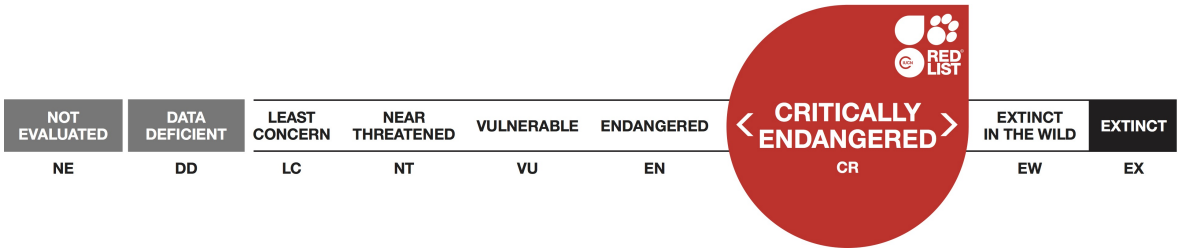
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Scope: Global
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Psammobates geometricus, Geometric Tortoise

Assessment by: Hofmeyr, M.D. & Baard, E.H.W.



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Taxonomy

Kingdom	Phylum	Class	Order	Family
Animalia	Chordata	Reptilia	Testudines	Testudinidae

Taxon Name: *Psammobates geometricus* (Linnaeus, 1758)

Synonym(s):

- *Chersine geometrica* (Linnaeus 1758)
- *Chersinella geometrica* (Linnaeus 1758)
- *Geochelone geometrica* (Linnaeus 1758)
- *Hydrone geometrica* (Linnaeus 1758)
- *Peltastes geographicus* Gray 1869
- *Peltastes geometricus* (Linnaeus 1758)
- *Testudo geometrica* Linnaeus, 1758
- *Testudo luteola* Daudin 1801
- *Testudo strauchi* Lidth de Jeude 1893

Common Name(s):

- English: Geometric Tortoise
- French: Sakafi, Tortue Géométrique
- Spanish: Sacafi, Tortuga Geométrica

Taxonomic Source(s):

Fritz, U. and Havas, P. 2007. Checklist of chelonians of the world. *Vertebrate Zoology* 57(2): 149-368.

Taxonomic Notes:

Wallin (1977) documented that the Linnaean type specimen of *Psammobates geometricus* is actually a specimen of *Geochelone elegans* with the type locality of "Asia". Hoogmoed and Crumly (1984) instead assigned the animal depicted by Piso (1658) as syntypical to *P. geometricus* and designated it as lectotype, and the type locality was restricted to "southwestern Cape Province, South Africa" by Baard (1991). No subspecies are currently recognized. Although earlier research showed no significant genetic distance among three seemingly isolated subpopulations (Cunningham *et al*. 2002), the phylogeographic relationships of these should be given further attention.

Assessment Information

Red List Category & Criteria: Critically Endangered A4ace ver 3.1

Year Published: 2018

Date Assessed: June 13, 2017

Justification:

Psammobates geometricus is assessed as Critically Endangered based on known past and projected future population reductions, which combined amount to > 90%, over three generations (90 years). Population decline is due primarily to anthropogenic land transformation, where the causes of destruction have not ceased, based on direct observation (survey data) (A4a), a decline in area of

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occupancy, extent of occurrence and habitat quality (A4c), the effects of introduced feral pigs and other subsidized predators (A4e), and unintentional but severe mortality from wildfires affecting small residual subpopulations in limited habitat patches (A4c). New threats to the species involve an increasing switch from sheep to cattle farming (greater trampling and habitat degradation); improper land management resulting in dense invasive vegetation that is unsuitable for tortoises (A4c, A4e); and climate change with an associated increase in drought frequency that intensifies physiological stress on the tortoises and the occurrences of wildfires. In addition, though currently not a major threat, there is the potential for rising levels of exploitation.

Previously Published Red List Assessments

2016 – Critically Endangered (CR)
http://dx.doi.org/10.2305/IUCN.UK.2016-1.RLTS.T18398A97166852.en

2015 – Critically Endangered (CR)
http://dx.doi.org/10.2305/IUCN.UK.2015-4.RLTS.T18398A76918966.en

1996 – Endangered (EN)
http://dx.doi.org/10.2305/IUCN.UK.1996.RLTS.T18398A8210444.en

1994 – Vulnerable (V)

1990 – Vulnerable (V)

1988 – Vulnerable (V)

1986 – Vulnerable (V)

1982 – Vulnerable (V)

Geographic Range

Range Description:

Psammobates geometricus is endemic to the Western Cape, South Africa. Historically, the species occurred from around Eendekuil and Piketberg in the north, southwards through the Swartland (Porterville, Hermon, Wellington, Paarl) to the Strand-Gordon's Bay area in the south, and eastwards in the Upper Breede River Valley, from Tulbagh in the north to just west of Worcester. It was also found in the Ceres Valley, in the northeast (Baard 1993). The range currently occupied has diminished markedly, but isolated subpopulations are still found in the Paarl district, north of Wellington towards Porterville, between Tulbagh, Wolseley, and Worcester, and in the Ceres Valley. Surveys and interviews by E. Baard (1993 unpubl. data) could not confirm suspected presence of this species in the Bot River and Villiersdorp area, or in the Darling area. The Darling record is based on two specimens collected from this area in 1905. No further locality data are available. Darling lies within the historic distribution of Granite and Shale Renosterveld, suggesting that this was the western extent of the species' range.

Country Occurrence:

Native: South Africa (Western Cape)

Population

The range currently occupied by *Psammobates geometricus* has diminished markedly since historic times, but isolated subpopulations are still found in the Paarl district, north of Wellington towards Porterville, between Tulbagh, Wolseley, and Worcester, and in the Ceres Valley. A total of 34 cited localities were known before 1993, when intensive surveys added 33 localities of (past) occurrence. All 67 localities were surveyed intensively in the mid-1980s and early 1990s, and continued occurrence was documented for 31 sites (Baard 1993). Population sizes differ immensely, but the largest population was estimated to contain between 1,500 and 3,400 tortoises in 1992 (Baard 1993), whereas the entire species population was estimated to have decreased to between 700 and 800 by 2012 (Goode *et al*. 2012). Over 90% of the species' original habitat has been irreversibly converted to agriculture (Baard and Hofmeyr 2014). Subpopulations in remaining habitat have suffered catastrophic declines from fire-induced mortality, with little indication of population recovery.

Current Population Trend: Decreasing

Habitat and Ecology **(see Appendix for additional information)**

Psammobates geometricus occurs in the Mediterranean climate region (mean annual rainfall 350-600 mm) of the southwestern part of the Western Cape of South Africa, at altitudes of about 70 to 600 m (Baard 1995a). It is found in the Fynbos Biome, primarily in the Northwest and Southwest Fynbos Bioregions, and peripherally in the West Coast Renosterveld Bioregion, in a number of Critically Endangered and Endangered vegetation types, including alluvium fynbos, sand fynbos, shale fynbos, shale renosterveld, granite renosterveld, and silcrete renosterveld (Rebelo *et al.* 2006). The general habitat comprises low-lying, undulating plains (seldom rocky terrain, but never koppies), with a dominant low to medium-high shrub layer, a strong restioid and ericoid presence, and an essentially annual, herbaceous understorey with perennial grasses (Baard 1995a). During the hot and dry season *P. geometricus* takes refuge in slightly damper microhabitats under dense vegetation (E. Baard pers. obs.). This tortoise does not dig its own burrows but occasionally uses the burrows of other animals. The Geometric Tortoise is a rather small tortoise; males average about 10.0 cm in carapace length (CL) and 200 g in mass, females average 12.5 cm CL and 430 g, respectively. Large females of greater than 20.0 cm CL with a mass of 680 to 850 g have been recorded (Baard 1990, 1995b; M.D. Hofmeyr unpubl. data). Males reach sexual maturity after 8 to 10 yrs, while females usually mature at 11 to 13 yrs of age, but may mature in 10 yrs (Baard 1995b, Goode *et al*. 2012, M.D. Hofmeyr unpubl. data). Females may produce one or more clutches of one to five eggs in suitable conditions; or skip egg production during adverse periods (M.D. Hofmeyr unpubl. data). Egg and hatchling survival rates may be very low (possibly up to 99% mortality in the first year), thus recruitment is slow and generation time is estimated as 30 yrs (M.D. Hofmeyr unpubl. data). Longevity has been estimated at about 40 yrs (Goode *et al*. 2012), but these tortoises can probably live longer. Body condition declines during summer and autumn, with a simultaneous increase in blood urea nitrogen, indicating severe osmotic stress in the dry season, particularly in males searching for mates (Hofmeyr *et al.* 2017).

Systems: Terrestrial

Use and Trade

The Geometric Tortoise is not utilized in great quantities, but occasional casual collection for local subsistence consumption occurs. Although infrequent, the illegal collection of specimens for the pet

trade remains a potentially emerging threat.

Threats (see Appendix for additional information)

Human-induced habitat alteration, degradation and destruction, largely due to extensive agricultural development (wine and wheat farming), have led to the irreversible alteration of more than 90% of *Psammobates geometricus* habitat. Human settlement, invasive alien species (both woody and herbaceous species), predators (including invasive feral pigs), overgrazing by domestic stock, droughts and wildfires (Baard 1997) seriously threaten survival in remaining habitats. Within its severely fragmented range, these threats are exacerbated in small, isolated subpopulations, which may not remain viable. Although infrequent, the illegal collection of specimens for local subsistence consumption and for the pet trade may be potentially significant threats. Subsidised native predators such as Chacma Baboons, Black-backed Jackals, and Pied Crows now exist in Geometric Tortoise areas, sometimes in high numbers, due to anthropogenic landscape change and management practices. The Pied Crow is increasingly common in mixed agricultural/native Fynbos tortoise habitat throughout the range of *P. geometricus* (Juvik and Hofmeyr 2015), and causes considerable mortality for many tortoise species (Fincham and Lambrechts 2014); it represents a currently unquantified but credible threat to recruitment in the remaining Geometric Tortoise subpopulations. For several decades, irrigation canals crossing the Ceres Valley's remaining Geometric Tortoise habitat have been acting as pitfalls, trapping and killing *P. geometricus* and other tortoise species in significant numbers (Juvik *et al*. 2014). A continuing threat involves improper management of *P. geometricus* habitat, which often becomes infested with alien plants and too densely vegetated to remain suitable for the species. A new threat is an increasing change of farming preferences from sheep to cattle, which cause greater damage to the habitat. The current conservation status is dire, and climate change, involving greater aridity (Midgley *et al*. 2005), is likely to seriously compromise the survival of remaining, fragmented subpopulations (Hofmeyr *et al*. 2006, 2017).

Conservation Actions (see Appendix for additional information)

Psammobates geometricus has been included in CITES Appendix I since 1975, banning all commercial international trade, and is afforded protection under South African legislation. Geometric Tortoises occur in a number of private protected areas, although catastrophic wildfires have affected these subpopulations on occasion. Continued research into aspects of conservation biology is necessary in order to inform conservation measures. Securing conservation stewardship of remaining lowland habitats by landowners should be prioritized. More remaining habitat should be included into more formal conservation arrangements. A PHVA should be conducted, and a Conservation Action Plan (CAP) has already started and is being implemented (priority population monitoring, investigating new populations, and implementing invasive alien clearing and ecological fire management planning). CapeNature established an internal Threatened Species Working Group that facilitates planning and implementation of operational research, monitoring and management actions for threatened species. A Geometric Tortoise Biodiversity Management Plan – Species (BMP-s), with action tables, is being drafted and will replace the current CAP.

Credits

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External Resources

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Appendix

Habitats

(http://www.iucnredlist.org/technical-documents/classification-schemes)

Habitat	Season	Suitability	Major Importance?
3. Shrubland -> 3.8. Shrubland - Mediterranean-type Shrubby Vegetation	Resident	Suitable	Yes

Threats

(http://www.iucnredlist.org/technical-documents/classification-schemes)

Threat	Timing	Scope	Severity	Impact Score
11. Climate change & severe weather -> 11.1. Habitat shifting & alteration	Ongoing	Whole (>90%)	Causing/could cause fluctuations	Medium impact: 7
	Stresses:	1. Ecosystem stresses -> 1.1. Ecosystem conversion 1. Ecosystem stresses -> 1.2. Ecosystem degradation		
11. Climate change & severe weather -> 11.2. Droughts	Ongoing	Whole (>90%)	Causing/could cause fluctuations	Medium impact: 7
	Stresses:	1. Ecosystem stresses -> 1.2. Ecosystem degradation		
2. Agriculture & aquaculture -> 2.1. Annual & perennial non-timber crops -> 2.1.2. Small-holder farming	Ongoing	Minority (50%)	Very rapid declines	Medium impact: 7
	Stresses:	1. Ecosystem stresses -> 1.1. Ecosystem conversion 1. Ecosystem stresses -> 1.2. Ecosystem degradation		
2. Agriculture & aquaculture -> 2.1. Annual & perennial non-timber crops -> 2.1.3. Agro-industry farming	Past, unlikely to return	Majority (50-90%)	Very rapid declines	Past impact
	Stresses:	1. Ecosystem stresses -> 1.1. Ecosystem conversion 1. Ecosystem stresses -> 1.2. Ecosystem degradation		
2. Agriculture & aquaculture -> 2.3. Livestock farming & ranching -> 2.3.2. Small-holder grazing, ranching or farming	Ongoing	Minority (50%)	Unknown	Unknown
	Stresses:	1. Ecosystem stresses -> 1.1. Ecosystem conversion 1. Ecosystem stresses -> 1.2. Ecosystem degradation		
4. Transportation & service corridors -> 4.1. Roads & railroads	Past, unlikely to return	Minority (50%)	Very rapid declines	Past impact
	Stresses:	1. Ecosystem stresses -> 1.1. Ecosystem conversion 1. Ecosystem stresses -> 1.2. Ecosystem degradation 2. Species Stresses -> 2.1. Species mortality		
4. Transportation & service corridors -> 4.2. Utility & service lines	Ongoing	Minority (50%)	Causing/could cause fluctuations	Low impact: 5
	Stresses:	1. Ecosystem stresses -> 1.1. Ecosystem conversion 1. Ecosystem stresses -> 1.2. Ecosystem degradation		

5. Biological resource use -> 5.1. Hunting & trapping terrestrial animals -> 5.1.1. Intentional use (species is the target)	Ongoing	Minority (50%)	Slow, significant declines	Low impact: 5
	Stresses:	2. Species Stresses -> 2.1. Species mortality		
7. Natural system modifications -> 7.1. Fire & fire suppression -> 7.1.1. Increase in fire frequency/intensity	Ongoing	Majority (50-90%)	Rapid declines	Medium impact: 7
	Stresses:	1. Ecosystem stresses -> 1.2. Ecosystem degradation 2. Species Stresses -> 2.1. Species mortality		
8. Invasive and other problematic species, genes & diseases -> 8.1. Invasive non-native/alien species/diseases -> 8.1.1. Unspecified species	Ongoing	Majority (50-90%)	Slow, significant declines	Medium impact: 6
	Stresses:	1. Ecosystem stresses -> 1.1. Ecosystem conversion 1. Ecosystem stresses -> 1.2. Ecosystem degradation		
8. Invasive and other problematic species, genes & diseases -> 8.1. Invasive non-native/alien species/diseases -> 8.1.2. Named species (Sus domesticus)	Ongoing	Majority (50-90%)	Slow, significant declines	Medium impact: 6
	Stresses:	2. Species Stresses -> 2.1. Species mortality		
8. Invasive and other problematic species, genes & diseases -> 8.2. Problematic native species/diseases -> 8.2.2. Named species (Corvus albus)	Ongoing	Unknown	Unknown	Unknown
	Stresses:	2. Species Stresses -> 2.1. Species mortality		
9. Pollution -> 9.3. Agricultural & forestry effluents -> 9.3.3. Herbicides and pesticides	Ongoing	Minority (50%)	Unknown	Unknown
	Stresses:	1. Ecosystem stresses -> 1.2. Ecosystem degradation 2. Species Stresses -> 2.1. Species mortality		

Conservation Actions in Place

(http://www.iucnredlist.org/technical-documents/classification-schemes)

Conservation Actions in Place
In-Place Research, Monitoring and Planning
Action Recovery plan: Yes
Systematic monitoring scheme: No
In-Place Land/Water Protection and Management
Conservation sites identified: Yes, over entire range
Occur in at least one PA: Yes
Invasive species control or prevention: Yes
In-Place Species Management
Harvest management plan: No
Successfully reintroduced or introduced beningly: No

Conservation Actions in Place
Subject to ex-situ conservation: No
In-Place Education
Subject to recent education and awareness programmes: Yes
Included in international legislation: Yes
Subject to any international management/trade controls: Yes

Conservation Actions Needed

(http://www.iucnredlist.org/technical-documents/classification-schemes)

Conservation Actions Needed
1. Land/water protection -> 1.1. Site/area protection
1. Land/water protection -> 1.2. Resource & habitat protection
2. Land/water management -> 2.1. Site/area management
2. Land/water management -> 2.2. Invasive/problematic species control
3. Species management -> 3.2. Species recovery
3. Species management -> 3.3. Species re-introduction -> 3.3.1. Reintroduction
4. Education & awareness -> 4.3. Awareness & communications

Research Needed

(http://www.iucnredlist.org/technical-documents/classification-schemes)

Research Needed
1. Research -> 1.2. Population size, distribution & trends
1. Research -> 1.3. Life history & ecology
1. Research -> 1.5. Threats
1. Research -> 1.6. Actions
2. Conservation Planning -> 2.1. Species Action/Recovery Plan
2. Conservation Planning -> 2.2. Area-based Management Plan
3. Monitoring -> 3.1. Population trends
3. Monitoring -> 3.4. Habitat trends

Additional Data Fields

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Distribution
Continuing decline in area of occupancy (AOO): Yes
Extreme fluctuations in area of occupancy (AOO): No
Estimated extent of occurrence (EOO) (km²): 2827
Continuing decline in extent of occurrence (EOO): Yes
Extreme fluctuations in extent of occurrence (EOO): No
Continuing decline in number of locations: Yes
Extreme fluctuations in the number of locations: No
Lower elevation limit (m): 70
Upper elevation limit (m): 600
Population
Number of mature individuals: 800
Continuing decline of mature individuals: Yes
Extreme fluctuations: No
Population severely fragmented: Yes
Continuing decline in subpopulations: Yes
All individuals in one subpopulation: No
Habitats and Ecology
Continuing decline in area, extent and/or quality of habitat: Yes
Generation Length (years): 30
Movement patterns: Not a Migrant

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