worth 100 marks. No allocation of marks but space provided for comment on the chase and the bite of the dog.

1998 - Chase and attack was worth 100 marks. It was marked the same as in 1997.

1999 - Chase and attack was worth 90 marks. Challenge began in the heel free position. Involved a short chase of offender armed with a stick. The offender stopped and confronted dog prior to apprehension. Heel free and challenge was allocated 20 marks as well as speed of the dog. The delivery of the bite allocated 20 marks with the range solid, moderate, soft and tentative, degree of chase allocated 20 marks with range strong, moderate and soft and intensity of bite allocated 20 marks with the range sound, re-biting and tentative.

2000 - Chase and attack was worth 120 marks. Emphasis on effective challenge, proper deployment, ability of dog and control. Challenge began in heel free. Offender at a distance of 50m ran away when challenged. Handler commanded dog to attack and dog required to seize arm and prevent escape. Handler followed dog and when 10m away called the dog off. Dog was required to release immediately and put in any position while handler searched offender. The area patrol position on lead and challenge worth 20 marks depending on volume and wording, release of dog worth 20 marks depending on time to respond to challenge and handling skills in release, speed and nature of chase worth 20 marks depending on response to command and if it was a determined chase, delivery of bite worth 20 marks with range solid, moderate, soft, tentative or failed to engage and depending on reaction to stick attack, intensity of bite after delivery worth 20 marks with range strong, moderate, soft, tentative or release and dog maintains bite until commanded to leave worth 20 marks with range sound, re-biting, tentative and released.

Control:

1997 - Control was worth 50 marks with no set allocations for mark.

1998 - Control was worth 50 marks with no set allocations for mark.

1999 - Control was worth 70 marks. Handler required to stop at least 5m from offender, call dog off and call dog to return and heel. Emphasis on release and return to handler. Handler required to remain stationary. Release worth 50 marks with deduction of 50 marks if extra commands were used. Re-biting worth 10 marks and return to handler worth 20 marks depending on manner of return.

2000 - Control was worth 70 marks. Release worth 50 marks with 5 marks deducted if extra commands used and 10 marks deducted if the dog re-bite. Return to handler worth 20 marks depending on manner of return with the range immediate, leave and return and slow. Space was allocated to comment on level of control.

Search and escort:

1999 - Search and escort was worth 60 marks. Control of the dog worth 30 marks, response of dog during search worth 10 marks, response to offender decamp or attack worth 20 marks.

2000 - Search and escort was worth 60 marks. Control of dog during search worth 40 marks and escort heel free worth 20 marks.