



# DISTRIBUTION AND STATUS OF THE GEOMETRIC TORTOISE *Psammobates geometricus* IN SOUTH AFRICA

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## Abstract

The published distribution of the endangered geometric tortoise *Psammobates geometricus* is updated by means of an intensive survey of the southwestern Cape Province, South Africa. *P. geometricus* is known from at least 31 localities (including 21 newly confirmed ones) in the western Cape lowlands, the Worcester and Ceres Valleys. During the past 14 years, six localities have been destroyed. Currently, there are five nature reserves (one private and four provincial) which contain geometric tortoise populations and two more are scheduled to be established shortly. However, the distribution range of *P. geometricus* still appears to be contracting.

## INTRODUCTION

The present distribution of the geometric tortoise, *Psammobates geometricus* (Linnaeus, 1758), is limited to the extreme southwestern Cape Province, South Africa (Fig. 1) (Greig & Burdett, 1976; Greig & Boycott, 1977; Greig, 1984; Boycott & Bourquin, 1988; Branch, 1988a). This area falls within the Mediterranean climatic zone of southern Africa experiencing warm, dry summers and cool, wet winters. The vegetation of this region forms part of the Cape Floral Kingdom (Takhtajan, 1969) or fynbos biome. As far as is currently known, *P. geometricus* is confined to a specific vegetation type within the fynbos biome, namely renosterveld. This vegetation type is described by Acocks (1975) and Moll *et al.* (1984). Evidence exists that, historically, *P. geometricus* used to occur from Strand/Gordon's Bay in the south to the Piketberg/Eendekuil area in the north, with populations in both the Worcester and Ceres valleys (see Fig. 1 and Juvik, 1971; Rau, 1971; Greig & Burdett, 1976). It may also have occurred in the Bot River area (Rau, 1971).

Renosterveld grows on soils suitable for cultivation, and it is generally believed that the destruction of the habitat favoured by the tortoise has been the major factor which has led to its depletion in numbers (Greig & De Villiers, 1982; Greig, 1984). In this context, human settlement and associated clearing of land for cultivation of grain would obviously have led to

a reduction in numbers of this species, since local populations would have disappeared as the land was cleared.

During the period 1971–1986 nature reserves were established in the southwestern Cape Province to preserve remaining populations of *P. geometricus*. These reserves are important in conserving its remaining habitat, since without protection, this would either deteriorate or be destroyed.

*P. geometricus* is receiving adequate legal protection both locally and internationally. It is listed in: (a) the 'Vulnerable' category of the IUCN International Red Data Book: Reptiles and Amphibians (Groombridge, 1982); (b) Appendix I of the Convention on the International Trade in Endangered Species of Wild Fauna and Flora (CITES) (Honegger, 1981); (c) the 'Endangered' category of the South African Red Data Book—Reptiles and Amphibians (Branch, 1988b); and (d) Schedule I of the Cape Nature Conservation Ordinance No. 19 of 1974, Chief Directorate Nature and Environmental Conservation, Cape Province, South Africa. Strict enforcement of these measures may eventually assist the survival of this species in its natural environment.

This paper compares published distribution records of *P. geometricus* with recently confirmed ones, and provides an account of both its historic and present distribution. Nature reserves containing geometric tortoise populations, and major aspects threatening its existence, are also discussed.

## METHODS

A list of all the published distribution records (e.g. Loveridge & Williams, 1957; Juvik, 1971; Rau, 1971; Greig & Boycott, 1977) for the species, as determined from a thorough literature survey, was initially compiled. Additionally, through press releases and radio announcements, an appeal was made to farmers in the southwestern Cape to disclose the presence of geometric tortoise populations on their properties. All traced localities, as well as those newly reported, were surveyed during 1985–86 to confirm the presence of the species. Three additional surveys of poorly known areas were undertaken in 1989, 1990 and 1991. At all such localities, a team of searchers, occasionally assisted by a dog, looked for tortoises in natural habitat areas.

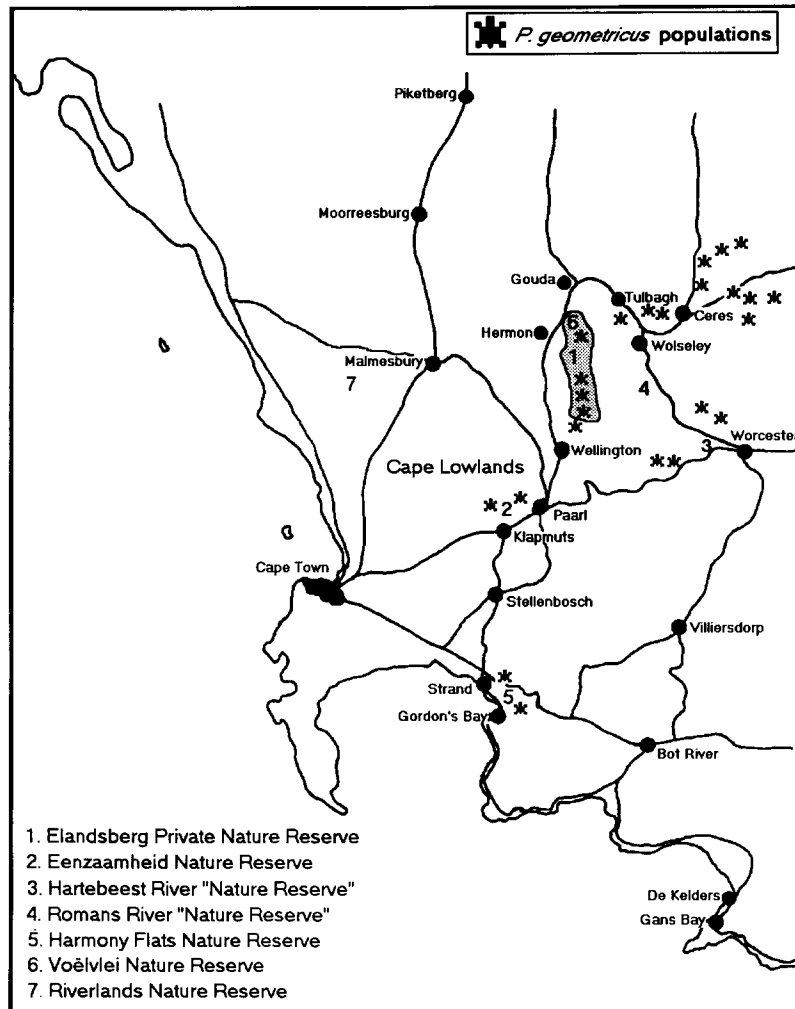


Fig. 1. The present distribution of *Psammobates geometricus* in the southwestern Cape Province. Note the location of the seven nature reserves (including the two deproclaimed ones) currently containing *P. geometricus* populations. Shaded area represents a long term viable conservation area. Road network included for reference purposes.

The future of these areas was discussed with the owners and the degree of alien vegetation encroachment into the typical renosterveld was evaluated at each site.

Research and management files of all established nature reserves where geometric tortoise populations occur were perused to assess the status of the populations within reserves and the degree of protection they provide.

## RESULTS

### Published distribution records

Loveridge and Williams (1957) list several distribution records for *Psammobates geometricus*, all in the southwestern Cape Province. Archer (1960, 1967) states that the geometric tortoise is 'indigenous to the Malmesbury area' (1960), but although its presence could not be confirmed in this area, the presently known range extends beyond this region. In view of Eglis' (1965) reported 're-discovery' of the species, it is unfortunate that he did not disclose the localities from where his specimens originated.

Rau (1971) presents a good summary of the then known distribution of the species. In addition to the localities cited by Loveridge and Williams (1957), he (Rau) lists a further six new localities and later confirms

Wolsley as a locality (Rau, 1976). In 1969 an archaeological record of *P. geometricus* (approximately 2000 years old according to radiocarbon dating techniques) was discovered at De Kelders, Gans Bay, and Rau (1971) argues that the historic distribution range of the species may have included the Breede River/Worcester valley southwards towards Villiersdorp and Bot River. G. R. McLachlan (South African Museum, Cape Town, pers. comm.) also states that he received what he considers to be a reliable report on the presence of the species in the Bot River area. Juvik (1971) confirmed Rau's (1971) localities, but considered the Ceres locality to consist of "captive" (?) specimens, with ultimate origin in doubt'. Greig and Boycott (1977) list 17 localities visited by them during 1976.

Before the survey reported in this paper was undertaken, the published distribution of *Psammobates geometricus* therefore comprised 34 cited localities. Subsequently, an additional 33 localities were identified by information from landowners, personal observations and an investigation by NACOR (the then National Committee for Nature Conservation, Pretoria, RSA) on the status of the remnants of West Coast Renosterveld in the southwestern Cape.

**Table 1. Localities (their respective sizes and estimated densities of populations) in the southwestern Cape Province, South Africa where *Psammodromus geometricus* presently occurs. The conservation value indicates the potential of the locality as conservation area. 1, high; 2, medium; 3, low; 4, very low**

Locality	Size (ha) (or available habitat)	Estimated densities	Conservation value
Elandsberg Private Nature Reserve, Hermon	1 000	2.7 ± 0.7 <sup>a</sup>	1
Krantzkop, Wellington	500		1
Voëlvlei Nature Reserve, Gouda	360	±1 <sup>b</sup>	1
Kasteelkloof Nature Area, Gouda	300		1
Farm Palmiet Valley, Wellington	150		1
Farm Limietrivier, Wellington	150		1
Farm Onderplaas, Worcester	50		1
Eenzaamheid Nature Reserve, Klapmuts	30	4–5 <sup>c</sup>	1
Farm Perdefontein, Ceres	25		1
Farm Elandsrivier, Prince Alfred Hamlet	500		2
Riverlands Nature Reserve, Malmesbury	100	±1 <sup>b</sup>	2
Farm Skilpadrug, Tulbagh	60		2
Farm De Heuwel, Tulbagh	60		2
Farm Kanaan, Goudiniweg, Worcester	60		2
Farm Elim, Prince Alfred Hamlet	50		2
Farm Die Oliene, Tulbagh	50		2
Hartebeest river 'Nature Reserve' Worcester <sup>d</sup>	44	±1 <sup>b</sup>	2
Romans river 'Nature Reserve', Wolseley <sup>d</sup>	35	<2 <sup>b</sup>	2
Harmony Flats Nature Reserve, Strand	10	2.5 ± 1.5 <sup>e</sup>	2
Farm Glen Etive, Ceres	100		3
Farm Ezelfontein, Ceres	100		3
Farm Haaswerf, Prince Alfred Hamlet	50		3
Farm Somarso, Worcester	50		3
Farm Quarta, Ceres	30		3
Farm Morgenrood, Worcester	30		3
Lwandle Development Site, Strand	15		3
Gustrouw Development Site, Gordon's Bay	10		3
Farm Bulelwa, Klapmuts	25		4
Farm Ellamoer, Klapmuts	10		4
Farm Kweperfontein, Ceres	10		4
Farm Vondeling, Wellington	≈ 5		4
Total area	3 969		

<sup>a</sup> Baard (1990).

<sup>b</sup> Departmental records and personal observations.

<sup>c</sup> Greig (1984).

<sup>d</sup> Deproclaimed provincial nature reserves.

<sup>e</sup> L. Lourens (pers. comm.); personal observations.

### Present distribution

During October 1985–February 1986, October–November 1989, April–May 1990 and September 1991 all 67 reported and otherwise identified sites were visited. It was established that, at present, *P. geometricus* occurs in at least 31 localities (Fig. 1 and Table 1), including one private (Elandsberg) and four provincial (Voëlvlei, Riverlands, Eenzaamheid and Harmony Flats) nature reserves. The presence of *P. geometricus* on Riverlands Nature Reserve was confirmed in 1990 (J. Cloete, pers. comm.). Apart from listing confirmed localities, Table 1 also grades these sites according to their conservation value.

To investigate the suggested occurrence of the species in the Bot River area, 12 localities in the Bot River/Villiersdorp region were surveyed. This subsidiary survey produced only one dubious locality from which *P. geometricus* was possibly known more than 50 years ago. However, since the locality lies midway between 11 others at which no person interviewed could recognise shells of this species, it is regarded as highly unlikely that *P. geometricus* ever occurred here in historic times

(people interviewed often found it difficult even to distinguish between the locally abundant tortoise species). *P. geometricus* may, however, have occurred there before human settlement of the area. This aspect is discussed elsewhere (Baard, 1990).

The main survey has indicated that since 1977 the habitat at six localities (two of which were confirmed as containing populations) has either been altered so radically or has been completely destroyed (three through the infestation of alien vegetation and three by being ploughed up) that they are now regarded as totally unsuitable for geometric tortoises. Twenty-one new localities were identified, one of which (Prinshof, Ceres) has since been ploughed for agricultural use. At 20 previously reported localities no geometric tortoises could be found, but more intensive future visits to these sites might reveal the presence of surviving populations.

### Conservation status

Between 1971 and 1986 five provincial nature reserves were established to protect geometric tortoise populations (Fig. 1). A sixth reserve, Elandsberg Private Nature

Reserve, was initially established for lowland fynbos conservation, but proved to contain the single largest remaining population of this endangered chelonian. As mentioned previously, a population has also recently been confirmed in Riverlands Nature Reserve. Regrettably, two of the mentioned 'reserves' (Romans River and Hartebeest River) are no longer administered or managed as provincial reserves by the Chief Directorate Nature and Environmental Conservation, Cape Province (H. W. Heard, pers. comm.) due to unforeseen circumstances leading to their deproclamation. The remaining four provincial reserves, together with Elandsberg Private Nature Reserve, incorporate about 1500 ha of renosterveld habitat suitable for geometric tortoises ( $\approx 1580$  ha including Romans River and Hartebeest River). Negotiations between the Chief Directorate and two private landowners are currently underway to conserve two more areas. This would increase the area of conserved geometric tortoise habitat to approximately 1650 ha (42% of the total habitat currently known).

Elandsberg Private Nature Reserve (3200 ha) has about 1000 ha of undisturbed renosterveld suitable for geometric tortoises and constitutes the core area of *P. geometricus* conservation. Voëlvlei Nature Reserve (360 ha), situated almost next to Elandsberg, is believed to contain the second largest population, but has been disturbed in places. Eenzaamheid Nature Reserve (30 ha) was the first ever tortoise reserve to be established in southern Africa for the protection of any chelonian (Rau, 1971), and also contains a healthy population (Greig, 1984). There are, however, indications that this population, and that of the Harmony Flats Nature Reserve (10 ha), is declining in numbers (personal observations). Herpetologists of this Chief Directorate are monitoring the situation. Riverlands Nature Reserve (1297 ha), situated on the western boundary of the distribution range of *P. geometricus*, contains about 100 ha of suitable renosterveld. The Voëlvlei, Eenzaamheid and Harmony Flats reserves are all unmanned and the intention is to maintain them and prevent their deterioration, with no aim for further development in terms of public access and/or recreational facilities.

## DISCUSSION

There has been an increase in the number of confirmed sites (12 to 31) for *P. geometricus* since Greig and Boycott's (1977) survey. However, despite this apparent improvement in distribution status, there is little doubt that the distribution range of this species is still being reduced. The conflict between the requirements of the geometric tortoise and man's utilization of the land continues; the tortoise is restricted to, and its survival precariously dependent on, the few remaining patches of renosterveld. The last remaining sites where they are still to be found should therefore be regarded as priority conservation areas and given appropriate protection.

Habitat degradation and destruction, and not the pet trade, as was previously believed, are currently the

biggest threats to *P. geometricus*. In addition, geometric tortoise populations in the southwestern Cape Province have been and are still subject to two main threats which operate in their natural distribution range.

(1) Unplanned and uncontrolled wildfires in renosterveld habitat, including those naturally ignited, threaten geometric tortoise populations. During summer, when this habitat becomes very dry, wildfires occur more frequently in this region. Although renosterveld may require fire to maintain species diversity, fires are usually detrimental to tortoise populations. Many adult tortoises may survive a relatively 'cool' fire (quick-moving with strong winds—personal observations), but too-frequent fires (for example, more than one every six years) pose a threat by depleting immature cohorts (Baard, 1990).

With relatively small reserves, a general management objective would be to maintain vegetation (habitat) quality in the seral stage that is optimal for the tortoises. For renosterveld habitat, a practical way in which to achieve this objective is a well-coordinated fire regime, resulting in a mosaic of differently aged habitat units at various tortoise localities to promote plant species diversity. The prior removal of as many tortoises as possible from the area to be burned is important in this regard.

(2) Invasive alien vegetation is an important factor in the deterioration of natural renosterveld habitat. This includes invasive Australian shrubs, e.g. the Port Jackson willow *Acacia saligna* and rooikrans *Acacia cyclops*, and annual and perennial grasses, e.g. *Briza maxima*, *B. minor*, *Bromus diandrus*, *Lolium perenne*, *Phalaris canariensis* and *Vulpia bromoides*. Dense stands of especially the first two species compete with and largely exclude important tortoise food items such as native annual grass and geophyte species.

Of all the areas where geometric tortoise still occurs, the Elandsberg Private Nature Reserve, together with the recently established Voëlvlei Nature Reserve, the land inbetween (Kasteelkloof Nature Area), and Krantzkop, Palmiet Valley and Limietrivier to its south, is regarded as the most important for its future survival. The combined area incorporates the largest remaining, relatively undisturbed, portion of geometric tortoise habitat in the southwestern Cape Province ( $\pm 2460$  ha) and the protection of this combined area against degradation will hopefully result not only in securing the future of the tortoise, but will also ensure the preservation of a threatened plant community.

Already almost 4000 ha of coastal renosterveld and mountain fynbos are incorporated into a conservation area reaching from the southern boundary of Elandsberg Private Nature Reserve, northwards along the foothills of the Elandskloof Mountains, to the northern boundary of the Voëlvlei Nature Reserve, including the natural veld surrounding the Voëlvlei Dam. This area has been awarded the second highest conservation priority in the southwestern Cape by conservation working groups (Jarman, 1986) and it constitutes the single largest conservation area of its kind in this region.

When two additional reserved areas are established in the Worcester and Ceres valleys, the number of protected geometric tortoise populations (seven) would be adequate in the short to medium term, provided they are managed correctly. However, to meet long-term conservation objectives, a contiguous conservation area, comprising the Voëlvllei Nature Reserve, Kasteelkloof, Elandsberg Private Nature Reserve, Krantzkop, and parts of the farms Palmiet Valley and Limietrivier (Fig. 1), is probably the only viable unit ( $\pm 2460$  ha) for the survival of *P. geometricus* without resorting to labour-intensive management and population manipulation. The reserve network 'design' is not optimal and has been predicted by economic rather than ecological factors. No natural corridors exist between the Elandsberg-Voëlvllei reserve unit and any other geometric tortoise habitats and attention must be given to the establishment of buffer zones around these areas, since catastrophic events may annihilate smaller ones.

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