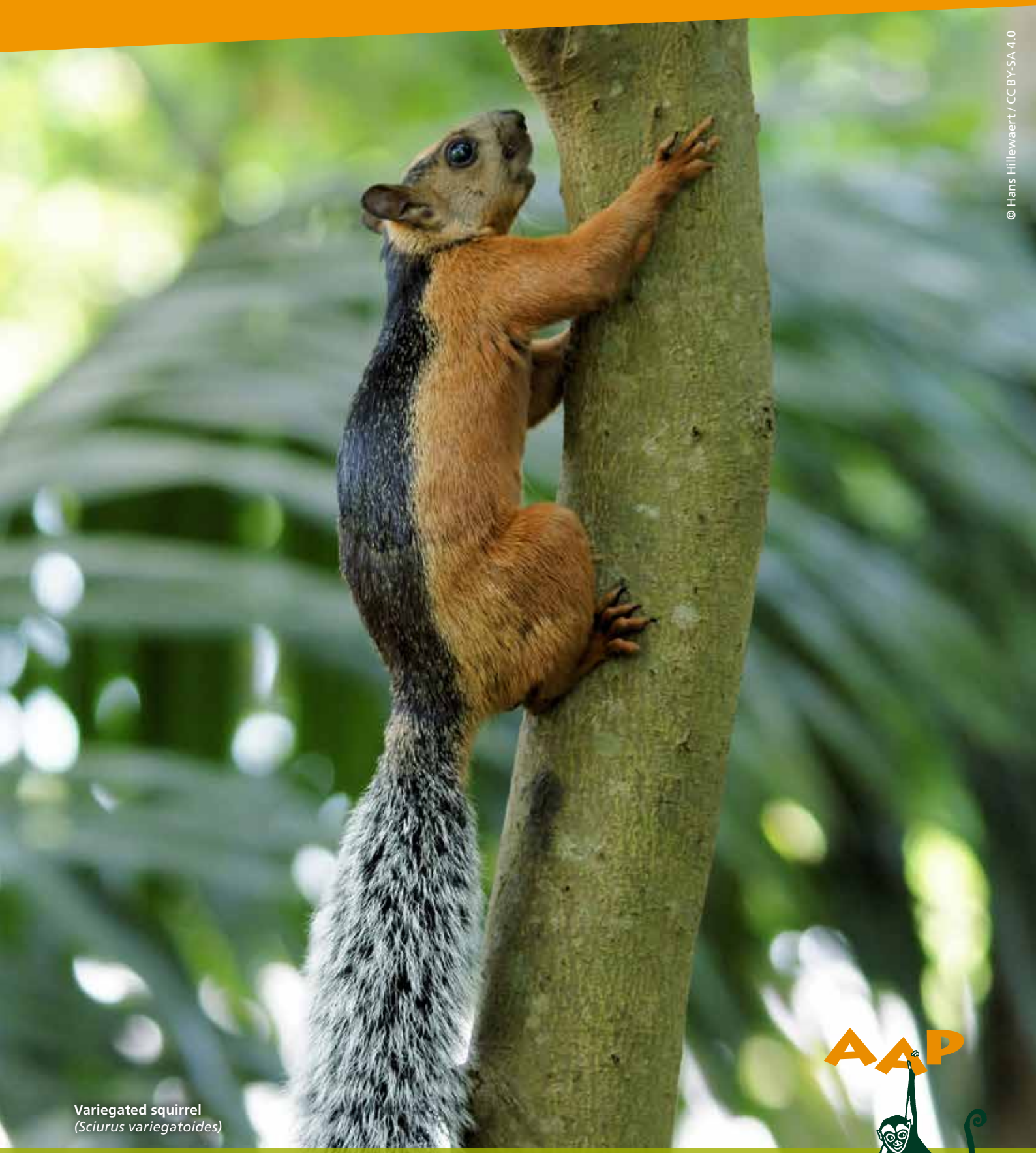
UNDER THEIR SKIN



Variegated squirrel
(Sciurus variegatoides)

ZOONOTIC THREATS FROM EXOTIC MAMMAL PETS

AAP

ZOONOTIC THREATS FROM EXOTIC MAMMAL PETS

1. INTRODUCTION

Zoonotic diseases are diseases which can be transmitted from animals to humans and vice versa.

An important and well-known factor in the increase of transmission risks of zoonotic infections is the booming global trade in wildlife, including for the exotic pet market[1]. This report describes some examples of health threats to humans posed by exotic mammal species commonly kept as pets. It also includes recommendations on how to take preventive measures through better regulation.

Zoonotic diseases are nothing new[2], but the outbreak of the recent SARS-CoV-2 pandemic shows the devastating effects of zoonotic disease transmission and generates a new global wave of attention for this subject. Health and veterinary experts have been ringing the alarm bell for years: the way we are dealing with nature and animals is turning into a ticking time bomb. Particularly, the role of wildlife as a reservoir for largely unknown pathogens, or their mutations, is causing increasing concerns.

Methodology

The Dutch Center for Infectious Disease Control (RIVM) registers notifiable zoonotic transmissions and informs experts around the world by their reports of emerging zoonotic diseases in the Netherlands and neighboring countries. Out of these RIVM reports from the last five years, we have selected and described one lethal zoonotic incident in Germany that arose from keeping an exotic pet.

Four other described high-risk zoonoses have not been caused by exotic pets directly, but since the species that are able to transmit these zoonoses are kept as pets, the private possession of these species does carry potential risks for their keepers, other humans and other animal species. A number of databases (see Annex I) on zoonotic threats were consulted for more details on outbreaks and incidents concerning the five selected zoonotic diseases.

[1] *UNEP distinguishes seven human-mediated factors that are most likely driving the emergence of zoonotic diseases (UNEP, 2020). Zoonoses are estimated to make up approximately 75% of today's emerging infectious diseases. Many of these zoonoses are associated with wildlife or exotic pets (Souza, 2009)*

[2] *Zoonotic diseases have always had serious large-scale impacts on human health; they cause about a billion cases of human illness and around 6.5 million of deaths every year, mainly in developing countries (Karesh et al., 2012).*

2. ZOONOTIC DISEASES

Zoonoses are diseases that are transmitted between vertebrates and humans under natural conditions. Zoonotic diseases are caused by micro-organisms or pathogens, like viruses, bacteria, parasites or fungi. They are transmitted through a vector, which transmits the disease from host animal to human.

Animals that naturally harbor the zoonotic pathogens are reservoir hosts. Animals carrying the pathogens transmitted from the reservoir host are called intermediate hosts. Hosts do not necessary get ill from the pathogen. There are five main routes via which zoonotic pathogens are transmitted to humans: 1) Inhalation, 2) ingestion, 3) non-traumatic contact (direct or indirect human contact with animal skin, hair, blood, carcass or excreta), 4) traumatic contacts (bites or scratches), or 5) via the arthropod vector (e.g. ticks, mosquitoes) (Merson, 2005). Vaccines and medication only exist for a relatively small number of zoonoses[3]. The total number and diversity of zoonotic disease outbreaks, has increased significantly since 1980 (Smith, 2014). Currently, around 360 new or re-emerging zoonoses are reported annually worldwide. That is roughly one per day!

2.1 RISKS AND MAMMAL SPECIES

A large number of zoonoses appear to come from mammals, especially non-human primates, bats, and rodents. Together, these species act as hosts of 75% of all known zoonotic pathogens (Can, 2019). However, we lack a comprehensive, exhaustive overview of all potential reservoirs for zoonotic diseases within all 5,416 mammal species[4]. It will probably never be possible to obtain such an overview given the limitations in detecting pathogens within wild animal species. Therefore, experts will not be able to trace back the source of a zoonotic disease outbreak in all cases (Johnson 2020). In addition, a wide variety of viruses is still to be identified in wild animal species[5]. In a recent study it was estimated that 1.6 million viral pathogens are yet to be discovered in mammal and bird populations. Of those, an estimated 650.000 to 840.000 have the capacity to infect and cause disease in humans (Carroll, 2018). In other words: which animals could carry which zoonotic pathogens is a very big known unknown.

Four-toed hedgehog *(Atelerix albiventris)*

- **IT IS NOT KNOWN WHICH MAMMAL SPECIES (CAN) CARRY WHICH ZOONOSIS.**
- **MANY ZOONOSES ARE YET TO BE DETECTED IN WILDLIFE.**
- **75% OF ALL KNOWN ZOONOSES ORIGINATE FROM NON-HUMAN PRIMATES, BATS AND RODENTS.**

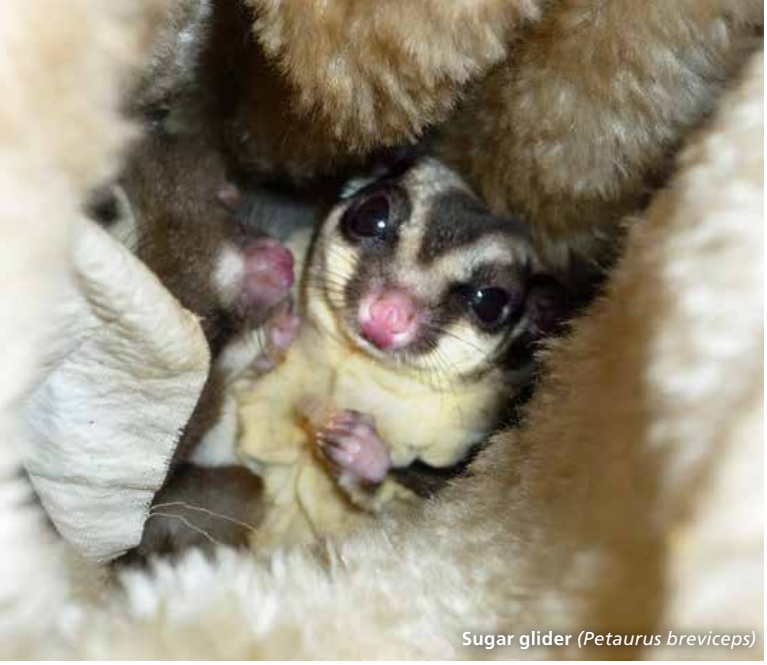
2.2 ZOONOTIC RISKS AND EXOTIC MAMMAL PETS

Among the reasons for the increased risk of zoonotic diseases is the drastic increase in the diversity of species kept as pets over the last decades (Bush, 2014). This is reinforced by other forms of increasing human-animal interaction, such as further encroachment of humans into biodiversity-rich areas (UNEP, 2020). Among the species kept as pets in Europe are bats, rodents and hon-human primates; taxa that host the majority of known zoonotic pathogens. A review of exotic, captive animal-linked zoonoses conducted in 2012 in the UK did not hesitate to state that, compared to other places where wild animals are kept (zoos and circuses), there is overwhelming evidence that the trade in and the keeping of exotic animal pets is by far the greatest potential threat to human health (Warwick, 2012).

[3] *There are as yet no vaccines or treatment for most emerging diseases, and many reasons for limited access to existing vaccines remain (WHO Managing Epidemics, 2018).*

[4] *According to Mammal Species of the World, 5,416 species were identified in 2005. (Wilson, D.E.; Reeder, D.M., eds. (2005). Mammal Species of the World: A Taxonomic and Geographic Reference (3rd ed.). Johns Hopkins University Press. ISBN 978-0-8018-8221-0. OCLC 62265494.)*

[5] *https://www.ncbi.nlm.nih.gov/pubmed/11516376*



Sugar glider *(Petaurus breviceps)*

In general, bacterial gastroenteritis and dermatophytosis are considered to be the most common zoonoses transmitted by exotic pets (Schoemaker, 2008). Exotic pets are also a source of several other human infections that vary from severe monkeypox (related to pet prairie dogs) or lyssaviruses in pet bats (Reed, 2014), roundworms (Baylisascaris procyonis) in pet raccoons (Page, 2011), to less severe but more common ringworm infections from African pygmy hedgehogs or chinchillas (Drotman, 2007). The Seoul virus, a severe Hantavirus was detected in homebred rats in the UK after breeders suffered acute kidney failure due to transmission of the virus (McElhinney, 2017). Rats are very commonly bred to serve as food for pet reptiles. Many other zoonotic diseases are diagnosed sporadically, and may have a detrimental impact on the person who is infected (Schoemaker, 2008).

2.3 DOMESTICATED VS NON-DOMESTICATED ANIMALS: DIFFERENCE IN LEVEL OF SURVEILLANCE

The ever-intensifying contact with both domesticated and wild animals by keeping more of them, can stimulate pathogens to jump the species barrier (ProVeg, 2020). Though there are no incidents reported by RIVM in the last five years in which a non-domesticated exotic mammal pet has contaminated a domesticated animal species (either a domesticated pet or farm animal), the chance of this happening cannot be fully ruled out. RIVM reported a number of zoonotic spillovers where the source remained unknown and could not be traced.

The absence of a structural health surveillance system for wildlife, including species commonly kept as pets, is a major gap in the surveillance of emerging zoonoses (Van der Giessen, 2010). It's evident that current track-and-trace systems commonly used in the livestock sector, just like identification and registrations systems for domesticated pets like cats and dogs, makes finding the owner of an animal and the source of a zoonosis a lot easier. On top of this, livestock and domesticated pets are often vaccinated against known zoonotic diseases, preventing health problems and risks of spillover to other species (see section 3.1 *Coxiella burnetii*). Many zoonotic pathogens do not affect their animal hosts negatively, and will thus not be instantly noted in the host species. As a result, these pathogens remain invisible, unrecognizable diseases in (intermediate) host animals until they are tested. However, these pathogens can be dangerous or potentially lethal to humans. The risk of zoonoses being present in non-domesticated, exotic animals is therefore considered high compared to those present in domesticated pets[6] (Warwick, 2012; Stull, 2015).

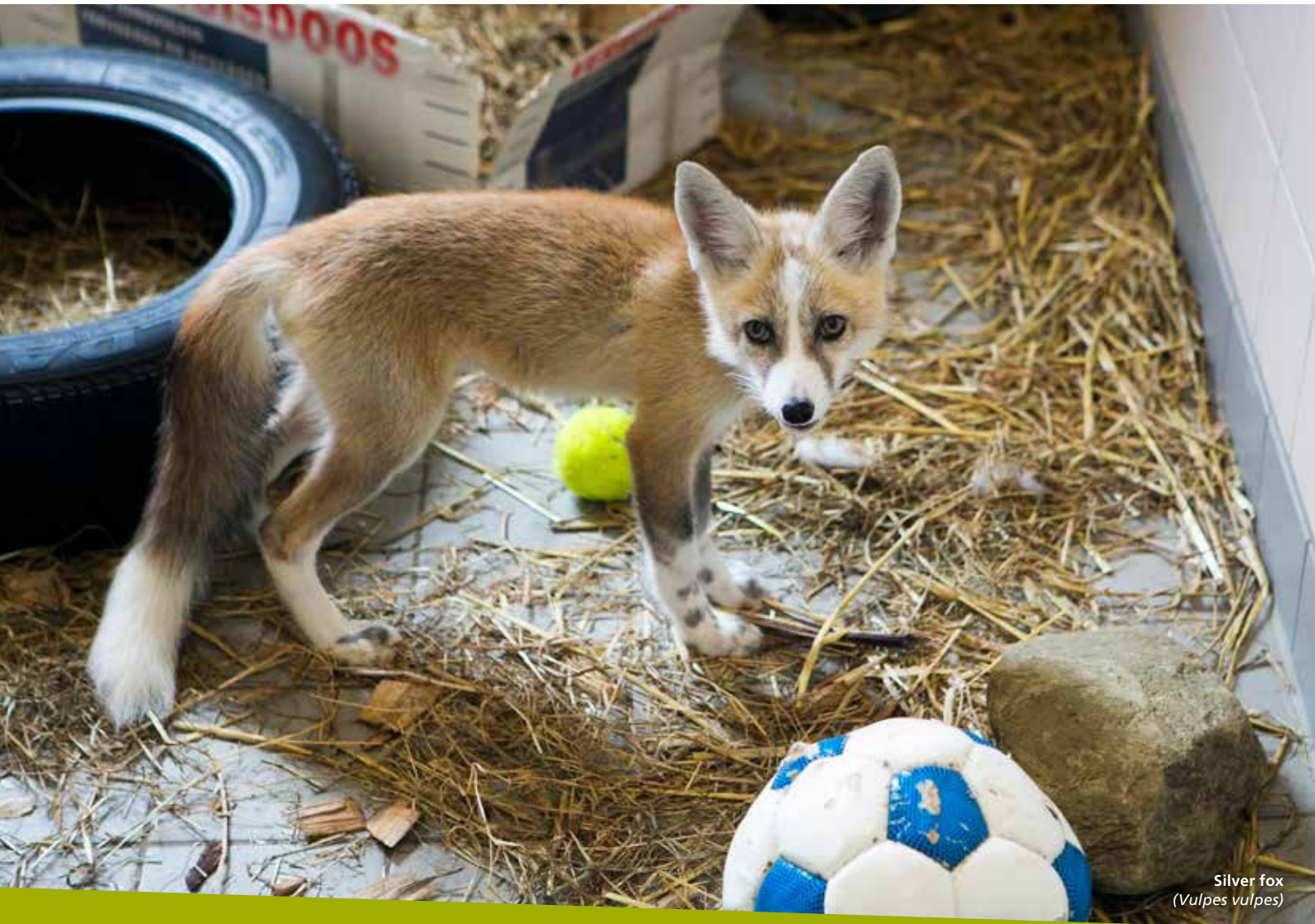
In addition, when animals in the wild develop symptoms due to infection, many species will only show illness or weakness when they can't hide it anymore from their predators or competitors. This natural behaviour also persists when such animals are being kept as a pet in someone's living room. Poor understanding of risk factors throughout the trade and pet keeping chain, sometimes even in healthcare and public health professions, sets exotic pet keeping apart as a threat to public health (Warwick, 2012). By the time the owner, or a veterinarian, notices signs of illness, the animal might have already infected humans. In fact, if this report had been written a year ago, SARS-CoV-2 would still belong to that 'unknown' category. In short: when someone acquires an exotic pet, chances are that there is very little to no knowledge about what the cute new addition to the family is carrying under the skin. It might even be 'Covid-20'.

- **THE DIVERSITY OF MAMMAL SPECIES KEPT AS PETS DRASTICALLY INCREASED OVER THE LAST DECADES.**
- **THE SPECIES THAT ARE MOST COMMONLY THE HOST OF KNOWN ZOONOSES, NAMELY RODENTS, BATS AND NON-HUMAN PRIMATES, ARE STILL BEING KEPT AS PETS ACROSS THE EU.**

[6] *The American Veterinary Medicine Association (AVMA) states as a consequence 'Wild animals are not good pets; they can be dangerous and are more likely to carry diseases that can infect you and your family' https://www.avma.org/resources/pet-owners/petcare/zoonotic-diseases-and-pets-faq*

An exotic mammal pet generally becomes a loved and respected member of the family. In that process, the risks can be downplayed by the owners. They tend to emotionally disconnect their exotic pets from their wild conspecifics. By elevating their wild animal to the status of a cute in-house pet, the associations that their pet could carry diseases from outside are gone, e.g. with pet rats. A concept of 'bounded purity' keeps the exotic mammal pet protected within the home, allowing owners to interact with their pet, in the safe belief that it is clean and disease-free (Robin, 2017). This mindset can get in the way of prevention and early detection of zoonoses.

- **THE ABSENCE OF STRUCTURAL HEALTH SURVEILLANCE ACTIVITIES IN WILDLIFE IS A MAJOR GAP IN THE DETECTION OF EMERGING ZOONOSES.**
- **THERE IS VERY LITTLE SURVEILLANCE OF ZOONOSES IN NON-DOMESTICATED EXOTIC PETS COMPARED TO DOMESTICATED PETS AND FARM ANIMALS.**
- **THE EVER-CLOSER CONTACT OF HUMANS WITH BOTH DOMESTICATED AND NON-DOMESTICATED ANIMALS BY KEEPING EVER MORE OF THEM, CAN STIMULATE PATHOGENS TO CROSS THE SPECIES BARRIER.**
- **EXOTIC MAMMAL PET OWNERS CAN EMOTIONALLY CONSTRUCT AN ERRONEOUS BELIEF THAT THEIR BELOVED PET IS SAFE INSIDE THE HOUSE AND IS DISEASE-FREE.**



Silver fox
(Vulpes vulpes)

3. SOME EXAMPLES OF ZOONOTIC DISEASES TRANSMITTED BY MAMMAL SPECIES

In this section, four zoonoses are highlighted. These zoonoses have been recently reported (from 2015 onwards) by the Dutch Center for Infectious Disease Control (RIVM) and are carried by species that are still allowed to be kept as pets in the Netherlands and/or abroad. In the described cases, exotic mammal pets were not the source of the zoonotic transmission. In some cases, the source of the zoonotic transmission remains unknown.

3.1 COXIELLA BURNETII

This bacteria is an extremely infectious pathogen, often responsible for large outbreaks among farming communities. During 2012-2018, Spain, France, and Germany accounted for most confirmed cases of coxiellosis (GIDEON, 2020). *Coxiella burnetii* has emerged and re-emerged on all continents of the world.

The known animal reservoirs for *Coxiella burnetii*, leading to Q-fever or coxiellosis in humans, are: ruminants, dogs, cats, coyotes, foxes, jaguars *(Panthera oncas)*, rodents, skunks, raccoons, rabbits, sloths, and birds (GIDEON, 2020). Many of these species are commonly and legally kept as pets in Europe.

Emission pathways are non-traumatic contact, ingestion, inhalation, and transmission via arthopods (via tick bites). The world's largest recorded outbreak of Q-fever (4.107 cases, 74 fatalities) was recorded in the Netherlands, where many people were left with permanent serious health issues (RIVM monthly report no 184, GIDEON, 2020). Infected animals (goats) were identified on 94 livestock farms during the outbreak – 62.500 animals were culled. Since 2010 all sheep and goats on Dutch dairy farms (with more than 50 animals) and other premises to which the public has access in the Netherlands are to be vaccinated against *Coxiella burnetii*. In April 2018 and December 2019 new notifications of acute Q-fever affecting six people were reported by RIVM. In all cases – despite extensive research – no source could be traced.

3.2 FRANSICELLA TULARENSIS

Tularemia, the disease caused by the bacteria *Fransicella tularensis*, is generally associated with the bites of ticks or flies, bites of coyotes and cats, inhalation of dust

Albino skunk *(Mephitis mephitis)*

contaminated by rodent feces, and (rarely) consumption of contaminated meat (ECDC, 2020). *F.tularensis* has been identified in over 250 species of mammals and it is endemic or potentially endemic to 51 countries (GIDEON, 2020).

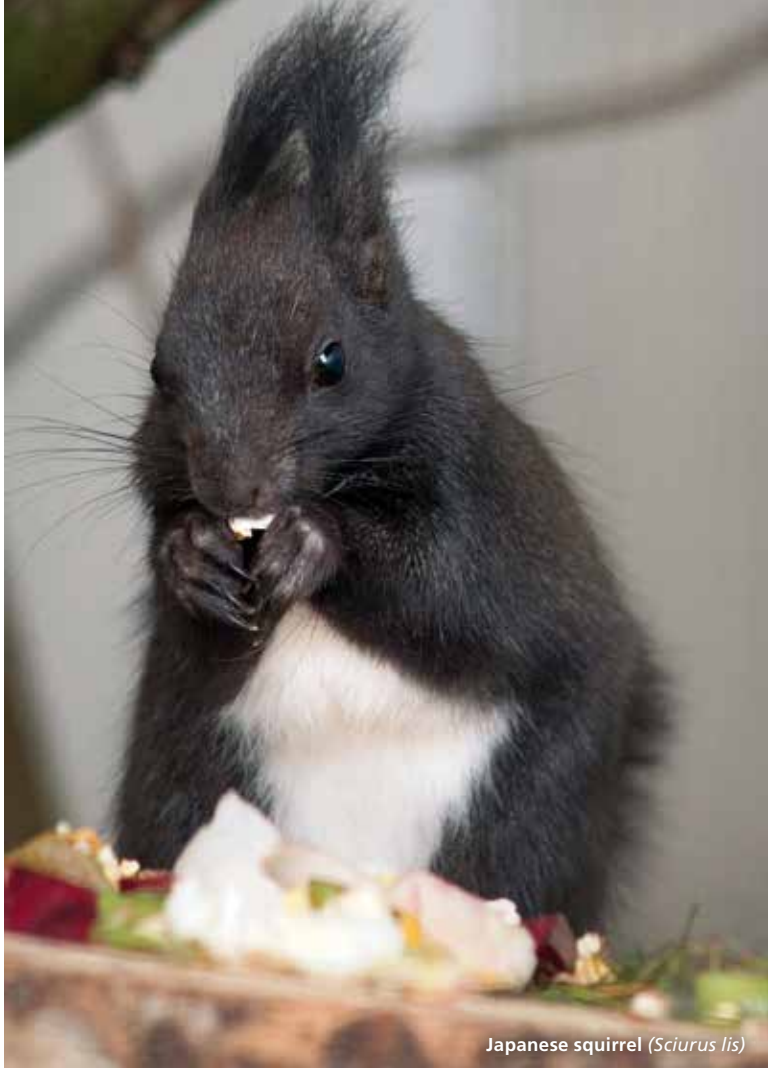
In Europe, the known principal animal reservoirs for this zoonotic bacteria, are lemming, hare, rabbit, water rat, and rats of the genera Microtus and Arvicola, ground squirrel, and meadow mouse. Infections have also been reported in a stone marten *(Martes foina)*. Shrews, dogs, cats, foxes, chipmunks, beaver, wood-rats, wild mice, rabbits, grouse, bobwhite, quail, and owls have proven to carry the bacteria in the United States. Many of the 250 mammal species susceptible to *F.tularensis* can still be legally kept as pets in Europe.

In the EU, around 700 cases of tularemia were annually reported between 2015-2018 (GIDEON, 2020). Two tularemia outbreaks after the year 2000 (in Serbia and Russian Federation) have included more than 1,000 patients each. Human to human transmissions have not been reported. There is no vaccine available against tularemia. Usually the disease starts in humans with a fever, headache, muscle aches and sore throat. Within 24 to 48 hours, an inflamed blister appears at the site of the infection, usually a finger, arm, eye, or palate. Because the disease is rare and the first appearing symptoms can be confused with many other human illnesses, it is hard to diagnose Tularemia in time. When not diagnosed in a few days and treated with an antibiotic, tularemia will lead to death. A small amount of organisms in human lungs can be lethal[7].

In the Netherlands, several hares were diagnosed with *F.tularensis* in 2018 and 2019. In June 2020, a wild beaver *(Castor fiber)* was diagnosed with the bacteria for the first time in the Netherlands (Dutch Wildlife Health Center, 2020). As recent as April 2020, Canada reported a mass mortality event involving muskrats due to *F.tularensis*[8].

3.3 MYCOBACTERIUM BOVIS

Mycobacterium (M.) bovis is one of the species of the Mycobacterium tuberculosis complex (MTBC), which



Japanese squirrel *(Sciurus lis)*

are capable of causing tuberculosis (TB). They are found across a broad taxonomy of social mammals including but not limited to humans, badgers, deer, boars, lions, elephant, meerkats, possums *(Trichosurus vulpecula and Didelphis albiventris)*, cattle, horses, swine, sheep, and goats[9] (OIE, WAHIS, 2020). *Mycobacterium bovis* has an exceptionally wide host range. Tuberculosis caused by *Mycobacterium bovis* is found worldwide in nearly every country. Children and females are disproportionately affected by *Mycobacterium bovis*. A *Mycobacterium bovis* infection accounts for 1.3% to 1.6% of all tuberculosis cases (Moonan, 2016) with nearly 150.000 cases and at least 12.500 deaths worldwide in 2010 (Ciszewski, 2015).

M. bovis infections in humans leading to tuberculosis is a major global public health priority of the WHO. *Mycobacterium bovis* is found in raw milk. People are most commonly infected with *M. bovis* by eating or drinking contaminated, unpasteurized dairy products.

[7] *When introduced into the lungs, 10 to 50 Francisella tularensis organisms have the potential to cause a tularemia infection that can be fatal. As a result, the bacterium has previously been developed as an aerosolized bioweapon and is considered a threat to national security. https://www.utsa.edu/today/2020/02/story/tularemia-vaccine.html*

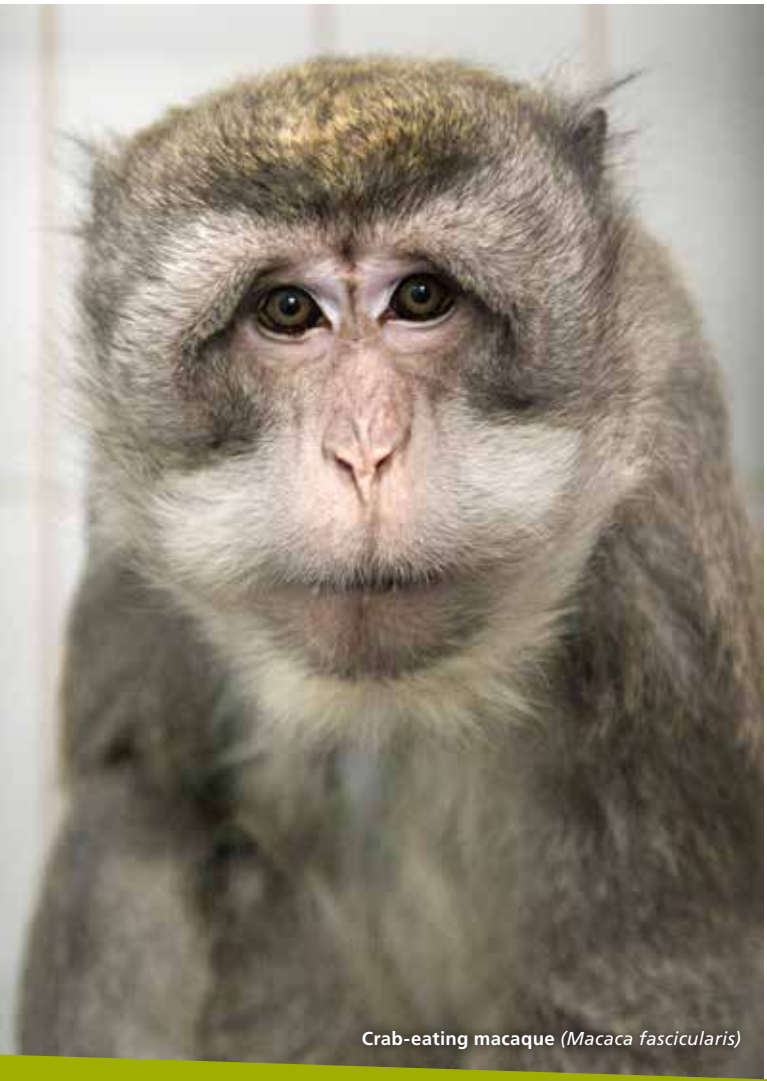
[8] *http://blog.healthywildlife.ca/tularemia-outbreak-in-muskrats-at-long-point-on/*

[9] *https://pubmed.ncbi.nlm.nih.gov/16596155/*

The pasteurization process eliminates *M. bovis* from milk products.

Infection can also occur from direct contact with a wound, for example during slaughter or hunting, or by inhaling the bacteria in air exhaled by animals infected with *M. bovis*. Direct transmission from animals to humans through the air is thought to be rare, but *M. bovis* can spread directly from person to person when people with the disease in their lungs cough or sneeze[10]. Not everyone infected with *M. bovis* becomes sick. People who are infected but are not sick have what is called *latent TB infection* (LTBI). People with LTBI do not feel sick, do not have any symptoms, and cannot spread TB to others. However, some people with LTBI can get TB disease in a later phase. *M.Bovis* Calmette-Guérin (BCG) is the only licensed vaccine that serves to control tuberculosis.

There are no outbreaks of *Mycobacterium bovis* or Tuberculosis directly related to exotic pet possession. When species that are able to carry and transmit *M.bovis* are kept as exotic pets, it adds to the existing risks. While that risk might be small, the impact can be significant when such unlikely event happens. Apart from livestock that may carry *M.bovis*, Possums *(Didelphis albiventris)* are currently also kept as pets in The Netherlands (RVO, 2019).



Crab-eating macaque *(Macaca fascicularis)*

3.4 SALMONELLA SPECIES

The worldwide estimates of Salmonella infections range from 200 million to 1.3 billion, with an estimated death toll of 3 million humans each year (Coburn, 2007). An estimated 3% to 5% of all cases of salmonellosis in humans are associated with exposure to exotic pets (Woodward, 1997). Most of these cases are linked to exposure to reptiles like iguanas and turtles, and, to a lesser extent, to mammals like sugar gliders and hedgehogs *(Salmonella tilene, Salmonella tuphimurium* and *Salmonella enteritidis)*. Every year, around 100.000 persons get infected with salmonellosis in the European Union (GIDEON, 2020).

Transmission is common via non-traumatic contact, ingestion, and inhalation (Woodward, 1997). In 2019, 54 people were infected with *Salmonella typhimurium* via pet four-toed hedgehogs in the USA[11]. Eight people were hospitalized. No deaths were reported. The Salmonella germ is a group of bacteria that can cause diarrheal illness in humans. Most people infected with Salmonella during this outbreak developed diarrhea, fever, and stomach cramps 12 to 72 hours after being exposed to the bacteria. Children under the age of 5, adults of 65 years and older, and people with a weakened immune system usually develop a severe illness and need to be hospitalized. Salmonella strains can cause infection in urine, blood, bones, joints, or the nervous system (spinal fluid and brain), and can cause severe disease[12].

Human health officials are concerned about the prophylactic use of antibiotics in exotic pets by breeders and wholesalers, as this may lead to antibiotic-resistant Salmonella strains (Schoemaker, 2008). The use of prophylactic antibiotic treatments should therefore be discouraged and limited to clinical cases with a proper indication. The dose, course duration, and route of administration should be determined with utmost care to avoid suboptimal therapy (Schoemaker, 2008).

[10] *CDC Center for Disease Control and Prevention website https://www.cdc.gov/tb/publications/factsheets/general/mbovis*

[11] *https://www.cdc.gov/salmonella/typhimurium-01-19/index.html*

[12] *https://www.cdc.gov/salmonella/general/index.html*

4. ONE EXAMPLE OF ZOONOTIC DISEASES TRANSMITTED BY AN EXOTIC PET

The Variegated Squirrel Bornavirus 1 (VSBV-1) is a clear example of a human health threat that has emerged from uncontrolled exotic pet trading and keeping in the last five years.

3.4 BORNAVIRUS 1 IN SQUIRRELS

The Bornavirus 1 has been identified in a large number of mammal species, like horses, sheep, goats, cattle, pigs, donkeys, deer, llamas, alpacas, rabbits, squirrels, pygmy hippopotamus, dogs, cats, monkeys, sloths, lynxes, shrews, ostriches, foxes, mallards, geese, psittacine birds, jackdaws, rabbits, wild voles, snakes, macaques, and raccoons (OIE WAHIS, GIDEON).

VSBV-1 is a specific bornavirus. The incubation time and the mode of transmission have not been determined. Animal scratches and bites are considered the main risk factors (Hoffman, 2015).

The virus was detected in 2015 as the cause of acute fatal encephalitis among three breeders of variegated squirrels *(Sciurus variegatoides)* in eastern Germany. The three breeders were males aging between 62 and 72. These breeders have been actively breeding, swapping and selling exotic squirrels to a large network of people. The complexity of such exotic animal trade networks, coupled with a lack of registration of squirrel breeders and keepers in Germany, make it difficult to conduct epidemiological investigations in such specific trade communities (Tappe, 2019).

It is scientifically proven that the *Sciurus variegatoides* is a reservoir for Bornavirus 1 (ECDC, 2015). These species are allowed to be kept as pets throughout Europe, but health officials don't know who keeps them due to lack of registration and oversight. *Sciurus variegatoides* was initially imported from Costa Rica to Germany in 1999. *Callosciurus prevostii* was introduced to Germany earlier, in the 1980s, from Southeast Asia (most probably Malaysia and Thailand). Many breeders kept both species, and kept them physically close to one another. Breeders and keepers were regularly exposed to the squirrels, whereas other household members had only occasional contact with the animals (Tappe, 2019). As a precautionary measure, direct contact with exotic squirrels should be avoided, ECDC advised in a rapid risk assessment response.

In 2018, after the recent detection of the VSBV-1 virus in a Prevost's squirrel *(Callosciurus prevostii)* in a zoo in northern Germany, health authorities retrospectively investigated a fatal case of a female animal caretaker who had worked at that zoo. She had died of limbic encephalitis in 2013. Analyses demonstrated a spillover infection from the Prevost's squirrel (Schlottau, 2017).

In the course of a squirrel trade investigation (Tappe, 2019), researchers identified another two male squirrel breeders who had died of encephalitis of unknown causes in 2005 and 2006 in the federal states of respectively North Rhine-Westphalia and Brandenburg. That brings the total to six either confirmed or probable human casualties of VSBV-1.

American red squirrel *(Tamiasciurus hudsonicus)*

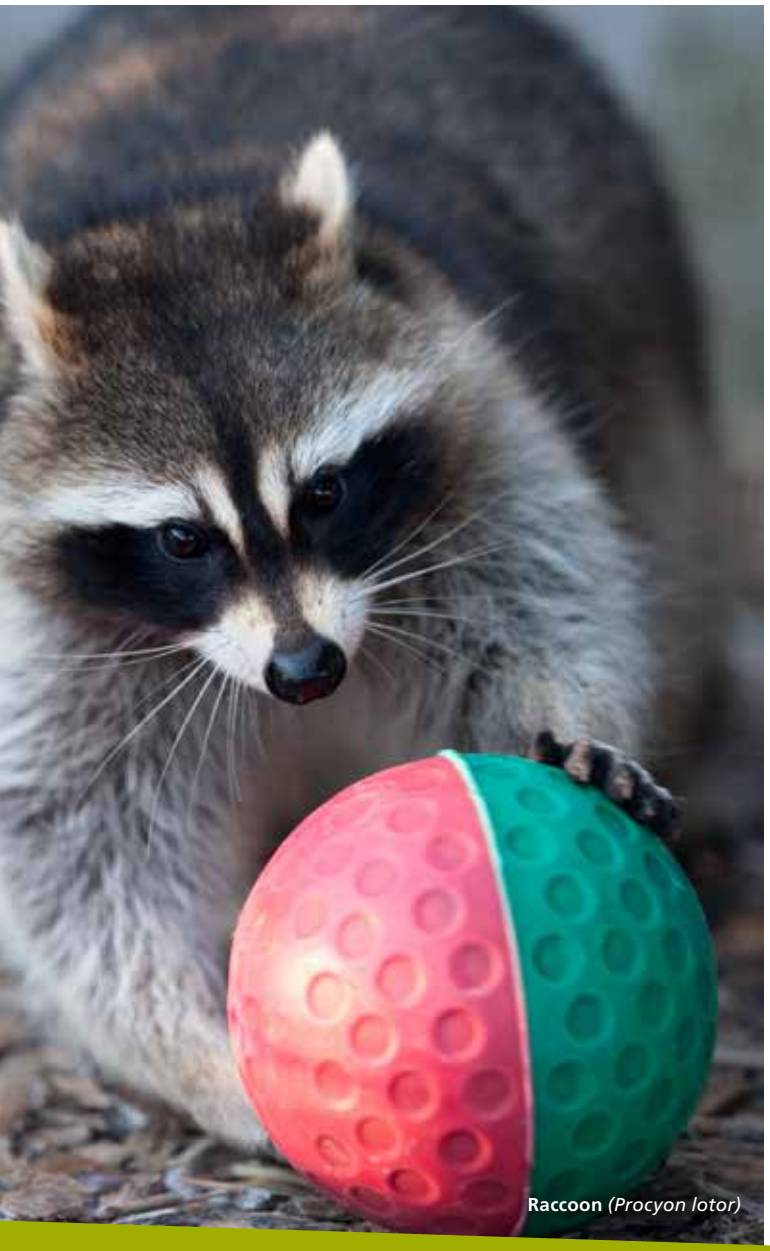
5. CONCLUSIONS AND RECOMMENDATIONS

THE GOOD NEWS

Luckily very few exotic mammal pets have been identified as a direct source for the transmission of notifiable zoonotic diseases in the last five years by RIVM and other organizations reporting on zoonotic outbreaks. In this report we presented one case of a zoonosis, Variegated Squirrel Bornavirus 1 (VSBV-1), transmitted by exotic pet squirrels, leading to six fatal encephalitis cases.

THE BAD NEWS

In the described cases of *C. burnetii, M.Bovis* and *Salmonella spp.*, the sources of zoonotic outbreaks remain – even after extensive research – unknown. It's not known which mammal species (can) carry which zoonosis and there are yet-to-be-discovered zoonoses, many of which are likely still hiding as a reservoir in wildlife. We therefore do not know what might be hiding under the skin of exotic mammals brought into our homes as pets.



Raccoon *(Procyon lotor)*

Exotic animals are not subject to the same level of structural health surveillance as domesticated animals. Exotic animals are not subject to identification and registration requirements, there is less knowledge and monitoring of zoonoses in these animals, and they are normally not vaccinated against or treated for the most common transmissible diseases (like Coxiella burnetii, leptospirosis or rabies) like domesticated animals are. It is therefore not surprising that many of the recorded emerging zoonoses originate from non-domesticated species or are transmitted to humans via an exotic mammal.

Many mammal species that could potentially be involved in zoonotic transmissions are still legally kept as pets around the world, in Europe and in the Netherlands. Four out of five of the described zoonoses have been labelled by the RIVM with the highest risk category for humans (EMZO risk IV, RIVM 2010). While the risk of transmissions originating from exotic pets might be low, it is still worth asking ourselves whether we are willing to take this risk with potentially huge consequences to satisfy a non-essential exotic pet hobby.

The societal impact of such zoonoses, once this small chance of transmission becomes a reality, cannot be disregarded. Exotic pet keeping poses an non-essential zoonotic risk to human health. The question is therefore: as a society, are we willing to accept the risk of exposure to serious zoonotic threats purely to satisfy the exotic pet hobby?

Bats *(Chiroptera)*

RECOMMENDATIONS

The keeping of exotic animals as pets is a largely uncontrolled trend which benefits from unclear, incomplete, or inexistent regulations and/or enforcement in most EU Member States. Many countries have no specific requirements to monitor the health status of exotic pets.

Exotic pets have the potential to constitute a severe public health hazard due to the zoonotic risks involved, which are to a large extent unknown and thus difficult to monitor. In order to minimize these risks, a new regulatory approach is required.

PREVENTION PREFERRED OVER EARLY WARNING

Dealing with zoonotic risks demands a prevention-based approach at national and EU-level; the focus should be on limiting the possibilities for transmissions of zoonotic diseases in the first place. This means reducing direct wildlife-human contact to the bare minimum. 'Wildlife distancing' to prevent a new episode of necessary 'Social distancing'.

EFFECTIVE REGULATIONS FOR EXOTIC PET KEEPING LIMITING RISKS OF ZOONOTIC THREATS

Exotic pet trading and keeping, a prime example of close proximity between wildlife and humans, should therefore be regulated at national and EU-level by means of a Positive List of animal species allowed to be kept as pets. The list would only include species which, after a careful scientific evaluation, do not constitute unacceptable risks for animals nor humans, also from a public health perspective. This approach is an important step in preventing zoonotic disease outbreaks, by curbing the potential of pathogens transmitting from animals to humans. All it takes is political will.

Annex 1: databases for infectious diseases and zoonosis

Organisation	Database	Link
RIVM, Dutch Center for Infectious Disease Control	Emerging zoonosis information and prioritizing systems	https://ezips.rivm.nl/
European Center for disease prevention and control (ECDC, Solna Sweden)	Communicable disease threats reports, 2019, 2020	https://www.ecdc.europa.eu/sites/default/files/documents/Communicable-disease-threats-report-13-june-2020.pdf Eurosurveillance, Europe's journal on infectious disease surveillance, epidemiology, prevention and control (ECDC) https://www.eurosurveillance.org
European Association of Zoo and Wildlife Veterinarian EAZWV	Transmissible Disease Fact Sheets	https://www.eazwv.org/page/UsutuVirus?&hhsearchterms=%22coxiella%22&#rescol_5576473
World Health Organisation (WHO)	Database of Situation reports World Animal Health	https://www.who.int/emergencies/diseases/en/
OIE	Information System (WAHIS)	https://www.oie.int/wahis_2/public/wahid.php/Wahidhome/Home
GIDEON Informatics	Global infectious disease and epidemiology network database	https://web.gideononline.com/

Prairie dog *(Cynomys)*

Literature

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https://www.aap.nl/uploads/inline-files/Alive-and-kicking.pdf

AVMA, American Veterinary Medicine Association, Zoonotic diseases and pets, FAQ, 2020
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https://pubmed.ncbi.nlm.nih.gov/24661260/

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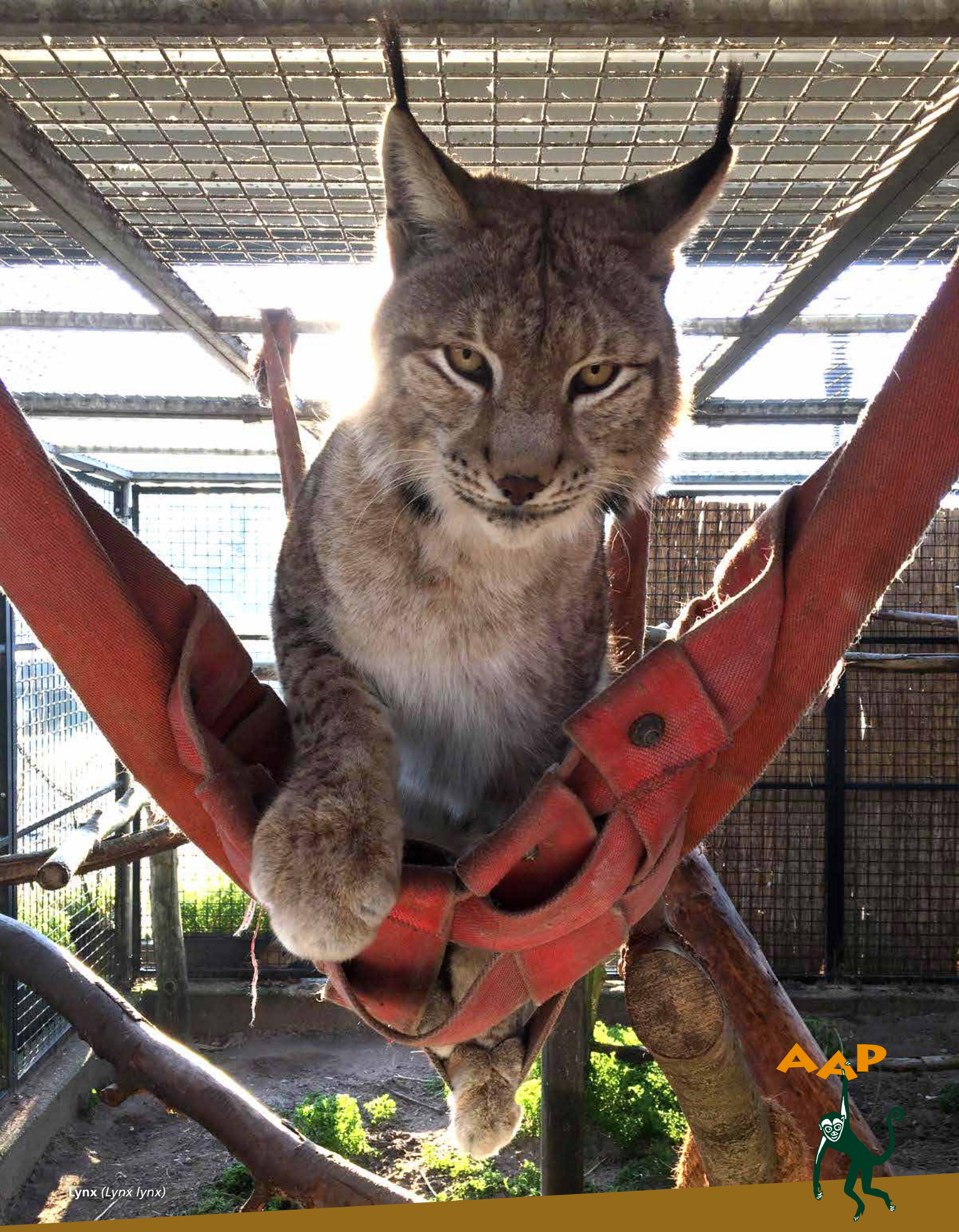

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