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AN ANNOTATED BIBLIOGRAPHY ON THE FERRET *(Mustela putorius furo)*

by

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&

Tom Moore

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Introduction

Ferrets have been prohibited in California since 1933. Under Fish and Game Commission regulations, ferrets are currently classified as detrimental mammals because they have not been determined by the Commission to be normally domesticated in California and they pose a threat to native wildlife agriculture, or to public health and safety. Existing law prohibits importation and possession of ferrets in California.

The California Domestic Ferret Association (CDFA) argues that restricting ferret ownership is a restriction on personal liberties, and that the ferret deserves the same legal status and protection that all other domestic pets share. Further, CDFA argues that domestic ferrets would not pose a significant problem to native wildlife in California as a result of their low chance of survival in the wild (3 to 5 days).

The scientific literature and literature related to keeping ferrets as pets address many of the questions concerning the potential risks associated with legalizing the domestic ferret in California. This bibliography was compiled and articles relevant to a risk assessment were reviewed, to provide a single source of information on the ferret and a basis for a scientific risk assessment.

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Contents Page

List of Keywords used:

anatomy
behavior
biological impact
biting
black-footed ferret
breeding
breeds
care
crossing breeds
detection in the wild
diet
disease
domestication
economic value
feral
ferreting
hunting
hyperestrogenism
introduction to NZ
introduction to US
origin
predator
rabbit control
risk assessment
Siberian polecats
survival
threat of escape
trapping
vermin control
wild populations

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Anderson, R. S. and A. T. B. Edney. 1962. Ferrets. p182 *in:* Practical animal handling. Pergammon Press.
Keywords: care.

"Ferrets vary considerably in temperament, ranging from non-aggressive pet animals to more unpredictable animals which are maintained for rabbiting." What follows is a description on the proper way to grasp and restrain a ferret. The ferret possesses a powerful and muscled neck. "The handlers thumb and forefinger should be beneath the mandible so that the ferret cannot lower its head to bite." (p. 182)

Apfelbach, R. and U. Wester. 1977. The quantitative effects of visual and tactile stimuli on the prey-catching behavior of ferrets *(Putorius furo* L.). Behav. Proc. 2:187-200.
Keywords : predator, diet

The study focused on the effects of visual and tactile stimuli on the elicitation of prey-catching reactions of ferrets. Both experienced and naive ferrets were tested to analyze how experience affects behavior after exposure to stimuli in the form of dummies. Experienced animals had previously caught mice and rats. All animals were fed deadmice, rats and chicks in between trials of study. Dummy forms had different shapes. Dummies ranged from hard to soft in consistency, light to dark in background and from 40% smaller than the ferret to much larger than the ferret. Dummies were presented to the ferrets in a stationary position and moving at different speeds.

Ferrets followed prey (dummy) at speeds about equal to the escape speed of mice, which is the main food of the ferret. There was no apparent preference for any dummy shape that stimulated prey-catching reactions. Ferrets "follow any moving object (speed 25-45 cm/sec) but only when it is not larger than the an adult conspecific. Moving objects double the size of a ferret or larger cause escape reactions." "To summarize, we assumed that the size and especially the speed of locomotion of an object are decisively external factors for releasing prey-catching reactions in ferrets" When taking into account earlier findings of Apfelbach (1973) concerning the reactions to olfactory stimuli "for eliciting hunting behavior, olfactorybehavior is of higher importance than optical stimuli. Therefore, within the biological rank order of senses, the olfactory sense seems to be dominant in this species". (p. 198)

Apfelbach, R. 1978. A sensitive phase for the development of olfactory preference in ferrets *(Mustela putorius furo* L.) Z. Saugetierkunde 43:289-295.
Keywords: diet, predator

Working with odors from different types of prey the author in past studies "found that young polecats *(Mustela putorius furo)* exhibit a preference for the odor of a prey on which they had been fed. These preferences were more marked the longer individuals had fed upon the prey in question . . . concluded that scent serves as a stimulus for prey selection in ferrets".

Ferrets do not pursue fleeing prey but " rummage over the ground with a slow scanning movements of the head and attempts to attack prey by a sudden dash. Search behavior can be elicited by odor alone". (p.291)

"From their second month of life on, young ferrets leave their nest and start to explore their surroundings. (Some animals of that age are able to kill mice already.)"... " During the fourth month of life the ferrets leave the litter and start to live a solitary life. **All animals are well able to kill prey."** . . . "At the age of twelve months (reproductive age) all animals in each of the test groups showed search reactions only when known odor was offered." The unknown odors of natural prey and other smelling substances were ineffective in eliciting any visible behavioral reaction. After a starvation period of three days there was an increased response toward known odors but still no response to unknown odors. (p.29l-93)

Prey of the ferrets in this study were mice and chickens. Odors from each elicited a very strong search reaction. The results of the three treatment groups suggest that there is a definitive imprinting period when exposed to a prey type during this period. Prey eaten during this time will elicit a stronger response than when the ferret is exposed to the other prey type outside of this time frame. This still occurs even when the prey exposure is for many more months.

Searching for prey by the ferret "can be elicited by odors alone and that innate olfactory recognition of prey does not exist. The results suggest that ferrets have to learn how their prey smells. There seems to be an innate age dependent readiness to react to olfactory stimuli with a searching behavior. This readiness is strongest in three month old ferrets, the age when the young animals leave the mother family and start to live solitary." (p.294)

" In adult ferrets, the searching behavior can be elicited only by familiar prey odors with no reaction to the unknown odors. The reactions to even two known odors are not necessarily the same: preference to a specific prey odor is less due to the length of prior feeding experience but rather due to exposure during a sensitive phase during development." (p.294)

Apfelbach, R. 1986. Imprinting on prey odors in ferrets *(Mustela putorius F Furo L.)* and its neural correlates. Behavioral Processes 12:363-381.

Keywords: predator

This follow-up study again addresses imprinting of ferrets upon familiar prey odors during a sensitive phase as well as its neural correlates. The results support the existence of a sensitive phase between the second and fourth month during which the ferret imprints on to the odor of prey. In addition this study suggests a plasticity of adults to new prey objects and new prey odors can learned. The strongest reactions were still to those prey odors received during the second and fourth months.

It is also "suggestive to assume a correlation between the sensitive phase of olfactory prey odor imprinting and the postnatal development of the investigated olfactory bulb." These "changes in the olfactory bulb cannot be regarded as the exclusive cause for the olfactory prey odor imprinting in ferrets." (p.379)

Bachrach, M. (1931) Fur. A practical treatise. Prentice-Hall M. C., New York, 677pp.

Keywords: origin

The ferret *(Putorius furo)* has been used in the extermination of small rodents that thrive in the presence of man. The fitch *(Mustela putorius)* is the same animal, but in the wild state. What follows is a description of the range and life habits, food and breeding of this animal in the wild state. The focus of the paper is geared towards production of pelts. (p.385)

Bernard, S. L., C. W. Leathers, D. F. Brobst, and J. R. Gorham. 1983. Estrogen-induced bone marrow depression in ferrets. Amer. Jour. Vet. Res. 44: 657-661.

Keywords: survival in wild

"Bone marrow depression is a common and potentially fatal disease recognized in female ferrets during estrus. Clinical bone marrow depression is seen in 20% to 30% of estrous females, and almost always leads to death." (Dr. Skip Nelson, Central Way Veterinary Clinic, 528 Central Way, Kirkland WA: Personal communication, 1982).

Besch-Williford, C. L. 1987. Biology and Medicine of the Ferret. Vet. Clinics of North America Small Animal Practice 17:1155-1183.

Keywords: Hyperestrogenisrn, survival in wild

This paper, written by a veterinarian, describes the biology and medical care of ferrets. Hyperestrogenism is a disease associated with the jill that remains in estrus throughout the duration of the breeding season. The female ferret can develop bone marrow hypoplasia due to the high levels of estrogen in circulation. This can result in toxic effects of estrogen on "the hematopoietic tissues, which results in the reduction of precursor cells in bone marrow."
(p.1174)

Bissonnette, T. H. 1950. Ferrets: the care and breeding of laboratory animals. Edmond J. Farris (Ed.), John Wiley and Sons, New York, London, Sydney. 515pp.

Keywords: behavior, diet, hyperestrogenism

This author had been conducting studies on photoperiodic control of sexual and breeding cycles in ferrets. The author refers to the ferret of England and America as *Mustela putorius*. The tame ferret and its wild relative (the polecat) interbreed freely. All the polecats, including ferrets, have similar habits and eat small mammals up to rabbit size, snakes, lizards, frogs, fish, eggs, and birds, particularly poultry. Like weasels, ferrets and polecats will kill far more than they can eat if they get loose in a chicken coop."... "Ferrets are vicious biters when wild or teased and hang on like bulldogs." When tamed by handling they may be handled without gloves and seldom bite unless hurt or teased. (p.235) There is another reference to one breeder in Ohio of selling over 2000 ferrets a season for ratting. (p.236)

Under practical suggestions: Frequent careful handling from time of weaning onward will "gentle" the animals and make them easy to handle without excitement and injure to ferret or keeper. Heavy leather gloves should be used at first to protect the handler. Bites from ferrets usually fester and should be thoroughly disinfected in both man and ferret. (p.253)

"Being carnivores, ferrets in nature would live mostly on meats and high-protein diets, with entrails of prey to furnish vitamins, and bones, the needed calcium." . . . "The old superstition, that if a female ferret is not mated and allowed to become pregnant she will die as a result, is not true. Females may be kept over two years at least without mating and live a healthy life properly fed and kept free from dirt and infection." (p.253)

Blandford, P. R. S. 1987. Biology of the polecat *Mustela putorius:* a literature review. *Mammal Rev.*, 17(4):155-198.

Keywords: anatomy, behavior, biological impact, breeding, breeds, crossing breeds, diet, disease, domestication, feral, hyperestrogenism, introduction to NZ, origin, predator, rabbit control, survival, wild populations

The available literature on the biology of the European Polecat *(Mustela putorius)* is collated. Aspects covered are general biology and systematics, distribution, physical characteristics, variation, skeletal characteristics, habitat, general behavior, diet and predatory behavior, breeding, juvenile development, population structure, mortality, parasites, diseases, relations with man, and history in Britain. Notes on field signs are also included.

Bomford, M. 1991. Importing and keeping exotic vertebrates in Australia: Criteria for the assessment of risk. Bulletin No. 12, Bureau of Rural Resources, Department of Primary Industries, 92pp.

Keywords: feral, risk assessment

This publication seeks to provide an informed approach to assessing and managing the risks associated with importing and keeping exotic vertebrates. The factors that influence the probability of a species establishing a pest population are assessed. The information is used to develop a decision-making system for categorizing species which could be available for public scrutiny and would minimize both bureaucratic intervention and administrative and enforcement costs.

Carnegie, W. 1988. Ferrets and ferreting: A practical manual on breeding, managing, training and working ferrets. Nimrod Press Ltd. Alton, Hants. 27pp.

Keywords: biting, diet, hunting, hyperestrogenism, predator

Black ferrets are referred to as nothing more than a male polecat in a new coat. In addition to the common ferret there is also the polecat ferret which is the result of cross between the two animals. "In regard to ferreting, the better and healthier progeny are obtained from a good strain of polecat ferrets, than from the white, though they require more careful handling." (p.3)

"Of the other congeners of the ferret, the weasel and stoat resemble one another in coloring and form but are more rat-like in many respects of forms and ways, whilst possessing the same very pronounced predatory instincts." (p.4)

Feeding and management: The author recommends to feed your ferrets twice or three times a week some small birds, the healthy livers of ground game, or portions of rabbit, without fur on them may be given. The heads and necks of fowls are also suitable. (p. 18)

"Ferrets are thirsty animals. When very thirsty they often go a long way to water; and many a ferret has been lost in underground drains with which the rabbit burrows have connected, when seeking for water to slack its thirst." (p.21)

"The ferrets should be handled round the neck, and there must not be the slightest hesitancy on the part of the handler, or his reward for his timidity --usually shown by a quick withdrawal of the hand-- will be a bite that he is not likely to forget." (p.26)

The author goes on to describe combinations of crosses between polecats and polecat ferrets to gain the desired traits. "A doe (female) ferret will sometimes die the first time she is refused access to the buck (male)." (p.27)

In training for ferreting one is encouraged to take out the previously handled young ferret and train it by releasing the ferret into a hole with other young ferrets or with the mother and the animal will learn in the field. (p.28)

Some ferrets will lie up after finding, then killing and eating the rabbit.

"There is a right way and a wrong way of even picking up a ferret. The wrong way is to put your hand crossways of the ferret and pounce down on his neck, if you miss him, he will either bite you or shoot back into the earth." (p.46)

Chadwick, D. H. 1991. Rescuing our rarest prairie predator. Defenders, Mar/April pp11-23.

Keywords: black-footed ferret, Siberian polecats, survival in wild

Prior to the introduction of captive bred black-footed ferrets *(Mustela nigripes)* a program was initiated to study ferret behavior and survival in the prairie dog towns in the plains of Wyoming. The animal used in the research was the Siberian or steppe polecat *(Mustela eversmanni)*. These animals were radio-collared and released to gather information for future release of black-footed ferrets. "Found across the great plains of Asia, it more closely resembles the black-footed ferret (than the European polecat, *Mustela putorius)*. In fact, black-footed ferrets very likely arose from Siberian polecats that colonized the New World via the Bering Bridge toward the latter part of the Ice Ages. The two types are still similar enough to interbreed, although blood protein analysis and certain behavioral traits confirm that they qualify as distinct species." (p. 12) Most of the steppe polecats used in the study were obtained from the Moscow Zoo in 1986 and the rest came from China not long before the study began.

A problem exists with the delay in releasing captive bred black-footed ferrets. "The longer the black-footed ferrets remain thus confined, the more like the Siberian surrogates, whose original traits already have begun to fade during their long sojourn in tame environments. Each new generation is a step farther along the road toward domestication, a process generally marked by a decrease in brain size as well as the disappearance of key survival instincts." p. 16

"Of the dozens of radio-collared Siberian polecats released into the wild, a third sooner or later ended up in the jaws of badgers. Nearly all the others were caught by coyotes. Night-hunting raptors such as the great horned owls snatched a couple as well." p. 16

There has been successful cross breeding of the black-footed-ferrets and the Siberian polecats at the University of Wyoming by veterinarian Beth Williams, to produce hybrids for study on a canine distemper vaccine. p.16

Constantine, D. G. and K. W. Kizer. 1988. Pet European ferrets: a hazard to public health, small livestock and wildlife. Calif. Dept. of Health Services, Sacramento. 70pp. (Report).

Keywords: biting, behavior, risk assessment

This report focusses on the public health hazards related to owning and handling domestic ferrets. It discusses attacks on infants and potential problems of ferrets carrying rabies.

Corbett, G. B. and D. Ovenden. 1980. The Mammals of Britain and Europe. Collins, London. 247pp.
Keywords: origin, feral

Domesticated ferrets *(Mustela furo) are* interfertile with wild western polecats *(Mustela putorius)* and often interbreed with them. Most feral populations of ferrets revert to a form that has the pattern of the wild Western polecat but in a rather dilute, faded form. Skulls of pure-bred ferrets differ from those of the western polecats, but resemble those of the steppe polecats *(Mustela eversmanni)..."*

"Established feral populations resulting from escaped domestic ferrets are found in parts of Britain, especially on islands (Anglesey, Man, Lewis, Arran) and on some Mediterranean islands (Sardinia, Sicily). They are not likely to persist as separate, recognizable forms where wild polecats occur. Domestic ferrets are widely kept, especially for the control of rabbits. **Feral animals behave as polecats." (p. 183)**

Corbett, G. B. and H. N. Southern. 1977. The Handbook of British Mammals. Blackwell, London.
Keywords: origin, feral

The ferret *(Mustela furo)* is a descendent of either the European polecat *(Mustela putorius)* or the steppe polecat *(Mustela eversmanni).* The distribution of ferrets in the wild is a result of escaped pets and "may be encountered anywhere and makes it difficult to detect well established feral populations". Colonies have been reported on the Isle of Man, Anglesey, in Renfrew and parts of Yorkshire. Colonies of feral ferrets once existed on the island of Mull and may still exist today. Colonies still exist on other Scottish islands like Lewis, Arran, and Bute. They are also widespread in New Zealand. (p.352-353)

Cowan, D. P. 1984. The use of ferrets *(Mustela furo)* in the study and management of the European wild rabbit *(Oryctolagus cuniculus).* J. Zool. 24:570-574.
Keywords: ferreting, rabbit control

This was a study on the effectiveness of ferreting in the study and management of the European wild rabbit. Ferrets, in pairs, were released into the warrens with the goal of chasing out all burrowing rabbits. The ferrets were always recovered without the need of digging them out. Ferreting is likely to be most effective for the management of rabbit populations that occupy small warrens as rabbits are better able to evade ferrets in the larger warrens. "Ferreting can only he effective in reducing the size of breeding populations when conducted just prior to the beginning if the breeding season." (p.573-4)

Daousi, P. Y., and D. B. Hunter. 1978. Spontaneous Aleutian disease in ferrets. Canadian Veterinary Journal 19:133-135.
Keywords: disease

Aleutian disease (AD), a common infection of ranch mink, is caused by a parvovirus. This study focuses on the necropsy results of nine ferrets that were diagnosed to have died from exposure to AD. The diseased ferrets were members of a colony that were kept for a reproductive study. They had been housed in pens which were previously occupied by mink infected with AD. The diagnosis was based on "histopathological changes in dead animals and the demonstration of serum antibodies against Aleutians disease viral antigen in survivors among a group of ferrets *(Mustela putorius)."*

de Lisle, G. W., K. Crews, J. de Zwart, R. Jackson, G. J. E. Knowles, K. D. Patterson, R. W. MacKenzie, K. A. Waldrup, and R.Walker. 1993. *Mycobacterium-bovis* infections in wild ferrets. New Zealand Veterinary Journal 41:148-149.
Keywords: disease

Bovine tuberculosis is one the more significant animal health problems in New Zealand. One of the reasons the disease persists is due to the transmission of *Mycobacterium bovis* from wildlife to cattle and farmed deer. The Australian brushtail possum is the number one host to the *M. bovis. M. bovis* has also been previously isolated in wild deer, feral pigs, feral cats, feral goats and feral cattle. This paper presents "the finding of *M. bovis* -infected wild ferrets in seven geographically distinct areas in New Zealand". The first infected wild ferret was located in

1982 and there have been 25 more wild ferrets isolated with *M. bovis.* Ferrets in New Zealand mainly feed on small mammals, but are know to also consume a range of foods which include carrion. Consumption of infected carcasses of possums or domesticated animals is the likely pathway for the transfer of the tuberculosis. New Zealand has the largest populations of wild ferrets in the world. The greatest densities of ferrets are in those areas with the highest densities of rabbits. All infected ferrets came from these areas. In all areas with infected ferrets, "there have been cases of bovine tuberculosis in cattle and deer and the source of infection could not be traced back to domestic livestock". (p. 149)

Dolensek, E. P., and B. Burn. 1976. Ferrets. pp90-93 in: A practical guide to impractical pets. Viking Press, New York.

Keywords: introduction to US, breeding

One of the authors of this book has owned ferrets as pets himself and writes from first hand experience. European ferrets were originally imported into the US around 1875 and used primarily for ratting. Ferrets were often raised in backyards and by professional breeders, particularly in Ohio were a town was called Ferretville. But "because ferrets are natural hunters and because they are hardy, they soon became a plague for poultry farmers who were appalled at the ease which a ferret could learn to love chickens and life in the woods." (p.91)

"Your most important responsibility--to poultry farmers this time rather than to the ferret--is to see that it has no chance to escape. Releasing a ferret deliberately would be as irresponsible as abandoning a dog or cat or letting a cow or sheep wander into the woods to live on its own. Ferrets would undoubtedly pull through, but you would have committed a grave disservice to your fellow man." (p.91)

"Any ferret that has been treated well and handled regularly and gently can be trusted to display only the most amiable of dispositions. As with any animal, even the Guinea pig, precautions must be taken when children are handling ferrets: quick motions, loud noises, and rough handling may provoke a hiss or a nip, but only out of fear not out of viciousness. (Of course, the word vicious does not rightfully belong in a discussion of animals, since it implies vice and evil motives: it is far more appropriately applied to the bitten than the biter, if the biter is a wild animal, who has been frightened, inadvertently or not, into using defensive mechanisms in a perfectly natural way.)" (p.93)

Druett, J. (Ed.) 1983. Exotic invaders: the introduction of plants and animals into New Zealand. Heinmann Publishers 291pp.

Keywords: introduction to New Zealand, predator

This book describes the invasion and occupancy by exotic species to New Zealand. Numerous descriptions of introductions of predators to attack the feral rabbit problem include cats, ferrets, stoats, weasels and more. The effects of these introduced predators at most had only temporary and local success. Other ecological processes other than predators seem to be more effective at controlling rabbit populations.

In one rabbit infested area, enclosed with a fence and a population of over a thousand rabbits, predators were effective. "Three or four feral cats and six ferrets had free access to this area, and reduced the population of rabbits to 13 in three and a half years. The scientists noted that the cats and ferrets exhibited division of territory, with the cats hunting above the ground and the ferrets hunting in the burrows." (p. 17)

Feller, D. L., and G. J. Benson. 1980. Manual restraint of the ferret. Veterinary Medicine/ Small Animal Clinician April, 690-693.

Keywords: anatomy, behavior,

The paper describes the ferret's "typical carnivore traits: teeth specialized for grasping and tearing, and exceptionally strong jaw muscles". The ferret also has "paws that are developed for ripping and tearing flesh." (p.690)

With this in mind, the veterinarian details an approach to handling and restraining a ferret brought in for examination and treatment. A slow and deliberate approach is best and "removed from its cage by gently grasping

the nape of its neck or grasping it by the tail."... " Although many ferrets may be handled without safety gloves, handling with light leather gloves instead of bare hands is prudent..." (p.691)

Glasier, P. 1982. Falconry and Hawking. B.T. Batsford Ltd, London.
Keywords: hunting

This guide to falconry and hawking espouses the practice of ferreting when rabbits are not lying about. "If you have white ferrets, not the polecat variety, and get the hawk used to them in advance by having their hutch and run in her view, she will not try to catch them when out hunting."... "Ferrets must be really tame and easy to pick up and handle. You should be able to curl up your ferret into a ball and toss her over the hedge for your assistant to catch." (p. 171)

Godbey, J. and D. Biggins. 1994. Recovery of the black-footed ferret: looking back, looking forward. Endangered Species Technical Bulletin 21:10, 13.
Keywords: black-footed ferrets, survival in wild

After sylvatic plague and canine distemper drastically reduced the last remaining wild populations of black-footed ferrets *(Mustela nigripes)* a recovery plan was enacted to keep the species from going extinct. The few individuals removed from the Meeteese, Wyoming area provided stock for a successful captive breeding program. There are now over 250 breeding adults at facilities across the country. "During 1991-1993, the captive population supplied 187 'surplus' animals for reintroduction in Wyoming's Shirley Basin." Some of the ferrets have survived over the winter but overall survival is low. Losses due to predation by coyotes *(Canis latrans)*, badgers *(Taxidea taxus)* and other predators has been high. "The 1991 release indicated an 86 percent loss of introduced animals within the first 90 days for the Shirley Basin populations, compared to a 17% loss in the wild Meeteese population. In 1992, 26% of the released animals were lost to predation in just 18 days." (p.10)

Hagedoorn, A. L. 1954. Animal Breeding (5th Edition). Crosby Lockwood & Son Ltd. London. 364pp.
Keywords: breeds, domestication

Mutation: The author uses the term "fitch" for the polecat *Mustela putorius* and the albino for the ferret *Mustela putorius furo.* In the section on mutation, a fitch (polecat) and an albino were crossed which produced "waltzing ferrets". These hybrids exhibited a behavior of whirling about in small circles due to a recessive trait. (P.31)

Domestication: "When we raise a young animal belonging to a wild species in captivity and in close contact with human beings, it may become absolutely tame: but this does not mean that its young, born in captivity, will likewise be tame." (p.49)

"The ferret has long been considered to be a domesticated fitch (polecat). It is true that the skull of the present ferret closely resembles that of the fitch, but this resemblance may have been due to cross-breeding with the fitch after the ferret was established as a domestic breed. From experience with the cage-bred fitch it seems to me almost impossible to believe that anybody would ever have thought of domesticating this animal. Even quite tame fitches are so quick and bold and snappy that the idea of going ferreting with a fitch sounds like going hunting with a pet tiger. It is probable that the original ferret was a domesticated Siberian fitch, a species that can readily be tamed and has a much quieter and more amiable disposition than our local fitch." (p.54)

Adaptation: "We cannot say that domestic animals are different from wild animals in that they are tame, for there exists domestic animals that are not any tamer than their wild-living relatives. There is only one definition that fits all domesticated animals, and it is the same that fits all cultivated plants. The races of cultivated organisms are fitted to live in symbiosis with mankind. They differ from related wild species and from the wild species from which they are descended, in their inherited make-up, in some way which makes them useful to man, and sometimes also dependent upon man." (p.57)

"By hybridizing ferret and European fitch, beautiful first-generation hybrids are produced, having food requirements somewhat less strict than in the wild species, and very valuable pelts. These hybrids were less susceptible to distemper than fitches, but seemed more susceptible than ferrets." (p.309)

"With a few animals there is the possibility of utilizing a domestic animal to ameliorate a wild fur-bearer. The fitch will readily cross with the domestic ferret, and the hybrids are fully fertile. From such hybrids I have produced a few animals that were as tame as ferrets ..." (p.3 10)

Haltenworth, T. H. and H. Diller 1977. A Field Guide to the Mammals of Africa including Madagascar. Collins, St. James, London.

Keywords: feral, origin

The ferret is the domesticated form of the European polecat *(Mustela putorius).* The Ferret is feral on Sardinia and Sicily as well as having been introduced with the Polecat-Ferret in New Zealand. Both are known there as the 'New Zealand Fitch'. (p. 180)

Harding A. R. 1915. Ferret facts and fancies: a book of practical instructions on breeding, raising, handling and selling: also their uses and fur value. A. R. Harding (ed.), Columbus, Ohio. 214pp.

Keywords: breeding, care, hunting

This book was written by a ferret breeder who had considerable first hand experience with ferrets. It includes a historical perspective, distribution of captive ferrets in America, practice of pest removal and hunting with ferrets, breeding, fur farming, and ferrets in Europe. What is most interesting is the absence of any mention of the high percentage of fatal bone marrow depression caused by high levels of estrogen in females with prolonged estrus.

"Ferrets are a domesticated wild animal" p. 11

"At the present time ferrets are mostly used to exterminate rats and for rabbit hunting."

"Ferrets are also used to some extent on the large Western ground squirrels, gophers and prairie dogs." p. 12

"The ferret of today, as bred and raised in America, is a slim very muscular animal and can kill animals much larger than itself." "This animal, according to naturalists, is merely a variety of the polecat, modified by effect of long continued captivity. p. 19

"Some (farmers) claim their ferrets will drive out skunks, mink, ground squirrels and other small animals." p.21

Chapter 11 describes events in Ferretville in the heyday of ferret breeding and shipping out to other states in the US and foreign countries.

"To hunt, drive and kill is a ferret's natural instinct and disposition. If a ferret has been well handled and is of proper age, very little training is necessary to make fine ratters of them."

Hart, J. 1987. Oestrogen toxicity in the **ferret. British J. Exp. Pathology 68:601-603.**

Keywords: survival in wild

This paper describes some of the effects of exposure to high doses of estrogen. "Synthetic estrogens cause marked haematological changes in the female ferret *(Mustela putorius furo)."* This "provoked protracted neutophil leucocytosis in the peripheral blood of one anoestrous ferret. This was accompanied by a moderate but progressive normacytic anaemia and latterly, thrombocytopenia. After 32 days the bone marrow showed erythroid and megakaryocyte hypoplasmia with no obvious changes in the myeloid cells. Other effects were noted and all abnormalities in this animal are typical of the female ferret in anoestrus treated with steroidal and non-steriodal oestrogens. (p.60l-2)

Hitchcock, J. C. 1994. The European ferret, *Mustela putorius*, its public health, wildlife and agricultural significance. Pages 207-212 in Proc. 16th Vertebrate Pest Conference (W. S. Halverson and A. C. Crabb, eds.) Univ. California, Davis.

Keywords: behavior, biting, disease, risk assessment

This article reviews the status of the ferret legalization issue in California. It emphasizes the risks of legalizing the ferret in California, particularly as they relate to public health concerns. Graphic photos of infants bitten by domestic ferrets are included. A summary of reported sightings of domestic ferrets in California is given.

Howes, C. A. 1980. Aspects of the history and distribution of polecats and ferrets in Yorkshire and adjacent areas. Naturalist 105:3-16.

Keywords: feral, survival in wild

"Since the domesticated ferret *Mustela furo* L. is interfertile with the polecat and as some dark forms of the polecat/ferret hybrids are externally indistinguishable from polecats confusion has occurred in the monitoring of the status and history of the indigenous polecat, particularly since the late nineteenth century. The ferret . . . is the product of selective breeding of albino polecats, white animals being chosen due to their visibility in the twilight when used to catch or flush rabbits. The earliest reference to ferrets in Yorkshire is of them being used by rabbit poachers in 1389." ... "With such an extensive history of ferret keeping in Yorkshire there would have been many occasions when animals escaped and interbred with indigenous polecats." (p. 11)

The ferrets (at time of printing of this article) were mostly kept as working pets. "Escapees from captivity and from rabbit hunting forays are frequently reported, mainly from the rural fringes of urban and particularly coal mining areas..." (p. 12)

"It is not known how long a ferrets survive in the wild. Some are relocated 'in the same warrens several months after their escape, though animals lost in regularly worked warrens are probably claimed by other ferreters and do not get the opportunity to go 'wild'. It is strange that there is so little evidence of the establishment of feral populations.". . . "Feral populations are know from the Isle of Man, Anglesey, Renfrewshire and a population was established on Mull up till at least 1951.

Hvass, H. 1961. Ferret. p136 in: Mammals of the world. Methuen & Co. Ltd. London.

Keywords: breeds

"Ferrets are the albino domesticated form of the polecat. The fur is usually white or yellowish, but polecat-colored ferrets are also found, which have been produced by matings between ferrets and polecats. Ferrets have long been used in hunting rabbits." They are found domesticated over most of Europe. (p. 136)

Jeans, D. 1994. A practical guide to ferret care. 1st ed. Deborah Jeans. Miami, Fla. (P.O. Box 450099, Miami 33245-0099).

Keywords: diet, care, threat of escape, predator

This book was written as a guide for obtaining and caring for ferrets as pets. The contents of this book are a conscious effort to provide the best care for the domesticated ferret as a pet in the home.

Chapter 2 Choosing a ferret

Reason to vaccinate your ferret for rabies "it may escape from your home and be bitten by an infected animal". (p.20)

Comments about behavior:

- "People who are unfamiliar with, or afraid of ferrets may mishandle your pet, which will sometimes create a bite situation." (p.20)
- "It is completely within the realm of possibility to find a stray ferret... a slow increase in human interaction may be necessary before a ferret will once more become outward and friendly". (p.23)

Chapter 3 Bringing a Ferret Home

"Unlike cats and dogs, ferrets simply cannot be given a free run, it is too dangerous." (p.28)

"Cage your animals when you are not at home: during parties: when guests or strangers are coming or going: or any other (unique or unfamiliar) occasion you can think of to prevent tragic accidents." (p.29)

Chapter 4 Handling and Socializing

"Since its vision is limited, always speak to your ferret in a gentle tone of voice before you pick it up. This will not only let it know you are approaching, but it will let it become familiar with your voice and its name." (p.45)

"Never grab your ferret unexpectedly!! Be careful not to make any sudden movements towards your ferret!! It may become nervous and nip if you do" (p.45)

"Warning, You must never leave an infant or small child alone with any animal, no matter how well you think you know the pet or the child. Ferrets and very young children simply do not mix and are not recommended." (p.47)

"Never hit a ferret for nipping. It will only make the ferret nervous and it may then bite out of fear." (p.47)

Another excellent aid for nipping is using a product such as Bitter Apple (or Orange, etc.) to train a ferret not to bite. It can be sprayed on your hands prior to handling. It can be put on socks and shoes for those 'ankle nippers.' It can also be sprayed along the neck and back of ferrets to prevent fighting (when introducing a new one). And finally, it can be sprayed on the mouth of a ferret that is 'hanging' onto you." (p.48)

Chapter 8 Ferret and Their Friends

"Ferrets usually will kill mice, rabbits, hamsters, birds, gerbils and guinea pigs" (p.78)

Jeffares, R. 1986. The feral ferret in New Zealand. New Zealand Wildlife 10:43-46.

Keywords: biological impact, economic value, diet, wild populations

The author looks at the utilization of the feral ferret in the "fitch" fur market. During a two year period he trapped and received over two hundred feral ferrets. There are a reasonable number of ferrets in New Zealand in the feral state. Ferrets come in three basic color variations. The darker version is referred to as the polecat although there is no record of polecats being imported to New Zealand. The ferret with white under fur and brownish guard hairs is termed "sandy in hunting circles and pastel in the fur trade". The last is the all white called the albino. All three are found throughout the country with the albinos tending to be located in more isolated pockets. (p.43)

A limiting factor to the population size of the feral ferrets is the skewed sex-ratio. There are generally five males (hobs) to every one female (jills). This may be due to the size advantage had by the male after only a few days of age. The larger males may have higher survival due to their larger size and aggressiveness. (p.45)

The ferret, unlike the stoat which kills for each meal but wastes the major part of the kill, will drag its kill to a lair or someplace for a future meal. The ferret may thus have a smaller impact on the local bird populations. (p.45)

Feral ferrets tend to live in dark, dry, draft free lairs at ground level. They may be found in old rabbit burrows, old buildings, and in holes in stumps. The feral ferret must have a permanent source of water due to its very simple digestive traits. (p.46)

Jenkins J. R. and S. A. Brown. 1993. A practitioner's guide to rabbits and ferrets. American Hospital Association.

Keywords: feral, hyperstrogenism, survival in the wild

This guide, written by two veterinarians, covers historical educational and health care of rabbits and ferrets. The domestic ferret still has wild members of its group living in parts of Europe. The natural or 'wild' color of the ferret is sable. The albino ferret also occurs naturally. In the US there are over 20 other recognized colors of ferrets that have been created like shades of silvers, pandas, black-eyed whites, cinnamon, Siamese and others.

"Female ferrets may remain in estrous for prolonged periods of time if they have not bred, which may result in hyperstrogenism. This is a disease that occurs in the intact female ferret who is in estrus. Since ferrets are induced ovulators, they remain in estrus until they are stimulated by breeding or by artificial means. The ferret may stay in estrus for six months or longer and, during this time, the body's estrogen levels remain high. This

high estrogen level can lead to toxic bone-marrow suppression that can eventually become fatal. Any ferret in estrus for one month or longer is at risk. Signs include anorexia, depression, hind limb weakness, lethargy, pale mucous membranes, and petechiae and ecchymoses present on the mucus membranes and skin. Females is estrus also develop a bilaterally symmetrical alopecia that may or may not be accompanied by the other signs." (p.71)

Kastner, D. and R. Apfelbach 1981. Effect of cyproterone acetate on the development of prey catching behavior in ferrets. Naturwwissenschaften 68:98.

Keywords: predator

In young male ferrets the killing of prey was observed between day 55 and 60 of life. By day 70 only 40% of all prey catching experiments the prey was actually killed. After day 83 all ferrets were successful in killing their prey (mice). The killing time averaged 73 seconds. Ferrets raised in isolation from day 30 on, did not consistently kill the prey until day 90.

The killing time averaged the same as those young ferrets raised in the groups. Ferrets were then exposed to antiandrogen cyproterone acetate which acted to isolate the drugged ferret from litter mates and stopped all social interactions These drugged ferrets consistently killed prey after day 89 with an average time of 290 seconds. "From day 96 on the prey catching behavior of drugged ferrets resembles in all respects that of untreated ferrets."

Kaufman, L. W. 1980. Foraging cost and meal patterns in ferrets. Physiology and Behavior, 25:139-141.

Keywords: diet

Ferrets were studied to gain information on the "generality of the relationships between the cost of access to food and the frequency and size of the meals across species differing in trophic level and niche." When food was available at all times they ate 9-10 meals a day. The ferretsincreased their food intake when the number of available meals declined. The ferrets maintained a constant level of daily food intake under the reduced number of meals. Body weights remained at normal ferret weight under all the feeding regimes. The ferrets chose small frequent meals when the access cost was reduced. The findings were similar to other species and ecological theory of foraging behavior.

King, C. 1984. Introduced predators and conservation. New Zealand Environ. 42:11-14.

Keywords: biological impact, predator

The earliest predators to New Zealand (rats, pigs, cats, dogs, and human hunters) had the greatest impact on the native species. The stoats, weasels and ferrets have "well-deserved reputations as fierce hunters of small animals (and birds) indeed they were brought here for that very reason, and they certainly look the part... the mustelids cannot be proved to be directly responsible for any of the long list of island populations of birds that we know to have gone extinct since the human colonization of New Zealand." The earliest invading predators denied mustelids the opportunity to inflict as much or more damage.

King, C. 1990. Ferret. pp320-330 *in:* The handbook of New Zealand animals. Oxford University Press.

Keywords: origin, diet, feral, biological impact, trapping

The author has done extensive studies on the mustelids in New Zealand. The ferret is the domesticated form of the polecat. There is still debate as to whether it is derived from the European *(Mustela putorius putorius)* or the steppe polecat *(M. eversmanni).* Ferrets are fully interfertile with *M. putorius* and have exactly the same karyotype; so some authorities regard them as a form of the subspecies *M. putorius.*

"Where ferrets are common, they may be seen on roads, illuminated by car headlights, or as road kills. During the day they are occasionally seen near poultry runs and in places with high numbers of rabbits." (p.323)

Introduction of ferrets began with a few individuals in 1879 and starting in 1882 thousands would eventually be introduced to combat the rabbit problem. Originally introduced in the pasture lands they spread to the forests with the help of government agents. By 1900 they were well established in the wild and had themselves come to be regarded as pests; legal protection was removed in 1903 and the first control campaigns began in the 1930s. (p.324)

"Ferrets may escape into the wild in a any country where they are kept, and small independent feral populations are known, for example, on several off shore islands in Britain (Man, Anglesey, Lewis, Arran and Bute). , New Zealand has the largest known population of fully feral ferrets." . . . "Marshall (1963) pointed out that areas without ferrets all have high (>1500mm/year) rainfall and little pasture, ie support few rabbits. No ferrets have been reported from Stewart I. or any offshore islands and it is now illegal to introduce ferrets to these places. No distribution surveys have been conducted since 1962. Ferrets are limited to pastoral habitats, especially pasture, rough grassland, scrubland and the fringes of nearby forests." (p.325)

Ferrets feed mainly on small mammals (lagomorphs, rodents, and possums), plus various other items when opportunity offers, including small birds, eggs, lizards, hedgehogs, frogs, eels, and various invertebrates (Table 53). "There is some seasonal variation in diet with lagomorphs predominant in the summer, rodents in the autumn and winter. Birds are eaten year round, though more often in the spring and summer." (p.325)

In New Zealand, little is know of the mortality of ferrets in the wild. "Ferrets in captivity can live for 8-14 years, but probably no more than 4-5 years in the wild." " Adult ferrets have few predators in New Zealand except man." (p.328)

Ferrets have been trapped in problem areas where some endangered and protected species of birds inhabit. Ferrets have been trapped successfully but "are always replaced from the outside the trapped area." Predator-exclosure fences, intensive local and seasonal trapping have improved the nesting success of the protected birds but they remain at risk to predation. The use of specific scent lures may increase the effectiveness of trapping for ferrets. "Elsewhere, the ferret apparently presents little threat to New Zealand wildlife." (p.329)

Kowalski, K. 1976. Mammals, an outline of theriology. Panstwowe Wydawnicto, Naukowe Warsaw, Poland.
Keywords: domestication, origin

"There is no strict borderline between domestic and wild animals. It is well-known that many domesticated animals easily run wild and in suitable habitats are able to exist and reproduce without man's care." (p.238) . . . "Domestic forms zoologically belong to the same species as their wild ancestors although often for the sake if convenience a separate Latin species name is given to them." (p.239).

"The ferret, *Mustela putorius furo* L., is an albinotic, domesticated form of the polecat. It was known as a domestic animal in Palestine some 1000 years BC and was used for fighting rodents and for hunting rabbits.. In Europe the ferret has been known since the Middle Ages. The famous painting by Leonardo da Vinci known as "The Lady with a Weasel" in the National Museum in Cracow actually does not depict a weasel but a ferret. The ferret's role in fighting rodents was gradually overtaken by the domestic cat, *Felis catus* L." (p.244)

"The ferret is the bred albino form of the polecat *(Mustela putorius)."* (p.533)

Lavers, R. B. 1973. Aspects of the Biology of the Ferret, *Mustela Putorius Furo* L. at Pukepuke Lagoon. pp7-12 *in:* Proceedings of the New Zealand Ecol. Soc., Vol 20.
Keywords: survival in the wild

Data from live trapping in the Pukepuke Lagoon showed that 76 (43%) of all captures were adult males, 33 (18%) of adult females and 69 (39%) of juveniles. (p.8) The population size in the study area fluctuated widely as new animals moved in and others disappeared. (p. 11) "Females appear to be resident for longer than the males, and there are more transient males than females." The females had smaller home ranges, although less well defined, but occupy them for a considerable time. Females did not appear to exhibit territorial behavior. Ranges of different females sometimes overlapped and size of these ranges varied greatly in size. (p. 12)

Lever, C. 1985. Weasel, stoat, polecat, ferret, polecat-ferret *(Mustela nivalis, Mustela erminae Mustela putoris, Mustela furo, Mustela putorius furo).* pp 9-64 *in:* Naturalized mammals of the World. Longman, New York. 487 pp.
Keywords: survival in wild

British Isles: The polecat-ferret is a cross between the polecat and domestic ferret. The presence of feral polecat-ferrets is "the result either of escaped albino ferrets breeding with wild polecats or are escaped dark or

partially colored animals which man has produced deliberately by crossing the domestic albino ferret with the wild polecat." (p.60)

The presence of feral polecat-ferrets on the island of Mull, off the west coast of Scotland, is due to escaped polecats and ferrets that were previously kept in domestication. They eventually became pests on the island preying on rabbits, ground nesting wild birds and domestic poultry. On the island of Harris they are believed responsible for the extirpation of the ptarmigan *(Lagopus mutus).* There are also thriving populations on the Scottish islands of Arran, and Bute, on the Isle of Man in the Irish Sea and on the Isle of Anglesey off the Coast of north Wales, as well as in the Renfrewshire and parts of Yorkshire. (p.60)

New Zealand: Presence is due to massive introductions for control of the introduced rabbit. It started in 1867 with only five ferrets and over the next 6 years a handful more were released. During 1882-3 there were 3300 ferrets released and over the next 15 years hundreds of weasels and stoats were released. Ferrets appear to have a restricted range here. They are locally distributed on "both main islands preferring dry brush, paddocks, dried-up riverbeds and open tussock land: being poor tree climbers their range is apparently largely governed by the distribution of rabbits." (p.62)

Lewington, J. H. 1988. Ferrets a compendium in Vade Mecum, series for domestic animals University of Sydney Post Graduate Foundation Veterinary Science. Craige, W. Australia.

Keywords: care, diet, ferreting predator, hyperstrogenism, threat of escape

This compendium on ferrets is from a series on domesticated animals. It gives a very thorough description of the nature of pet ferrets and a good description of the responsibilities required by pet ferret owners. The author is a veterinarian who favors the ferret as a pet.

Nature of ferrets: Ferrets must be kept away from poultry. (p.1)

"Ferrets, while in a household situation, will kill mice and keep the garden free of vermin." (p.1)

"Ferrets can bite but usually only nip in play. When a ferret bites the teeth sink in and the jaw locks. This hurts and is as painful as a kick by a horse." (p.3)

"Ferrets dig, but normal asbestos fenced garden with a solid garden gate flush to paving stone surrounding the yard is required." (p.4)

Ferrets can climb except directly vertical. Avoid having plants and other objects that lean at an angle against the fence. (p.4)

Ferrets jump, like from a solid base of the roof of a shed that provides a great platform from which to vault to the neighbors yard or just outside of yours. (p.4)

"Ferrets are animal Houdinis." (p. 16)

"Ferrets are very prone to heat stroke."

"Female ferrets if not mated may experience estrus anaemia."

Ferrets and ferreting:, "Have your ferret hand trained and willing to come on a whistle. Then with no previous training take your pet ferret out to a previously selected warren, cover all entrance holes with purse nets and then "slip your ferret into one of the holes and stand back to wait quietly." This accounting mentions no previous exposure to training before this experience. (p.31)

Linn, I. 1958. Carnivores. The Mammalian Society of the British Isles. Bulletin 9:4-7.

Keywords: detection in the wild

Mink had been escaping from fur farms for many years, but only recently have established breeding feral mink populations been discovered. Many of these carnivores are nocturnal terrestrial predators and detection of them by the novice can be difficult. Some of the sensory equipment of these carnivores is more acute than ours. Other senses like sight, are poorer and this may be an advantage in discovering them. Carnivores are also creatures of habit and follow routines and paths that can be detected once the observer knows what to look for. What follows is a plan to observe and collect data about the carnivore of your interest.

McKay, J. 1989. The Ferret and Ferreting Handbook. The Crowood Press, Ramsbury, Marlborough, 140pp.
Keywords: diet, hunting, origin, survival in the wild

This book is about ferrets and ferreting (hunting with ferrets to flush out prey). The book has some good recommendations and equipment for retrieving your ferret when your ferret fails to return from the hunt and stays underground.

Accompanying this summary is a three page photocopy regarding the origin of the domesticated ferret (p. 13-14) and training them to hunt (p.25). The author describes capturing an escaped pet ferret "which had been living in the wild in some allotment gardens in Yorkshire" and "He had obviously gotten used to being his own boss". (p.15)

Feeding suggestions included dog food, dry foods and chickens in the form of: giblets which are available at the market; poultry, which is available at poultry farms especially in the from of male chicks. (p.37-38) Fish are also relished (p.38) and eggs are recommended as an occasional treat. (p.39)

Mannix, D. P. 1967. A sporting chance: unusual methods of hunting. E. P. Dutton & Co., Inc. New York.
Keywords: hunting, vermin control

The author recounts his visits to the largest breeder in Ohio and relates his first experience of witnessing ferrets being used in ratting.

> "Ferrets were brought to this country in 1875, and soon proved so popular that the demand greatly exceeded the supply." p.91
>
> "Ferrets were not only used on rats and rabbits (their only quarry in Europe) but on just about every animal that has been bolted from burrows." p.91
>
> "Using ferrets on wild game is illegal in most states, but as Dick Farnsworth (ferret breeder) remarked, 'It's mighty funny how right before the hunting season we get a big rush on orders from all over the country." p.96
>
> "They did occasionally bite, but never maliciously. I doubt if they could see more than three feet, so they depended almost entirely on their noses." p.99

The author then describes how his pet ferrets successfully took out a colony of muskrats that were undermining the banks of their pond. This took place in spite of the fact that possession of ferrets was illegal in the state in which he resided. A few days after the muskrat problem was solved, game wardens visited his farm and confiscated the pet ferrets. p.100

Mathews, L. H. 1982. Mammals in the British Isles. Collins, St. James Place, London
Keywords: origin

"The ferret is the domesticated form of the polecat *Mustela putorius*, perhaps with some hybridization with the Steppe polecat of eastern Europe which may be more specifically different; as it breeds successfully with the polecat, and some specimens cannot be distinguished either by color or skull structure, the specific name *Mustela furo*, for it seems superfluous. Albino ferrets are popular with the breeders and users of these animals." (p.32)

Miller, G. S. 1912. Catalogue of the mammals of Western Europe. British Museum, London.
Keywords: origin

"The ferret is referred to by the author as *Martes furo* (Linnaeus) and though usually assumed to be a domesticated variety of *Mustela putorius*, appears to be related to the Asiatic *M. eversmanni* Lesson." This is due to more similarity in their skulls.

Morton C., and F. Morton. 1985. Ferrets: Everything about purchase, care, nutrition, diseases, behavior, and breeding. Vriends, M. M. (Consulting ed.). Barrons Publishers, Woodbury, New York. 72 pp.
Keywords: care, disease

This book is written by the two biggest ferret breeders in Pennsylvania. The contents include purchase, care, nutrition, diseases, behavior, breeding and some historical perspectives. The details appeared to influenced by their

economic gains and differ from most scientific findings. Ferrets do escape from the home. “We frequently get calls saying my ferret is lost. What should I do?” (p.35) Suggestions by the authors encourage owners to contact neighbors, stores and other public places.

“Aplasmic anemia and septicemia- two diseases that are the direct result of prolonged heat in females- are the leading causes of death in female ferrets.” (p.41) “If a female is not spayed or repeatedly bred there is about a 90% chance that she will die in the first heat season.” (p.48) (Ryland and Bernard (1983) (Bernard et al. 1983) state that the risk of death due to prolonged estrus for the female ferret is from 20%- 50% not 90%.)

The authors encourage a diet of cat food in dry and moist forms, which include well known commercial brands.

Included is a brief description of the history of ferrets with references to their domestication as far back as the time of the Egyptians and the use of ferrets in hunting and ratting. “It is only fairly recently that so many people have ‘discovered’ what wonderful pets ferrets can be.” (p.62) The following statements pertain to establishment of ferrets in the wild. “Another misconception is that ferrets will establish in the wild. Ferrets have been in the United States in large numbers for over 300 years and have never been able to do this. There are no wild ferret colonies anywhere in the world.” (p.63)

Ferrets do not have a very well developed sense of sight. “Because ferrets are interested in everything, they can be difficult to train. You are competing with a multitude of things for their undivided attention.” (p.65)

Murray, D. 1992. Mackenzie Basin black stilt area predator control. pp52-53 *in:* Proceedings of the National Predator Management Workshop. 13-16 April, Craigieburn, Canterbury. Veitch, D., Fitzgerald, M., Innes, J. and E. Murphy (Eds). Threatened Species Occasional Publication No 3.

Keywords: *predator*

The presentation from the Proceedings of the National Predator Management Workshop describes the attempts by wildlife management to protect the endangered Black stilts *(Himantopus novaezelandiae)* in New Zealand from predators. “Predation by introduced mammals (cats *(Felis catus),* ferrets *(Mustela furo),* stoats *(Mustela erminea)* and rats has been the main cause of decline.“... “Eggs and chicks are particularly vulnerable to predation and nesting adults are occasionally preyed upon.” (p.52)

“Trapping to reduce predator numbers is carried out around some nests during incubation and chick rearing period. Leg hold, Fenn and cage traps have been used. Leg hold traps are the most effective type as they have the ability to catch and hold all predator species.” . . .“Traps are baited with fresh meat, mainly rabbit, and are replaced as required. Traps are checked daily and old baits and trapped animals are removed from the area.“ (p.52) Table 2 accounts for all predators caught in traps.

“As a management technique predator trapping is very labour intensive and costly. It provides seasonal protection only with no follow effect. It is believed to be biologically, if not statistically, effective as a short term boost to chick protection in a species so rare that every chick counts. In the long term other methods of eliminating or excluding predators are required.” (p.53)

Norbury, G. and E. Murphy 1996. Understanding the implications of Rabbit Calicivirus disease for the predator/prey interactions in New Zealand: A review. Landcare Research, Contract Report LC9596/61. 28pp.

Keywords: *predator*

The objective of this review is “to identify impacts of predators on other species when rabbit numbers are reduced in a range of New Zealand ecosystems... to identify and develop recommendations to minimize any potential conservation impacts caused by a widespread reduction of rabbit numbers due to rabbit calicivirus disease (RCD)“. (p.5). Main Findings (p 5-6)

“Any impacts that the RCD-induced declines in rabbit numbers may have on the native fauna will depend on the number of complex ecological interactions. These include the impact of RCD on the rabbit populations; the response of vegetation and improvements in the habitat for native fauna; the functional and numerical responses of rabbit predators (ferrets, cats, harriers, and to some extent, stoats) to rabbit population declines; the flow-on

effects of these responses on native fauna; changes in predator guilds if rabbit predators decline; and the impact of new predator guilds on native fauna"

"Five major habitat types were identified that contain a total of about 20 native animal species currently threatened and vulnerable to increased predation after rabbit declines. Habitat types included semi-arid tussock grassland/river bed habitat, coastal areas bordering semi-improved pastures, open forest valleys, forest/scrub/pasture mosaics and wetlands. With the current evidence predators will shift to some native fauna after RCD outbreaks in the tussock grassland and semi-improved pasture habitats. The evidence also indicates declines in the predator densities in the rabbit-prone tussock grasslands, semi-improved pasture, and possible predator density declines in open forest valley habitat. (p.5)

"The overall effect on native fauna is unknown but early indications are that stoats and rats are more serious conservation pests than ferrets and cats. (p.6)

Table 2 indicates the diet shifts of rabbit predators after RCD. In the semi-arid tussock grassland ferrets would shift to increased predation of lizards and invertebrates. In the semi-improved pasture ferrets would increase their predation on birds after RCD. After RCD predator decline would decline from 60-90% largely as a result of decrease in recruitment from ferrets and cats. Table 3 lists those predators experiencing declines by habitat with ferrets declining in all but the open forest floor where they already are at low densities. Table 4 lists native species most at risk from predators in each of the previously mentioned habitats.

Heyward and Norbury (1995) found that the decline in predator densities outweighed the shift to native species in semi-arid tussock grasslands. The three-fold increase in predation of common skinks was offset by the 71% decline in predators (ferrets and cats) after RDC. The result was 87% of the original predation. (p.19)

Nowak, R. M. and J. L. Paradiso. 1983. Walker's mammals of the world. 4th edition. Vol. II. Johns Hopkins Univ. Press, Baltimore.

Keywords: origin, feral, hunting

"The domestic ferret, sometimes given the subspecific name *Mustela putorius furo,* is thought to be a descendent of the European polecat. It was bred in captivity as early as the fourth century B.C. It is usually tame and playful, and is used to control rodents and drive rabbits from their burrows. It is now found in captivity in much of the world. Unlike the wild polecat, it is generally white or pale yellow in color. Both the domestic ferret and the polecat were apparently introduced in New Zealand, and large feral populations are now established there." (p.992)

Owen, C. 1969. The domestication of the ferret. pp489-493 *in:* Proceedings of Research Seminars in Archaeology and Related Subjects, Institute of Archaeology, London University.

Keywords: origin

The first reference with any probability relating to the ferret was by Strabo (about 63 B.C. to A.D. 24). This reference was to "a Libyan animal, bred purposefully, muzzled and put into rabbit holes to flush out rabbits." The use of the ferret for rabbit catching would appear to have been the reason for domestication of this somewhat troublesome animal and its use is associated with the spread of the rabbit as a semi-domesticated food animal and, later, a feral species." (p.489) "The use of the ferret for killing rats is not mentioned until later."... "Pliny (A.D. 23-79) mentions the rabbit as does the reference in A.D. 600, by Isidore of Seville, to ferret and rabbit hunting ...references are then scarce until medieval manuscripts." (p.490) "The original ferret was undoubtedly the color of a wild polecat and we do not know at what period the break to white occurred." (p.491)

"The ferret's ancestor is the wild polecat. There are two forms- the eastern and western." Attempts to equate with one of these wild forms has mostly depended on comparison of skull measurements, and opinions have varied. The author, although unable to obtain a live specimen of the eastern form, still believes both the eastern and western forms were domesticated, (p.49 1) What continues is an additional historical perspective of the origin of the ferret although these accountings shed little additional evidence.

Poole, T. B. 1972. Some behavioral differences between European polecat, *Mustela putorius*, the ferret, and their hybrids. J. Zool. London, 166:25-35.

Keywords: *behavior*

The author tested for behavioral differences between the polecats *(Mustela putorius),* ferrets *(Mustela furo)* and their hybrids (polecat-ferrets). All the mustelids, but 7 of the hybrid polecat-ferrets, were tamed animals raised in captivity. Those 7 hybrids were identified due to a cross between two of them that produced albino offspring. "The albino gene is rare in the wild polecat, while common amongst the domesticated ferret. All the hybrids used in the study resembled the polecat, rather than the ferret in their appearance." (p.27)

"The polecat shows extreme caution while exploring unfamiliar environments; it takes frequently to cover, uses definite pathways in the immediate vicinity to its home range and regularly returns to its home area after making forays into unfamiliar territory. The ferret, on the other hand, shows what Hediger termed 'spatial emancipation' of the domesticated animal. When moved to an unfamiliar cage or area it shows no sign of fear or disorientation. The F1 hybrids between the two species tend to be generally more like *M. putorius* in the caution which they display during exploration but resemble the *M. furo* in showing spatial emancipation." (p.28)

Fear of man does not develop in wild polecats and the F1 hybrids if they are removed from their mother at any time prior to the second day after their eyes have opened. The presence of the mother therefore facilitates the development of a fear of man in the young even though the mother may, herself, appear to be quite unafraid of human beings.". . . " It seems possible that the phenomenon of imprinting may be involved." (p.29)

The results showed that "as compared with the European polecat or F1 hybrids, the ferret is less alert, unafraid of man, tolerant of drastic changes in environment and shows less neophobia." ... "Young polecats and F1 hybrids grow out of the juvenile stage by developing the alertness and fear of man which is characteristic of the wild animal whereas ferrets never reach that stage." (p.35)

Poole, T. B. 1973. Aggressive behavior of individual male polecats *(Mustela putorius, M. furo* and hybrids) towards familiar and unfamiliar opponents. *J. Zoo & Lond* 170:39--414.

Keywords: *survival in wild*

The experiment here was to "investigate the significance of individual differences in aggressiveness between polecats and the relation between the familiarity of the opponent and the pattern and outcome of fighting." (p.396) The animals used in this experiment were the "polecat *(Mustela putorius),* the ferret *(Mustela furo)* and the F1, F2 and F3 hybrids between the two species.. No differences in social behavior were detected between the species and the animals are all referred to as polecats." (p.396)

The results can be discussed under three headings, namely fighting and intimidation of the opponent, the importance of individual differences in aggressive interactions and the relation of the formation of rank order to the familiarity of the opponent. "Three types of fighting are found in polecats namely play-fighting, uninhibited fighting and companion fighting."

"Of the three types of fighting found in polecats only uninhibited fighting shows uninhibited biting and this is the only type of fighting associated with intimidation of the opponent." (p.409) The results, of this study show that the dominant subordinate relationships of polecats are related to their familiarity rather than expertise in fighting. Familiarity in polecats is more than simply recognition of a well known individual. Uninhibited fighting occurs even after mates have been caged together for three months prior to experiments. After separation of only two days they treat each other as aliens and form a rank order. "The polecats showed some of the characteristics of behavior which are present in animals with true hierarchies but they showed little cohesive behavior. Under the conditions of captivity the polecat may show some characteristics of social animals even though it is generally believed to be a solitary animal. It is possible that the socially oriented aspects of the polecat's behavior originally facilitated its domestication." (p.411)

Ragg, J., H. Moller and K. Waldrup, 1995. Aspects of bovine tuberculosis *(Mycobacterium bovis)* infections in feral populations of ferrets *(Mustela furo),* stoats *(M. erminea)* and cats *(Felis catus)* in Otago and Southland, New Zealand. Page 497 *in* Proceedings Joint Conference American Association of Zoo Veterinarians, Wildlife Disease Association, and American Association of Wildlife Veterinarians, August 12- 17, 1995, East Lansing, Michigan. (Abstract).

Keywords: disease

Twenty-one areas around the Otago region on South Island, New Zealand were surveyed for the presence of signs of *Mycobacterium bovis* infection (Tb) in feral cats, ferrets and stoats from 1993-1994. Animals were necropsied for Tb lesions. Both Tb free and Tb positive areas were surveyed. No infected feral cats, ferrets, or stoats were found in Tb free areas , but were all found in Tb endemic areas. The "prevalence rates in Tb-endemic areas were 0.5% (n=214) for cats, 17.6% (n=544) for ferrets, and 4.55% (n=66) for stoats. More adult ferrets were infected with Tb compared to juvenile (2.5%) ferrets (Chi-square, $p < 0.001$) and a higher proportion of male ferrets (14.8%) were infected with Tb than females (9.5%) (Chi-square, p=0.029)" (p.497)

Roots, C. 1976. Animal Invaders. Universe Books, New York.

Keywords: predator, survival in wild

"Most of the deliberate releases of these aggressive small mustelids, and the related polecat and domestic ferret, were as biological controls, mainly to combat rabbits, mice and rats. None accomplished even this primary task with success, and they destroyed far more than just vermin. The introduction of the weasel and ferret into New Zealand-- and foxes, cats dogs, and other carnivores into many countries-- cannot under any circumstances be considered successful, They all failed to control the pest species and caused much heartache with their own depredations on native animals." (p.109)

"Stoats are now numerous in a wide variety of habitat, and are the commonest and most widely distributed of the introduced mustelids. With no native carnivores in New Zealand, the major control agents are feral cats and even the introduced ferrets. This poses a problem in the 400,000-acre sanctuary established for rare flightless notornis, for neither feral cats nor ferrets are welcome there. The cream-colored ferret is a domesticated descendent of either the Asiatic or European polecat, but can soon revert to its wild form." (p. 108-110)

Russell, W. C., E. T. Thorne, R. Oakleaf, and J. D. Ballou. 1994. The genetic basis of black-footed ferret reintroduction. Conservation Biology 8:263-266.

Keywords: Black-footed ferret, survival in wild

After removal of a small number of wild ferrets for captive breeding programs failed due to the animals contracting canine distemper, all wild black-footed ferrets *(Mustela nigripes)* were removed from the wild. A captive breeding program started with 18 individuals in 1987. "A total of 49 black-footed ferrets (32 males and 17 females) were selected for release in 1991. ".... "The success of the introduction is not totally known at the time of the writing of this paper. By December 1991, a minimum of 10 black-footed were thought to have survived. Survival for 30 days by at least 25% of the reintroduced animals is very encouraging. Natural mortality during the first year in the wild is very high (Forrest et al. 1988). In July 1992 two wild-born litters were identified, providing great hope that reintroduction will be successful." (p.265)

Ryland L. M., and S. L. Bernard. 1983. A Clinical guide to the pet ferret. The Compendium on Continuing Education for the Practicing Veterinarian 5:25-32.

Keywords: disease, hyperstrogenism, survival in wild

"There are two varieties of ferrets, based on coloration: fitch ferret are buff with black masks, feet, and tails: albino ferrets are white with pink eyes. The albino phenotype and color mutants (e.g. Siamese and silver) are recessive to the fitch. Female ferrets are called *jills* and males, *hobs.* Baby ferrets are *kits."(p.25)* "Ferrets typically have genial personalities and adapt well to human companionship, particularly if they are raised from infancy in close human contact." (p.26)

"Estrous females have high endogenous estrogen levels which cause a. greater than 50% prevalence of fatal bone marrow depression." (p.28) "One of the most common clinical problems seen in pet ferrets is bone marrow depression associated with prolonged estrus. There is a greater than 50% prevalence of this disorder during the months of April through July in intact nonbred females. Bone marrow depression is due to high endogenous estrogen levels during estrus, producing pancytopenia." . . . "Pancytopenia predisposes animals to secondary bacterial infections and bleeding disorders." (p.30)

Ferrets are highly susceptible to canine distemper." (p.29) The case fatality rate approaches 100%.

Smallwood, K. S. and T. P. Salmon. 1992. A rating system for potential exotic bird and mammal pests. Biological Conservation 62: 149-159.

Keywords: rating system

"A rating system was developed to prioritize research and control efforts for preventing species invasions and eradicating established exotic pests. Four rating criteria were the species potential (1) to be introduced; (2) to establish: (3) to cause damage: and (4) to be controlled. Each species was rated independently for each criterion and these ratings summed to provide a total score. The system was developed with 24 exotic bird and mammal species with well-known invasion and pest histories. It was then run on 14 of the California Department of Food and Agriculture most wanted exotic species list. The European ferret scored 25 out of a total 27 points. "A quick response apparatus was also developed to provide information on perceived exotic species threats. It consisted of a data base of expert contacts and citations on exotic pest species damage, biology, ecology and control technology."

Smith, G. P., J. R. Ragg, H. Moller, and K. A. Waldrup. 1995. Diet of feral ferrets *(Mustela furo)* from pastoral habitats in Otago and Southland, New Zealand. New Zealand J. Zool. 22: 363-369.

Keywords: biological impact, diet, feral

This study focused on the diet of carnivorous ferrets *(Mustela furo)* of New Zealand to determine their impact on the endemic species as a potential conservation threat. Results of necropsies on 277 ferrets showed that lagomorphs comprised the largest contribution by weight (77.1%) and were found in 65% of the ferrets' guts. Birds contributed only 8.2% by weight, and were found in just 13% of the ferrets' guts.

Eighteen different bird species were identified which included eight Passerines, two Anseriformes, two Falconiformes, and six unknown. There was no significant difference between the diets of males and females. Only 51% of the ferrets had identifiable prey items in their guts. This may be due to the fact that mustelids have a very quick passage time of between 142 to 203 minutes.

Results of this study confirmed past studies that although lagomorphs are the main prey item ferrets are "opportunistic generalist predators". There was no data indicating the prey densities for this study which may have better supported this statement of ferrets as being opportunistic generalist predators.

Table 3 demonstrates variability of diet of the feral ferrets in the various studies conducted.

Stevens, W. F. 1975 The biology of the European rabbit, *oryctolagus cuniculus,* on San Juan Island, Washington. Unpublished Master of Science thesis, University of Washington, WA.

Keywords: detection in wild, feral, predator, rabbit control

Incidental observations of feral ferrets on San Jaun Islands were made during a study of European rabbits,

Stevens, W. F. 1982. Observation and analysis of European rabbit *(Oryctolagus cuniculus)* crash on San Juan Island and in San Juan Island National Historical Park, Washington. Report to National Park Service, Pacific Northwest Region.

Keywords: detection in wild, feral, predator, rabbit control

Incidental observations of feral ferrets on San Jaun Islands were made during a study of European rabbits. Ferrets were not believed to be the cause of rabbit population decline.

Suminski, V. P. (1989) The predators of Europe - population and endangered status. Z. Jagdwiss. 35:77-85 (in german with english summary).

Keywords: biological impact, predator

"A survey in 1987 indicated the presence of 36 predator species in Europe including three domesticated species. The domesticated predators were the dog, cat and the ferret. The survey also includes data on distribution, the average annual hunting kill, and the endangered status of the individual species." (p.84)

The New Hunter's Encyclopedia. 1966. Third edition. Stackpole Books. Harrisburg, PA.

Keywords: ferreting

Ferreting is a popular sport in Europe, that originated in Asia. It is not a common sport in America due to laws against its practice. Ferrets are thought to have been derived from a cross between the Asiatic strain and the European species. "The training consists of little more than bringing the ferret into top condition by restrictive feeding and breaking it to handling." "There are three practices used for ferreting: two for rabbits and one for rats." (p.958)

"Ferrets are carnivorous animals and under natural conditions eat raw meat but when not being used for hunting may be fed much the same food as a house cat." (p.959)

Walton, K. C. 1967. Some aspects of polecat biology. The Mammalian Society Bull. 28:7-8.

Keywords: origin

The paper focuses on the status of the polecat *(Mustela putorius)* in Britain. Although there has been much in the literature "that the escaped ferrets have destroyed the status of the truly wild polecat, the wild population was found to be very uniform. It may be true that ferrets are escaping and breeding with the polecats, but the polecat has been able to retain its dark marking and "shows a distinctive parallel-sided brain case in marked contrast to the constricted post-orbital region of the ferret." (p.7) The paper continues with descriptions of distribution, breeding behavior and diet of the polecat.

Weisser, P. 1991. Ferrets - playful pets or health menace? *Outdoor California,* Mar. - Apr. 1991.

This article reviews the history of ferret legalization in California.

Welchman, D., M. Oxenham, and S. H. Done. 1993. Aleutian disease in domestic ferrets: diagnostic findings and survey results. The Veterinary Record 132:479-484.

Keywords: disease

This study was undertaken after an initial diagnosis of Aleutian disease (AD) in six domestic ferrets that belonged to the Wessex ferret club (UK). Subsequent examinations were of the other 446 ferrets in the club revealed that 8.5% of the ferrets were seropositive and also had AD. This was the first reported incidence of AD in the UK. Spontaneous Aleutian disease has been reported in non-domestic ferrets in the US, Canada and New Zealand. There were 13 possible sources for the AD virus transmitted to the ferrets of the Wessex club. One particular ferret had been thought to be the main vector. This ferret had been reared in close proximity to mink. The exact source of the virus is difficult to determine because of the "frequent interchange of animals between owners" and the anecdotal information is not always accurate.

Wellstead, G. 1981. The ferret and ferreting guide. David & Charles, London. 157pp.

Keywords: crossing breeds, escape, feral

The author suggests that the ferret is a descendent of the European polecat. They are so close that colored ferrets (usually known by ferreters as polecats, and referred to as polecat/ferrets by the author) are often completely indistinguishable from their wild brethren. "They interbreed readily, the offspring are all fertile and their chromosome count is identical. Released from captivity, the ferret (if it survives) quickly reverts, and in a generation or two, is absorbed into the wild population."

"The European polecat, as a wild and free creature in the UK, is only found in the more remote parts of the west and central Wales. Those that have spread eastwards are often considered to be feral ferrets or deliberately introduced, captive-bred wild stock. Those animals found in and around the border counties often seem to have more white hair, which suggests a watered-down type of the wild stock owing to polecat-ferret escapees mixing with the lower numbers of truly wild animals. In heavily populated areas very large numbers of ferrets, both white and coloured, escape every year. A check with the local police following the escape or unauthorized release and deliberate shooting of one of my own animals revealed that three ferrets are reported found every two weeks or- put another way, seventy-eight per year, and that in one suburban town. How many escapees are not found, one wonders? Certainly a great many do not survive for one reason or another." (p.12)

This author refers to his pet polecat and its keen ability to hunt with him.
"In the last forty years or so the ferret has changed from being a pure-and-simple working animal and takes on other roles. The number of working animals now runs second to those kept as laboratory animals. Two other types of ferret-keeper have also emerged: the fur breeder and the pet owner."... "Ferrets are becoming increasingly popular as pets. In the US and Canada they fetch high prices as exotic pets. In the US it is against the law to use ferrets as working animals and therefore those that are kept must live as pets"... "Ferrets make very good pets provided you take sensible and reasonable precautions."

Ferrets "pocket-sized Houdinis" are notorious for escaping and all precautions should be taken to prevent this from happening. With this said the author states Over the years it is almost inevitable that one or two (ferrets) will escape.

For food "ferrets fare best on a diet of fresh meat, preferably whole carcasses. Wild polecats are amazingly catholic in their choice of food and an analysis of their stomach contents, coupled with observations of animals in the wild state has shown that their diet, in addition to rabbits and other small mammals, extends to soft fruits, molluscs, fish, birds' eggs and if occasion presents itself, the birds themselves." (p.31)

Extended estrus in females: It is not uncommon for unmated jills (females) to go out of heat after a short time and into a phantom pregnancy. Some even produce milk and will, if given the chance, rear orphan kits: or if housed with a nursing jill they will assist with the upbringing of the family. More often, though, the jill will stay in heat unless mated and for generations, ferret breeders have believed that unless you allow a jill to have a litter by her second season she will sicken and die. It is true that a number of unmated jills do die each year but I don't know anyone who has taken a jill for postmortem examination and been told: 'your jill died because she was not bred from'!

Falcons with ferrets: The goshawk and the Harris hawk in the US are two of the most commonly used birds for falconing for game like rabbits and similar sized game using ferrets.

Willis, L. S. and M.V. Barrow. 1971. The ferret *(Mustela putorius furo* L.). Lab. Anim. Sci. 21:712-716.
Keywords: predator

"The ferret *Mustela putorius furo* L. has been described as a vicious and dangerous laboratory animal. After extensive experience with this carnivore, we have found this description to be a myth." What follows is a description of the assets of using ferrets in bacteriological and virological studies. The authors make the distinction between the domesticated ferret and the endangered black-footed ferret. The author encourages that ferrets be fed meat in addition to commercial dry cat food, canned cat and dog food (preferably horsemeat). "Occasionally live food has been supplied (mice and chicks), but if the ferret is otherwise well fed, it will usually kill but not eat the kill."

Wilson, G., N. Dexter, P. O'Brien, and M. Bomford. 1992. Pest Animals in Australia: A survey of introduced wild mammals. Bureau of Rural Resources and Kangaroo Press. Australia. 64pp.
Keywords: hunting, wildpopulations

Although the ferret is popularly used in rabbiting the ferret is not widely distributed in Australia. There exists an isolated population of ferrets to the south of Launceston in Tasmania. (p.58)

Woodford, M. 1967. A Manual of Falconry. Adam and Charles Black, London.

Keywords: hunting

This manual on falconry contains a brief description of the use of ferrets in flushing out rabbits and other burrowing mammals for their hunting falcons. The ferrets are a valuable asset when "the buries chosen are isolated and reasonably small and the ferret used should be a white one." . . . "The reason for using a white ferret is that the hawk might easily mistake a polecat ferret for a stoat and be tempted to take it." (p. 114)

Wywialowski, A. P. 1987. Habitat structure and predators: choices and consequences for rodent habitat specialists and generalists. Oecologia (Berlin) 72:39-45.

Keywords: predator

Domestic ferrets were used as the mammalian predator in an experiment on risk of predation and its influence in rodent population composition in different habitats. Only two adult ferrets, one of each sex, were used in these experiments. A single ferret was first given a minimum of 15 minutes to explore each trial arena, prior to a mouse being released into the arena. After the ferret was removed, a mouse was placed in the arena to explore. At the end of the mouse's exploration the ferret was place in the arena and the capturing event by the ferret was timed. "Mice were taken from the ferret after capture to prevent complicating the subsequent trials by using a progressively more sated ferret." (p.41)

Zeuner, F. E. 1963. The Ferret. pp 401-403 (Chapter 17) *in:* A history of domesticated animals. Hutchinson of London.

Keywords: origin

"The ferret is one of the domesticated species the history of which is not evidenced by fossil remains" (p.401).

"The ferret *(Putorius putorius furo* L.) is closely related to the common polecat *(Putorius putorius)* and is usually regarded as the domesticated form of this animal, which is widely distributed in western and northern Europe. "Miller (1912), however, pointed out that the characters of the ferret's skull are closer to those of the steppe polecat than to those of the original European species. An early historical perspective on the domestication and literature references originates with the Greeks and continues through Linnaeus' description, in 1758, of *Mustela furo* a species distinct from the wild polecat (p.403).

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