



# Colonisation of Australia by the Rabbit

E. Stodart and I. Parer



*Front Cover : Prince Alfred, Duke of Edinburgh at a rabbit shoot at Barwon Park in December 1867. Just seven years after Thomas Austin of Barwon Park introduced the wild rabbit into Australia Prince Alfred, the second son of Queen Victoria, shot 416 rabbits in three and a half hours. His guns became so hot that "they blister the hands of the loader, and he can only hold them by the stock". Source : The Illustrated Australian News, 27 December. National Library of Australia.*

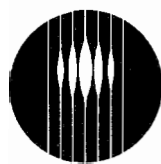
# **Colonisation of Australia by the Rabbit**

*ORYCTOLAGUS CUNICULUS* (L.)

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Project Report No.6

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## SUMMARY

Domestic rabbits came to Australia with the First Fleet in 1788 and on many subsequent occasions. Only in southern Tasmania did they become colonising feral populations. The only known introduction of wild-type rabbits was from England by Mr Thomas Austin who liberated them near Geelong in Victoria in 1859. The rabbits spread from there and from another centre at Kapunda, near Adelaide in South Australia. The rabbits from these two centres had merged by about 1880 and then spread through New South Wales to Queensland by 1886, to the east coast by 1885-1900 and to the west coast by 1907. The rate of spread varied from 10-15 km a year in the wetter and forested ranges and coastal plains to over 100 km a year in arid to semiarid rangelands. The many thousands of kilometres of barrier fences that were built to halt the spread were either erected too late or at best provided a delay of only a few years. The rabbits advanced in a surprisingly clear wavefront, but how much of the spread was due to the unaided movement of rabbits and how much was due to man is a question that is unlikely to be resolved.



## INTRODUCTION

As Europeans settled around the world they took their domesticated animals with them to their colonies. It was natural for them to take familiar stock to new settlements for food and other needs such as clothing. The British in Australia also imported other animals that they liked to have around them, such as sparrows, starlings, foxes and hares. Even if they had realised the way in which these animals would disrupt the Australian flora and fauna, the British may not have done otherwise for these animals were intended to help them establish a new Britain on the other side of the world.

Domestic animals sometimes escaped and established themselves in the wild. Cats and camels fit into this category. Some species were deliberately released and established themselves more thoroughly and destructively than their liberators could have imagined. One of these was the wild-type rabbit. Most rabbits brought to Australia were domesticated breeds which were easily obtained and transported, but some wild animals were also imported and released. The spread of these rabbits across Australia is one of the better documented colonisations in the world.<sup>1</sup> The spread within Western Australia and the Northern Territory has been described by Long and Strong respectively.<sup>2</sup>

This paper expands these descriptions to provide an outline of the spread of the rabbit across the whole of Australia and discusses the various factors that appear to have influenced that spread. Data on the spread are from three main sources - relevant Parliamentary Papers and Debates; contemporary newspapers; and historical accounts of certain districts. Country newspapers were examined by a sampling method. A likely year for a locality was chosen, and papers for 3-6 months in that year were scanned. If rabbits were not mentioned a later year was sampled and if obviously established in the district then an earlier year was examined, until the report of their first appearance was found.

## IMPORTATIONS AND INTRODUCTIONS

Rabbits were associated with the Australian colonies from the days of the earliest European settlement. Five arrived in Sydney in 1788 with the First Fleet and domestic rabbits were bred around houses in Sydney in 1825;<sup>3</sup> the Hentys imported rabbits from England to the Swan River in 1829 and from Tasmania to Portland Bay in 1834;<sup>4</sup> and 16 arrived on the *Governor Gawler* in South Australia in 1840.<sup>5</sup>

The first legal dispute in the colony on the Yarra River was over the destruction of rabbits in 1836.<sup>6</sup>

Rabbits were probably imported repeatedly in the following years, although little publicity was given to them till the 1860's. Mrs Kirkland took a pair to Travalla, near Ballarat, in 1839.<sup>7</sup> By 1846 the Police Office in Melbourne was undermined by the burrows of rabbits which had escaped from the market and still fed on the market scraps.<sup>8</sup>

In the 1850's and 1860's interest in importing rabbits was renewed in the flood of enthusiasm for acclimatisation. The colonies were then well established and there was time to import some animals less essential to the economy than sheep and cattle. An article in *The Sydney Morning Herald* in 1860, one of several in similar vein, praised acclimatisation as 'the enterprises which enrich a country and enhance its attractions' and advocated the introduction of alpaca, elands, rabbits, dromedaries and salmon.<sup>9</sup> Acclimatisation societies were formed in most colonies. The Queensland Society was a vital body supported by a grant from the government. It introduced many varieties of rabbits to Queensland and released them mainly on islands, but also on the mainland.<sup>10</sup> A strong acclimatisation movement in Victoria included Edward Wilson of Melbourne, who established a warren of silver-grey rabbits and Mr Thomas Austin of Barwon Park, who introduced rabbits several times, culminating in the group of wild-caught ones which are considered to be the source of the spread over the whole mainland of Australia.<sup>11</sup> The Acclimatisation Society in Adelaide was subsidised by the government in 1864, but its main interest at the time appeared to be silkworms.<sup>12</sup>

Several liberations established colonies which flourished, at least for a while (Figure 1).<sup>13</sup> In the New England District of New South Wales in 1854 rabbits caused local annoyance and destroyed the best land, forcing landholders to build paling fences.<sup>14</sup> Twenty-four rabbits from England arrived in Melbourne on Christmas Day 1859 in the brig *Lightning* and were released at Barwon Park near Geelong in the Western District of Victoria by Mr Thomas Austin.<sup>15</sup> A reminiscence by a great nephew of Mr Austin suggests that there may have been only 13 and some of them were caught in the wild and some were hutch-reared.<sup>16</sup> This warren was a source of further liberations such as the successful one on Woody Island, Queensland, by

the Queensland Acclimatisation Society and an unsuccessful one at Wood's Point, Victoria by the Victorian Acclimatisation Society.<sup>17</sup> Mr Thomas Holt established a colony of 'The English wild rabbit' brought from Tasmania and New Zealand, starting with 60 rabbits, on his property "The Warren", on the Cook's River near Sydney in 1860.<sup>18</sup> Although described as the English wild rabbit these would have been derived from domesticated stock as this is the type that had been previously released in Tasmania and New Zealand.<sup>19</sup> Rabbits in a warren near Castlemaine, Victoria, escaped when the fence was burnt down in a bush fire in 1863.<sup>20</sup> Unsuccessful releases were also made on the Canning and Swan Rivers, and near Bunbury in Western Australia and in the Riverina District of New South Wales, some 20 years before they became a plague there in the 1880's.<sup>21</sup>

Mr Austin of Barwon Park was the only person recorded to have imported wild-caught rabbits from England. It is possible that some less public figures did also, although the difficulties of transport would have ensured that only small numbers could have been brought in. Mr Austin and Mr Holt tended their warrens until they were well established.

About this time the rabbit was considered to have a valuable potential. In 1864 the South Australian Parliament included the rabbit with other animals in the Games Act, protecting it for four months of the year, August to December.<sup>22</sup> In Queensland rabbits in the wild state were protected under the Imported Games Act.<sup>23</sup>

By 1864 Mr Holt's property near the Cook's River in N.S.W. had 2-3000 rabbits, only four years after the 60 rabbits were introduced.<sup>24</sup>

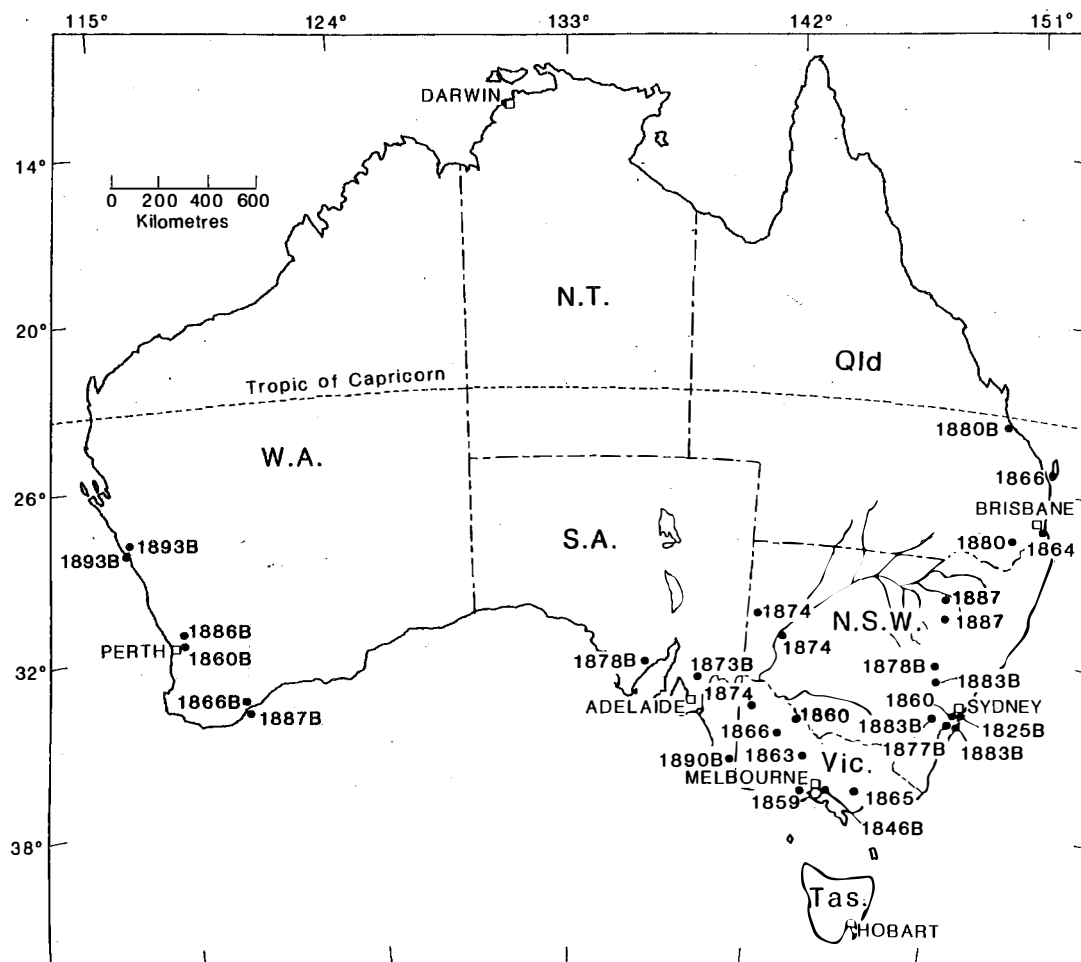


Fig. 1 Mainland Australia showing sites and dates of known liberations of rabbits. The letter B after a date indicates that rabbits were known to be present on that date and may have been released before that date.



The numbers at Barwon Park also increased rapidly; over 6,000 were harvested in January-August 1865, only five years after the colony was initiated.<sup>25</sup> By 1867, just two years later, they had spread 55 kilometres to the east, and 20 kilometres to the north west.<sup>26</sup> In the late 1860's the rabbits were becoming a pest to the landholders in the Western District of Victoria.<sup>27</sup> Rabbit skins were exported for the first time in 1869, two bales being shipped from Geelong.<sup>28</sup> A few men who understood the rabbit from the English farmer's point of view foresaw what was to come.<sup>29</sup> Mr Connor prophesied in the Victorian Parliament in 1869 that 'the rabbit nuisance in this colony promised to be as great as that of the locusts in the land of Egypt' and unsuccessfully moved to introduce control measures into the Local Government Bill.<sup>30</sup> Others with the outlook of the English landowner continued to encourage liberations to provide sport for gentlemen. New liberations were made and gentlemen continued to enjoy rabbit-shoots and coursing. Perhaps the statement of Fred Ragless illustrates a typical attitude- 'when I was a boy at Yalpara [1850's-1860's] I kept a number of rabbits as pets. Somehow I let several get away'.<sup>31</sup>

In about 1870 rabbits were released near Kapunda, South Australia, on one or more occasions, perhaps by lads and by landed proprietors.<sup>32</sup> The source of these rabbits is not known as no mention of their being imported has been found. The rabbits spread widely from Kapunda which appears to have been a second centre of the spread and almost as important a source as Barwon Park. They established themselves so quickly that in 1873, nine years after the Parliament passed a law to protect them, and only three years after their release at Kapunda, residents of several districts petitioned for legislation to destroy them.<sup>33</sup> The first Act for destruction of rabbits was passed two years later in 1875.<sup>34</sup>

Many other liberations were less well documented (Figure 1). In 1866 four pairs were taken to Morton Plains in the mallee in Victoria and in 1874 rabbits were released in the Barrier Ranges of N.S.W. and at Campbell's Creek on the Darling River near Menindee.<sup>35</sup> Around 1870 they were introduced and cared for at Wentworth and Balranald in N.S.W.<sup>36</sup> They were released at Point Sturt on Lake Alexandrina and Franklin Harbour, South Australia and at Mudgee and on the Shoalhaven River in New South Wales, and their progeny may have merged with the main spread.<sup>37</sup> Over

30 liberations were recorded and there must have been many more. Most were only temporarily successful or completely unsuccessful, often because domestic animals were used or because only one pair of rabbits was released.

#### THE SPREAD IN VICTORIA, WESTERN NEW SOUTH WALES AND EASTERN SOUTH AUSTRALIA

By 1875 rabbits were thoroughly established in Victoria at Swan Hill, in the Western District with their particular stronghold in the Stony Rises near Colac and in localised colonies near Birchip where the progeny of the four pairs released at Morton Plains formed a second centre of spread; in South Australia in the hilly country to the north-east of Adelaide and in the southern end of the Flinders Ranges (Figure 2); and in New South Wales around Sydney.<sup>38</sup>

The main spread stemmed from these Victorian and South Australian centres in the years following 1875. The Wimmera and Mallee districts of Victoria and the whole south-eastern corner of South Australia became infested. Complaints of losses due to rabbits in the Wimmera District commenced in 1878.<sup>39</sup> Rabbits were also becoming abundant in the mallee and were reported as being spread from Swan Hill to the South Australian border and northerly to the Murray River.<sup>40</sup> They appeared in the north-western foothills of the Victorian Alps about 1877.<sup>41</sup> These sightings may have been of isolated colonies because rabbits were not mentioned in the area of Wangaratta at the time by the Wangaratta Dispatch.<sup>42</sup> They crossed the Murray into New South Wales near the junction with the Murrumbidgee in 1878 or earlier.<sup>43</sup> The early spread from Kapunda was described by the Commissioner for Crown Lands, Hon. T. Playford -

*They had not spread much to the south.... In the south-east they had spread to the Murray and down the flats to the lakes. In the east they had spread beyond Mt. Bryan, and in the north-east to Paratoo. In the north-west they had spread to Mannanerie, Rocky Gully, Blackrock Plains, Weparie, Booleroo, Mt. Brown, and Pichirichi. They had not spread to any great extent westward to the sea....*<sup>44</sup>

The eastward spread in South Australia linked up with the north-westward spread in Victoria in about 1880, forming a single block of infested country from Spencer's Gulf to the western slopes of the Dividing Range. There

was some disagreement at the time as to whether the rabbit spread from Victoria to South Australia or in the other direction. The Wellington (S.A.) correspondent of *The Southern Argus* claimed that rabbits were spreading from Victoria through the scrub to the Murray and that wild dogs were following the rabbits across the border.<sup>45</sup> Samuel Hubbe, Chief Inspector under the Vermin Destruction Act had a different opinion as he stated that there were no evidence of rabbits having come from the Victorian side, but there was evidence that they had come from South Australia into the Victorian mallee.<sup>46</sup>

In 1881 people were abandoning runs in Victoria because of rabbits.<sup>47</sup> The Mallee and the Wimmera were then the worst infested areas, and the only ones in which the economy was affected disastrously. In the more closely settled Western District the rabbit pest could be kept under some sort of control; for example *The Portland Guardian* in 1880 describes the crops at Bridgewater near Portland as being 'in a better condition at the present time than they have been for some years past at the same date ... The farmers at Bridgewater have waged a ceaseless war with their enemy, the rabbit, for many years and now the tide of battle has turned in their favour, thanks to their new ally, phosphorus....'<sup>48</sup> Rabbits were repeatedly

reported as being a pest in parts of the Western District, but they did not disrupt the finances of the farmers as they did in the drier and less settled Wimmera and Mallee Districts. Rabbits ate ripening crops to the ground again and again, particularly around Kapunda in South Australia.

The spread further northwards in South Australia is not well documented because of the sparsity of settlement, but a few records exist. They reached Beltana in 1886, Callabonna in 1888 and Lake Eyre in 1891.<sup>49</sup>

The spread northwards across New South Wales is better documented. In 1878, or before, some rabbits crossed the Murray from Victoria to New South Wales. It is probable that rabbits crossed the Murray at several places and that some were deliberately carried over.<sup>50</sup> The density of rabbits in 1881 (Figure 3) suggests that the main centre of the invasion was around the junction of the Murray and Murrumbidgee rivers. From information gained by Ronald it appears that they spread in a north-easterly direction over the riverine plain, possibly along the rivers, and were near Darlington Point on the Murrumbidgee in 1880.<sup>51</sup> They also spread northwards west of the Lachlan and appeared at Ivanhoe in 1880.<sup>52</sup> Another invasion into New South Wales probably entered from South Australia, near where Broken Hill now is, and merged with the rabbits moving northwards from

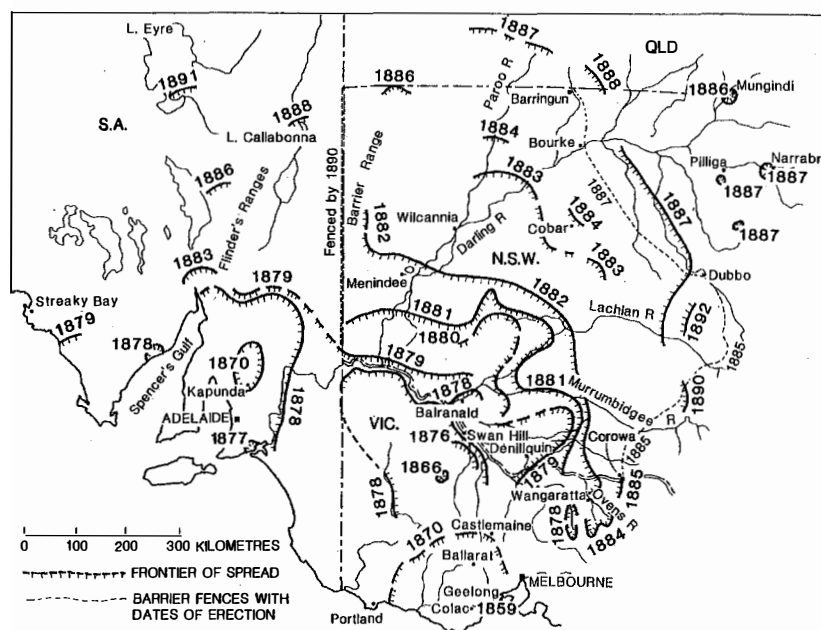


Fig. 2 Detail of the spread of the rabbits in west and central Victoria, eastern South Australia and western New South Wales.

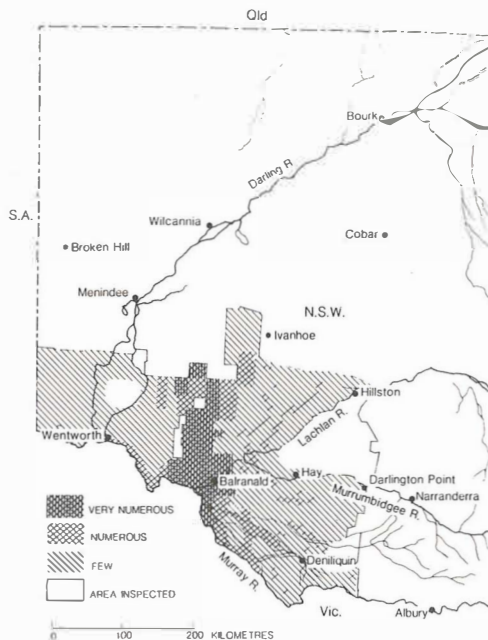


Fig. 3 Distribution of rabbits in New South Wales in 1881. Map copied from a map in "Rabbits and Marsupials (Reports of inspectors under the Pastures and Stock Protection Act as to increase of)" NSW Leg. Ass. Votes & Proc. (1881 Vol. III), 849-854.

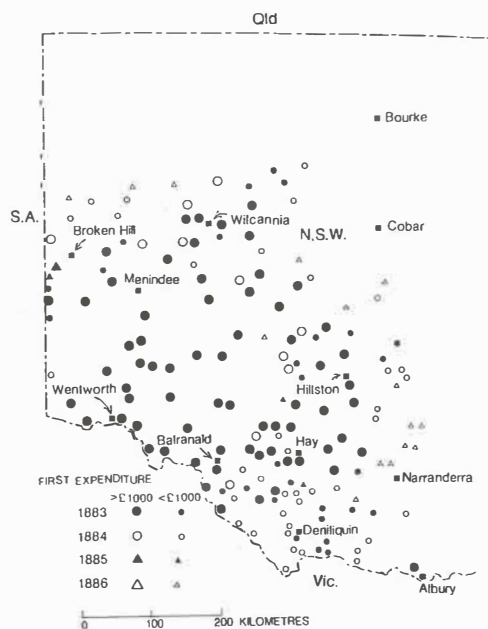


Fig. 4 Locations and year of first expense on eradication of rabbits under the Rabbit Act of 1883 in New South Wales in the years 1883-6 and the amount expended - derived from a table in "The Rabbit Pest (Runs infested and cost of extermination)" NSW Leg. Ass. Votes & Proc. (1887-8), 974-978.

Victoria. Government subsidies encouraged landholders to spend money on rabbit control and the dates of first expenditure on control (Figure 4) lag slightly behind the arrival of the rabbits in an area (Figure 2) and are a further indication of the north-easterly spread from the south-western corner of the State.

The main courses of the spread through south-western New South Wales were northwards along the western plains between the Darling and the Lachlan Rivers to meet the Darling near Wilcannia; along the Darling near its southern end; north-east along the Lachlan; east along the Murrumbidgee and north-east from the South Australian border to link up with the northerly spread along the Darling.

In the five years after they crossed the border in 1878 rabbits had spread about 450 km north through western New South Wales but had spread eastwards only about 150 km (Figure 2). The spread in each direction continued so that rabbits reached the Queensland border in 1886 and were near Dubbo in 1887 with isolated colonies further east. The erection of a barrier fence on the western border of New South Wales did not affect the spread as the rabbit was well established on both sides of the fence before it was completed in 1890 (Figure 2).

#### THE SPREAD IN QUEENSLAND

Before the rabbit reached Queensland the people there were aware of its potential as a pest. The Queensland Parliament considered a Rabbit Nuisance Bill in 1879 and passed a Rabbit Nuisance Act in 1880.<sup>53</sup> Queenslanders watched the pest advance closer and closer and built a border fence to protect themselves from an invasion from the south. However, tenders for the border fence were not let till 1886 when rabbits had already been seen on the border at Wompah in the west and Mungindi in the east.<sup>54</sup> The southern border, westwards from Mungindi and the western border with South Australia, almost as far north as Haddon Corner, were fenced in 1887-90 (Figure 5). Maintenance of the 1050 kilometres of fence was a difficult task. 'The measures taken to maintain the fence are by a staff of boundary riders, each of whom has a length of from 30 to 40 miles to look after and keep in repair. They are provided with huts, paddocks, horses and water supply. Married men are placed at crossings of roads so that their wives can attend to the gates - a most important duty.'<sup>55</sup> Floods delayed building of the fence across the Bulloo swamp, damaged the fence elsewhere and prevented access so that two boats

were bought in 1890.<sup>56</sup> Fires also damaged the fence.

By 1890 most of the Queensland border fence was built but rabbits were already found farther north, although their advance was much slower than in New South Wales (Figure 5). They had been found north of Cunnamulla and on the Balonne River about 100-130 kilometres south of St. George and they continued to spread up the Balonne and Culgoa Rivers and up Cooper Creek.<sup>57</sup>

In 1892 several rabbit boards were formed in Queensland to supervise rabbit control in specified districts. Most of them concentrated their efforts in fencing off infested areas of the districts and on their southern and western boundaries. By 1895 east-west fences were built or under construction along the southern border of Queensland, about 130 km north of the border and 130 km farther north along the southern boundary of the Mitchell and

Leichhardt Rabbit Districts, and several north-south fences portioned off infested areas (Figure 5).<sup>58</sup> The main barrier fences were financed by the Queensland Government but there were also numerous fences built privately around properties, so that the southern part of the colony became a network of rabbit-proof fences.

By 1896 the rabbit was as far north as the southern boundary of the Leichhardt and Mitchell Rabbit Districts. It had spread about 250 kilometres northwards into Queensland in ten years.<sup>59</sup> Rabbits had been sighted farther north on the western border of Queensland and continued to spread there, reaching the headwaters of the Georgina River by 1904, and a point 80 kilometres north of Camooweal in 1910.<sup>60</sup> The southern barrier fence of the Mitchell and Leichhardt Districts appeared to delay the spread in the central area of the colony, but the rabbits were about 95-190 kilometres north of the fence in 1910.<sup>61</sup>

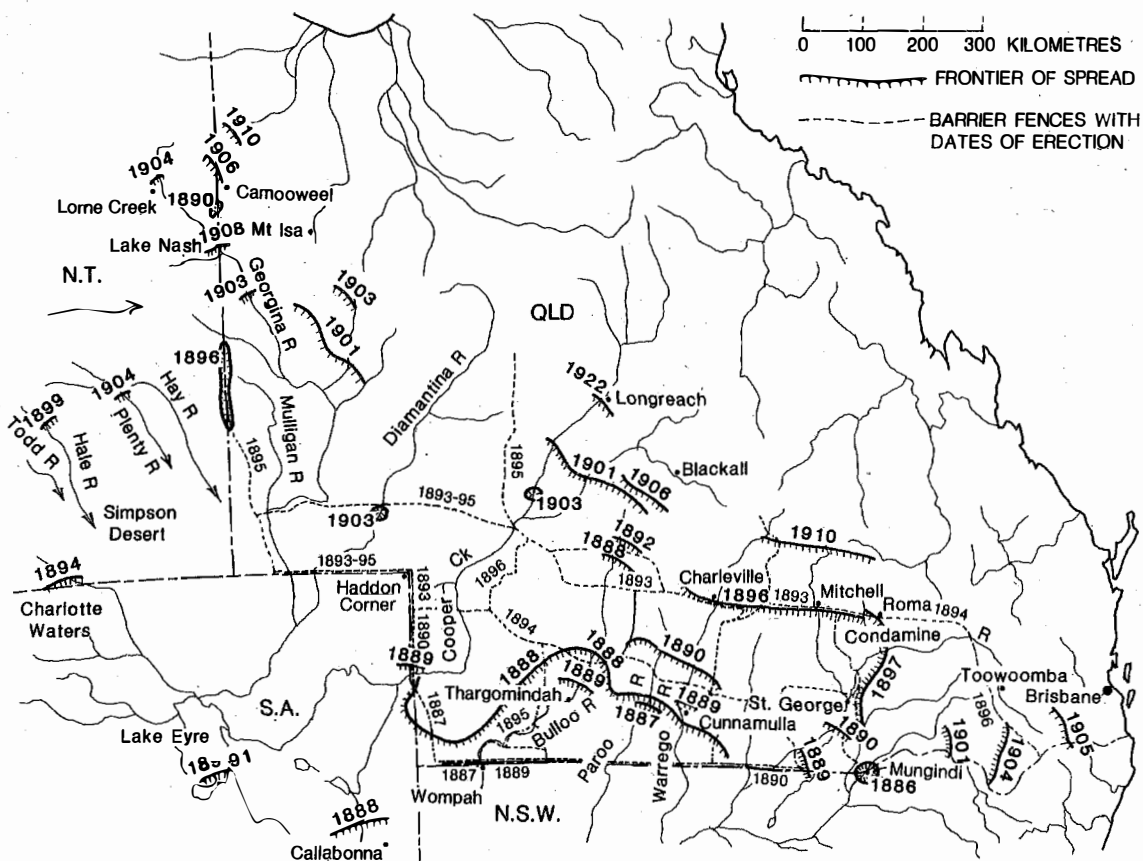


Fig. 5 Spread of rabbits in southern Queensland and south-eastern Northern Territory.

They continued up the Georgina River into the Northern Territory, and were at Lake Nash Station and Lorne Creek in 1904.<sup>62</sup> There may have been a patch of rabbits established on the Georgina River some ten years ahead of the general spread but this report is based on a reminiscence made in 1948 and so could be a number of years out.<sup>63</sup>

Meanwhile the spread east was continuing at a slower pace. In the south-eastern corner of Queensland it took longer than the spread northwards over the whole of western New South Wales. Rabbits appeared on the Darling Downs in 1910 but were not on the coastal plain.<sup>64</sup>

### THE SPREAD IN THE NORTHERN TERRITORY

The other river basins that seem to have provided routes for the invasion of the Northern Territory lead directly from South Australia. Here, as in the northern part of South Australia, sparse settlement prevented good documentation. However, a number of sightings quoted by Strong suggest routes of invasion up the river basins and from the ranges in the southwest.<sup>65</sup>

As stated earlier, the rabbits reached Callabonna in 1888 and Lake Eyre in 1891.<sup>66</sup> Sighting at Charlotte Waters by the Horn Expedition in 1894, at Henbury on the Finke River in 1895, at Coolatta Springs, Tempe, Hermannsburg and Haasts Bluff in 1896 suggest that the initial route of the spread was up the Finke River (Figure 6).<sup>67</sup>

They also made the ranges their stronghold and one report stated they were in the Musgrave Ranges in 1903, but not further north.<sup>68</sup> However, according to other reports they were further north, at about 250 kilometres south of Lake Mackay in 1901 and at Lake Amadeus in 1902, which may indicate a route through the low lying salt pans and lakes, or a general spread over the whole area. Old warrens but no actual rabbits were sighted between Ryans Well and Lake Mackay in 1913, and they were at Tanami in 1925.<sup>69</sup>

Rabbits may also have spread along the flood basins that flow to the south-east into the Simpson Desert. They were present at Arltunga in about 1899 and on the Plenty River at latitude 23 15'S in 1904.

Even though rabbits were widely spread throughout the southern half of the Northern

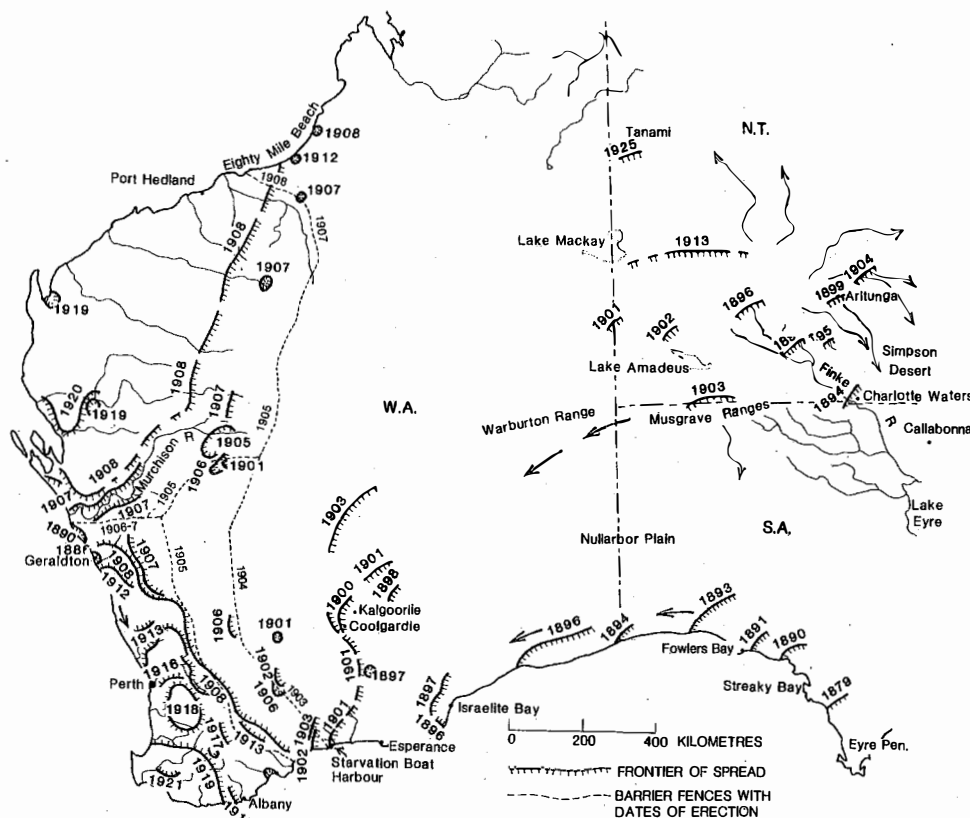


Fig. 6 The spread of rabbits in western South Australia, Northern Territory and in Western Australia.

Territory by the early 1900s, they were not in great numbers and their presence was not watched for as it had been in neighbouring Queensland. In 1904 and 1905 the *Northern Territory Times and Gazette* reported on the rabbit's progress in Queensland and forecast trouble in the Northern Territory but stated complacently that the Northern Territory was practically free of the pest.<sup>70</sup>

#### THE SPREAD IN EASTERN NEW SOUTH WALES AND NORTH EASTERN VICTORIA

In New South Wales the pest continued to advance eastward despite the building of barrier fences. A fence from Barrington on the northern border, through Bourke and Dubbo to Corowa on the southern border was started in about 1886 (Figure 2 and 7).<sup>71</sup> The Barrington-Corowa fence was erected at about the time the rabbits were entering the area. In the north the rabbits had spread well past this fence line by 1887, as far east as Narrabri.<sup>72</sup> In the south they were also past the fence line at Wagga Wagga in 1884 and at Corowa in 1885.<sup>73</sup> However, in central New South Wales they did not reach the fence line till the 1890's and here the fence appeared to act as a check. Another government fence was built from Mungindi to Narrabri after 1895 to protect the north-eastern corner.<sup>74</sup> Many runs were also fenced at this time with rabbit-proof netting and a few fences were erected by public subscription so that some districts, e.g. Forbes, were surrounded by these fences.<sup>75</sup>

The Great Dividing Range was crossed in the late 19th century and the early 20th century. The upper Hunter Valley was reached in 1895, Bowral in 1898, the southern tablelands by 1900 and the New England Tableland was crossed about 1902 (Figure 7).<sup>76</sup> Rabbits arrived at Bega on the south coast of New South Wales in 1901 and by 1904 were in high densities in parts of the district.<sup>77</sup> The spread over the north coast of N.S.W. was slow. Rabbits did not reach the lower Macleay River till 1907 and were still only in the upper reaches of the Clarence River in 1912.<sup>78</sup> The rugged country east of Armidale became a stronghold for the rabbits and there was talk of building a fence to prevent their returning westward.

In Victoria rabbits crossed the Great Dividing Range at the head of the Mitta Mitta River in the late 1890's and the east coast was reached by this route, rather than by the coastal plains. The first rabbit was caught near Omeo in about 1889.<sup>79</sup> In the late 1890's scattered

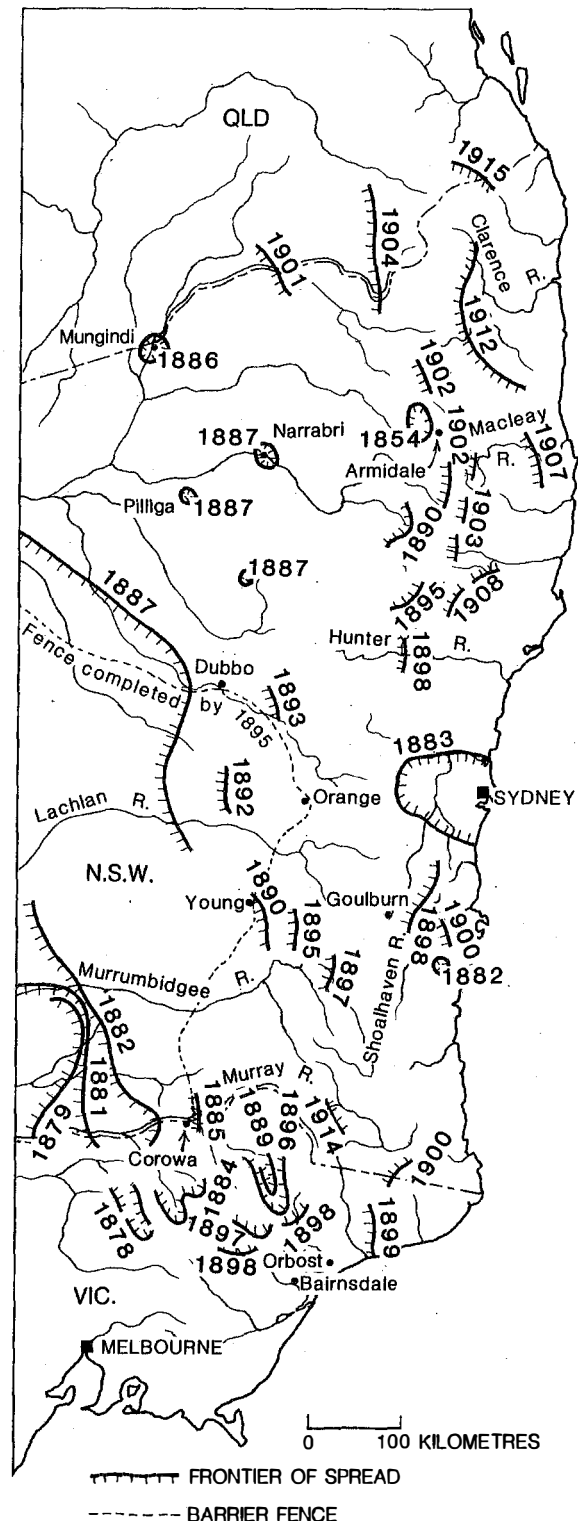


Fig. 7 The spread of rabbits in eastern New South Wales and eastern Victoria.

occurrences of rabbits were reported in the valleys of the Tambo, Wentworth, Dago, and Mitchell Rivers. In 1899 they were reported to be in the Orbost shire, well and truly on the coastal plain.<sup>80</sup>

#### THE SPREAD FROM SOUTH AUSTRALIA TO THE WEST COAST

The rabbit spread westward along the coast of South Australia at the same rate, 110-130 kilometres a year, as it had spread northward in New South Wales (Figure 6). In 1888 the west coast of Eyre Peninsula was listed as one of the worst infested areas in South Australia.<sup>81</sup> Rabbits were 100 kilometres west of Fowler's Bay in 1893, the Western Australian border in 1894, north of Israelite Bay in 1897 and they were past Kalgoorlie in 1900.<sup>82</sup> Apparently they entered Western Australia north of the Nullabor Plain as well as along the coast, going by the Warburton Ranges down to Coolgardie.<sup>83</sup> They extended as far north as the 26th parallel in W.A. and the Musgrave Ranges in S.A. in 1903.<sup>84</sup>

Isolated occurrences of rabbits had been recorded in Western Australia at Lynton near Geraldton from about 1890 onwards, Cheynes Beach in the early 1890's and in the Darling Ranges, but rabbits from these colonies did not spread to other areas.<sup>85</sup>

An ambitious project was started in Western Australia in 1902 to build a barrier fence from Starvation Boat Harbour in the south to Eighty Mile Beach on the north coast about 1900 kilometres away. When construction commenced rabbits were already across the proposed fence line in the south. In 1904, when only 750 kilometres of the first fence were completed, rabbits were known to be hundreds of kilometres west of it, so a second fence, about 120 kilometres to westward, was authorised.<sup>86</sup> It was completed in 1905 and a third fence to run east-west north of Geraldton was started in 1906.<sup>87</sup> The first and third fences were completed in 1908.<sup>88</sup> Erecting the fences across so much desert country involved building dams, digging wells for water and carting the fencing materials by bullock and mule teams for many hundreds of kilometres from the railhead and ports. The fences were repeatedly damaged by wash-aways in the north, and by fires and traffic along the reserve. Maintenance was often difficult as water was stolen.<sup>89</sup>

While the fences were being built the rabbits continued to spread in a north-westerly direction till they reached the Murchison River in about 1906. They spread down the river to

reach the coast by 1907 where there was already a small colony of rabbits at Lynton.<sup>90</sup> They also spread northwards and were within the settled districts of the Kimberley in 1908.<sup>91</sup> Isolated occurrences near Eighty Mile Beach were reported in 1908 and 1912. From the Murchison River the rabbits spread southwards and covered the Greenough flats by 1912.<sup>92</sup> They continued to spread down the coast and to close in from the east, reaching North Fremantle in 1916.<sup>93</sup> The second fence appeared to delay the westward spread in the south as the rabbits made little headway there between 1908 and 1916. The settlers did not take the pest seriously, optimistically thinking that the rabbit would not thrive. In the more arid country in the south, east of the first fence, the rabbits disappeared from large areas in dry seasons but waves would strike the fence at any time, especially after a series of good seasons.<sup>94</sup> Rabbits were found throughout the whole of the south-west corner of the State by 1922.<sup>95</sup>

#### THE RABBIT IN TASMANIA

There are few records of the spread of the rabbit in Tasmania because the threat they posed was unrecognised until the 1870's when they had already occupied most of the settled areas. As on the mainland, landholders at first encouraged the release and cultivation of rabbits for sport. Domestic rabbits were in the colony from the earliest days and were in thousands on some large estates in 1827.<sup>96</sup> Some were exported to Portland Bay in 1834, and Thomas Holt imported a number to New South Wales in 1860.<sup>97</sup>

By 1869 the rabbits were causing losses in the Midlands District and almost every property in the Ross and Campbelltown Districts was becoming overrun. The increase had been very rapid in the preceding two or three years, but the evil was 'still confined to very narrow limits'.<sup>98</sup> The first Rabbit Destruction Act was passed in 1871 and by 1884 all rural municipalities were declared infested, one of the last to be declared being only 50 kilometres north east of Hobart.<sup>99</sup>

Analysis of genetic polymorphisms has shown that the northern populations of rabbits in Tasmania are genetically distinct from the southern populations and are similar to mainland and English populations. The southern populations may be derived from domestic breeds.<sup>100</sup>



## ANALYSIS OF THE SPREAD ON THE MAINLAND

Since rabbits were present in the colonies right from the start, and since once they started to spread they did so rapidly, one might ask why did the major spread not begin before the 1860's. There are probably many facets to the answer. Domestic rabbits in hutches were evidently readily available, whereas the wild rabbit was difficult to catch and transport alive over thousands of kilometres. There seems to have been little awareness of the significance of using wild-caught animals at the time. Often only one or two pairs of rabbits were released. Many liberations were reported as flourishing for a few years and then dying out, and usually native predators were blamed. Some of the early releases were on coastal or tableland districts which were still largely uncleared and therefore not a suitable habitat for the rabbit.

The rabbits released at Barwon Park in 1859 were mostly wild-caught in England and they were released in a district of naturally open woodland. Subsequent releases were sometimes of wild rabbits from Barwon Park. The other main centre of the spread, the Kapunda area of South Australia, was also open woodland. The rabbits released at Kapunda may have been the

progeny of Barwon Park rabbits. As mainland rabbits from many sites are genetically similar and are similar to British populations of wild rabbits but different from southern Tasmanian rabbits (of probable domesticated ancestry), it appears that the local colonies of domesticated stock did not play a significant part in the colonisation.<sup>101</sup>

The map summarising the spread (Figure 8) shows that the advance of the rabbit was fastest in low rainfall areas where the vegetation is predominantly shrub steppe, scrub savannah and low tree savannah. The spread over the wetter and more densely wooded or forested mountain ranges and coastal areas was much slower. The rabbit is still in low numbers over most of the tropical north.

Except in special situations the country occupied after 1910 is ecologically unsuitable and even today rabbits exist there in isolated populations. The rate of spread slowed after 1910 as colonising rabbits would have had to move large distances to find suitable habitat. In the 1960's and 1970's the main spread was in subcoastal Queensland as expanding agriculture provided conditions suitable for rabbits. It is unlikely that the rabbit will move north of the limits of distribution reached by 1980.

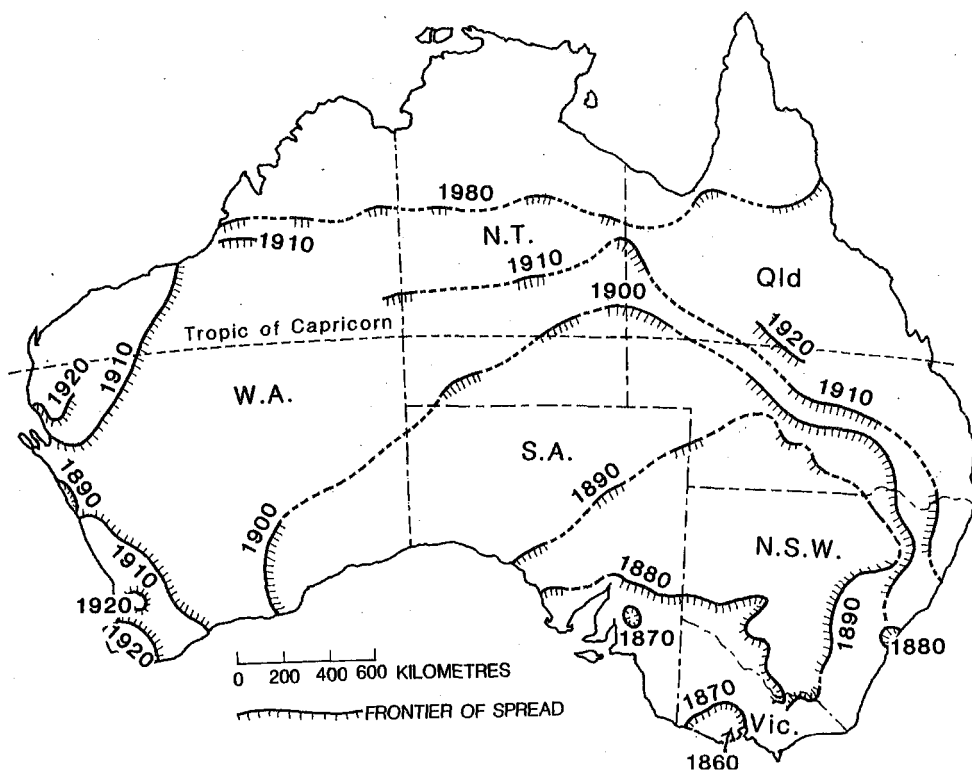


Fig. 8 Summary of the spread of the rabbit over the mainland of Australia.

Seasonal conditions at the time may also have influenced the origin and rate of the spread. The early 1860's, while rabbits were becoming established at Barwon Park, were years with above average rainfall in that area.<sup>102</sup> Then followed years with below average rainfall until 1870. During 1870-75 while rabbits became established in the Wimmera district in Victoria and around Kapunda in South Australia the rainfall in both areas was continually above average, with a particularly wet year in 1875. Then followed a drier period as the rabbits spread from the two centres over the mallee and western New South Wales. During the years 1876-1885 the front of the rabbit spread was almost continually in districts with below average rainfall at the time. Although rabbits were held responsible for selectors abandoning their holdings in the Victorian mallee in 1879-80 low rainfall at this time must have been a contributing factor.

The rabbit advanced into Queensland in two very wet years, 1886-87. Despite a severe drought in the following year the rabbit spread far up the flood plains of the Bulloo River probably feeding on the high quality food which would have grown there after the 1887 floods. In the Northern Territory, western New South Wales and Queensland many of the first reports of rabbits came from locations near river systems. There are several reasons for this. Dispersing rabbits coming to a river would have been forced to follow its course. Rabbits transported by man would probably have been released near rivers as most of the early grazing properties were on rivers and itinerant workers travelled along them. The probability of discovering new colonies of rabbits would have been highest near rivers as the density of people was highest there.

The rabbits appeared to travel at a steady rate across the Nullabor Plain to Kalgoorlie, although the decade 1891-1900 contained some years of above average and some years of below average rainfall. They reached the Murchison River in dry years. As they spread southward along the west coast they seemed to go farther in a dry year (1913), than in a very wet one (1915). During a series of good years (1915-18), there was little spread in the south-west, but during 1919-20, which were average years, they spread further.

The information available is not precise enough to draw more than a description of the rates of spread and seasons. However, it is evident that the rabbit spread as far or farther in

dry years than in wet ones, although the numbers were much greater after wet seasons. In dry seasons more young rabbits move longer distances than in good seasons.<sup>103</sup> A complication affecting this comparison is that trappers and itinerant workers, who could have carried rabbits into new areas, may have travelled greater distances in dry seasons in search of work.

Man's efforts to control the pest seem to have been insignificant except, perhaps, in continually disturbing the rabbit he hastened the spread. Rabbit preserving works were established at Colac in the Western District of Victoria about 1872 and at Kapunda, South Australia, in about 1875 to cope with the increase in rabbits.<sup>104</sup> Rabbit meat was tinned and shipped to England. By 1878 the works at Kapunda had depleted the neighbourhood, and trappers went 50 kilometres for their main supplies.<sup>105</sup>

As rabbits advanced into Western Australia 300 cats were released at Eyre to deal with them, but apparently many of the cats starved.<sup>106</sup> In New South Wales goannas were declared enemies of the rabbit and were protected in the Rabbit Nuisance Act 1883.<sup>107</sup> A conference in Brisbane in 1888 resolved that goannas, carpet snakes, native cats and feral cats, should be protected.<sup>108</sup> In Western Australia the Rabbit Act 1902 protected the natural enemies of the rabbit.

The barrier fences acted as temporary checks, or checks on local migrations only. Dead rabbits at times piled up against one side of the fence.<sup>109</sup> Some of the fences were built in areas where the rate of spread was slowed by natural features, for rabbits once through the fence did not spread very fast, e.g. rabbits had been reported within the southern boundaries of the Mitchell and Leichhardt districts in 1896 and they had not advanced any farther by 1903 as the soils to the north were unsuitable for warrens.<sup>110</sup> In small areas, particularly on individual properties, a policy of fencing and then internal eradication was sometimes successful.

In the southern States attempts to control rabbits by interested graziers were nullified to some extent by trappers and others who made a profit from the scalp bonus system. Some graziers profited from their having rabbits by selling stores at high prices to the trappers.<sup>111</sup> There are several reports of trappers breeding rabbits, or scalping them to collect the money and letting them go alive, particularly females.<sup>112</sup> Rabbit preserving works did not take young

rabbits so they were often released.<sup>113</sup> Bonuses paid for scalps in New South Wales made rabbit infestations so valuable that Western Australia prohibited such payments, and a conference in Brisbane in 1888 resolved that they should be prohibited.<sup>114</sup>

Many liberations were made in advance of the main spread e.g. at Menindee, perhaps at Pilliga and Coonabarabran, in the desert of Western Australia, or into unprotected country.<sup>115</sup> Strong, however, found no documented evidence of rabbits being transported within the Northern Territory.<sup>116</sup>

The spread was often described as being of a few scout rabbits which were followed a year or two later by advancing waves. The "advancing waves" may actually have been such, as there were later reports of dead rabbits piling up on one side of a fence only, and rabbits probably tended to move into new country, but the effect may have resulted largely from the multiplication of the scouts and their progeny.<sup>117</sup> After a few years of rabbits at high density some areas reported the outbreak of disease and a marked reduction in numbers of rabbits e.g. "Tintinallergy" disease along the Darling River in 1887, about three years after the rabbits reached there.<sup>118</sup> Diseased rabbits were also reported on the west coast of South Australia in 1887, eight or more years after rabbits arrived there.<sup>119</sup>

The rate of spread of the rabbit in Australia was much faster than that recorded for any other introduced mammal anywhere in the world and faster than the spread of the rabbit in New Zealand and Argentina where the rates of spread were about 15 km a year.<sup>120</sup> In New Zealand as in Australia the spread was faster in areas with lower rainfall. In Britain it was not until the early 19th century that rabbits became widespread, but even then, some 600 years after the first introductions many large areas were still free of rabbits.<sup>121</sup>

The slow rate of spread in Britain may have been due to an unfavourable climate as the rabbit is adapted to a Mediterranean climate. In Italy, where the climate should be very suitable, the distribution of the rabbit is very limited even though it was introduced in Roman times.<sup>122</sup> The rabbit was still colonising areas of France in the nineteenth century even though it had been present in the country since the Middle Ages. The difference in the rate of spread in Australia and Europe is surprising as the rabbit was highly valued in Europe and was constantly transported.

During the last glaciation the

distribution of the rabbit contracted to the southern half of the Iberian peninsula and it was a 'disappearing species before man reversed its fortunes so dramatically'.<sup>123</sup>

There were many factors which contributed to rapid colonisation of Australia by rabbits:

1. Shelter was readily available as there were numerous burrows dug by bettongs, bilbies and wombats.<sup>124</sup> Also widespread felling of trees provided abundant rabbit harbour. Australia has many areas of sandy soils where rabbits could easily establish warrens.
2. Many of the areas in southern Australia have climates similar to that in southern Spain which is the ancestral home of the rabbit.
3. Grazing by domestic stock had changed native pastures of low quality perennial grasses into pastures of high quality annual grasses and forbs. The rabbit may be regarded as an animal weed as it most readily colonises areas that have been disturbed by human settlement.
4. The rabbit did not bring its full complement of parasites to Australia.<sup>125</sup>
5. In the arid areas there were few native predators and in the higher rainfall areas there were large-scale predator destruction campaigns.<sup>126</sup> Native predators may not have recognised the rabbit as suitable prey.<sup>127</sup> The fox was introduced too late to affect colonisation by the rabbit.<sup>128</sup>
6. Man's efforts to control the advancing wave were ineffective due to lack of effective control techniques and adequate resources. The density of the human population in the areas of rapid spread was extremely low.
7. In a Mediterranean environment a female rabbit can produce 38 young in a breeding season.<sup>129</sup> Because of this high rate of reproduction and the small size of warrens in newly colonised areas there would have been many surplus young rabbits which would have been forced to disperse.
8. Rabbits can move long distances. Of seventy rabbits tagged and recovered in Victoria five had moved more than twenty kilometres.<sup>130</sup>

One issue which has not been resolved is how much of the spread of the rabbit in Australia was due to man. The spread appeared to be on an advancing front which suggests that it was mainly due to the natural movements of the rabbits; however the rate of spread in some areas seems to have been too fast for it to have been due to the unaided movements of rabbits and there are a number of records of releases in advance of the main spread. If man was

responsible for much of the spread then a series of questions are unanswered. Why was the rate of spread slower in the more closely settled areas than in the less populated areas when the opposite might be expected? Why did the rate of spread increase dramatically the further the rabbit was in time and space from the point and date of introduction (Figure 8)? Why did the rate of spread increase with time as the dangers of disseminating the rabbit became more and more apparent? Why were there not more examples of the rabbit suddenly appearing many hundreds of kilometres ahead of the advancing front?

Brown hares, *Lepus europaeus*, colonised south-eastern Australia almost as quickly as the rabbit yet they are difficult to keep in captivity and there are few records of their being transported by man. It has been suggested that the rapid spread of the hare was mainly due to an innate tendency of hares in a colonising population to disperse over long distances.<sup>131</sup> The dispersal behaviour of erupting hares and rabbits may differ from hares and rabbits in stable populations. Certainly there are large selective advantages for dispersing individuals when a species invades a favourable environment and there could be rapid changes in the innate tendency to disperse. This idea is supported by the slow initial spread of the rabbit and its increasing rate of spread as it moved further in time and space from the original release.

## REFERENCES

1. Eric Rolls, *They All Ran Wild* (Sydney: Angus & Robertson, 1969).
2. J.L. Long, *Introduced Birds and Mammals in Western Australia* (Agriculture Protection Board of Western Australia, Technical Series 1, 1972); B.W. Strong, *The Invasion of the Northern Territory by the Wild European Rabbit *Oryctolagus cuniculus** (Alice Springs Conservation Commission of the Northern Territory, Technical Report No.3, 1983).
3. An account of livestock in the Settlement 1 May 1788, *Historical Records of Australia 1914*. (Sydney: Gullick Gov. Printer 1914), Series I, Vol.I, 52; P.M. Cunningham, *Two Years in New South Wales* (London: Henry Colburn) 1827, as quoted by A.W. Greig in *The Argus*, Melbourne, 31 May 1919.
4. F.M. Bassett, *The Hentys* (Melbourne: Melb. Univ. Press, 1962), 108, 298, 306; R.D. Boys, *First Years at Port Phillip* (Melbourne: Robertson and Mullens 1935), 37.
5. F. Wood Jones, *The Mammals of South Australia Part III* (Adelaide: Govt. Printer, 1925), 286.
6. 'Rabbit in Australia: its introduction and spread', *Journal of the Department of Agriculture, Victoria* 26 (1928), 121-3.
7. Margaret Kiddle, *Men of Yesterday - A Social History of the Western District of Victoria 1834-1890*. (Melbourne: Melb. Univ. Press, 1961), 90, 318.
8. *The Port Phillip Patriot*, 26 June 1846.
9. *The Sydney Morning Herald* 3 Dec. 1860, 4.
10. *The Brisbane Courier* 8 June, 27 July 1865; 9 May, 13 May 1865; 30 Oct., 20 Nov. 1866; K.T. Cameron, 'Queensland's struggle against rabbits (1880-1930)', *Journal of the Historical Society of Queensland* 5 (1956), 1201-17.
11. *The Argus Supplement*, Melbourne 23 May 1868, 3.
12. *The South Australian Weekly Chronicle*, 1 Oct. 1864, 6-7.
13. Sources of information for releases were mainly *Progress Report of Royal Commission of inquiry into schemes for Extermination of rabbits in Australia 1889*. N.S.W. Parl. Votes & Proc. 5 (1890); *Q. Parl. Debates* 1880; *N.S.W. Parl. Debates* 1883; and Rolls, *op.cit.* (n.1).
14. Mr. Feez in *Q. Parl. Debates* (1880), 309.
15. F.G.A. Barnard, 'Gleanings from the Richmond 'Australian' 1859-61', *The Victorian Historical Magazine* 3 (1913), 36.
16. A.W. Austin, 'The Rabbit in Australia', *The Field* 205 No.5344 (1955), 1034.
17. *The Brisbane Courier* 30 Oct., 20 Nov. 1866; *The Australasian*, Melbourne, 2 Sept., 28 Oct. 1865.
18. *The Sydney Morning Herald*, 3 Dec. 1860, 4 Nov. 1861; *The Brisbane Courier*, 27 July 1864.
19. K. Wodzicki, *Introduced mammals of New Zealand*. (New Zealand Department of Scientific and Industrial Research Bulletin No.98, 1950).
20. J. Matthams, *The Rabbit Pest in Australia* (Melbourne: Specialty Press, 1921), 20-21. Concerning the establishment of this warren, also see Rolls, *op.cit.* (n.1), 28.
21. Mr Haywood in *W.A. Parl. Debates*, (1902), 2286; Mr Simpson in *Q. Parl. Debates* (1880), 307; and Rolls *op.cit.* (n.1), 32.
22. Games Act. *S.A. Parl. Debates*, (1864).
23. *The Brisbane Courier*, 13 May 1865.
24. Letter dated 14 June from T. Holt to Q, Acclimatisation Society, in *The Brisbane Courier*, 27 July 1864.
25. *The Australian*, Melbourne, 12 Aug. 1865, 7.
26. Rolls, *op.cit.* (n.1), 26.
27. Mr Conner in *Vic. Parl. Debates* (1869), Vol 7, 311-2; Vol 8, 897-9.
28. *The Argus*, Melbourne, 15 Oct. 1869.
29. For example, letter to the editor, *The Brisbane Courier*, *op.cit.* (n.23).
30. Mr Conner *op.cit.* (n.27).
31. Hans Mincham, *The Story of the Flinders Ranges* (Adelaide: Rigby 1964), 130.
32. *The Kapunda Herald*, 18 Feb. 1873, 3; Mr Wrigley in *S.A. Parl. Debates* (1877), 1182.
33. Petition for Destruction of Rabbits. *S.A. Parl. Paper No 74*, presented 19 Aug. 1873; *The Kapunda Herald*, 15 Aug. 1873.
34. *S.A. Parl. Debates* 1875.
35. Report by E.H. Lascelles in *Progress Report of Royal Commission op.cit.* (n.13), 123.
36. *The Riverine Grazier*, Hay, 1 Dec. 1883.
37. Rolls, *op.cit.* (n.1), 38; Hon. T. Playford in *S.A. Parl. Debates* (1878) Col.133; Mr. G.H. Cox, in the Leg. Council, in *N.S.W. Parl. Debates* (1883), 988; *The Sydney Morning Herald*, 7 July 1887, 7.
38. *The Argus*, Melbourne, 17 Oct. 1878; Rolls, *op.cit.* (n.1), 35.
39. *The Argus*, Melbourne, 17 Oct. 1878.
40. *Ibid.* 6 Nov.; 8 Nov. 1878. The difference between Map 2 and that for 1879 given by Rolls 1969, *op.cit.* (n.1) rests mainly on the letter to the Editor of *The Argus*, 8 Nov. 1878, stating that rabbits were spread to the South Australian border. Rolls evidently did not see this letter. His references do not suggest such a wide distribution, but nor do they negate it.
41. Mr Graves in *Vic. Parl. Debates* (1880), 908.

42. *The Wangaratta Dispatch* (1877) Most issues for the year were consulted (the collection in the Victorian Public Library was not complete). Hare coursing was mentioned and also the rabbit problem in other districts.
43. Robert B. Ronald, *The Riverina: People and Properties* (Melbourne: Cheshire, 1960), 147.
44. Hon. T. Playford, Commissioner for Crown Lands, in *S.A. Parl. Debates* (1878), col.132.
45. *The Southern Argus* 13 Nov. 1879; 1 July 1880.
46. *Progress Report of Royal Commission N.S.W. op.cit.* (n.13), 100.
47. Mr Madden in *Vic. Parl. Debates* (1881), 1419.
48. *The Portland Guardian* 26 Oct. 1880, 2.
49. Thomas Griffith Taylor, *Australia, a study of Warm Environments and their Effect on British Settlement* (London: Methuen 1940); Hans Mincham *op.cit.* (n.31), 130.
50. *The Wentworth Telegraph and Murray and Darling News* 11 Feb. 1882, 4.
51. Ronald *op.cit.* (n.43).
52. Diary of R.G. Casey, unpublished.
53. Mr. Davenport presented the Bill on 24 July 1879. Debate followed in August 1880. *Q. Parl. Debates* 1879, 1880.
54. C.L. Morgan, *The Rabbit Question in Queensland* (Brisbane: Walson and Ferguson, 1898).
55. Dept. Public Lands Annual Report 1888 in *Q. Leg. Ass. Votes and Proceedings* (1889 Vol.3), 5.
56. Dept. Public Lands Annual Report 1890, in *Q. Leg. Ass. Votes and Proceedings* (1891 Vol.4).
57. Morgan, *op.cit.* (n.54).
58. Morgan, *op.cit.* (n.54).
59. Morgan, *op.cit.* (n.54).
60. Rabbit Inspectors Reports, Appendix II in *Q. Dept. Public Lands Annual Report 1904*, in *Q. Govt. Report, Bureau of Census and Statistics* (1904), 64; The Rabbit Boards Act, Appendix VI in *Q. Dept. Lands Annual Report Q. Govt. Report, Bureau of Census and Statistics* (1910), 15.
61. *Ibid.*
62. *Ibid.*
63. Strong, *op.cit.* (n.2), 6.
64. The Rabbit Boards Act, *Q. op.cit.* (n.60).
65. Strong, *op.cit.* (n.2), 3-7.
66. Mincham, *op.cit.* (n.31); Taylor, *op.cit.* (n.49).
67. Strong, *op.cit.* (n.2), 4,5.
68. Dept. Agriculture Annual Report for year ending 30 June 1903, Paper 31 in *W.A. Minutes, Votes and Proc. Parl.* (1903-4 Vol.II), 22.
69. Strong, *op.cit.* (n.2), 5,6,14.
70. *Northern Territory Times and Gazette*, 13 May 1904; 28 April 1905.
71. Address by Minister for Lands to a Conference on the Rabbit Pest, as reported in *The Sydney Morning Herald*, 3 April 1895, 4.
72. Mr. Kelly in *N.S.W. Parl. Debates* (1887-8 Session), 2123.
73. *The Wangaratta Dispatch*, 2 July 1885, 2; *The Border Post*, Albury, 4 July 1885, 2.
74. *The Sydney Morning Herald*, 4 April 1895, 4.
75. *The Grenfell Record*, 17 Feb. 1894, 4.
76. W.E. Abbot, *The Rabbit Pest and the Balance of Nature. An experiment and a mathematical analysis.* (Sydney: William Brooks Co., 1913), 14; *The Scrutineer and Berrima District News*, Moss Vale, 12 Jan.; 13 July; 31 Aug.; 15 Oct. 1898; *Bega Standard*, 21 Dec. 1900, 2; *The Shoalhaven News and South Coasts District Advertiser*, 7 Sept.; 14 Sept.; 21 Sept. 1901; *Armidale Chronicle*, 1 Nov. 1902, 4.
77. D. Lunney and T. Leary, 'The impact on native mammals of land-use changes and exotic species in the Bega district, New South Wales, since settlement', *Australian Journal of Ecology* 13, (1988), 67-92.
78. *Macleay Argus* 31 Mar. 1906; 3 Aug.; 16 Nov. 1907. Note: the whole of the eastern and central divisions of the State had been declared rabbit infested as a preventive measure *Macleay Argus* 4 July 1903; *Clarence and Richmond Examiner*, Grafton, 3 Oct.; 22 Oct. 1912.
79. *The Bairnsdale Advertiser*, 29 July 1897, 4.
80. *Ibid.* 15 Aug.; 2 Aug.; 27 Aug.; 28 Oct. 1897: 20 Jan.; 28 Apr. 1898: 14 Mar. 1899: 13 Nov. 1900.
81. Progress Report of Royal Commission N.S.W. *op.cit.* (n.13), C.J. Valentine's (Chief Inspector of Stock S.A.) evidence p.100 and S.G. Hubbe's (Chief Inspector under Vermin Destruction Acts) evidence p.102.
82. Paper A28 Report of Inspector of Rabbits for year ended 30 June 1893, *W.A. Minutes, Votes and Proc. Parl.* (1893); Mr John Calaby of CSIRO Division of Wildlife and Ecology, pers.comm.; Paper A12 Report of Inspector of rabbits 30 June 1897. *W.A. Minutes, Votes and Proc. Parl.* (1897) Vol.II); *The West Australian*, 18 Dec.,6: 29 Dec.,3 1900.
83. Report of Royal Commission of Inquiry into the Rabbit Question, 1901. Paper 10, *W.A. Minutes, Votes and Proc. Parl.* (1901-2 Vol.I), 54.
84. W.A. Dept. Agric. Ann. Rep. 1903, *op.cit.* (n.68).

85. Annual Report of Chief Inspector of Rabbits to year ending 30 June 1908 in paper 16, Dept. Agric. Ann. Rep. *W.A. Minutes, Votes and Proc. Parl.* (1908-9 Vol.II), 24; Extracts from Reports of Rabbit Inspectors for the year 1891, Paper A25 *W.A. Minutes, Votes and Proc. Parl.* (1891-2); *W.A. Dept. Agric. Ann. Rep.* 1903, *op.cit.* (n.68).
86. The Premier in *W.A. Parl. Debates* (1902, 2173); Mr Thomas *Ibid.* 2433; Dept. Agric. Ann. Rep. Paper 25 *W.A. Minutes, Votes and Proc. Parl.* (1904 Vol.II), 7.
87. Dept. Public Works Ann. Rep. Paper 13 *W.A. Minutes, Votes and Proc. Parl.* (1907 Vol.II), 44.
88. Dept. Public Works Ann. Rep. Paper 18 *W.A. Minutes, Votes and Proc. Parl.* (1908-9 Vol.II), 60.
89. Dept. Agric. and Indust. Ann. Rep. to 30 June 1911. Paper 1 *W.A. Minutes, Votes Proc. Parl.* (1912 Vol.I), 20.
90. Report on Rabbit Branch in Dept. Agric. Ann. Rep. to 30 June 1907 *W.A. Minutes, Votes and Proc. Parl.* (1907 Vol.II), 34.
91. Mr. Male (Member for Kimberley) *W.A. Parl. Debates* (1908), 439.
92. Dept. Agric. and Indust. Ann. Rep. to 30 June 1912 Paper 19 *W.A. Minutes, Votes and Proc. Parl.* (1912 Vol.II), 43.
93. Dept. Agric. Ann. Rep. to 30 June 1916 Paper 19, *W.A. Minutes, Votes and Proc. Parl.* (1916-17 Vol.II), 30.
94. Dept. Agric. Ann. Rep. to 30 June 1922 Paper 5 *W.A. Minutes, Votes and Proc. Parl.* (1922-3 Vol.I), 40.
95. *Ibid.*
96. Rolls, *op.cit.* (n.1), 12.
97. Bassett, *op.cit.* (n.4); Boys, *op.cit.* (n.4); *The Sydney Morning Herald op.cit.* (n.18).
98. Petition to House of Assembly 1869 (*Tas. Parl. Papers*).
99. Bill to provide for the destruction of rabbits in Tasmania, passed on 7 Dec. 1871, *Tas. Parl. Debates.* (1871); The last declared were the Municipality of Sorrell and portion of the Police District of Selby. Report of Inspector-Rabbit Destruction Act 1884 *Tas. Parl. Papers* (1884).
100. B.J. Richardson, P.M. Rogers and G.M. Hewitt, 'Ecological genetics of the wild rabbit in Australia. II. Protein variation in British, French and Australian rabbits and geographical distribution of the variation in Australia', *Australian Journal of Biological Sciences* 33, (1980), 371-83.
101. *Ibid.*
102. J.C. Foley, *Droughts in Australia: Review of records from earliest years of settlement to 1955.* (Bureau of Meteorology Bulletin No.43, 1957).
103. I. Parer, 'Dispersal of the wild rabbit, *Oryctolagus cuniculus*, at Urana in New South Wales', *Australian Wildlife Research* 9, (1982), 427-41.
104. *The Argus, op.cit.* (n.38); Mr. White in *S.A. Parl. Debates* (1875), col.245.
105. *The Border Watch* 6 July 1878, 2.
106. Report of Royal Commission of inquiry into the Rabbit Question. Paper 10, *W.A. Minutes, Votes and Proc. Parl.* (1901-2 Vol.I), 13; Arthur Mason in letter to the editor *The West Australian* 11 Jan. 1901; *The West Australian* 29 Dec. 1900, 3.
107. *N.S.W. Parl. Papers* 1883.
108. Morgan, *op.cit.* (n.54).
109. G.W. Keith, *The Rabbit Question: Across the rabbit warrens of N.S.W.: A warning to Queensland.* Book printed from articles published in the *Brisbane Courier* in Oct. 1892.
110. Morgan, *op.cit.* (n.68); I. Parer, 'Factors influencing the distribution and abundance of rabbits (*Oryctolagus cuniculus*) in Queensland', *Proceedings of the Royal Society of Queensland* 98, (1987), 73-82.
111. *The Daily Telegraph*, Sydney 24 Aug. 1887.
112. *The Wentworth Telegraph and Murray and Darling News* 11 Feb., 4; 18 Nov., 2, 1882. *The South Australian Advertiser* 2 Aug., 7; 14 Sept., 5; 21 Sept., 5, 1885.
113. *The South Australian Advertiser.* 8. Aug. 1878, 7.
114. *W.A. Rabbit Act* 1902; Morgan *op.cit.* (n.54).
115. H. B. Hughes (p63) and Inspector Hubbe (p101), *Progress Report of Royal Commission N.S.W. op.cit.* (n.13); Mr. Abigail in Legislative Assembly, *N.S.W. Parl. Debates* Vol.XXX (1887), 2319; Report of Royal Commission *W.A. op.cit.*(n.106), 15,32; *The South Australian Advertiser* 14 Sept. 1885, 5.
116. Strong, *op.cit.* (n.2), 9.
117. Keith, *op.cit.* (n.109).
118. Progress Report of Royal Commission N.S.W. *op.cit.* (n.13), XXIII-XXX; Lunney and Leary, *op.cit.*(n.77).
119. *The Daily Telegraph*, Sydney, 24 Nov. 1887.
120. G. Caughley, *Analysis of Vertebrate Populations* (London: Wiley, 1977); Wodzicki *op.cit.* (n.19); W.E. Howard and J.N. Amaya, 'European rabbit invades western Argentina', *Journal of Wildlife Management* 39 (1975), 757-61.
121. H.G. Lloyd, 'Biological Observations on Post-Myxomatosis Rabbit Populations in Britain 1955-79', in *Proceedings of the World Lagomorph Conference*, Guelph, Ontario 1979 eds. K. Myers and C.D. McInnes (1981), 623-8.



122. F.E. Zeuner, *A History of Domesticated Animals* (London: Hutchinson, 1963).
123. G.B. Corbet, *The Terrestrial Mammals of Western Europe* (London: Foulis, 1966), 186.
124. Rolls, *op.cit.* (n.1), 41-2.
125. J. Dunsmore, 'The role of parasites in population regulation of the European rabbit (*Oryctolagus cuniculus*) in Australia', in *Worldwide Furbearers Conference Proceedings held in Frostburg, Maryland, August 1980*, eds. J.A. Chapman and D. Pursley. (1981), 654-69.
126. W. K. Hancock *Discovering Monaro* (Cambridge: Cambridge University Press, 1972), 114.
127. F.M. Jaksic and R.C. Soriguer, 'Predation on the European rabbit (*Oryctolagus cuniculus*) in Mediterranean habitats of Chile and Spain: a comparative analysis', *Journal of Animal Ecology*, 50 (1981), 269-81.
128. Peter Jarman, 'The Red Fox - an Exotic Large Predator' in *The Ecology of Exotic Animals and Plants*, ed. R.L. Kitching (Brisbane: Wiley, 1986), 45-61.
129. N. Gilbert, K. Myers, B.D. Cooke, J.D. Dunsmore, P.J. Fullagar, J.A. Gibb, D.R. King, I. Parer, S.H. Wheeler and D.H. Wood, 'Comparative dynamics of Australasian rabbit populations', *Australian Journal of Wildlife Research* 15, (1988), in press.
130. G.W. Douglas, *Movements and Longevity in the Rabbit* (Vermin and Noxious Weeds Destruction Board of Victoria Research Bulletin No.12, 1969), 71-2.
131. Peter Jarman, 'The Brown Hare - a Herbivorous Mammal in a New Ecosystem' in *The Ecology of Exotic Animals and Plants*, ed. R.L. Kitching (Brisbane: Wiley, 1986), 62-76.

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