REVIEW OF FERRETS

for the

ANIMAL HEALTH BOARD

by

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OBJECTIVE TWO:

LAYPERSONS VERSION

Our brief from the Animal Health Board was to provide a laypersons summary of the AHB-funded research projects. Objective One of this review was to produce a format summary of AHB funded research reports and consequently these summaries are more detailed. Objective 2 is divided into two parts: the first is a summary of the knowledge base on ferrets, Tb epidemiology and ferret control; and the second provides individual summaries of research projects funded by AHB and other relevant published literature. For this version, only scant details on the methodology are presented and if readers require more details then they should refer to either Objective 1 or the actual reports and published material. We considered that it was valuable to include other relevant published literature in this review to provide a comprehensive overview of the information known. We have indicated which summaries are of AHB-funded research projects. We have also categorised the research into 8 sections for easy reference.

Section 1. Surveys of Tb infections in ferrets
Section 2. Transmission of Tb to stock
Section 3. Pathology and epidemiology of Tb
Section 4. Ferret control technology and issues
Section 5. Movement and dispersal
Section 6. Other relevant aspects of ferret biology and ecology
Section 7. Low trapability in winter and spring
Section 8. Poison technology

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PART ONE

Biology, ecology and behaviour

Description

Ferrets belong to the Mustelidae family, to which weasels, stoats, otters, pine martens, badgers, and skunks also belong. Most members of this family typically have long narrow bodies with short legs, and are characterised by a musky smell. Another distinguishing feature of this family is that the males are often much larger than the females (called sexual dimorphism). Female ferrets can weigh anything between 500 g and 1.1 kg, whereas males weigh from 700 g to 2 kg. Weight varies seasonally, with a noticeable increase in winter, particularly for males. Ferrets are easily distinguished from stoats and weasels because of their much larger body size and coloration. Stoats and weasels look very similar, especially if glimpsed in the field. They can be distinguished on close examination, with stoats having a black tip on their tail which is absent from weasels. Weasels are quite rare in most parts of New Zealand and it is likely that most field observations will be of stoats.

Ferrets exhibit a range of colour types from light tans to animals that appear almost black due to the presence of dark guard hairs; albino and piebald animals are also reasonably common. Coloration can vary from area to area and may have been influenced by the release of fitch farm ferrets into the feral population. Smell and hearing are the main senses of the ferret; eyesight is poor by day but better at night. Ferrets can swim; they have been known to cross small stretches of water and rivers. They also dig extremely well, but unlike the other mustelids in New Zealand, they are poor climbers.

History

The ferret is very closely related to the polecat found throughout Europe and the UK. It is actually a domesticated form of the polecat, and genetically is almost identical. Polecats and ferrets are usually distinguished by their responses to humans; the polecat is a truly wild animal whereas the ferret has been domesticated since Roman times. The nature of ferrets is reasonably placid compared with other mustelids. Ferrets that regularly contact humans will quite quickly lose fear of people. Researchers have found that ferrets can become "trap happy" (repeatedly trapped) and tame. This nature is probably due to their history of domestication.

Ferrets were first introduced to NZ in the late 1870s to control rabbits, which had by then become a serious agricultural pest. Ferrets were initially protected but this was lifted in 1903, when it became clear that they were not restricting themselves to hunting rabbits, and were eating native wildlife. The first control programmes were initiated in the 1930s. Ferrets were often kept by farmers and pest controllers from the 1940s to 1960s for ferreting (the sport of hunting rabbits using ferrets). A few people still pursue this sport today.

In most habitats, ferrets have not been regarded as serious a conservation threat as cats and stoats, because ferrets are more often found in those habitats of lower conservation value. Ferrets are a conservation pest though in semi-arid grassland and braided riverbed systems (where they eat lizards, birds and invertebrates), whereas stoats are more of a pest in forests. Few ferrets are found in native forest, and because they can't climb they are not a major predator of forest birds. Because of this lower conservation threat, ferrets have received little research attention in the past, even though New Zealand has the largest population of feral ferrets in the world. Since

1995, ferrets became the focus of greater attention when feral ferret populations were discovered to be infected with bovine tuberculosis.

Habitat and distribution

Ferrets are present throughout the North and South Islands of New Zealand, except on Stewart Island, parts of Westland, Nelson and Fiordland, eastern Bay of Plenty and northern Northland. The recent spread of ferrets into some areas (particularly Westland and Northland) may have been aided by the establishment and subsequent failure of fitch farms. The escape of pet ferrets may thus have contributed to widening the distribution of ferrets. The areas where they are not found are those with high rainfall and little pasture to support rabbit populations. Ferrets are not present on offshore islands.

The distribution and abundance of ferrets is very closely associated with that of rabbits. This association with rabbits is seen on a macro-level, with ferrets found in those areas of NZ where rabbits are present, and also on a micro-level, where areas of farm properties with greater numbers of rabbits (for example the sunny faces) are more likely to support ferrets. Ferrets are found mostly in pasture, rough scrubby grasslands, tussock grasslands, and the fringes of forests. In the grassland habitats of the South Island, ferret densities range from 2.8 to 8.4 ferrets per km^2. They are generally absent or at low abundance on highly developed grassland, high altitude grasslands and continuous forest.

Ferrets are attracted to vegetation cover and their movements are closely associated with the edges of cover and along boundaries where there is a change in habitat. In pastoral habitats, they concentrate their movements along forest-pasture boundaries, fencelines (associated with gorse and broom), patches of cover, water-courses and rivers. They will move along gully systems, especially as gullies are often associated with increased vegetation cover. Ferrets often use animal tracks and runs created by rabbits, possums and stock. They will also use larger tracks like those created by farm vehicles.

Ferrets are also attracted to cover for denning. Ferrets rarely create their own dens, even though they can dig quite well. Rabbit holes are the most common type of den site. Ferrets will also den in farm buildings, like woolsheds and haybarns. They may be attracted to these den sites because of the presence of rodents or offal, or because buildings offer warm, dry places to den.

Ferret diet

The diet of ferrets consists mostly of small mammals, supplemented by birds, reptiles and invertebrates. However the main prey item is rabbit, and young rabbits are especially important for ferrets. Ferrets are opportunistic predators, meaning they will eat most things if they have the chance, even each other. Examples of other ferret food are beetles, weta, eels, frogs, eggs, possums and of course threatened native wildlife such as black stilts, penguins, shearwaters, kiwi, skinks and snails. There is seasonal variation in diet that corresponds to the seasonal availability of prey, with seasonal trends driven mostly by rabbits. There is also variation in ferret diet across New Zealand that corresponds to changes in availability of prey in different habitats. For example, more rats are eaten in forest habitats. Female ferrets are more likely to eat the smaller prey items such as rodents, birds and invertebrates.

When rabbit densities are reduced, ferrets have been known to increase their consumption of secondary prey items. This ability to change diet is a problem for native wildlife, because these species come under increased predation pressure. Ferrets can not keep rabbit populations under

control in the semi-arid tussock grasslands of Central Otago but they do have some effect on rabbit populations in wetter lowland areas like central Canterbury.

Ferrets will scavenge carcasses to supplement their diet of live prey. They will scavenge dead livestock, and have been known to live inside carcasses and open offal pits. Ferrets are cannibalistic.

Ferrets usually hunt rabbits underground. Because ferrets prefer young rabbits, they target occupied rabbit stops during the rabbit breeding season. They rarely run down prey, because they are not built for high speed chases and can not run fast for long distances. Ferrets will often kill rabbits in their burrows, alternating between eating and sleeping. It can be quite common for them to 'hole' up in a den for a number of days until a prey carcass has been consumed. Ferrets have been known to cache prey. In general, ferrets are considered lazy predators, only hunting for food when necessary - but they will surplus kill if given the chance. They have gained a bad reputation for this behaviour, especially for raiding farm hen-houses.

Social organisation
Male and female ferrets share the same ground. Traditionally ferrets were thought to be territorial against the same sex (called intrasexual territoriality) because other mustelids exhibit it. Most field studies have found little support for this with home ranges overlapping between and within the sexes. Ferrets will share dens. One study found reasonably high rates of simultaneous den sharing (two or more ferrets denning together) and sequential den-sharing (different ferrets using the same den at different times). Ferrets are thought to be mainly nocturnal, but many studies have also recorded ferret activity during the day. Ferrets are usually solitary hunters but they have been observed hunting in family groups (while the young are still dependent on their mother) and also in pairs when they are fully independent. Ferrets of an independent age have been observed sharing carcasses; up to four ferrets were videoed scavenging a possum carcass. The higher level of sociality (compared to other mustelids) may be due to the ferret's history of domestication.

During the mating season, contact between ferrets can be aggressive. Males will fight each other over access to females and inflict serious skin wounds. Females are also wounded at the back of the head and neck during mating. Outside of the breeding season wounds are rarely observed on ferrets of either sex.

The typical home range size for a male ferret is around 140 ha, with female ferrets having smaller home ranges at around 100 ha . Home range size varies greatly though, and home ranges from around 20 ha to over 300 ha have been recorded. Variation in home range size is probably related to amount of suitable habitat, prey abundance, and competition from other predators (other ferrets, cats and stoats). After rabbit poisoning in spring, ferret home ranges tripled in size at a Central Otago site that experienced a 99% rabbit kill, but home ranges stayed the same at a similar site that experienced only a 77% rabbit kill.

A portion of the juvenile ferret population will disperse from the areas where they are born (called natal areas). Most juveniles disperse in February and March. The incidence of road-killed ferrets is always highest when juveniles become independent and start dispersing. Some juvenile ferrets have been recorded travelling large distances, up to 50 km in the Mackenzie Basin. Some ferrets may disperse as a response to reductions in rabbits. It is thought that ferrets follow natural topographical features like rivers and the bases of foothills. The other time that

ferrets move around is during the mating season. Male ferrets will leave their normal home range in search of receptive females. The incidence of road-killed male ferrets increases during the mating period. The greater number of males caught in traps is probably not because there are more of them but because they have a greater probability of being caught (due to larger home range sizes, movements and other behaviour).

Scent plays an important role in social organisation. Ferrets have anal glands and will "scent mark" throughout their home ranges. Scent is important for communication of sex and status: i.e. whether the ferret is a transient or resident. Scent becomes very important as a social communicator during the mating season allowing males to find females. Ferrets will also make and use latrines outside their dens.

Reproduction
Ferrets mate during August and September. A change in daylight length is the trigger for the onset of oestrus in females, and they become receptive 4-5 weeks later. Males respond with an increase in size (and dissension) of testes around August. Evidence of mating behaviour is observed by the presence of mating wounds. Mating is described as brutal and prolonged, with females forcibly held down by males. Mating induces ovulation.

Under normal conditions most ferrets in a population will breed. Pregnancy lasts six weeks and young are born in October and November. Litter sizes range from 4-14 young. Ferrets can have more than one litter per year but this is not common unless the first litter fails. Young ferrets are weaned from 6-8 weeks of age. Juveniles emerge from natal dens during January and February. Ferret capture rates increase dramatically with juvenile recruitment and a peak in abundance is experienced from February to April. Because of the high numbers of juveniles and high rates of mortality, ferret populations experience a pronounced fluctuation in abundance over one year.

Juveniles reach adult size by about four months. Size is no indicator of age, in fact it can be very deceptive. A juvenile animal can often be bigger than an adult, because adults are often in poor condition after breeding. Juvenile ferrets become sexually mature by winter and almost all will breed in the following spring. In fact if a female doesn't breed it can die from oestrogen toxicity, a problem with keeping pet ferrets. From January to May it is quite easy to distinguish the adults from the young of the year. Both adult males and females have shorter coats, often old scars can be seen and teeth are clipped or worn. Adult females may still show signs of lactation and adult males often have bald tails. After May, it becomes hard to distinguish juveniles from adults, and the most reliable method is to count the numbers of annuli (yearly rings) in the cementum of the canine tooth.

Age structure and mortality.
Ferrets suffer high mortality. Between 75% and 80% of ferrets will die within their first year of life. Mortality is still high from then on, but there is some evidence that female ferrets live longer than males. An old ferret would be one that is two or three years old. Only a small proportion of the population survives to breed twice. This means that the majority of a given population consists of animals less than one year old. Mortality is reasonably constant throughout the year. There is no difference in trapability of juvenile and adult ferrets. Mortality rates of juveniles are dependent on population density. Mortality rates are lower when ferret populations have been artificially reduced – for example, after ferret control – and highest when populations are naturally high.

Starvation is probably the biggest killer of ferrets. Ferrets have a high metabolic rate, so they need to eat regularly. They do not store energy as fat (except for a few weeks in winter) so they have few reserves. Disease is another cause of mortality. Mortality rates are higher for males than females, possibly because males lose so much body condition over the mating season (due to high levels of activity and reduced food intake). The bald tail observed in male ferrets is an indicator of physiological stress.

Bovine tuberculosis

Mycobacterium bovis, the bacterium responsible for causing the disease bovine tuberculosis (Tb), was probably brought to New Zealand with the first cattle introduced in 1840. Voluntary testing of dairy herds was initiated in 1945. By 1961 testing was compulsory for all dairy herds, with a compulsory scheme for beef cattle by 1970. A compulsory testing programme was introduced for deer in 1990. The Animal Health Board (AHB) makes policy for and administers the national control scheme for tuberculosis in cattle and deer in New Zealand. The AHB regards Tb as a problem for three main reasons: (i) overseas trade; tuberculosis levels in New Zealand are high by international standards and therefore dairy, beef and venison exports are at risk; (ii) human health concerns; bovine tuberculosis has been an important health problem in the past and is re-emerging as a problem with immuno-compromised patients of HIV and AIDs; and (iii) farm production losses; tuberculosis is a lingering, chronic and eventually fatal disease in cattle and deer.

To facilitate management of Tb, New Zealand is categorized into (i) Tb Vector Risk Areas (VRAs; traditionally called Tb endemic areas) which are areas where Tb has been identified in wild/feral animals, and/or epidemiological information from Tb breakdowns in stock indicates that the source of infection includes wildlife, and (ii) Tb Vector Free Areas: areas where Tb is neither established nor suspected in wildlife. It is well recognized in New Zealand that the major problem with tuberculous control is the re-infection of domestic stock by tuberculous feral and wild animals. *Mycobacterium bovis* has been detected in at least 11 wild and feral animals: the possum, rabbit, hare, hedgehog, pig, goat, cat, ferret, stoat, weasel and rat. It is thought that possums are the main wildlife reservoir and vector of Tb for stock.

In 1982, bovine tuberculosis was first identified in a feral ferret from Taumarunui. This was treated as an isolated incident, however, and it was not until a survey in 1992-3 in the Mackenzie Basin that ferrets were seriously considered as having a role in the wildlife cycle of Tb. Surveys conducted after this in other VRAs often found tuberculous ferrets and soon there was much debate and interest in the ferret as a possible vector of Tb. Ferrets present a challenge to managers for two reasons: they may transmit infection to stock and they may be involved in or responsible for some of the geographical spread of Tb.

Can ferrets transmit infection to stock?

From the available evidence it appears that ferrets are capable of transmitting infection to stock. In instances were ferret populations have been reduced by trapping, the incidence of Tb in stock declines. This has been demonstrated in two experiments, one in North Canterbury conducted by Landcare Research and the other in Waipara Gorge conducted by AgriQuality NZ. Both trials found that it is very hard to reduce ferret populations for any length of time. Ferret control results in a change in the age structure of the ferret population, with proportionally more juveniles after control. As the prevalence of Tb is lower in juveniles, control results in a lower prevalence of Tb in the general ferret population. This lower prevalence corresponds to a lower rate of

transmission to stock. Many farmers have also experienced progress in reducing Tb levels in stock when they start ferret control. While the debate continues as to whether ferrets are spillover or maintenance hosts, it seems that (at least at the moment) ferret control is justified.

Epidemiological evidence supporting the ferret's capability as a vector is excretion of bacteria from tuberculous ferrets. In the most comprehensive study of the routes of excretion, about a quarter of tuberculous ferrets were excreting *M. bovis* via the oral cavity, about 16% from faeces, 6% from the respiratory tract and 7% from urine. Lesions that drain externally have been recorded, but are not so common, around at 1-2%.

Direct transmission of Tb between animals is possible if they come into close contact. Ferrets in the last stages of tuberculosis may show weakness, muscle wasting and on occasions paralysis of the hind limbs, so they may not be able to escape investigation by livestock. In trials with
L1 sedated ferrets (to mimic terminally ill ferrets) cattle and deer investigated ferrets. Stock came into close contact with the ferret and it was concluded that ferrets could spread Tb by this type of interaction. Although ferrets den mostly underground, a disproportionate number of dead ferrets are found on the surface, so stock could conceivably come into contact with them.

Given that a proportion of the juvenile population will disperse from their natal area, there is a risk that juvenile ferrets are involved in the geographical spread of Tb. In recent times, New Zealand has been experiencing a decline in stock reactor rates but an increase in the size of VRAs. There are a number of different scenarios that may involve ferrets:
(i) Spread of Tb within VRAs. It is likely that ferrets within VRAs are involved in re-infection of areas and isolated, sporadic, unexplained outbreaks (which are suggestive of a passing vector). This maintains the size of a VRA, because even a low level of transmission from ferrets to stock prevents areas from being cleared of Tb. This has a very real consequence for management because continual intervention is required to clear herds of infection, and managers are forced to be reactive rather than proactive.
(ii) Expansion of VRAs by encroachment on the boundaries. Most VRAs are expanding but
L2 some have expanded very quickly, much faster than fronts of infection thought to involve possums. This has been seen in North Canterbury where infection spread very quickly through herds. It was thought that ferrets were involved because they were abundant at the time, had a high prevalence of Tb and ferret control reduced cattle infection rates.
(iii) Movement into buffer zones. Dispersing ferrets may be attracted to areas of lowered ferret abundance and may settle in buffers, compromising the purpose of the buffer.
(iv) Movement into Tb free areas and creating new foci of infection.

How are ferrets becoming infected?
It is important to know how ferrets become infected with Tb, to determine how to control the disease in feral ferrets. If ferrets transmit infection to each other and do not require constant re-infection from other wildlife such as possums to maintain the disease in their population, then they would be called "maintenance hosts". If they are becoming infected from other wildlife, and do not transmit infection to each other at high enough rates to maintain the disease in their own population, they would be called "spillover hosts". The logic is that maintenance hosts should be controlled to reduce transmission to stock, but infection in spillover hosts should progressively disappear if the disease is reduced or eliminated in the species that are acting as the source. Traditionally it has been thought that control is not warranted for spillover hosts. It is accepted that possums are the main maintenance host for Tb in New Zealand, and some have argued that controlling the disease in possums will adequately control the disease in ferrets.

Possums are undoubtedly a source of infection for ferrets. The prevalence of Tb in ferrets has been correlated with possum abundance. There are numerous observations of ferrets scavenging possums and possum has been recorded in several diet studies of the ferret. Ferrets are susceptible to *M. bovis* infection by ingestion and epidemiological studies have found that ferrets are mostly infected by ingesting Tb-infected meat (around 70% of tuberculous ferrets have primary lesions in the alimentary tract).

The arguments about host status hinge on whether Tb in ferrets would exist if possums were not the source of infection. Although some people assume that the ferret is probably a spillover host because it is a carnivore, others find it hard to accept that the high prevalence of Tb observed in
11 ferrets in some areas of NZ is caused solely by possums. High prevalence of Tb in ferrets has been observed even when possum numbers are naturally low, or when possum control has already reduced populations, or when wildlife surveys have failed to find infection in possums.

12 There are several possible sources of infection for ferrets. Ferrets are very likely to be infected from other animals, such as Tb possums or hedgehogs. There is also the possibility that ferrets become infected through contact with bacteria in the environment, but this is thought to be unlikely. There is much debate about the amount and significance of "ferret-to-ferret" transmission. There are many potential ways that ferrets could transmit Tb to each other, and although it is relatively easy to come up with ideas about how it could occur, it is difficult to determine which ferret-to-ferret contacts might be the most significant. Transmission of disease could occur through fighting: 25% of tuberculous ferrets have been found to excrete Tb from their mouths. Fighting takes place to establish social hierarchies and sometimes over access to food. Fighting that involves wounding is most likely to happen during the mating season. Mating activity, which is prolonged, vigorous and involves wounding, is an obvious risk. In one study, over half of the ferrets had microscopic debris in peripheral lymph nodes (lymph nodes draining the skin) probably caused by skin wounding. In the same study, around 20% of ferrets had primary lesions in peripheral lymph nodes, indicating that infection was acquired through bite wounds.

There is also a wide range of routine social activities that may increase the risk of disease transmission. Ferrets are playful animals (they make good pets for this reason), so play fighting is common, especially among developing litter-mates. Ferrets will share carrion and this may involve a risk because of close contact with other ferrets, or if the carcase becomes contaminated from a tuberculous ferret feeding on it (Tb is often found in the mouth and can be transported in saliva). Scent is a strong social communicator in ferrets, and contact between ferrets involves much sniffing of anal and genital areas. Also, ferrets will inspect the scats (faeces) of other ferrets, and Tb has been isolated from faeces. It is possible that mothers may infect their offspring through milk, as *M. bovis* has been isolated from mammary tissue. Ferrets will also den together. Transmission could result through close contact activities, or if the den is contaminated with *M. bovis*. Coughing and sneezing by tuberculous ferrets could conceivably result in transmission. Obviously, contact with any ferret that has externally draining lesions carries a large risk of disease transmission. Cannibalism is another way that ferret-to-ferret transmission may occur; cannibalism has been observed in feral ferrets and it fits the evidence of infection derived from ingestion.

Some aspects of ferret behaviour might result in more ferrets being exposed to infection. For example, mother ferrets will bring back carcases to their offspring, and so it is also possible that a

litter could become infected through one tuberculous carcase. Also the fact that ferrets will share carcasses with other ferrets means that many ferrets could become infected from one carcase.

Epidemiology, the study of disease
Tb infection causes lesions in the lymph nodes. Lymph nodes become enlarged and often small cream-coloured lesions can be seen. Almost all tuberculous ferrets have lesions in the liver, although very few of these lesions are detectable with the naked eye. The most common site of infection is the mesenteric lymph node (a lymph node draining the intestinal tract) suggesting that infection was acquired by ingestion. There are many tuberculous ferrets that do not show signs of the disease (called subclinical infection) and infection is only determined from histology or culturing of tissues. Sometimes the proportion of ferrets with sub-clinical infection is very high, with almost every ferret being diseased in a population. The percentage of ferrets showing lesions (called gross infection) can also be very high and prevalence of around 20% is quite common. There is a trend for more males to be infected than females. The reason for this is not clear; it could be that males contact tuberculous sources at a higher rate or that they are more susceptible to infection. Adult ferrets are much more likely to be infected with Tb than juveniles. It appears that ferrets may be able to live for some time with Tb and that the disease does not manifest in the animal until later in life.

Ferret control technology and issues

Ferrets have traditionally been controlled through trapping. Trapping is time consuming, logistically demanding and requires a certain amount of know-how for success. More recently there has been an investment into developing poisons for ferrets. Poisoning has the potential to be used over larger areas and to be less demanding logistically, especially if bait stations are left in position and restocked when necessary. Currently there is only one poison registered for ferret use: PestOff® ferret paste (using diphacinone) developed by Landcare Research and Animal Control Products.

There are a number of traps available for ferrets: leg-hold traps like the Victor and Bridger traps, usually used in conjunction with a wire cage to prevent non-target species such as cats and dogs from being caught. Timms, a kill-trap that was designed primarily as a trap for possums, is also produced with a tunnel for ferrets (called KBL trap). The Fenn is another kill-trap; it works by breaking the spine. Fenn traps are no longer recommended and are likely to be phased out over time for animal welfare reasons. Wire cage traps are effective and are usually used for research projects because animals are unharmed and usually not stressed. The Holden trap, a plastic tunnel with a treadle mechanism is another effective live-capture trap.

Traps are often used with a variety of trap covers, surrounds, and tunnels - with use often depending on the presence of non-target species. It is hard to say which is the best trap for ferrets as there have been few studies comparing the different trap types. Ferret contractors usually use leg-holds or Timms traps. As a general rule, a mixture of traps is probably the best as individual animals will respond differently to different trap types and there will always be some animals that will avoid a certain trap type but will go into another.

Fresh meats, such as rabbit and possum, are probably the best bait to catch ferrets. Scent lures, based on the anal gland secretions of ferrets, have been developed and can be used as attractants for control stations. Ferrets are curious animals and can be trapped in traps that do not contain any bait or attractant, although catch-rates are higher if a bait or attractant is used.

Ferrets are attracted to cover and their movements are closely associated with the edges of cover and along boundaries where there is a change in habitat. Control stations are likely to have higher encounter rates with ferrets if placed along forest-pasture margins, shelter-belts, and waterways. If obvious features such as these are not present then placement alongside areas of vegetation cover will increase the probability of interception. Traps placed along streams or down gullies are usually successful. Traps set near to rocky outcrops are also likely to be better than those set in open country. In areas with high rabbit abundance, habitat can often be quite uniform, with little cover or natural features. Ferrets will still be living in these areas so aim to cover the area as uniformly as possible with traps. Given that ferrets often den in rabbit holes, traps placed in areas where rabbits breed may also yield favorable results. If rabbits are patchy, then set more ferret traps where rabbits are present, as ferrets are more likely to be hunting in these areas. Ferrets commonly use buildings to den in, so traps set around hay-barns, woolsheds and other farm buildings are also likely to be successful, as well as open offal pits.

Traps are usually set in traplines, which are easy to service and re-find. It is often practical to set traps along farm tracks. Ferrets will use vehicle and sheep tracks and the smaller animal runs. A good rule of thumb for the number of traps to set is 10 per km^2. The optimal number of traps will vary with ferret density and habitat. Also, high catches of non-target species may have an effect on a trapping operation in that it may take longer to remove the trappable ferret population. Research has found that trapping for 10 nights is a suitable length of time to remove a high proportion of the population, as long as trap density is sufficient.

It is easiest to trap ferrets from the time of juvenile emergence (which starts mid January) until early April. Because there is a high rate of juvenile mortality, many of the animals that are trapped during these months would normally die anyway. Also, because juveniles disperse during this period, areas that receive ferret control are likely to be invaded by new ferrets quickly. It is thought that autumn may be the best time to conduct ferret control because it is outside the dispersal period. Ferrets start to become hard to trap around June and trap catch remains low until December. This low trapability is especially pronounced in female ferrets, which are the most valuable animals to control because of their reproductive potential. Because of this, control is restricted to the summer and autumn period. Recent research has found that female ferrets will avoid traps that they encounter in winter and spring – which is possibly a behavioural response induced by oestrus or pregnancy. Ferret populations recover quickly from control, due to immigration to the control site, higher rates of successful breeding and higher rates of juvenile survival. With a high reproductive potential, a few successful breeding females have the ability to quickly replenish a population. It is very hard to reduce ferret populations; even regular trapping programmes have little effect on the numbers caught in the long term.

Ferrets can die from eating prey species such as rabbits, rodents and possums that are poisoned. Ferrets are susceptible to 1080 poisoning aimed at rabbits; Talon poisoning (active ingredient: brodifacoum) aimed at both rodents and possums; and 1080 jam operations aimed at possums (although it is possible that ferrets may have eaten the jam directly). Secondary poisoning may be an effective means of controlling ferrets, especially in winter and spring when they show aversion to control stations.

Good summaries (with references) of the knowledge base on ferrets are provided in:

Lavers, R.B. and Clapperton, B.K. 1990. Ferret. In: The Handbook of New Zealand Mammals. Edited by King, C.M. Oxford University press, Auckland.

Clapperton, B.K. 2001. Advances in New Zealand mammalogy 1990-2000: Feral ferret. Journal of the Royal Society of New Zealand 31: 185-203.