

Common padloper
Homopus areolatus



Studbook Management Plan

Version 4, November 2020

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VERSION HISTORY

Version	Date	Changes
1 (draft)	April 2015	-
2	July 2015	Comments from studbook participants implemented
3	September 2020	Five-yearly update
4	November 2020	Comments from studbook participants implemented

This plan will be reviewed and updated once every five years. Progress will be reported annually, in the annual reports of Dwarf Tortoise Conservation.

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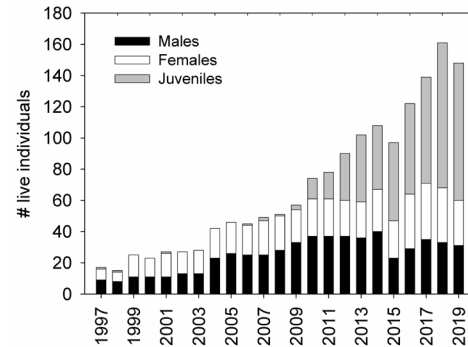
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1. INTRODUCTION

In 1997, two wild-caught and four captive-bred *Homopus areolatus* were exported from South Africa to initiate a studbook. All six individuals were surplus at Tygerberg Zoopark in Kraaifontein. A second (eight wild-caught individuals) and third (four wild-caught individuals) export of surplus tortoises followed in 1999 and 2001, respectively. Since 2001, several *H. areolatus* that were already present in the Netherlands, Germany, South Africa, Sweden and Namibia were added to the captive population.

Initially, husbandry success in the studbook was poor, in part due to the physical condition of the newly imported founder tortoises. However, since 2006 mortality rates decreased and breeding success increased, leading to a steadily increasing population size. The development of the captive population and the realisation of the aims in successive studbook management plans are reported annually in the [reports of Dwarf Tortoise Conservation](#). This studbook management plan is updating the studbook management plan drawn up in 2015.

The following chapters clarify the long-term (i.e., 50 years) aims for the studbook, and the policies and methods that will be used to get there. The format is analogous to the [studbook management plan for *Chersobius signatus*](#).



2. DISTRIBUTION

Homopus areolatus is endemic to South Africa, where it occurs in the Mediterranean southern coastal parts (Branch 2008). The taxon occurs in two provinces, the Eastern Cape and the Western Cape.

3. HABITAT

The habitat of *H. areolatus* is relatively moist and consists of heathland, thornveld, bushveld, fynbos and transitional habitats (Boycott and Bourquin 2000; Branch 2008). The tortoises prefer dense vegetation and use shrubs and grass tufts to retreat.

4. PROTECTED STATUS

In South Africa's range provinces, *H. areolatus* is protected fauna that may not be hunted, collected, or handled without permits from the provincial authorities. In both provinces, *H. areolatus* is a Protected Wild Animal as listed in Schedule 2 of the Nature and Environmental Conservation Ordinance No. 19 of 1974. In the Western Cape, this outdated Ordinance is currently being turned into the Western Cape Biodiversity Bill.

International trade of *H. areolatus* is regulated through the Convention on Trade in Endangered Species (CITES). The species is listed in Appendix II, because it is not necessarily threatened with extinction, but utilisation may be incompatible with its survival. An export permit or re-export certificate (only if the specimen was imported in accordance with the convention) issued by the Management Authority of the state of export or re-export is required. An export permit may be issued only if the specimen was legally obtained and if the export will not be detrimental to the survival of the species. Furthermore, live *H. areolatus* must be prepared and shipped in a way that minimises any risk of injury, damage to health or cruel treatment. Although CITES requires no import permit for species on Appendix II, it is a requirement in many national laws. Import permits in the European Union can only be issued after confirming the exporting country's non-detriment finding.

5. CONSERVATION STATUS

Homopus areolatus is listed Least Concern in the IUCN Red List of Threatened Species (IUCN 2020). This indicates that it is not currently threatened in the wild.

6. STATUS IN CAPTIVITY

The global information system [Species360/ZIMS](#) lists 1.1.1 (= number of males.females.juveniles) live *H. areolatus* at one species holding. The institution is located in the USA and participates in this studbook.

The studbook totals 28.29.83 live individuals available for the studbook. Except three individuals at Behler Chelonian Conservation Center in the USA, all individuals are housed at private facilities. Most studbook locations are in Europe, except two locations in Namibia and South Africa.

Besides the animals listed here, several *H. areolatus* are present in private facilities in Europe and elsewhere. It is likely that these facilities produce (some) offspring. South Africa irregularly exports *H. areolatus* for commercial purposes. In the [CITES trade database](#), 91 individuals (35 wild-caught, 17 captive-born and 39 captive-bred) originating from South Africa were reported by importing countries between 2015–2018. These imports are matched by only 14 individuals reported by South Africa as exported in the same time-range. Consequently, it is highly likely that most *H. areolatus* imported by Germany, Hong Kong, Italy and Japan have been illegally exported from South Africa.

Homopus areolatus can successfully reproduce in captivity. Reproduction has succeeded at many locations (see annual reports of Dwarf Tortoise Conservation, and Gorseman 1980; Barzyk 1994; Broschell 2000; Fleck and Fleck 2001; Schleicher 2005, 2012). Breeding has occurred into second generation (Appendix 1). A husbandry protocol and publications are available at the [website of Dwarf Tortoise Conservation](#). In the studbook, mortality does not appear to be excessive, with steady growth of the population as a result.

7. STUDBOOK COORDINATION AND CONTINUITY

To guarantee the continuity of the studbook, it is coordinated by two persons. Supervision of the [European Studbook Foundation](#) (ESF), a well-established private studbook organisation, gives access to a reservoir of experienced studbook coordinators. This studbook management plan will play an important role in the supervision by the ESF.

Currently, the studbook is coordinated by the following two persons:

Dr. Victor J.T. Loehr (strategic and tactic studbook management)
IJsselstein, Netherlands
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Mr. Martijn Kooijman (operational studbook management)
The Hague, Netherlands
E-mail studbookhomopus@gmail.com

8. PARTNERS AND STAKEHOLDERS

The studbook is a collaborative effort of Dwarf Tortoise Conservation and the European Studbook Foundation. Public facilities may participate in the studbook. Five private facilities in Austria, Belgium, Germany and South Africa harbour the majority of the tortoises. Any facility in Europe, Africa, USA, or elsewhere interested in participation in the studbook is considered a potential partner.

Although there is no relationship between the studbook and the wild *H. areolatus* population in terms of conservation, [CapeNature](#) (South Africa) is an important stakeholder for the studbook because it is responsible for conservation in most of the taxon's range. Furthermore, it is the competent authority for permission to keep *H. areolatus* in captivity in the Western Cape Province and to export individuals to

other studbook locations outside South Africa. In addition, the Namibian [Ministry of Environment and Tourism](#) is considered a stakeholder, because the ministry requires *H. areolatus* kept and bred in Namibia to be registered in the studbook and is the competent authority for exports of individuals to other studbook locations outside Namibia.

Due to the very small scale of the commercial trade in *H. areolatus* and the uncertainties regarding its legality (see Chapter 6), commercial reptile dealers are not considered stakeholders.

9. SUITABILITY OF FACILITIES PARTICIPATING

Most of the current participants in the studbook are tortoise husbandry experts, with long-term breeding experience. Many of them also have field experience. *Homopus areolatus* is a small species and does not require large enclosures. Their climate is easily imitated in indoor enclosures, and some keepers experiment with outdoor keeping during summer. *Homopus areolatus* requires an herbivorous diet that is easily catered for. A [husbandry protocol](#) is available at the website of Dwarf Tortoise Conservation.

Of particular concern is the husbandry of founders that were recently caught in the wild. Poor husbandry results in the past indicate that such individuals should be housed at expert keepers, or at keepers with extensive experience keeping captive-bred *H. areolatus*.

10. ULTIMATE GOAL FOR THE CAPTIVE POPULATION

The goal for the captive population is the resultant of the following:

- *Homopus areolatus* is not threatened (Least Concern) in the wild, so there is no need for an assurance colony.
- Available founders in the studbook originate from unknown and mixed locations, not suitable for the development of an assurance colony.
- *Homopus areolatus* is scarce in captivity and may disappear when the captive population is not properly managed.
- Legal exports of *H. areolatus* from South Africa are virtually absent.

Consequently, the studbook population should develop into a population that may persist without the need to (frequently) introduce additional wild-caught founders. Population management should minimise inbreeding to avoid genetic disorders such as morphological, growth and reproductive issues. Any *H. areolatus* available in captivity should be recruited, especially unrelated bloodlines. When captive *H. areolatus* will be irregularly added, the time-span to develop a captive population that does not need additional founders is estimated at approximately 25–50 years.

11. GENETIC AND DEMOGRAPHIC GOALS

11.1. Population size

A large population size can better conserve genetic variation over many generations than can small population sizes. However, with an increasing population size come, statistically, tortoises lost for the studbook and unresponsive participants. Missing tortoises and participants complicate the management of the studbook and increase administrative efforts. The studbook will seek balance and aims at an ultimate population size of approximately 400 live individuals (currently 140).

11.2. Number of founders and generation time

Given the goal for the captive population, the number of founders and generation time should be carefully chosen to facilitate the conservation of genetic variation within the maximum manageable population size. Ideally, founder couples should produce equal numbers of F1 offspring to fill the maximum population size, followed by a long generation time to avoid genetic loss from one generation to the next, and replacement breeding for subsequent generations.

In this studbook, starting with 50 founders would translate to the preservation of 99.99% of the genetic variation into the first generation (i.e., 25 couples times 14 offspring makes 350 individuals, plus 50 founders is 400 individuals). Fifty founders is at the lower end of the minimum number of founders recommended for tortoise studbooks (50–100 founders, E. Gubbels and G. Hofstra, pers. comm.), but appears realistic for a species that is scarce in captivity.

It is unlikely that all founders will be recruited for the studbook in a short period of time (i.e., Chapter 10 provides an estimate of 25–50 years). Therefore, the studbook will take care not to fill the maximum population size with offspring of founders that are already available. Based on the low mortality among captive-bred *H. areolatus*, the studbook will aim for approximately 20 offspring per founder couple, while deaths might be replaced by the production of additional offspring as long as founders are alive.

To avoid genetic loss into next generations, subsequent reproduction should be delayed. Considering growth rates and mortality in the studbook, reproduction should take place when captive-bred animals are at least 10 years old.

12. SEX RATIO

Male and female *H. areolatus* can be kept in couples year-round, so the studbook aims to form a population with equal numbers of males and females. The actual studbook population is well-balanced in terms of sexes, but is biased towards female founders.

13. SOURCES FOR SPECIMENS INCLUDED IN THIS PLAN

The current studbook contains 19 founders (12 deceased or lost for the studbook) and five potential founders. All but one live and available founders are privately-owned. Additional founders will be sourced from keepers of *H. areolatus* outside the studbook. In addition, governments might like to place confiscated *H. areolatus* in the studbook, ensuring traceability of the tortoises and their offspring. Moreover, the studbook is able to guarantee that confiscated individuals will not be used for commercial purposes, a situation that already exists for 15 live *H. areolatus* formally owned by Dwarf Tortoise Conservation and one owned by the European Studbook Foundation. The studbook has no intention to collect *H. areolatus* in the wild.

It must be noted that five of the currently available founders in the studbook have produced little or no surviving offspring into F1 (see Appendix 1). This indicates that a first priority for the studbook, along with recruiting new founders, is combining appropriate founders and improving reproductive success.

14. GENETIC ISSUES THAT NEED TO BE RESOLVED

The taxonomy of some wild *H. areolatus* populations is not clear (i.e., isolated populations may represent independent entities). Because the founders in the studbook originate from unknown localities, it is possible that the studbook hybridises different taxa. The issue of potential hybridisation is acknowledged and accepted, because:

- the risk of hybridisation is probably small, because it is more likely that founders originate from large populations than from isolated, small populations;
- the studbook does not have a conservation goal.

15. MANAGING THE STUDBOOK

15.1. Dispersal of offspring

Most *H. areolatus* in the studbook are privately owned. Therefore, the decision where offspring goes and the conditions for the transfer are usually up to the studbook participants. For the successful realisation of the studbook management plan, it is important that offspring remains in the studbook (but see Section 15.2) and is transferred to participants that avoid inbreeding into the next generation. The studbook

coordinator will advise participants where to transfer offspring to.

15.2. Surplus

Studbook participants who privately own *H. areolatus* may breed offspring beyond the recommended number of 20 offspring per founder couple that is required for the studbook (see Section 11.2). On the request of the participant involved, surplus will not be registered in the studbook.

15.3. Individual identification

It is the responsibility of each studbook participant to individually recognise each tortoise. The shape and colour pattern of the carapace may help identify individual *H. areolatus*, but it is recommended to use nail polish, permanent marker, PIT tags, coloured marks for queen bees, or other tools to avoid confusion.

16. REQUIREMENTS TO SUCCEED IN ESTABLISHING A LONG-TERM CAPTIVE COLONY

The most important and challenging requirement for the studbook management plan is the availability of privately-owned *H. areolatus* for the studbook. Participation in the studbook is voluntary but comes with responsibilities and restrictions. For example, the plan cannot succeed if participants would consistently place private interests over the interests of the studbook. What the studbook offers in return is a means to ensure that *H. areolatus* will remain available in captive collections in the long-term future. The unmanaged keeping of *H. areolatus* is not sustainable; eventually the captive population is likely to crash as a result of inbreeding and genetic drift. The studbook is a tool for keepers to join efforts and genetically manage the scarce captive *H. areolatus*.

Further requirements for success are:

- the presence of at least 31 additional unrelated founders in captivity over the next 25-50 years;
- successor studbook coordinators in the next decades.

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APPENDIX 1: LIVE *HOMOPUS AREOLATUS* BLOODLINES IN THE STUBBOOK ON 13 SEPTEMBER 2020, EXCLUDING DEAD INDIVIDUALS AND INDIVIDUALS LOST FOR THE STUBBOOK

All numbers are studbook numbers.

Reproduction into F1											Reproduction into (partial) F2						
Bloodline:	A	B	C	D	E	F	G	H	I	J	K	Bloodlines:	WILD x D	A x D	WILD x G	I x G	K x WILD
Founders:	16 [♂] x 17 [♂]	22 x 24	10 [♂] x 11 [♂]	5 [♂] x 4 [♂]	192 [♂] x (191+192)	23 [♂]	58 x (59+60)	210	63 [♂] x 64 [♂]	223 [♂]	288 [♂] x 289 [♂]	F1:	47 [♂] x 37 [♂]	94 x 62	40 x 81	234 x (123+128+129)	283 x 282
Offspring:	94	46	207	37 [♂]	194		69		234		283	Offspring:	107	130		235	
	266	65	209	62	196		71						111	132		239	
	267	66	236		214		79							133		240	
	269	172	237		215		81							149		241	
		173			216		84							185		245	
		174					85							186		246	
		177					96							187		247	
		178					124							201		248	
		179					126							224		249	
		180					127							225		250	
		183					128							226		251	
		211					129							228		252	
		212					136							229		253	
		213					138							230		254	
		263					139							232		270	
		264					141							233		271	
		284					142							256		273	
		285					143							257		274	
		286					144							259		275	
		287					145							260		282	
							162							261		283	
							163							262		294	
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Conclusions:																	
- The population is currently free of inbreeding																	
- The genetic variation in the founder population is not fully exploited, because five founders (one subadult) are housed without mates																	
- The live and available founder population is biased towards females																	
For maximum delay of inbreeding (in this order):																	
- Produce F2 offspring from WILD x G and K x WILD																	
- Combine founder 223 (when mature) with founder 40																	
- Combine founders 191, 192 and/or 210 with F1 offspring from bloodline C (i.e., transfer 191, 192 and/or 210 from South Africa to the USA)																	
- Combine F1 offspring from bloodline E with F1 offspring from B (i.e., transfer F1 offspring from bloodline E to Europe)																	
- Combine F2 offspring from bloodline WILD x D with F1 offspring from bloodline A																	
- Combine F1 offspring from bloodlines A and G (this should be delayed as long as possible)																	
For maximum delay of inbreeding, considering feasibility (in this order):																	
- Produce F2 offspring from WILD x G and K x WILD																	
- Combine founder 223 (when mature) with founder 40																	
- Combine F1 offspring from bloodline E with F1 offspring from bloodline B (i.e., transfer F1 offspring from bloodline E to Europe)																	
- Combine F1 offspring from bloodline E with F1 offspring from bloodline C (i.e., transfer F1 offspring from bloodline E to USA)																	
- Combine F2 offspring from bloodline WILD x D with F1 offspring from bloodline A																	
- Combine F1 offspring from bloodlines A and G (this should be delayed as long as possible)																	

Black cells indicate bloodlines that cannot produce additional offspring because they died (*) or are lost for the studbook (*). Male 269 (♂) is too small for breeding and does not grow. Female 223 (♀) is subadult. Female 223 (♀) is not made available for breeding by the owner.

Anticipated bloodline clustering in this plan			
Cluster 1	Cluster 2	Cluster 3	Cluster 4
A	F	B	K x WILD
D	G	C	
WILD x D	I	E	
	WILD x G		