



European rabbit

By staff of the Vertebrate Pest Research Section, Forrestfield.

European rabbits (*Oryctolagus cuniculus*) originated in Spain but they are now found throughout most of the temperate regions of Europe, North Africa, Chile and Australasia.

The majority of Australian rabbits are descended from 24 wild rabbits released near Geelong in 1859. By the 1920s, rabbits had colonised most of the southern half of Australia and were present in extremely high numbers over most of that area. Rabbits were established on at least one island off the coast of Western Australia in 1827 and may have been present on some others even earlier than this. It was common practice for early mariners to leave rabbits on small islands for meat as a food supply in case of shipwreck or future visits.

Until the successful release of the myxoma virus, and the introduction of 1080-based (sodium fluoroacetate) poisoning programs in the 1950s, rabbit numbers remained essentially unchecked. During this period they

had a profound effect on Australia's economy. Even today, rabbits are estimated to cost the nation at least \$600 million annually in lost agricultural production.

Rabbits have a well-documented history for causing severe environmental damage. In Western Australia they are declared pests of agriculture under the *Agriculture and Related Resources Protection Act 1976* and as such, landholders are required to control rabbits on their properties.

Identification

The typical European rabbit is grey-brown with a pale belly. Black or ginger forms are not uncommon, though they represent a small proportion of the population; white rabbits are rarely seen in the wild. In Western Australia adult wild rabbits weigh from around 1200 to 2250 grams.

Behaviour

Rabbits are largely nocturnal animals, emerging from shelter in the late afternoon and retreating early in the morning. They avoid high temperatures and predators by living in burrows or in the shelter of dense scrub or fallen timber.

During the winter breeding season, rabbits live in small coherent social groups that tend to break down in summer when breeding ceases. A large warren may contain several groups. Each social group has its own territory, which it actively defends against intruders. Members mark their territory on logs, grass or other objects with faeces, urine and secretions from a gland beneath their chins. Dominant males (bucks) will also use dung piles to mark their territories. Within each group there is a strict social hierarchy. High-ranking females (does) breed more successfully and lose fewer young (kittens) than lower ranking animals. Dominant males father more offspring than subordinate animals.



European rabbit (photo courtesy of CSIRO).

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Why rabbits have succeeded in Western Australia

Rabbits evolved in the western Mediterranean region, which has a cool wet winter and hot dry summer. This is similar to the climate of the south-west of this State. Rabbits can produce relatively large numbers of offspring, which allows them to take advantage of favourable conditions and to colonise or recolonise areas quickly.

Rabbits are best suited to districts with a long winter, which allows a lengthy breeding season. The biggest populations occur where areas of uncleared scrub, or other suitable cover, are interspersed with improved pastures. These conditions combine the advantages of both high quality refuge areas and food resources.

Remnant vegetation in the south-west of Western Australia offers considerable complexity and protection so that rabbits from these areas have less reliance on warrens than in other parts of Australia. Warrens and/or short breeding burrows (stops) are still required for successful reproduction, however.

Reproduction

The main breeding season of rabbits in south-west Western Australia extends from about May to November depending on availability of suitable green feed. It is usually shorter in other areas of the State. The percentage of adult females that are pregnant rises steadily through the breeding season to nearly 100 per cent in July and August. Later, the pregnancy rate falls, as does the average litter size. While breeding virtually ceases when pastures dry off, in the south-west of Western Australia, a small proportion of females can be pregnant in most months. Where favourable conditions for breeding persist, a single doe may produce up to 30 kittens in six or seven litters a year.

Female rabbits usually conceive their first litters shortly after the first autumn rain, thus ensuring the maximum numbers of litters are born while green feed is available. Gestation lasts about 30 days.

In many rabbit populations, the high reproductive rate can be offset by a 60 to 70 per cent death rate amongst kittens up to a month old. The mortality of kittens born late in the year may rise to nearly 100 per cent due mainly to lack of suitable feed. Climatic factors, predators and diseases are the main causes of natural mortality. As kittens become older, their survival rate improves markedly. Once they reach adult weight their chances of survival are good. Adult rabbits have an average life expectancy of two to five years.

Damage

Rabbits compete directly with livestock and many native animals for food. It has been estimated that eight rabbits



Rabbit warren in a pasture paddock.

eat as much as one sheep. However, unlike sheep, which graze over the entire paddock, rabbit grazing tends to be concentrated near refuge areas. This can result in very severe localised degradation of both pasture and bush reserves, and in significant soil erosion.

Rabbits graze plants closer to the ground than livestock, often killing germinating clover seedlings, preventing good clover establishment. Rabbits may overgraze perennial grasses during summer, even eliminating them from a paddock. The pasture is then more likely to be invaded by weeds, and can become more prone to erosion.

Rabbits do considerable harm to the natural environment and the detrimental impact of rabbits on the regeneration of native plants is well recognised. In many rangeland areas, as few as four rabbits per hectare can prevent the regeneration of native plants, for example, some *Acacia* species. During drought rabbits can strip bark from shrubs and trees. This increased grazing pressure often results in the loss of vegetation cover, leading to soil erosion. The digging by rabbits to make warrens may also cause soil erosion and tree losses.

Biological control

Two viral biological control agents, Myxomatosis and Rabbit Haemorrhagic Disease or RHD (also known as Rabbit Calicivirus or RCD) have been introduced to Australia to help reduce the impact of rabbits on agricultural production and the natural environment.

Myxomatosis

The myxoma virus was introduced into eastern Australia in 1950 and to Western Australia in 1951. Despite some less virulent strains evolving, outbreaks (epizootics) of myxomatosis (the disease caused by the myxoma virus) are still important in helping to keep rabbit numbers under control.

The virus is transmitted on the mouth-parts of biting insects, particularly mosquitoes and fleas. Mosquitoes were the only efficient spreaders of the myxoma virus in Australia until the European Rabbit Flea and the Spanish Rabbit Flea were introduced in 1969 and 1996. Outbreaks of myxomatosis during winter are mainly spread by European rabbit fleas and often tend to kill more rabbits due to the added stress imposed by lower temperatures at this time. Mosquito-borne outbreaks generally occur in summer.

Studies by research staff from the Department of Agriculture have shown that myxomatosis alone will often not reduce rabbit numbers to an acceptable level. Death rates for this disease can vary from 30 per cent to up to 90 per cent, but are typically around 50 per cent. In some years, high mortality may occur but the rabbit population can recover quickly the following year because most surviving rabbits are immune. Following an outbreak of myxomatosis, infected rabbits that survive acquire lifelong immunity. As well, young born to immune mothers are protected from the disease during the first six weeks of their lives by maternal antibodies. Exposure to the virus during this period will convert the temporary immunity into life-long immunity.

Because of this, an outbreak of myxomatosis does not usually occur in two consecutive years because there are too few susceptible rabbits. By the third year, natural attrition, and the birth of new susceptible rabbits, reduces the proportion of immune individuals and the population again becomes susceptible to the disease.

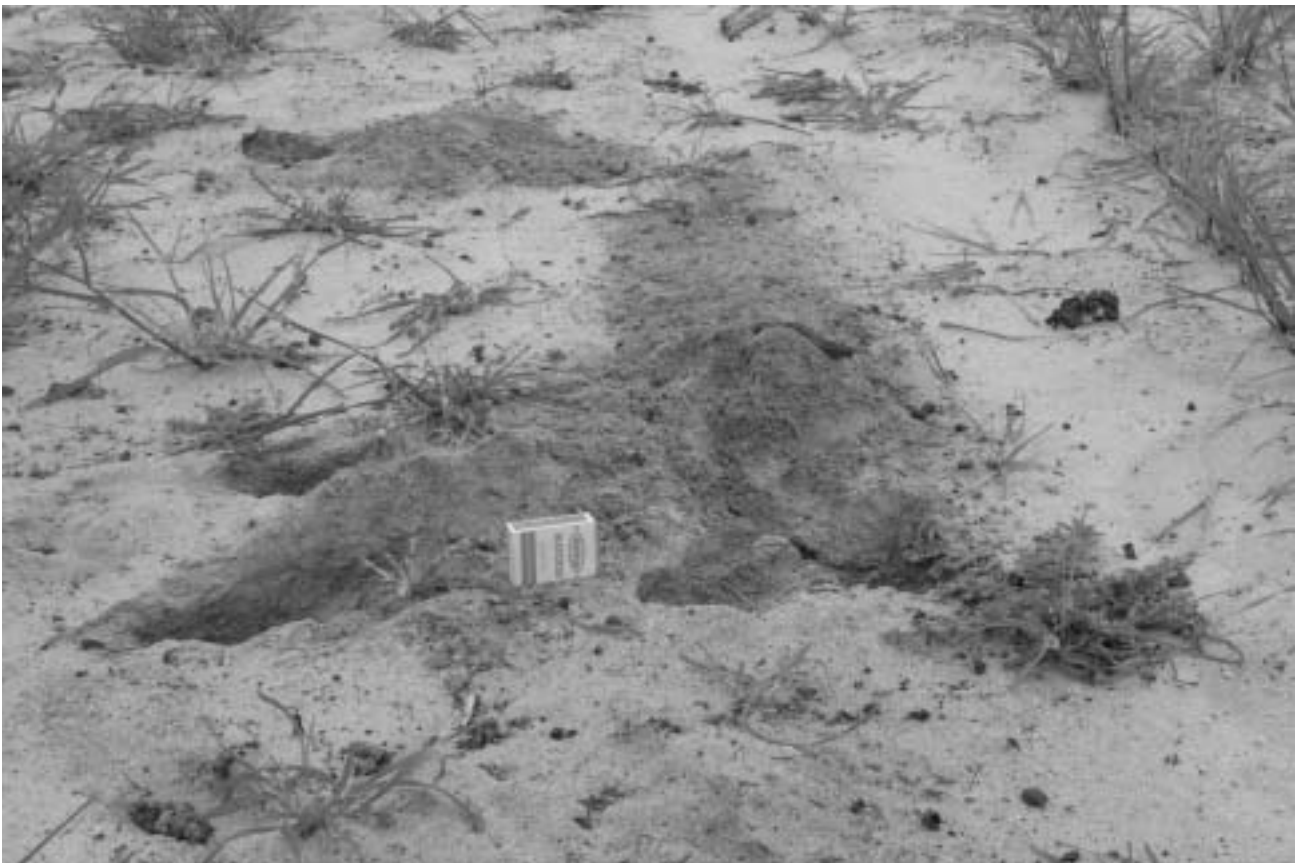
Rabbit haemorrhagic disease

RHD has recently been introduced to Australia. This virus, which is specific to rabbits, was first detected in China in 1984 and spread rapidly to Europe. RHD was accepted as a biological control agent against rabbits in Australia in October 1996 after undergoing rigorous testing on livestock and native species. The virus was deliberately released into selected rabbit populations at about the same time it began to arrive in Western Australia from other parts of the country.

The initial impact of RHD was dramatic, causing drops of up to 90 per cent in some rabbit populations, but there were other areas where little or no apparent effect was seen. The greatest impact occurred in the drier parts of the country (less than 300 mm annual rainfall). The reasons for the variability in the impact of RHD are not clearly understood and research continues.

RHD is spread by direct contact between rabbits and by some biting insects. It is also transmitted by some species of blowflies. The virus can persist in the environment for several weeks under mild conditions but its survival is shorter than this at higher temperatures.

For reasons not well understood, young rabbits up to about eight weeks of age are less susceptible to RHD than are older rabbits. In addition, maternal antibodies temporarily protect rabbits born to immune mothers. If exposed to the RHD virus at this time, these kittens are likely to survive and develop antibodies, which give them life-long immunity to the disease.



Typical evidence of the presence of rabbits (match box for scale).

The timing of RHD outbreaks is therefore important in the long-term impact of RHD on rabbit populations. If outbreaks occur, either by deliberate release or naturally, when there are many young rabbits present, sufficient rabbits are likely to survive, allowing the population to recover.

The interaction between myxomatosis and RHD and their combined impact on rabbit populations requires further study. To date, RHD does not appear to have lessened the occurrence or impact of myxomatosis on Australian rabbits. Outbreaks of both diseases continue to cycle through many rabbit populations, occasionally simultaneously at some sites.

It is not possible to control outbreaks or the impact of biological control agents such as the myxoma virus and rabbit haemorrhagic disease. The susceptibility of rabbit populations to these diseases will depend upon a number of factors including the number of susceptible rabbits (those without antibodies), and the availability of suitable vectors for transmitting each disease. These diseases should be viewed as an aid in controlling rabbit numbers and should be supported with other control methods such as poisoning, refuge removal, ripping, fencing and shooting to ensure greater long-term effect. The addition of follow-up control is vital to maximise the benefits from these diseases.

Controlling rabbit numbers

Landholders are legally required to control rabbits on their land. There are several methods of control available and the Department of Agriculture can provide help and advice. Control methods include:

- baiting;
- warren fumigation;
- warren ripping;
- harbourage destruction;
- rabbit-proof fencing; and
- shooting, trapping and the use of ferrets.

The key to success is persistence and choosing the best control method for the particular situation. An approach that combines all possible options will give the best long-term result. The involvement of surrounding landholders will reduce the extent and speed of re-infestation as a large area will be controlled simultaneously.



Rabbit damage is evident from this graze line on the edge of the crop.

Keeping rabbits

It is now legal to keep domestic breeds of rabbits in Western Australia without permits or conditions but the keeping of wild-type rabbits is still prohibited. Pet rabbits should be kept in insect-proof hutches to reduce their chances of contracting RHD and myxomatosis. Good animal hygiene will also help to reduce the number of vectors available for transmitting myxomatosis. Rabbits should be kept humanely, and commercial breeders are advised to abide by the *Code of Practice for the Keeping of Rabbits in Western Australia* (available from the Department of Local Government and Regional Development).

Pet and commercial meat rabbits can be protected from RHD by vaccination. The vaccine used is a killed vaccine and is unable to reproduce in the rabbit, so annual boosters are recommended. There are no suitable vaccines for use against myxomatosis in Australia. Vaccinating domestic rabbits against myxomatosis is prohibited as the current vaccines are based on live viruses and these could spread to the wild rabbit populations, resulting in their immunisation against the disease. This would have serious implications for agricultural production and the environment.

Further Reading

There are a number of publications on rabbits that are available from the Department's website and District Offices.

Further information

Contact any Department of Agriculture District Office or South Perth on tel: 9368 3333.