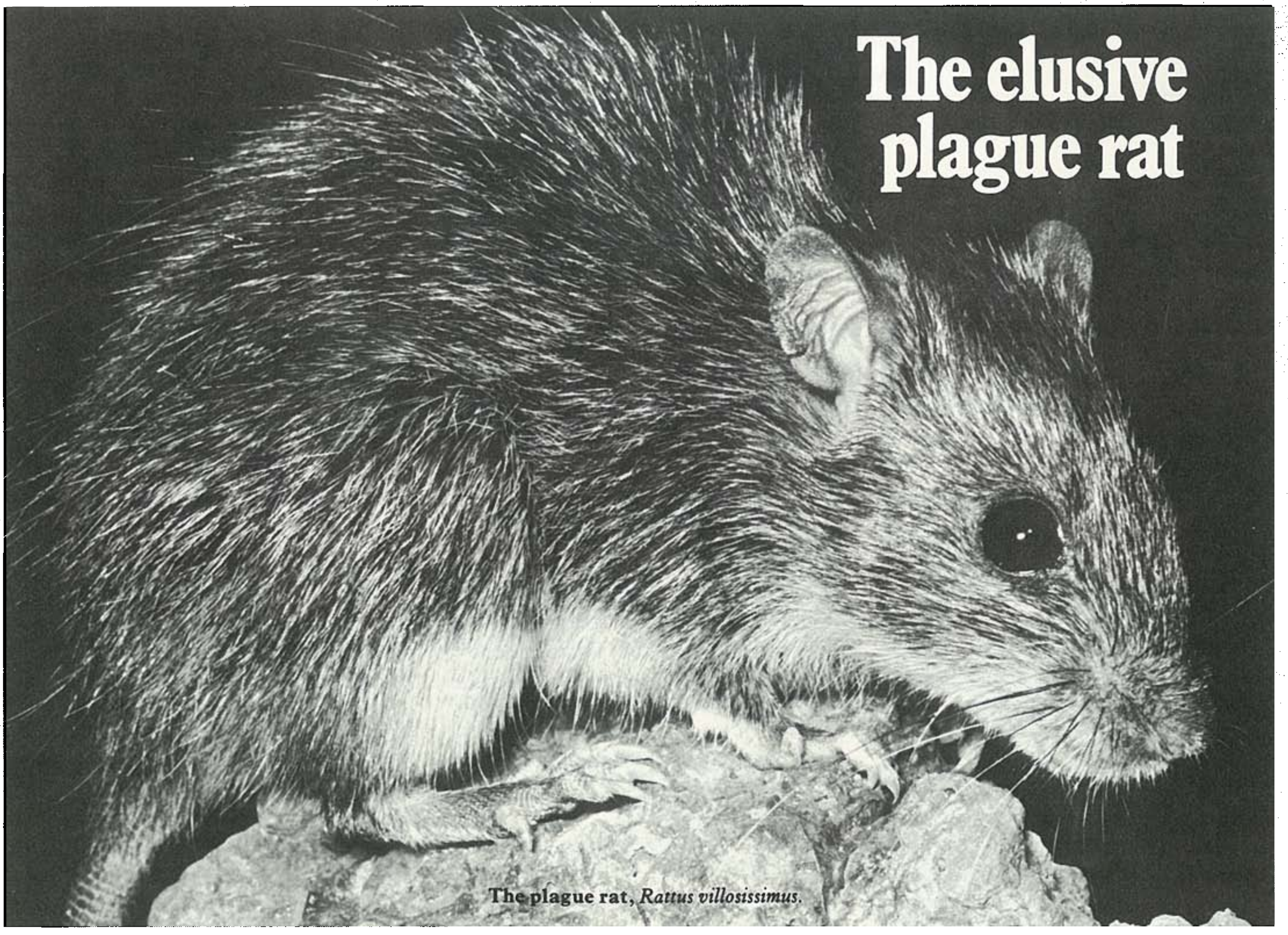


The elusive plague rat

The plague rat, *Rattus villosissimus*.

A little more than 10 years ago, drenching rain broke a 6½ -year drought in central Australia. On the Barkly Tableland and surrounding country in the Northern Territory and Queensland, the floods were followed by a plague of rats that continued, at varying intensity, for 3 years.

Dr Alan Newsome and Mr Laurie Corbett, of the CSIRO Division of Wildlife Research, visited Brunette Downs cattle station on the Barkly Tableland several times during the plague, and have described the scene at its height:

> 'Cattle and horses had hooves nibbled, saddlery was eaten, and people camped away from settlements were bitten in their sleep. To walk about at night with a torch was to see rats every few paces scurrying along worn trails to numerous holes, to see them foraging on the open grassland, and to hear them squeaking and fighting in every quarter. There was no other word than fantastic to describe it all.'

During the plague, rats were sighted as far west as the Northern Territory–Western Australia border and as far south as the Simpson Desert.

A plague rat burrow on Lorna Downs station, Qld.

In the last few years the area has experienced similar drenching rain, but no major rat plague. Why rat populations exploded on one occasion and not the other is only one of the questions that remain to be answered about the phenomenon and about the native rat involved, *Rattus villosissimus*, the long-haired or plague rat.

Some other native rodents form plagues, but not on the scale of major long-haired rat plagues, which have been recorded frequently since the first years of white settlement in the area. The other rodent whose numbers can build up on a similarly grand scale is the introduced European house mouse, *Mus musculus*. Its plagues in the wheat belt of south-eastern Australia, which sometimes cause extensive crop losses, have been studied by Dr Newsome and CSIRO colleagues. In many ways they parallel those of the plague rat (see the box).

Rat facts

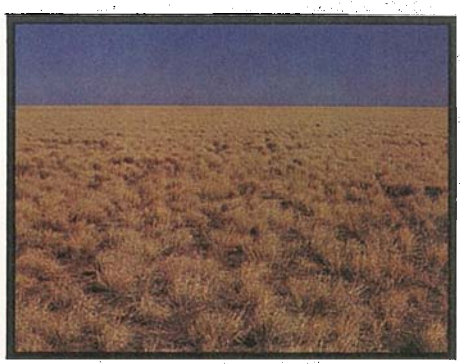
Notable for the long black hairs along its back, which rise during aggressive displays, this rat feeds mainly on green grass and seeds. Plagues occur during periods of lush pasture growth, and because of this it seems unlikely that they have much effect on the availability of fodder for cattle. However, the rats can be an expensive nuisance around homesteads — raiding food stores, chewing clothes, and even puncturing sturdy plastic water pipes. In non-plague years they are very rarely seen, and their populations then contrast dramatically with those in plague years.

The rats are seemingly not well equipped for life in arid areas. They need green feed. When this is lush, it can supply all the water they need, but at other times they require free water. By contrast, two species of hopping mouse of Australia's arid zone can survive without water on a diet of dry seed.

But the plague rat has great reproductive potential; in ideal conditions females can produce litters of up to seven every month, and the young can start breeding 2–3 months after they are born. The ability to multiply rapidly and colonize large areas during periods of favourable conditions is almost certainly necessary for survival of the species. It greatly increases the chances that, when dry conditions return, some will find themselves in areas in which small populations can live and breed, for some years at least.

Dr Newsome and Mr Corbett were studying the relation between dingoes and their prey in the arid zone when the last major rat plague occurred. It began on the Barkly Tableland in mid 1966 and lasted until late 1969.

To monitor changes in rodent populations, they trapped regularly on Brunette Downs and less frequently at 11 other

Barkly Tableland grassland after rain in January 1972, and 7 months later.

Barkly Tableland cattle stations from March 1966 to December 1971. The plague rat was the only rodent caught. They also trapped regularly in three areas to the south — in mulga woodlands around Alice Springs, on drier saltbush country further south, and in the Simpson Desert. The trapping records for these areas reveal less dramatic plagues of the house mouse and the brown hopping mouse (*Notomys alexis*).

The CSIRO scientists' trapping program, and that of a Monash University researcher, Dr Jim Carstairs, now in the Australian National University Zoology Department, showed rats increasing from great rarity in 1966 to great abundance by the end of 1967.

The drought breaks

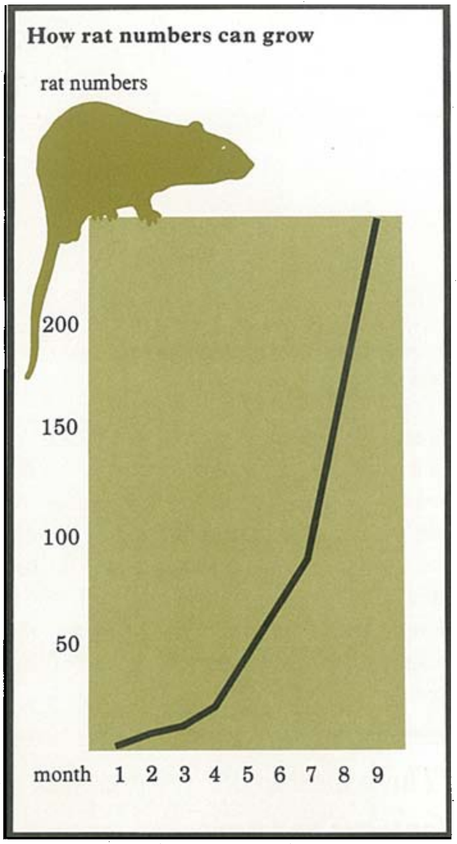
The trigger was the breaking of the drought in January 1966, followed by particularly heavy rain in the 1966–67 wet season. The 1967–68 wet season also brought good rain. Grass remained plentiful, and developed seed from December 1966 until well into 1968. It gradually dried out from the middle of that year, was not revived strongly by the below-average rainfall of the 1968–69 wet season, and then continued to dry out throughout 1969. Rat numbers fluctuated, but remained high until mid 1969. Then they plummetted, bringing the plague to an end in the second half of that year.

'There was no other word than fantastic to describe it.'

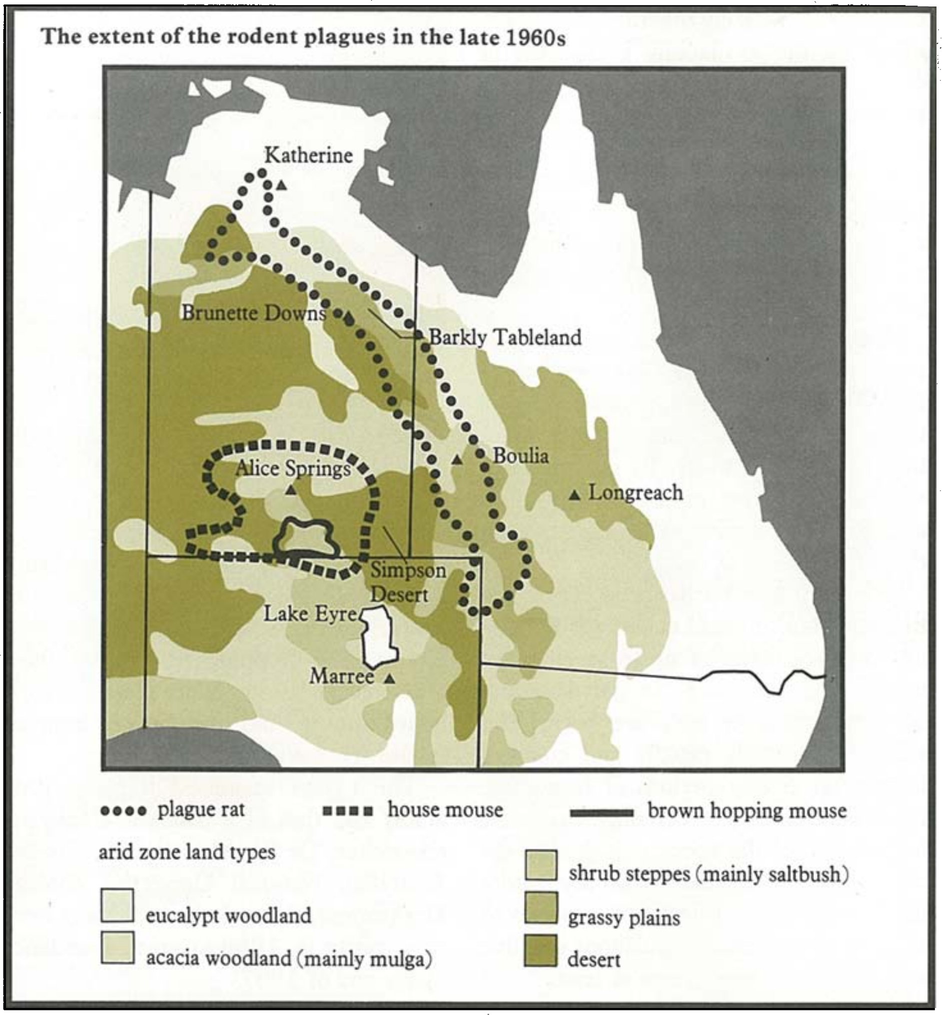
From January 1972 Dr Kent Williams and Mr Trevor Redhead, of the CSIRO Division of Wildlife Research, observed the decline of a minor plague of the rats around Boulia, east of the Barkly Tableland in Queensland's channel country. The decline this time was quite gradual, continuing until the middle of 1973. Unlike the plague that began in 1966, this one was not preceded by heavy rain in the area. Instead, cyclonic rains 800 km to the north had flooded dry rivers and creeks, spreading water over large areas. Probably the floods created conditions that enabled residual populations from the previous plague to multiply.

No plagues of *Rattus villosissimus* have been reported since then, but in 1974 Dr Williams and Mr Redhead found a small colony of the rats on one of the 'dry lakes' of the Barkly Tableland. These depressions, scattered widely throughout the flat, grassy clay plains of the Tableland, are flooded each wet season and retain their moisture and green vegetation considerably longer than the surrounding country. The scientists' vehicles became bogged in the moist clay of the lake where they found the rat colony at a time when the surrounding plains were completely dry. Dr Williams and Mr Redhead think this type of country may be particularly important to the rats as a provider of refuges between plagues.

The fork-tailed kite is a predator of the plague rat. Here a partially eaten rat shares a kite's nest.



The totals are based on the assumption that females start breeding at the age of 3 months and produce three male and three female young each month. This could only apply if conditions remained ideal for the rats.



A hazardous life

If the survival of the species depended on only a few such refuges, its prospects would be bleak. Much can go wrong for the rats. Drought can dry out some refuges while localized rainfall may enable colonies elsewhere to survive. Heavy rain can flood refuge burrows and drown the rats. The other constant threat is predators — cats, dingoes, foxes, birds of prey (including the barn owl and letter-wing kite), snakes, and goannas. Rats may survive in a refuge area between one plague and the next, but be wiped out in the same area in the following between-plague period — hence the importance of widespread dispersal when conditions favour the rats.

Predators undoubtedly influence population levels. The evidence suggests that they can delay and even prevent the development of plagues at times when vegetation and soil moisture are ideal for rats, and that they hasten the end of plagues when conditions deteriorate.

Dr Newsome and Mr Corbett examined the stomach contents of dingoes on the Barkly Tableland between 1968 and 1970 and found that rats were a major part of their diets. This was the period during which the plague reached its peak and declined. Even in the final stages of the decline, when rats had virtually disappeared and none were finding their way into the scientists' traps, up to half the dingoes sampled were eating rats. This indicates that the declining rat populations suffered severe predation.

Numbers of dingoes, foxes, and cats increased during the plague, as did those of other predators. Dr Newsome and Mr Corbett report that the harsh screech of barn owls, usually rare, became a nightly event. Snakes were seen more often after the plague subsided — Dr Carstairs received a report of ten sightings nightly in April 1970. There is a popular belief in the area that plagues of snakes follow rat plagues; however, it is likely that one reason snakes are seen more often after a plague declines is that it becomes necessary for them to move around more in the open in search of prey.

Low predator numbers due to the long drought before 1966 may have been important in enabling the subsequent plague to erupt.

Conditions for upsurge

Dr Newsome and Mr Corbett suggest that, at the end of the drought, predator populations were probably concentrated on small scattered groups of surviving rats. The predator:prey ratio probably favored the predators in most places, preventing an immediate population explosion in response to the sudden advent of conditions favourable to rats. But, with the continuation of good conditions, a general increase in breeding among the rats — or possibly reduced predator interest in the rats as other prey such as birds, lizards, and insects grew in numbers — allowed rat populations to take off. Predator numbers also grew, but much too slowly to allow predation to have an impact on growing rat populations. Only when conditions deteriorated for the rats could predators regain the upper hand.

Increased predator numbers may be an important part of the reason why no major rat plagues have occurred in the Barkly Tableland area since 1969. Dr Newsome and Mr Corbett think the outbreak of the minor plague near Boulia in 1972, referred to earlier, may have been associated with a big reduction in dingo numbers the previous year as a result of poisoning.

In 1968 Dr Carstairs distributed questionnaires to 1000 properties in the Northern Territory, western Queensland,

Comparing the causes of plagues

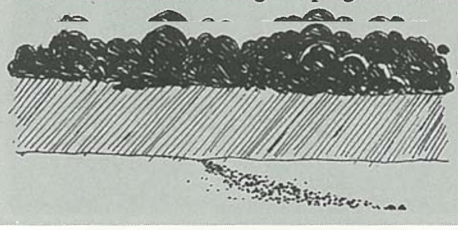
From a detailed study of house mouse populations in the wheat belt of South Australia, Dr Newsome has concluded that plagues will arise when two conditions hold for at least 3–5 months:

- the soil is moist and friable, and therefore suitable for burrowing
- abundant food is available

Usually the two conditions are out of phase: spring growth provides ample food in summer but the soil is too dry and hard then, while in winter the soil is suitable but food is too scarce. Dr Newsome observed plagues develop on two occasions when good summer rains brought the two conditions into phase. Further confirmation of his theory came when he saw mice multiply to plague numbers in early winter in an experiment in which he provided them with ample food at times when it is not normally available. Reed beds along creeks were found to provide refuges for small populations between plagues.

Observing the rodent plagues in central Australia in the late 1960s, Dr Newsome and Mr Corbett found many similarities with the house mouse plagues of the wheat fields. Each population eruption — of the house mouse in the Simpson Desert and adjoining mulga and saltbush country, of the brown hopping mouse in the same saltbush country, and of the plague rat on the Barkly Tableland — followed prolonged rain or flooding caused by rain elsewhere. Common factors were abundant food and soil soft enough for burrowing.

However, there were differences, the most important being that, north of the wheat country, not all bouts of favourable weather resulted in plagues. Another was the slower response of rodent populations there to favourable conditions; 3–5 months of abundant food and soft soil were sufficient to bring on plagues in the wheat fields, whereas in central Australia the delay was generally about a year.



Dr Newsome and Mr Corbett suggest that the main reason for the differences is heavier pressure from predators on the central Australian rodents. The role of predators in influencing plague rat populations is discussed in the main article. The scientists suggest that more-complex interactions between predators and the house mouse and hopping mouse may explain the fact that populations of these rodents grew rapidly in the first half of the plague period, but then declined despite further good rain.

Their sampling indicates that dingoes turned their attention almost completely from the rodents to rabbits soon after the good conditions arrived, allowing the initial rodent population explosions to take place. But then, the scientists suggest, the combined pressure of increased numbers of foxes, cats, barn owls, and snakes became sufficient to prevent the rodents taking advantage of the renewed abundance of food and good burrowing conditions.

and northern South Australia to attempt to find out, among other things, the extent of past plagues of the rat. He concluded from the responses that the species appeared to be near its limits south and east of Alice Springs, north of Katherine, south of Longreach, and south of Marree.

He found that plagues recorded in the scientific literature, in 1916–18, 1930–32, 1940–42, 1950–52, and 1956, were well remembered in the districts affected, but that apparently a widespread unrecorded plague occurred in 1948. The responses show wide variation in the size of areas affected. Between 1940 and 1943, and again between 1948 and 1952, rat numbers reached plague proportions far to the south and east of the 1966–69 plague area as well as throughout that area.

Predicting plagues?

Much remains to be learnt about the way plagues develop. Some records refer to them as migrations of expanding rat hordes over great distances and, by comparing the times when rats have appeared at different points, observers have derived figures of 1·6 and 3 km per day for the speed of migrations. However, observations during the most recent plagues, and the discovery that the rats can establish refuge colonies in the 'dry lakes' of the Barkly Tableland, suggest that major plagues spring from increases in many local populations.

Plague rats under the floor of an outback feed store they have raided.

A much greater understanding of the conditions needed to initiate rat plagues will be needed if there is to be any hope of predicting plagues accurately. Preventing them would be still more difficult. Whether it would be desirable is doubtful; the prevention of rat plagues would be a major disturbance to the ecological processes of a very large part of Australia.

More about the topic

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