GLOBAL INVASIVE SPECIES DATABASE

FULL ACCOUNT FOR: ***Vulpes vulpes***

Vulpes vulpes 简体中文 正體中文

System: Terrestrial

Kingdom	Phylum	Class	Order	Family
Animalia	Chordata	Mammalia	Carnivora	Canidae

Common name vos (Dutch), red fox (English), rev (Norwegian), Rotfuchs (German), lis (Polish), raposa (Portuguese), fuchs (German), renard (French), zorro (Spanish), silver, black or cross fox (English), lape (Lithuanian), volpe (Italian)

Synonym *Canis vulpes* , (Linnaeus 1758)

Similar species *Vulpes vulpes*

Summary The European red fox is probably responsible for declines of some small canids and ground-nesting birds in North America, and numerous small- and medium-sized rodents and marsupials in Australia. A programme to reduce predation pressure on native fauna within the critical weight range of 35 g to 5.5 kg in Western Australia has involved the use of 1080 fox baits.

view this species on IUCN Red List

Species Description

The red fox is a member of the family Canidae which includes wolves, jackals and coyotes. Males are slightly larger than females. Both males and females, but particularly females, have seasonal variations in body weight. Geographic and subspecies variations in size also occur. Adults have a head and body length of 570 to 740 mm, a tail length of 360 to 450 mm and weigh between 4.5 to 8.3 kilograms (Coman 1983, in Saunders *et al*. 1995). In general, throat and abdomen are white, lower legs and ears are black and a bushy tail is tipped in white. Three colour morphs of *V. vulpes* are recognised: red, silver/black and cross. A pale-yellowish colour morph is common on the Arabian peninsula and within native subspecies in North America.

Notes

There is a close relationship between fox and rabbit numbers (Saunders *et al*. 2007). When rabbit populations crash, due to drought, myxomatosis or Rabbit Calicivirus Disease (RCD), there will be a lag period until fox numbers decline and adjust to the reduced prey population. The likelihood of increased predation pressure on native wildlife over this period needs to be considered. Rabbit numbers may also be affected by foxes. Preliminary studies suggest that foxes and feral cats may slow the recovery of rabbit populations after they crash due to drought or disease. The potential role of foxes in rabbit control and the impact of foxes on native wildlife following crashes in rabbit populations needs to be clarified (Saunders *et al*. 2007).

Lifecycle Stages

Parturition occurs after a gestation of 51 to 53 days. Lactation lasts for approximately five weeks and weaning occurs gradually. Females can breed before one year of age, however, in areas of high density most yearlings do not produce pups. *V. vulpes* can live up to 9 years in the wild, although few individuals live more than 6 years. In the northern hemisphere, dispersal usually occurs from September to January.

Uses
Wild-caught *V. vulpes* are used in sport hunting. Foxes are also raised in farms, where they generate millions of dollars a year worldwide; for example in the EU from 2001 to 2002 fur farms generated US $4 600 million (International Fur Trade Federation Undated). Most of the world's farmed fur is produced in Europe, accounting for 63% of fox production (EU = 47%); Finland is the world's largest producer and exporter of fox skin (International Fur Trade Federation Undated). Russia/the Baltic States and China account respectively for 11% and 27% of fox production (International Fur Trade Federation Undated).

Habitat Description
The worldwide distribution of the red fox, ranging from tundra to the desert as well as urban areas, suggests that it can survive in most sorts of environments (Saunders *et al*. 1995). The fox is probably most abundant in fragmented environments typically found in agricultural landscapes because these offer a wide variety of cover, food and den sites (Saunders *et al*. 1995). More uniform, open environments are less favoured as are heavily forested or mountainous areas. Foxes do not live entirely within closed canopy forests but can penetrate some distance into them in search of food (Jarman 1986, in Saunders *et al*. 1995). The red fox appears to be absent from areas with tropical climates, such as Asia, although the reasons for this are unclear. In Australia the fox can survive in habitats ranging from arid through to alpine as well as urban. The only limitations on distribution appear to be the presence of dingoes and the tropical climate of the northern parts of Australia (Saunders *et al*. 1995).

Reproduction
Females reproduce only once a year. Gestation lasts 51 to 53 days with most cubs born during August and September. In Australia females are reproductively active from July to October with a peak during August in southeastern Australia (McIntosh 1963a, Ryan 1976a, in Saunders *et al*. 1995). In temperate regions breeding occurs from December to April (later in more northern latitudes). Mean litter size is four up to a maximum of about ten (Saunders *et al*. 1995). Both sexes become sexually mature from ten months of age (Saunders *et al*. 1995). Although social groups of one male and several vixens do exist, most foxes are thought to have only one mate; males may also leave their normal territory temporarily in search of other mating opportunities (Saunders *et al*. 1995).

Nutrition
Foxes prey particularly on small to medium-sized, ground-dwelling and semi-arboreal mammals, ground-nesting birds and chelid tortoises (DEWHA 2008b). Terrestrial mammals in Australia at the greatest risk are those that weigh between 35 g and 5.5 kg (*critical weight range* species), including ground-nesting birds, many of which are endangered or vulnerable (DEWHA 2008a). Although predominantly carnivorous, the fox is an opportunistic predator and scavenger with no specialised food requirements (Saunders *et al*. 1995). Foxes are omnivorous, consuming fruit, vegetables, eggs and insects, especially when they are seasonally available. Diet studies conducted in Australia show rabbits, house mice and sheep taken as carrion to be the most common food items (Saunders *et al*. 1995).

General Impacts
Reduction in native biodiversity: The damage to Australian wildlife since European settlement has been catastrophic (e.g. Salo *et al*. 2007). At least 20 species of Australian mammals have become extinct (Saunders *et al*. 1995). This represents about one half of the world's mammal extinctions in the last 200 years; a further 43 species are judged to be either endangered or vulnerable (Commonwealth Endangered Species Advisory Committee Report 1992, in Saunders *et al*. 1995). The causes are complex and the impact of foxes on wildlife have probably been exacerbated by habitat modification and fragmentation (Saunders *et al*. 1995).
In Austrialia the fox has eliminated remnant populations of some native rodent and marsupial species. The best known Australian example of impact on a native species as reported by Saunders and colleagues (1995) is that of the 'Near Threatened (NT)' black-footed rock-wallaby (*Petrogale lateralis*), living in small, relict colonies in the wheatbelt of Western Australia. Management of local fox populations using poisoned baits resulted in a substantial increase in wallaby numbers. Another threatening process which has recently come to light is the impact of predation by foxes on native marsupials and on the 'Vulnerable (VU)' malleefowl *Leipoa ocellata*) (Saunders *et al*. 1995). For more examples of Australian fox removal studies please see Saunders *et al*. 1995.
In North America, introduced foxes have negative impacts on many ground-nesting birds, such as ducks and grouse. In California, European red foxes have to be controlled on an annual basis to protect the nesting grounds of several endangered species of birds. European red foxes also negatively impact smaller native canids, such as the endangered San Joaquin kit foxes and subspecies of native red foxes.
Competition: The impact of competition by foxes appears to be secondary to that of predation. Morris (1992) suggests foxes may compete with the chuditch or western quoll (*Dasyurus geoffroii*) for food in jarrah forest in Western Australia. Foxes also prey on young chuditch.
Agricultural: European red foxes are also a threat to livestock as they prey on poultry, lambs and kids.
Disease Transmission: In its introduced range in Australia the fox carries no diseases of serious economic or public health significance, although recently foxes have been found to harbour the hydatid parasite (Saunders *et al*. 2007). Controversy still surrounds its possible role as a wild reservoir host for the rabies virus (Saunders *et al*. 2007). In many parts of the northern hemisphere, the fox is the main reservoir of this disease and, given the widespread distribution of foxes in Australia, the possibility of rabies developing as an established disease in fox populations cannot be dismissed (Saunders *et al*. 2007).
Many other infectious diseases occur in foxes, although little is known of their incidence in Australia, or their impact on population regulation. These include mange, canine distemper, parvovirus, toxoplasmosis, canine hepatitis, tularaemia, leptospirosis, staphylococcal infections and encephalitis (Saunders *et al*. 1995). Like most carnivores that feed on a wide range of prey, foxes also carry a variety of endoparasites (Saunders *et al*. 1995). The incidence of helminth parasites, in foxes in particular, has been intensively surveyed in southeastern Australia because of their potential transmission to domestic animals (Saunders *et al*. 1995).

Management Info
An analysis by Salo and colleagues (2007) has confirmed that introduced predators generally have detrimental impacts on populations of native species. Impacts on prey are much greater in Australia than in other parts of the world. Since the early days of European settlement in Australia, control of predators has been attempted using a variety of methods, including shooting, trapping, fencing and poisoning (Rolls 1969, in Glen *et al*. 2007). Control of urban foxes also presents a problem, as conventional lethal techniques (e.g., shooting, poisoning and trapping) cannot be used in built up areas. Efforts are now directed towards mitigating the impact of the fox using baits to deliver vaccines or poisons or to regulate fertility (Armstrong 2004; Marks *et al*. 1996; Vos 2003). The ongoing costs of fox control are high. To aerially bait approximately 35 000 square kilometers/year costs approximately $1.3 million (Saunders & McLeod 2007, in DEWHA 2008b). Exclusion fencing costs up to $10 000/km (DEWHA 2008b).
Preventative Measures: Fox scats are surprisingly persistent in the field and sufficient DNA is contained within scats for 100% accuracy in species identification, even after three months of weathering. DNA-based species identification is robust, no matter what method is used to extract DNA (Berry *et al*. 2007). DNA extraction with the commercial kit was the most costly (about AU$6.0, Euro 3.6, US$4.4 per sample in consumables) and time-consuming aspect of scat processing (compared with less than AU$0.10 per sample for chelex). Use of a cheaper and more straightforward extraction protocol places fewer constraints on the number of scats that could be processed.
Physical: Exclusion fencing is used to protect areas of high conservation value (Algar & Smith 1998, in Robley *et al*. 2007). It has proven to be a valuable tool in aiding the re-introduction of species to areas from which they have been previously eliminated by feral animals such as foxes (Robley *et al*. 2007). Results from fencing trials by Robley and colleagues (2007) indicate that fences should be 1.8 m high, have an overhang that is at least 600 mm in circumference that is curved or shaped in such a way that prevents animals climbing over from underneath, and have an apron with a mesh hard enough to prevent foxes chewing through. Electric fencing is not required.
Chemical: In Australia the fox is most commonly managed by setting baits impregnated with 1080 (sodium fluoroacetate) poison (Gentle *et al*. 2007). Fox numbers are controlled by laying dried meat baits containing the poison 1080 (sodium monofluroacetate) at least four times per year. The poison is a naturally occuring substance found in native plants called gastrolobiums or 'poison peas'. While native animals have evolved with these plants and have a high tolerance to the poison, introduced animals do not. Baits consist either of fresh or dried meat, offal, chicken eggs or commercial mixtures (Saunders & McLeod 2007, in Glen *et al*. 2007). Baiting is the only method currently available for predator control that can be used successfully over broad areas (Gentle 2005, in Glen *et al*. 2007). However, the long-term effectiveness of such control campaigns is likely to be limited due to the ability of foxes to disperse over considerable distances and to swiftly recolonise areas (Gentle *et al*. 2007). In southeastern Australia, baiting for foxes by landholders is encouraged by state government agencies. However, for reasons including bait caching and bait degradation, current baiting practices may not always be efficient or effective (Gentle *et al*. 2007). Managers should adopt a approach which seeks to minimise potential risk to non-target individuals, while clarifying population-level effects through continued research (Glen *et al*. 2007).
Fertility regulators include cabergoline, a dopamine agonist that has previously been demonstrated to have an abortifacient effect in cats (*Felis catus*) and dogs (*Canis familiaris*) (see Marks *et al*. 1996). Marks and colleagues (1996) report that the chemical is palatable to foxes and easily incorporated into a non-poisonous bait. The incidence of cubs was significantly lower in treatment dens than in the controls.
Vos (2003) reports that as a result of oral vaccination of foxes rabies has almost been completely eradicated from Western and Central Europe.

Pathway
Introduced for sport hunting purposes in Australia and USA

Principal source:

Compiler: IUCN SSC Invasive Species Specialist Group
Updates with support from the Overseas Territories Environmental Programme (OTEP) project XOT603, a joint project with the Cayman Islands Government - Department of Environment

Review: Jan F. Kamler, Wildlife Conservation Research Unit.\ Oxford University UK

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ALIEN RANGE

[14] AUSTRALIA
[1] ISLE OF MAN
[1] NORTH AMERICA
[14] CANADA
[1] MEXICO
[49] UNITED STATES

Red List assessed species 125: EX = 6; CR = 22; EN = 30; VU = 20; NT = 24; DD = 3; LC = 20;

Acanthophis rugosus **LC**
Antechinomys laniger **LC**
Bettongia gaimardi **NT**
Bettongia penicillata **CR**
Burramys parvus **CR**
Caretta caretta **EN**
Chlamydotis undulata **VU**
Dasyornis broadbenti **LC**
Dasyurus maculatus **NT**
Echiopsis curta **NT**
Euastacus armatus **DD**
Euastacus balanesis **EN**
Euastacus bindal **CR**
Euastacus brachythorax **EN**
Euastacus claytoni **EN**
Euastacus dalagarbe **CR**
Euastacus diversus **EN**
Euastacus fleckeri **EN**
Euastacus girurmulayn **CR**
Euastacus guruhgi **CR**
Euastacus hirsutus **EN**
Euastacus jagabar **CR**
Euastacus maccai **EN**
Euastacus mirangudjin **CR**
Euastacus pilosus **EN**
Euastacus rieki **EN**
Euastacus simplex **VU**
Euastacus sulcatus **VU**
Euastacus urospinosus **EN**
Euastacus wiowuru **NT**
Euastacus yarreansis **VU**
Heleioporus australiacus **VU**
Lagorchestes asomatus **EX**
Lagorchestes hirsutus **VU**
Leipoa ocellata **VU**
Litoria raniformis **EN**
Macropus eugenii **LC**
Macrotis lagotis **VU**
Anser erythropus **VU**
Ardeotis australis **NT**
Bettongia lesueur **NT**
Burhinus grallarius **NT**
Caloprymnus campestris **EX**
Chaeropus ecaudatus **EX**
Dasyornis brachypterus **EN**
Dasyurus geoffroii **NT**
Dasyurus viverrinus **NT**
Elusor macrurus **EN**
Euastacus australasiensis **LC**
Euastacus bidawalis **EN**
Euastacus bispinosus **VU**
Euastacus clarkae **CR**
Euastacus crassus **EN**
Euastacus dharawalus **CR**
Euastacus eungella **CR**
Euastacus gamilaroi **CR**
Euastacus gumar **EN**
Euastacus guwinus **CR**
Euastacus hystricosus **EN**
Euastacus jagara **CR**
Euastacus maidae **CR**
Euastacus monteithorum **CR**
Euastacus polysetosus **EN**
Euastacus setosus **CR**
Euastacus spinichelatus **EN**
Euastacus suttoni **VU**
Euastacus valentulus **LC**
Euastacus yanga **LC**
Euastacus yigara **CR**
Isoodon obesulus **LC**
Lagorchestes conspicillatus **LC**
Lagostrophus fasciatus **EN**
Leporillus conditor **VU**
Macroderma gigas **VU**
Macropus parma **NT**
Macrotis leucura **EX**

Mastacomys fuscus **NT**
Neophema chrysogaster **CR**
Notoryctes typhlops **DD**
Onychogalea fraenata **EN**
Onychogalea unguifera **LC**
Pedionomus torquatus **EN**
Perameles bougainville **EN**
Perameles gunnii **NT**
Petrogale penicillata **NT**
Petrogale xanthopus **NT**
Phascogale calura **NT**
Plectrophenax hyperboreus **NT**
Polytelis alexandrae **NT**
Potorous longipes **EN**
Pseudemoia pagenstecheri **LC**
Pseudocheirus occidentalis **VU**
Pseudomys higginsi **LC**
Pseudomys occidentalis **LC**
Pseudomys shortridgei **NT**
Sminthopsis dolichura **LC**
Sminthopsis psammophila **EN**
Sterna albifrons **LC**
Sterna nereis **VU**
Thinornis rubricollis **NT**
Turnix melanogaster **VU**

Myrmecobius fasciatus **EN**
Notoryctes caurinus **DD**
Numenius tahitiensis **VU**
Onychogalea lunata **EX**
Parantechinus apicalis **EN**
Pelecanoides garnotii **EN**
Perameles eremiana **EX**
Petrogale lateralis **NT**
Petrogale rothschildi **LC**
Pezoporus occidentalis **CR**
Phascogale tapoatafa **NT**
Podiceps cristatus **LC**
Potorous gilbertii **CR**
Potorous tridactylus **LC**
Pseudemydura umbrina **CR**
Pseudomys fumeus **EN**
Pseudomys novaehollandiae **VU**
Pseudomys oralis **VU**
Setonix brachyurus **VU**
Sminthopsis douglasi **NT**
Spheniscus magellanicus **NT**
Sterna dougalii **LC**
Strophurus taenicauda **NT**
Thylogale billardierii **LC**

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Summary: The IUCN Red List of Threatened Species provides taxonomic, conservation status and distribution information on taxa that have been globally evaluated using the IUCN Red List Categories and Criteria. This system is designed to determine the relative risk of extinction, and the main purpose of the IUCN Red List is to catalogue and highlight those taxa that are facing a higher risk of global extinction (i.e. those listed as Critically Endangered, Endangered and Vulnerable). The IUCN Red List also includes information on taxa that are categorized as Extinct or Extinct in the Wild; on taxa that cannot be evaluated because of insufficient information (i.e. are Data Deficient); and on taxa that are either close to meeting the threatened thresholds or that would be threatened were it not for an ongoing taxon-specific conservation programme (i.e. are Near Threatened).
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Summary: This compilation of information sources can be sorted on keywords for example: Baits & Lures, Non Target Species, Eradication, Monitoring, Risk Assessment, Weeds, Herbicides etc. This compilation is at present in Excel format, this will be web-enabled as a searchable database shortly. This version of the database has been developed by the IUCN SSC ISSG as part of an Overseas Territories Environmental Programme funded project XOT603 in partnership with the Cayman Islands Government - Department of Environment. The compilation is a work under progress, the ISSG will manage, maintain and enhance the database with current and newly published information, reports, journal articles etc.
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Summary: Models for assessing the risk that exotic vertebrates could establish in Australia have been developed for mammals, birds (Bomford 2003; Bomford 2006, 2008), reptiles and amphibians (Bomford 2006, 2008; Bomford *et al*. 2005). These Risk Assessment models have been further explored by Western Australia Department of Agriculture & Food (DAFWA) to confirm that they reasonably predict public safety, establishment and pest risks across a full range of exotic species and risk levels. Mammals and birds were assessed for the pest risk they pose if introduced to Australia, by calculating Vertebrate Pests Committee (VPC) Threat Categories. These categories incorporate risk of establishing populations in the wild, risk of causing public harm, and risk of becoming a pest (eg causing agricultural damage, competing with native fauna, etc). The 7-factor Australian Bird and Mammal Model was used for these assessments.
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