

Why own an exotic pet?

F. Moutou⁽¹⁾ & P.-P. Pastoret⁽²⁾

(1) Agence Française de Sécurité Sanitaire des Aliments (AFSSA), Laboratoire d'Etudes et de Recherches en Pathologie Animale et Zoonoses (LERPAZ), 23 Avenue du Général-de-Gaulle, 94706 Maisons-Alfort, France

(2) World Organisation for Animal Health (OIE), 12 rue de Prony, 75017 Paris, France

Summary

Even though people have owned a wide variety of companion animals since times of old, the modern craze for increasingly exotic and little-known species raises a number of questions, including some of an ethical nature. While trade in exotic animals is certainly profitable for those who practise it, it poses great risks of varying types: ecological risks, threats to biodiversity conservation and health risks. Several introduced animal populations have gone on to establish a line in their new host country. We are just starting to measure the adverse impact this has had, in some cases on a very large scale. The veterinary profession doubtless has a major role to play in endeavouring to reform this trade in living creatures that unfortunately results in many losses.

Keywords

Biodiversity – Companion animal – Ecology – Ethics – Exotic species – Health implications – Risk – Trade.

Introduction

The presence of companion animals certainly predates that of domestic animals. Still today, most of the remaining human populations of hunter-gatherers that do not keep productive livestock have companion animals, for the most part mammals or birds. The reasons are complex. Does this explain the continuing craze of people in the world's most developed countries for new, ever-more exotic, companion animals? It is a question that calls for further examination. Is it an age-old instinct, a much more contemporary fashion, or a need to 'return to nature' at a time when more than half the human population is living in urban areas, or maybe just pure consumerism? In fact the answers are not necessarily mutually exclusive. All these are fields of enquiry to be explored and re-explored. However, apart from the ethical, ecological, social and economic aspects associated with trade in exotic animal species, there is a further area of concern, which is less often mentioned but could very soon take on more importance. It is the health consequences of these species movements.

It is readily accepted that, in the process of successfully marketing just one unusual companion animal, numerous other individuals of the species may well perish. We also know that the animal can later escape, or else be

deliberately released into an environment totally alien to its country of origin, and contribute to the phenomenon of biological invasion. What many people fail to consider is that these animals can harbour a number of agents that are potentially pathogenic for their owners and for other domestic or wild animal species in the host country.

A special case that is not discussed at length here is that of species for zoological gardens. Their situation is different because they cannot truly be considered companion animals. The movements of zoo animals are not always commercial, they tend to be supervised and the zoo of destination acts as a *de facto* quarantine facility. Nevertheless, a few fairly recent examples illustrate the type of health situations that need to be prevented. In 1987, African horse sickness arrived in Spain, evidently carried by two imported zebras from southern Africa. They were bound for a zoo on the outskirts of Madrid. The disease was successfully eradicated in 1989. In 1988, New World screwworm (*Cochliomyia hominivorax*) was identified in Libya. The precise circumstances of its arrival in North Africa remain unclear. The most likely hypothesis is the importation of a zoo animal from its native home in South America (3, 6). In this case, too, the disease was successfully eradicated. The more recent introduction of the bluetongue virus into the Benelux countries (serotype BTv-8) in 2006 will perhaps never be elucidated, but one

avenue of enquiry was that the virus had come from an exotic animal imported for a zoological collection. In this case, the disease could become well and truly established in Northern Europe.

Confining our discussion to exotic pets, a point of concern is that these companion animals travel with the agents of their diseases, all the more so since these diseases, which are often unknown or little known, are not at all easy to keep under surveillance or to anticipate. Adverse consequences are to be expected for the people who come into contact with such animals, or for livestock in the colonised regions, and even for indigenous wild fauna. The potential impacts therefore concern three areas: public health, the economy and ecology.

Background

Generally speaking, non-domestic animal species are authorised for travel between countries provided that at least two sets of requirements are complied with: the requirement of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), and the animal health documentation requirements laid out in national, regional and international texts (notably the *Terrestrial Animal Health Code* and the *Aquatic Animal Health Code* of the World Organisation for Animal Health). The CITES regulates the movements of species endangered by international trade, and is normally administered by the environment ministry of every country that has signed the Convention. Not all countries have done so. Animal health documentation requirements, which do apply to all countries, state that any animal exported from a country must (or ought to) be accompanied by an animal health certificate attesting to its good health. For the most part, it is the agriculture ministry that is responsible for delivering animal health documents. As regards disease risks, the main problem is that very little is known about which diseases to guard against because, in most cases, no-one knows the natural and acquired pathology of exotic species, including those that are traded. It is paradoxical to see the enormous concern currently shown by the public authorities and consumers for food safety issues, but their comparative indifference to the distinctly more disturbing potential risks associated with trade in exotic animals. This is probably due to lack of information.

Exotic pets can come from a variety of sources. First there is the legal market and, in some cases, an associated unofficial market, which makes it easy to buy a wide range of animals, both aquatic and terrestrial, invertebrate and vertebrate, along with their requisite accessories (aquarium, terrarium, cage, ornaments, etc.). In addition, various types of animal feed are imported to feed all these animals. An apt illustration of the dangers of these

activities is the recent epidemic of around 200 cases of *Salmonella* Typhimurium linked with the introduction into the United Kingdom (UK) of frozen North American mice to feed pet snakes (25). According to the ensuing survey by the UK Department for Environment, Food and Rural Affairs (DEFRA), a total of 85,000 live snakes had entered the UK legally between July 2008 and June 2009, of which 44,000 came from the United States. Again according to DEFRA, in 2008 the UK had also imported 28 tonnes of frozen rodents to feed pet reptiles. Nobody knows how much is being imported via unofficial channels. Cases of human salmonellosis are common among people handling reptiles. Luckily, accidents with feed for companion animals are less common, but have been reported in the United States (25).

Trade in exotic animals is worth vast amounts of money. Evidently social phenomena can set off a craze, as happened a few years ago when a new cartoon character prompted an increase in sales of clownfish (*Amphiprion* spp., of the family Pomacentridae). Some private individuals specialise in zoological groups and build up real collections. Examples include: fish (Cichlidae), reptiles (Gekkonidae), birds (Psittacidae) and mammals (primates). This collecting behaviour, where the aim is to complete the entire category, can lead to transgressions, not to mention the problem of what happens to the animals when the owner dies, compounding the risk of secondary invasions and health impacts. There is also the 'travel souvenir' trade, where an animal is bought on impulse from a colourful market or with the deliberate intention to bring home a souvenir other than the usual craft item.

The authors have chosen to base their argument, in which they plead for greater respect for these animals, on zoological groups, limiting the discussion to mammals, although they could equally well have chosen other taxa, or else diseases. The aim is to avoid waking up one day to discover a new, potentially serious disease that has been introduced by an exotic pet. In the absence of tougher regulations to address the problem of highly variable enforcement, the authors wish to improve the information available.

Zoological groups concerned by the exotic pet trade

Marsupials

The Australian marsupial *Trichosurus vulpecula*, commonly known as the brushtail possum, has become a reservoir for bovine tuberculosis caused by *Mycobacterium bovis* in New Zealand, where it was introduced from Australia

in the 19th Century (12). The brushtail possum is a highly adaptable species that is probably capable of surviving in the wild in Europe. Judging by the economic impact caused by this species in New Zealand, close surveillance is called for. Clearly trade in the brushtail possum poses a threat. However, the brushtail possum is already on sale in Europe. Its presence in France was revealed when a survey was conducted in connection with a case of rabies in an Egyptian fruit bat (*Rousettus aegyptiacus*) in Nîmes, in the French department of Gard (see section on 'Bats' below). As a brushtail possum had been in contact with the bat prior to the sale of both animals from the same pet shop, the brushtail possum had to be retrieved from its owner, euthanised and tested for rabies. The test was negative.

Carnivores

Apart from the three 'official' domestic carnivores in the European Union – the dog, cat and ferret – a few other carnivore species are still authorised for sale, but as non-domestic companion animals. For various reasons, the main associated risk is that of rabies (24). In 2001, France was recognised as rabies-free (21) after many years spent fighting the rabies epizootic that had raged among red foxes (*Vulpes vulpes*) since 1968. It is fortunate that none of the carnivores that had been introduced into France or other countries in Europe during the 20th Century and went on to become naturalised, stepped in to take its place as the new reservoir (14, 18). However, the northern raccoon (*Procyon lotor*), the Far Eastern raccoon dog (*Nyctereutes procyonoides*), or even the American mink (*Neovison vison*) could have created a real problem. Raccoons are the reservoir for rabies throughout the eastern and south-eastern United States, and raccoon dogs have caused a specific epidemiological problem in Central and Northern Europe (Ukraine and the Baltic States). These three species were originally introduced in connection with the fur trade. However, a secondary pet trade is possibly already in operation in France for the American mink, even though the indigenous European mink (*Mustela lutreola*) is an endangered species. One of the acknowledged reasons for the decline of the European mink is competition from American minks that have escaped or been released from farms. The expansion of the pet trade for the American mink, again with individuals escaping from captivity that are sure to breed in the wild, is likely to hasten the extinction of the few remaining populations of the indigenous species in Western Europe. Lastly, 'accidental' introductions should not be overlooked. In April 1998, a raccoon, weak but alive, was offloaded from a container in the French port of Le Havre, six weeks after the container had been sealed in the United States port of Houston, Texas (11). Could this already have happened elsewhere without being noticed?

The fate of these animals after they are sold remains problematic. In May 2002, a striped skunk (*Mephitis mephitis*), a North American mustelid, was observed and photographed in a forest in Cerisiers, Burgundy, France. The animal's friendly behaviour might have been a clue that it had escaped from captivity. The animal was never seen again. Similarly, in 1996 a case was discovered in the far northern department of Nord, in France, of a 'farm' for skunks and raccoons (*Procyon lotor*) in the cellar of a private home (8; A. Fournier, personal communication, 2002). The striped skunk is one of the chief rabies reservoirs in North America, and is more important than foxes in some states (10, 24). More recently, in March 2005, an African mongoose of the genus *Crossarchus* was found in the street in the town of Queue-en-Brie, just south-east of Paris, France. We need to bear in mind that, for most of these species, neither the rabies virus incubation period nor the pre-symptomatic period of excretion is known.

That said, it was the illegal introduction of a dog from Morocco in late 2007 that lost France its rabies-free status in 2008, for a two-year period. The first dog infected a second animal, which itself caused a third and last infection, the only one to be detected.

To conclude this section, it is worth remembering that the recent emergence of severe acute respiratory syndrome-associated coronavirus infection (SARS-CoV) was linked with the breeding and consumption of the masked palm civet (*Paguma larvata*) in southern China. Some firms from both mainland China and Chinese Taipei had been planning to market this species as companion animals (17). The epidemic seems to have put paid to the plan.

Bats

Bats (Chiroptera) are a special case because nobody really imagines them being sold for pets. However, this is just what has happened, at least in the case of fruit bats, a group of rather large chiropteran species. However, Chiroptera harbour six of the seven known genotypes of *Lyssavirus* (the genus to which the rabies virus belongs), four of which are specific to them (2). The incident that occurred in France in 1999 is rather telling. An Egyptian fruit bat (*Rousettus aegyptiacus*), bought by a private individual from a pet shop in Bordeaux in March 1999, died from rabies in Nîmes two months later. It was not possible to ascertain the bat's African country of origin, as it had been imported into Europe via Belgium. The virus was genotype 2 lyssavirus (Lagos bat virus). After the event, around 130 people had to be treated and all the mammals that had come into contact with the fruit bat during its stay in France had to be euthanised. They included an Australian brushtail possum that was also present in the Bordeaux pet shop. In fact, trade brings into contact species that would never normally meet in nature.

This makes an analysis of the health risks more complex because it is difficult to anticipate the behaviour of pathogens on new species. What is their sensitivity and susceptibility, what are the risks of seeing the emergence of new vectors and new reservoirs?

Like other African species, the Egyptian fruit bat could also serve as a reservoir of the Ebola virus and the Marburg virus, as was demonstrated recently (19). The large fruit bats of the genus *Pteropus*, from Asia, Australia and Oceania, act as a reservoir for two viruses identified in the 1990s – Hendra virus and Nipah virus – both of which are fatal to humans. It is likely that some fruit bats are still being imported into Europe illegally, either for consumption or for the pet trade.

Rodents

This is the mammalian group with the largest number of species. More than 2,000 have been listed to date. Some, like the Norway rat (*Rattus norvegicus*), the house mouse (*Mus musculus*), several hamsters, the Mongolian gerbil (*Meriones unguiculatus*) and the guinea pig (*Cavia porcellus*), have been bred for many years and are fairly well known. By contrast, others continue to arrive on the market even though little is known about their health backgrounds.

There is no shortage of health hazards, some of which have already been clearly identified. Plague (*Yersinia pestis* infection) is a bacterial disease of rodents from desert and semi-desert areas in several regions of the world, as well as of their fleas. Burrowing species, such as marmots (*Marmota* spp.), ground squirrels (*Spermophilus* spp.), prairie dogs (*Cynomys* spp.) and gerbils, are among those most affected, but the list is much longer. The black rat (*Rattus rattus*) was responsible for spreading the epidemic that wiped out one-third of Europe's human population in the Middle Ages. Even though the plague has now disappeared from Europe, it is still found in large parts of the Americas, Asia, Africa and Madagascar. The fleas of rodents contribute to the bacterium's cycle in animals. Humans are the only primate to carry their very own flea; the human flea (*Pulex irritans*) was probably passed from a domestic or commensal species, such as a dog or rodent (1, 5).

Large numbers of 'companion' rodents are on sale, including one particularly disturbing group of species, prairie dogs (the black-tailed prairie dog, *Cynomys ludovicianus*). In fact, they are North American ground squirrels, which are native to the western Great Plains and are present from the north of Mexico to southern Canada. There is little or no breeding of prairie dogs in captivity. Instead, the young are captured in the wild in spring and exported to Europe and Japan. Even though only two states in the United States (Texas and South Dakota) officially authorise prairie dogs for export, it would appear

to be difficult to verify the exact provenance of the animals sold (A. Ruiz, personal communication, 2001). Since 2000, a severe plague epizootic has raged in prairie dog colonies virtually throughout their geographical range (23). Despite this, prairie dogs were still on sale in European pet shops until mid-2003. On 19 October 2000 (20), France issued a recommendation to importers to ban direct imports, but the animals were still able to enter via other European Union member states and be sold freely within the Union as part of intracommunity trade. The reason for the French ban on the sale of prairie dogs in 2003 was not linked with the plague but with monkeypox, caused by a virus of African rodents, chiefly squirrels.

In the spring of 2003, an episode of monkeypox was declared in humans in the United States. North American prairie dogs, sold as companion animals, had infected a number of private individuals, luckily without serious medical consequences. A survey revealed that around 800 African rodents of various species (striped mouse, giant Gambian pouched rat, squirrel, African dormouse and porcupine) had been introduced into the United States as pets a short time earlier. They had come from Ghana. As carriers of the monkeypox virus, some of the rodents had infected prairie dogs at the points of sale. The European Union then banned the import of prairie dogs (*Cynomys* spp.) from the United States, together with rodents of non-domestic species and squirrels from sub-Saharan Africa (6). The animals imported from the United States would not have been tested for the monkeypox virus because nobody knew that they could harbour it. After the presence of the virus was discovered, a search was carried out for the imported rodents, but not all were found.

Circumstances like these highlight the failings of current importation systems. Faster trade and communication flows and commercial pressures all militate against the implementation of basic health rules. Is it really appropriate to market prairie dogs or African rodents? The monkeypox virus was already known, but these species may well harbour other, as yet unknown, viruses that could come to light if contacts between exotic rodents and humans increase. The emergence of new diseases is a widely-acknowledged possibility nowadays. The movement of these new species could represent a potential means of entry for such emerging diseases.

As an ever-growing variety of rodents are being kept as companion animals, there could be further surprises in store. Hantaan virus, which causes the disease haemorrhagic fever with renal syndrome, is only one other example, but it seems to be highly cosmopolitan, with strains of variously mild or more severe pathogenicity for humans, depending on the region of the world and the reservoir species (4). It is further proof of the possible consequences of species from different continents coming into contact in pet shops and passing on their pathogens:

while the African rodents mentioned above were healthy carriers, the North American prairie dogs developed a fatal disease and went on to infect humans.

Another more recent example of problems that could become more widespread as the popularity of rats increases is the 2009 epidemic of cowpox virus among a number of owners of pet rats (*Rattus norvegicus*) in at least three European countries: Belgium, France and Germany. The animals that caused the infections appear to have come from a farm in Central Europe. The virus is known among wild rodents in some regions of Europe. Could the domestic rats have created the link between a wild reservoir and the human patients?

Primates

Even though there is a ban on trade in primates, nearly every year there are several reported cases of smuggled monkeys (pygmy chimpanzees, macaques and guenons [*Cercopithecus*]) or prosimians (slow loris [*Nycticebus*]). Although clinical disorders among such animals, or bites, raise real fears of a contagious disease, no structure has been provided to take charge of such animals. Who should be responsible for maintaining a secure diagnostic laboratory to house illegally imported animals (or samples taken from them)? The costs would be considerable. When they come to buy an animal, owners are not good at assessing the risks, which are rarely limited to themselves alone.

The diseases to fear are viral haemorrhagic fevers, such as Ebola, Marburg (9), simian herpes B, certain forms of viral hepatitis, or even simian immunodeficiency virus (15). Another risk is rabies. In the late 1980s, a small trade in Barbary macaques (*Macaca sylvanus*) between Algeria (Kabylia) and France ended in the death of several small monkeys. They had become infected with rabies after being vaccinated using a live attenuated virus vaccine not suitable for the species. All the buyers had to be alerted because they could also have been infected. As the macaques had been purchased illegally, it was no easy matter to locate them. More recently, in December 2005, a young bonobo, or pygmy chimpanzee (*Pan paniscus*), was seized at the international airport of Paris-Charles-de-Gaulle from the rucksack of a passenger who was in transit from Kinshasa to Moscow. The animal was returned to a specialist centre in its country of origin.

Discussion

Trade in exotic species has posed a host of problems for many years (16). It is by no means certain that raising awareness of the health risks will do much to change this,

but we do need to bear in mind the wide range of potential health consequences, the real risk of cross-contamination between animals in marketing channels or at points of sale, and the importance of the unofficial parallel trade. Nor should we underestimate the difficulties in diagnosing clinical suspicions, and in organising a chain that starts with an animal's arrival and sampling and ends at the diagnostic laboratory.

The cases reported above are difficult to interpret. Are they the tip of the iceberg? Or maybe just one-off cases? The answer is complex because, by its very nature, 'parallel' trade is not included in the official statistics. We need to remember that a single 'successful' import can end in an epizootic or epidemic outbreak. The potential for cross-contamination of animals in marketing channels is a further concern associated with trade in exotic pets. While contact between an Australian marsupial and an African bat, or between North American prairie dogs and West African rodents, might seem unlikely at first sight, this is precisely what has happened at points of sale. As far as we know, the contact between the Australian marsupial and the African bat did not cause a problem, and the animals in question have died in the meantime. By contrast, the contact between North American prairie dogs and West African rodents led to the emergence of monkeypox in the United States. Fortunately, no prairie dogs with the virus were released into the wild. It is difficult to anticipate which pathogens are carried by each of these species traded as pets. It is even more difficult to predict the fate of each pathogen on another species with which it may come into contact in these marketing channels, and in such situations animals can exhibit unusually high susceptibility, exacerbated by captivity.

A number of possible steps could be proposed for addressing the problem. It ought to be feasible to assess the most likely risks posed by each species placed on the market (not only health risks but also ecological risks), by considering the risks of biological invasion by species capable of becoming established in the wild in a new country. Pet shops should be banned from holding a number of species on health grounds, especially species that act as potential or confirmed reservoirs for a variety of viruses and lyssaviruses, including Marburg, Ebola, Nipah and Hendra.

By way of example, while the brushtail possum presents chiefly an ecological risk, it also plays a role in maintaining bovine tuberculosis in New Zealand. This has led a number of countries to ban pet shops and ordinary members of the public from keeping the brushtail possum. All carnivores ought to be considered from the standpoint of their rabies risk. Lastly, controls should be stepped up to clamp down on introductions of primates. Regulations ought to lay down specific conditions for species that pose a health risk and those that pose an ecological risk (invasive species).

The list of such species ought to be updated to take into account advances in knowledge.

In parallel, it should be possible to organise a chain for sampling and taking charge of animals in the event of a clinical suspicion about an animal, and for a list of laboratories to be drawn up for each country or region, which can be contacted regarding a suspicion. The above-mentioned diseases could also be included in national regulations as notifiable diseases. Ultimately, an accredited reference laboratory, diagnostic tests and recognised screening methods could be introduced for these diseases in order to provide clearer guidance on which approach to adopt in the event of a suspicion. European consultations are taking place on this matter (13).

The real solution would be to take action as far as possible upstream of this chain. Commercial pressures remain strong. Public awareness, the only thing capable of reversing the trend, does not always exist. We are still seeing numerous cases of illegal possession of unauthorised, non-domestic species. It is becoming difficult to control burgeoning Internet-based electronic commerce effectively. Websites can advertise and offer species that are officially banned from sale. In spite of the favourable trend in regulations, together with various communication campaigns, run chiefly by national environment ministries in a number of countries and by specialist non-governmental organisations, a huge effort is still required in the areas of public education, information and accountability. We should be grateful that there has been no major accident as yet. Nevertheless, the increase in the number of incidents of every sort calls for heightened vigilance.

Conclusion

Dog fanciers would recognise some 258 dog breeds, and cat lovers, several dozen, plus hundreds of varieties. Competitions and shows for pigeons, canaries, rabbits and guinea pigs illustrate the endless possibilities for breeding domestic pets, even by highly traditional means. Moreover,

some countries, such as France, have issued regulations listing the species officially classed as domestic, either as productive livestock or companion animals, or for other services rendered. The French ministerial decree (22) covers 24 mammals, 88 birds, 2 amphibians, 5 fish and 3 insects. Day-to-day experience has shown that much progress is still required in the care of, and respect owed to, these animals, some of which have been our faithful companions for a very long time. There are certainly many different ways of raising a companion animal. Although it is hard to determine which way is the best, we can point out a few unacceptable practices. In some places, animals are mistreated, or discarded as though they were worn-out objects or toys that have gone out of fashion. In other places, excessive care is lavished upon them, which is not only extreme but, worst of all, it fails to meet the animals' real needs. In all such cases, we are preventing the animal from being itself, whilst at the same time forgetting that it is a sentient being. Since there is still so much progress to be made with 'traditional' species, why go in search of new, exotic and largely unknown species? This pet trade is threatening the survival of many species and poses ecological and health risks. At a technical level, how can we take proper care of animals belonging to species about which we know practically nothing? Is it acceptable for there to be vocational training courses on the castration or mutilation of exotic, so-called companion, animals for reasons of convenience? The ethical argument is perhaps the most universal one. If we humans claim to take an interest in other animal species but this results in their death, we need to start asking ourselves some searching questions.



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