

kept in outdoor pools prior to release, allowing acclimatisation to outdoor conditions and natural foods.

2.4. Evaluation

2.4.1 Indicators

The survival levels will provide the indicators of success. Survival of over 75% after 6 months will be regarded as successful release. The released terrapins will be monitored by radio tracking for a year. Trapping will be used on an annual basis beyond this time period, this is unlikely to be completely efficient so long-term survival measures may be subject to error. Detection of successful reproduction will indicate successful reintroduction once the released animals have reached maturity, approximately 5 years after the release.

2.4.2 Monitoring of released populations

The release will be monitored by radio-tracking for the first year. Trapping for recapture will be used at quarterly intervals after the year. 10g radio-tags will be used, this represents less than 10% of the juvenile terrapin body weight, a proportion that is generally regarded as acceptable in chelonian tracking.

2.4.3 Monitoring of impacts

Ecological data on habitats and prey species will be gathered at the time of release. These will be repeated at monthly intervals over the life-time of the project to determine whether the released terrapins are having any impact on their environment.

2.4.4 Evaluation of success

Reintroduction success will be evaluated annually, using the indicators described above.

2.5 Reporting

Results of the release will be included in project reports distributed to NPTS, North island and the Seychelles Ministry of Environment, and will contribute to publications on the conservation of the terrapins.

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Seychelles Terrapin Action Plan

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Summary

Three native terrapin species have been recorded in Seychelles. One is probably extinct (*Pelusios seychellensis*) and the remaining two are Critically Endangered endemic subspecies (*Pelusios subniger parietalis* and *P. castanoides intergularis*). These are threatened by habitat loss (marsh drainage, river canalisation), predation and invasion by alien water plants and introduced terrapins. The following conservation measures are proposed: protection of remaining populations through agreements with land-owners, reintroduction to secure sites, control of invasive species. This plan should be reviewed in 2007 and revised in 2012.

Introduction

Terrapins in Seychelles are represented by two endemic subspecies, the black mud turtle *Pelusios subniger parietalis* and the yellow-bellied mud turtle *P. castanoides intergularis* and an endemic species, the Seychelles terrapin *P. seychellensis*. Historically they were widespread and abundant but have declined as a result of habitat loss, pollution and predation, in 2001 they were categorised as Critically Endangered. This Action Plan aims to reduce this category of threat through conservation of habitat and establishment of secure populations. The Action Plan has been developed through discussion with a wide variety of Chelonian conservation experts and the proposals were discussed at a public meeting in March 2002 (a presentation on Seychelles terrapins as part of the Island Conservation Society's public lecture series). This action plan was drafted by The Nature Protection Trust of Seychelles and was circulated for comment to:

Conservation Division, Ministry of Environment, Seychelles
Pelusios interest group
IUCN/SSC Reintroduction Specialist Group
IUCN/SSS Madagascar and Mascarene Amphibian and Reptile Specialist Group
IUCN/SSC Tortoise and Freshwater Turtle Specialist Group
Island Conservation Society

The draft was revised in the light of comments received.

2. Status

2.1 Taxonomy

The Seychelles terrapins belong to the African genus *Pelusios*. This is a widespread and diverse genus, species boundaries within the genus are very poorly understood. The Seychelles terrapins comprise one endemic species *Pelusios seychellensis* (Siebenrock, 1906) and two endemic subspecies *P. subniger parietalis* Bour, 1983 and *P. castanoides intergularis* Bour, 1983. *P. subniger parietalis* and *P. castanoides intergularis* are well defined but *P. seychellensis* is closely related to the west African *P. castanaeus*. This species is known from only 3 specimens collected in 1895 although some *P. castanoides* individuals show characteristics of *P. seychellensis* (Gerlach & Canning 1996) and therefore it is possible that the two species have hybridised. There have also been suggestions that *P. seychellensis* is not a Seychelles species but represents mislabelled specimens of *P. castanaeus*. There is no evidence of the survival of *P. seychellensis* as a valid species in the Seychelles and it is currently considered to be extinct.

2.2 Brief summary of morphology and reproduction of the extant species

P. castanoides Hewitt, 1931 *intergularis* Bour, 1983

Straight carapace length 124-212mm.

Diagnostic features: elongate carapace (length/width = 1.25-1.92), plastron not constricted at humero-pectoral seam, intergular moderate (intergular/gular = 1.0-1.3), plastron yellow with dark patches, may be covered with a brown or black layer. Skin colour yellow, supralabial absent to moderately large (Bour 1983 & 1984).



Fig. 1 *Pelusios castanoides intergularis*, adult female (photo: R. Gerlach)

1.5 Reporting

Results of the release will be included in NPTS reports distributed to the Seychelles Ministry of Environment, Islands Development Company and subscribers, and will contribute to publications on the conservation of the terrapins.

2. North island reintroduction

The NPTS proposes to undertake an experimental reintroduction of *Pelusios subniger parietalis* to North island in conjunction with North island management. It is proposed that 10 adults be released once the main marsh has stabilised following the recent hotel development on the island. Radio-tracking will be used to follow the movements of each terrapin in order to gather data on survivorship, movement and behaviour of released terrapins for use in refining further reintroductions and the protection of wild populations.

2.1. Appropriateness of re-introduction

North island is believed to have been part of the range of *P. subniger* in the past and the reintroduction is appropriate on ecological and biogeographical grounds. Terrapins have not been recorded on the island. No threats are believed to exist.

2.2. Aims of re-introduction

The aim is to establish a secure population of *P. subniger* and monitor survival and behaviour of a standing marsh population.

2.3. Pre-project requirements

2.3.1 Taxonomy and genetics

The released animals will all be of the endemic Seychelles subspecies *P. subniger parietalis* from Mahé island. This is biogeographically the most suitable source population.

2.3.2 Wild status

None present on North island.

2.3.3 Suitability of re-introduction site

The release site at North island is considered to be suitable for a re-established population. Historical causes of extinction are believed to have been human predation. This factor no longer operates and no potential threats have been identified in the area. Natural food (aquatic invertebrates and plants) are abundant and a range of natural habitats are available. The site covers at least 1 hectare.

2.3.4 Population modelling

The available data have been used to devise a basic model of population growth, this will be revised following the results gained from monitoring the reintroduction to Silhouette.

2.3.5 Disease considerations

No diseases or parasites have been recorded in Seychelles *P. subniger*. Screening of the captive population demonstrates that no parasites are present.

2.3.6 Release of individuals

The animals will be acclimatised before release, animals used for release will be captive bred 3-4 year olds from the captive breeding project on Silhouette. These will be

suitable source population.

1.3.2 Wild status

The wild population has been extinct on Silhouette for some 50 years.

1.3.3 Suitability of re-introduction site

The release site at Grande Barbe is considered to be suitable for a re-established population. Historical causes of extinction are believed to have been human predation and drainage. These factors no longer operate and no potential threats have been identified in the area. Natural food (aquatic invertebrates and plants) are abundant and a wider range of natural habitats are available. The site covers some 30 hectares.

1.3.4 Population modelling

The available data have been used to devise a basic model of population growth. The experimental release is needed to revise the model for future reintroductions.

1.3.5 Disease considerations

No diseases or parasites have been recorded in Seychelles *P. subniger*. Screening of the captive population demonstrates that no parasites are present.

1.3.6 Release of individuals

The animals will be acclimatised before release, animals used for release will have been kept in captivity, either from the captive breeding project or long-term captives from Mahé. These will be kept in outdoor pools prior to release, allowing acclimatisation to outdoor conditions and natural foods.

1.4. Evaluation

1.4.1 Indicators

The survival levels will provide the indicators of success. The experimental release suggest that high adult survival is likely, a survival rate of over 90% after 6 months will be regarded as successful release. The released terrapins will be monitored by radio tracking for a year. Trapping will be used on an annual basis beyond this time period, this is unlikely to be completely efficient so long-term survival measures may be subject to error. Observation of hatchlings will indicate successful breeding of released animals, these have been difficult to locate on other islands and an increase in trapped animals 5 years after release will be an indication of successful population establishment.

1.4.2 Monitoring of released populations

The release will be monitored by radio-tracking for the first year. Trapping for recapture will be used at quarterly intervals after the year. 10g radio-tags will be used, this represents less than 5% of the terrapin body weight, a proportion that is generally regarded as acceptable in chelonian tracking and has been used successfully in the experimental release (Gerlach 2002).

1.4.3 Monitoring of impacts

Ecological data on habitats and prey species have been gathered for the Grande Barbe marsh. These will be repeated at monthly intervals over the life-time of the project to determine whether the released terrapins are having any impact on their environment.

1.4.4 Evaluation of success

Reintroduction success will be evaluated annually, using the indicators described above.

P. subniger (Lacepede, 1788) *parietalis* Bour, 1983

Straight carapace length 100-166mm.

Diagnostic features: rounded carapace (length/width=1.25-1.47); plastron strongly constricted at humero-pectoral seam, yellow with dark triangles; integular large (intergular/gular=1.5-3). Skin colour grey, supralabial large (Bour 1983 & 1984).

Clutch size: 9 (6 clutches). Egg dimension 15.8-23.5x29.5-37.6mm.

Incubation: 45-50 days (Gerlach 2000).



Fig. 2 *Pelusios subniger* juvenile (photo: R. Gerlach)

Pelusios seychellensis (Siebenrock, 1906)

Straight carapace length 127-165mm.

Diagnostic features: rounded carapace (length/width = 1.40-1.56); plastron not constricted at humero-pectoral seam, black; integular small (intergular/gular = 0.5-0.6). Skin colour yellow, supralabial large (Bour 1983 & 1984).



Fig. 3 : R. Bour)

2.3

P. subniger parietalis has been recorded from 6 marshes and rivers on the islands of Mahé, Cerf, Praslin, Cousin, La Digue and Fregate. It was probably present

on St. Anne, Silhouette, Curieuse but the historical populations were not identified on those islands. The present distribution is reduced to 6 sites (3.1 hectares).

P. castanoides intergularis has been recorded from 9 marshes and rivers on Mahé, Cerf, Praslin and La Digue. Historically it was probably also present on Silhouette. The present distribution is reduced to 8 sites (3.0 hectares).

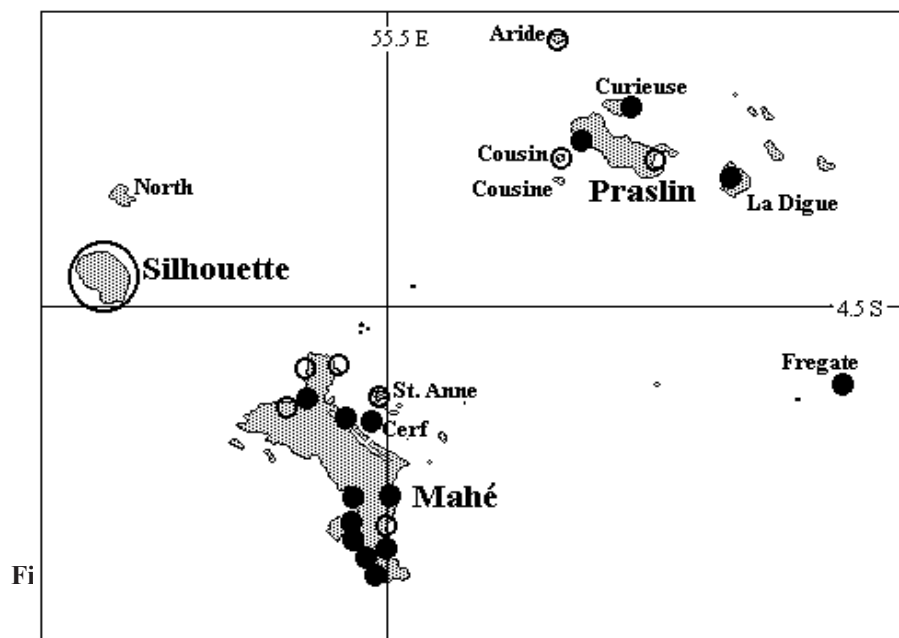


Table 1 Current populations and areas of *Pelusios* in Seychelles

Island	Marsh	sites		Area (ha)		Population	
		cast.	subn.	cast.	subn.	cast.	subn.
<i>subn</i>							
Mahé	Anse Forbans	-	+	-	2.3	-	181
	Beau Vallon	+	-	0.2	-	27	-
	Roche Caiman	+	-	0.2	-	2	-
	Anse Royale	+	-	0.2	-	17	-
	Anse Poules Bleus	+	-	0.3	-	1	-
	Anse La Mouche	+	-	1.2	-	?	-
Cerf		+	+	0.3	0.3	34	24
Silhouette	La Passe	+	-	0.4	-	9	-
Praslin	Anse Kerlan	+	+	0.2	0.2	?	?
La Digue	Grande Anse	-	+	-	0.1	-	6
	Mare Soupape	+	+	7.1	6.4	?	?
Fregate		-	+	-	0.2	-	16
Total		8	6	3.0	3.1	90	227

2.4 Populations

Population estimates based on mark-recapture studies indicate that total

Review action plan
Prepare full revision

MoE, NPTS
MoE, NPTS

2007
2012

Acknowledgements

We are grateful to everyone who has provided information to the Seychelles Terrapin Conservation Project and during the preparation of this action plan. Particularly helpful reviews were provided by Dr. G. Rocamora, P. Soorae and P.P. van Dijk.

Appendix I Reintroduction proposals

These have been developed in accordance with the NPTS Policy on Reintroductions and the IUCN Reintroduction Guidelines. Only *Pelusios subniger* is considered below. The proposal for Grande Barbe will also apply to *P. castanoides* once successful captive breeding has elucidated the details of reproductive requirements in this species.

1. Grande Barbe reintroduction

The NPTS proposes to undertake an experimental reintroduction of *Pelusios subniger parietalis* terrapins to Grande Barbe, Silhouette island. It is proposed that 10 adults be released at Grande Barbe in 2002. Radio-tracking will be used to follow the movements of each terrapin in order to gather data on survivorship, movement and behaviour of released terrapins for use in refining further reintroductions and the protection of wild populations.

1.1. Appropriateness of re-introduction

Silhouette is believed to have been part of the range of *P. subniger* in the past and the reintroduction is appropriate on ecological and biogeographical grounds. Terrapins have been extinct on the island for approximately 50 years, the cause of this is believed to have been direct human consumption. This threat no longer exists.

1.2. Aims of re-introduction

The aim is to establish a secure population of *P. subniger*, test the release methods for future releases and monitor survival and behaviour.

1.3. Pre-project requirements

1.3.1 Taxonomy and genetics

The released animals will all be of the endemic Seychelles subspecies *P. subniger parietalis* from Mahé island. This is biogeographically and demographically the most

- 8.4. Increase populations
Reintroduce to Grande Barbe – Silhouette, North
- 8.5. Remove invasive water plants and prevent further introductions
Remove any wild red-eared sliders, discourage import and keeping.
- 8.6. Taxonomic investigation
- 8.7. Reproductive ecology investigation
- 8.8. Review progress at 5 and 10 year intervals

Summary of actions

Action	Appropriate organisations	Date	Outline cost
<u>Secure sites through agreements with land owners</u>			
Sites: Anse Forbans, Beau Vallon, Anse Royale, Cerf, Grande Anse	MoE, land owners	When practical	Within existing plans
<u>Secure Anse Kerlan population</u>			
Investigate status and reintroduce in necessary	NPTS, Lemuria Resort	2002-3	\$320
<u>Restore Mare Soupape</u>			
Remove water lettuce	MoE	Ongoing	
<u>Reintroduce populations</u>			
Grande Barbe, Silhouette	NPTS	2002	\$1,800
North island	NPTS, North island	2003/4	\$1,000
<u>Reduce alien threat</u>			
Remove invasive water plants, prevent introductions	MoE	Ongoing	
Remove wild red-eared sliders, discourage import and keeping	MoE	Initiate 2002	
<u>Taxonomic investigation</u>			
Molecular study of <i>Pelusios</i>	International research	2002-4	

Review progress

populations are reduced to approximately 100-250 adults of each species. A significant proportion of these are in small, non-viable or declining subpopulations and the numbers in relatively secure sites number fewer than 60 *P. subniger parietalis* and 70 *P. castanoides intergularis*.

2.5 Status assessment

The first investigations into the status of the terrapins were carried out in 1983 (Bour 1984) when a list of distributions was produced. In 1996 the location and size of populations were investigated on all the islands where terrapins were present, or reported (Gerlach & Canning, 1996). This produced the first status assessment and monitoring of selected populations continued through 1997.

The most recent status assessment (Gerlach & Canning 2001) concluded that both species qualify as Critically Endangered according to the IUCN Red List criteria (version 3.1) A1c, B1,2c. This is based on a direct observation of decline of over 80% in range in the last 10 years or three generations, whichever is the longest (note generation time is not known at present) (A1c), an area of occupancy of less than 100 hectares (B) with fragmented populations (B1) continuing to decline (B2) in area, habitat and quality (B2c). Previous IUCN Red Lists have not included the Seychelles terrapins (with the exception of a 'Vulnerable' *P. seychellensis*) as subspecies were not listed prior to 2002. It is expected that the 2002 list will include the Critically Endangered listing proposed by Gerlach & Canning (2001).

3. Ecological requirements

3.1 *Pelusios subniger parietalis*

P. subniger parietalis is a marsh species, occurring in slow flowing marshes with reed beds. It feeds on aquatic animals (especially snails and fish) and plant matter (aquatic plants and fruit). The exact nature of nest sites is not known but they are associated with areas of low lying damp ground and open grass, nest sites are probably in grassy banks near marshes. In favourable habitats population densities may reach 80 adults per hectare. These are high density estimates but the areas concerned are very small and populations are not as high as might be expected from these figures.

3.2 *Pelusios castanoides intergularis*

P. castanoides intergularis occurs in both marshes and rivers, population densities are highest in flowing lowland rivers in woodland. Some individuals move between rivers and marsh areas (particularly areas prone to seasonal flooding). Food requirements are as *P. subniger*. Nesting habitats have not been identified but probably include river banks under woodland cover. Population densities reach 115 per hectare in rivers and 65 per hectare in marshes. As for *P. subniger* the high population densities are associated with very small ranges and small populations.

4. Threats

Three main threats have been identified as currently significant: habitat destruc-

tion, predation and alien invasion. Historically terrapins were consumed by humans and stuffed as curios for the tourist market. These threats are no longer significant. Small numbers are kept in captivity despite legal restrictions, there is no direct evidence that this represents any threat to wild populations although it may be a concern if it is combined with an inbreeding depression. The main threats are described below.

4.1 Habitat destruction

Terrapins are associated with coastal marshes and rivers, these habitats are subject to major development pressures and drainage for agricultural land. In the 1800s and early 1900s most of the large marsh areas were drained. During the 1990s some of the remaining marsh areas were drained for hotel and airport developments, resulting in a habitat loss of over 90%. Further losses in the future would represent a significant threat to the surviving terrapins although the remaining coastal marshes and rivers may not be suitable for future drainage.

4.2 Predation

Predators of Seychelles terrapins are dogs and potentially cats and tenrecs. 90% of *P. subniger parietalis* adults and 20% of *P. castanoides intergularis* show evidence of attack by dogs. This probably arises because of the high population density of domestic dogs near the coastal marshes associated with urbanisation of these areas. Tenrec population density also appears to be high in coastal areas and the main habitats of *P. castanoides intergularis* on Mahé show evidence of foraging by large number of tenrecs which may represent a threat to terrapin nests and hatchlings, although there is no direct evidence of such predation.

4.3 Alien invasion

Invasive species relevant to terrapins comprise alien water plants and the red-eared slider terrapin (*Trachemys scripta*). The water plants comprise water hyacinth (*Eichhornia crassipes*), water lettuce (*Pistia stratiotes*) and Canadian pond weed (*Elodea cf. canadensis*). Canadian pond weed is a recent arrival and not widespread at present although it may be problematic in the future (Gerlach 2002). Water hyacinth has been replaced by water lettuce over most of its range in Seychelles but the two plants can be considered and treated together. They form a complete blanket over the surface of the water, preventing light penetration and causing the stagnation of marshes. This has led to ecological collapse in small marshes and the Mare Soupape on La Digue. Attempts to control this species have achieved temporary success at North Point (Mahé) and the Mare Soupape but have not been repeated and the clear water has been only temporary. Successful water lettuce eradication was achieved by the Division of Environment at Amitie on Praslin. although limited but regular control operations still need to be continued to eliminate small plants resulting from germinating seeds (V.Laboudallon pers. comm.).

The red-eared slider is widely claimed to be a major threat to indigenous terrapin populations in many countries through competition for food and nesting sites and direct aggression (Newberry 1984; Bouskila 1986; Giugliano 1988; Frisendas & Ballasin 1990; Platt & Fontenot 1992; Luisellia *et al.* 1997) although direct evidence

7.7. Review progress.

A review of progress should be made after 5 years, with a full revision of the plan after 10 years.

Table 2. Secure populations and areas, currently existing and after proposed conservation measures. Population sizes are estimates from population density studies

Category	Island	Marsh	Sites		Area		Population	
			cast.	subn.	cast.	subn.	cast.	sub.
Existing	Mahé	Anse Forbans	-	+	-	2.3	-	181
		Beau Vallon	+	-	0.2	-	27	-
		Anse Royale	+	-	0.2	-	17	-
	Cerf		+	+	0.3	0.3	34	24
	Silhouette	La Passe	+	-	0.4	-	9	-
	La Digue	Grande Anse	-	+	-	0.1	-	6
	Fregate		-	+	-	0.2	-	16
	Total		4	4	1.1	2.9	87	227
	Investigate/establish (66)	Praslin	Anse Kerlan	potential		0.5		0.9 (52)
Total			5	5	1.6	3.8	139	301
Restore	La Digue	Mare Soupape	+	+	7.1	6.4	818	510
	Total		6	6	8.7	11.1	957	811
Establish	Silhouette	Grande Barbe	+	+	4.5	2.3	523	182
	North		-	+	-	1.5	-	120
	Total	Populations	7	8	13.2	14.7	1,480	1,114

8. Summary of actions

8.1. Prevent further declines.

Secure sites through agreements with land owners: Anse Forbans, Beau Vallon, Anse Royale - Mahé; Cerf; Grande Anse - La Digue.

8.2. Investigate Anse Kerlan population and reintroduce if necessary

8.3. Restore Mare Soupape

population. Historical causes of extinction are believed to have been human predation and drainage. These factors no longer operate and no potential threats have been identified in the area. Natural food (aquatic invertebrates and plants) are abundant and a wider range of natural habitats are available. The site covers some 30 hectares of which at least 4.54 hectares are suitable for *P. castanoides intergularis* and 2.27 hectares for *P. subniger parietalis*. This site provides the most secure, natural and easily monitored habitats for the experimental stage of population establishment and it is recommended that this site be used for the first reintroductions.

Although the marsh area on North island is relatively small it offers sufficient secure habitat for a population of *P. subniger parietalis*. The marsh area has been extensively disturbed during the hotel development but on completion of this the area should be secure from further disturbance. A release of juvenile or adult terrapins would be expected to have a high probability of success.

Reintroduction plans are outlined in Appendix I.

7.5. Prevent establishment of new aquatic invasive species, eliminate existing invaders.

Restrictions on the import of alien plants need to be enforced. This is particularly important for plants imported for horticulture or aquaria. Existing introductions should be eliminated before further problems develop, this applies to water lettuce and water hyacinth (as discussed above) and to Canadian pondweed.

Introduction of aquatic animals should also be prevented. This is especially important for the red-eared slider terrapins. No further imports should be permitted and a public information campaign is needed to discourage illegal imports. Any reports of wild red-eared sliders should be followed up with a programme of trapping to prevent the establishment of any wild populations.

The practice of keeping red-eared sliders could be discouraged by facilitating the keeping of Seychelles terrapins. Keeping terrapins in captivity does not represent a major threat to the species as long as it remains at low levels. If Seychelles terrapins were available for people who wish to keep terrapins it would discourage any interest in importing red-eared sliders and instead promote pride in unique local natural heritage. Release of captive terrapins would not pose a threat to natural ecosystems if the terrapins were indigenous. Any such change in approach should be accompanied with an extensive public information campaign to discourage inappropriate keeping of the animals and reduce the risk of excessive collection from the wild.

7.6. Determine the status of *Pelusios seychellensis*

The identity of *P. seychellensis* needs to be determined. Morphological characters of *Pelusios* species appear to be too variable to allow *P. seychellensis* to be distinguished from some individuals of *P. castanoides* or the west African *P. castanaeus*. A recently initiated molecular study of *Pelusios* will provide a new perspective on *Pelusios* taxonomy and, it is hoped that the existing specimens of *P. seychellensis* can be incorporated into the study. This may determine whether any *P. seychellensis* genotypes survive in Seychelles terrapin populations.

is rarely presented. It is not known to be established in the wild in Seychelles but both males and females have been caught on Mahé and eggs have been laid in captivity. There is a high risk that this species will become established in the wild in the near future. The species was introduced through the pet trade and despite legal restrictions, imports continue.

4.4. Inbreeding

The Seychelles populations of terrapins can be assumed to have originated from small founder populations and a low level of genetic variation is expected to be present. These species may be adapted to a high degree of inbreeding but historical fragmentation of populations may result in inbreeding problems. There are no appropriate measures of inbreeding or of the size of viable populations. It is known that a small group of *P. subniger parietalis* introduced to Fregate has persisted for approximately 60 years and has continued to reproduce. In contrast a similar population introduced to Cousin island appears to have died out for unknown reasons, possibly including stochastic loss and inbreeding depression. Existing populations are estimated to vary from 6 to 181 individuals. The smaller populations may not be viable without intervention to reduce inbreeding effects. In the absence of precise data on real and optimal inbreeding levels a subjective definition of a small, non-viable population is required. In general most conservation projects have considered 50 adults to be the minimum viable population size. If that criterion is used for the Seychelles terrapins intervention would be required at two populations on Mahé (Beau Vallon and Anse Royale) as well as Cerf, Silhouette (La Passe), La Digue (Grande Anse) and Fregate. The persistence of the Fregate population may indicate that a relatively high level of inbreeding can be tolerated and populations of at least 15 individuals may be stable, this would mean that only Silhouette (La Passe) and La Digue (Grande Anse) may require intervention. Intervention could take the form of introducing new terrapins to the population at a rate of approximately 10% every generation (estimated at 2 individuals every 10 years). Any terrapins used to reduce inbreeding should be obtained from nearby populations so as to preserve any inter-island genetic variation. Manipulation of the genetic variation of the populations could be ensured by 'rotating' animals between populations. Recently initiated research into genetic diversity should refine these considerations.

5. Conservation measures currently in effect

5.1 Legal measures

Under the Wild Animals and Birds Protection Act – Chapter 247 legal restrictions on keeping terrapins have existed since the 1970s. These were imposed with the aim of preventing declines due to human consumption, the primary reason for keeping terrapins at the time. These regulations remain in place but are not enforced as keeping terrapins in captivity is on too small a scale to contribute significantly to their decline.

5.2 Captive breeding & ecological research

The Nature Protection Trust of Seychelles (NPTS) started the Seychelles Ter-

rapin Conservation Project in 1997 with the approval of the Division of Environment. This project aims to gather data on the ecological requirements of Seychelles terrapins and to breed terrapins for reintroduction. In 2000 the first hatchling *P. subniger parietalis* was bred and 23 have been hatched since then. *P. castanoides intergularis* eggs have been laid but not hatched to date. This project depends on reproduction of long-term captive terrapins in semi-natural enclosures. To date no data on Environmental Sex Determination (ESD) have been obtained and the project is investigating ESD in this genus by incubating eggs at 26°C and 29°C, temperatures which are expected to produce male and female hatchlings respectively if ESD is operating.

5 radio tagged *P. subniger parietalis* were released in March 2002 to investigate movement patterns and habitat use. This study is being combined with data from the captive breeding project to determine the habitat requirements of the terrapins and plan future reintroductions.

6. Conservation targets

In order to improve the Red List status of the Seychelles terrapins the following targets need to be met:

Prevention of further declines - currently this causes Critically Endangered status (A1c), if these declines can be halted criterion A1 will continue to apply until at least 10 years or three generations, whichever is the longest after such decreases have ceased. If no further declines occur from 2002 Critically Endangered status on the basis of A1c will be lost in 2012 or three generations, whichever is the longest.

Population increases: the currently restricted populations will keep both species categorised as Endangered as long as populations remain below 250 adults (D). Removing them from Endangered into the Vulnerable category would require a population increase to over 1,000 adults (D1). Population viability considerations mean that the secure populations should be established on different islands and be large enough to be secure from stochastic losses. Future threats should also be prevented, by their nature these are difficult to predict but likely threats include invasive species.

These requirements can be summarised as:

For each species,

- a. Prevent further declines - ensure security for at least 5 viable populations on 5 islands.
- b. Increase populations to over 250 reproducing adults in the short term and ultimately to over 1,000 reproducing adults.
- c. Prevent establishment of new aquatic invasive species and eliminate existing invaders.

7. Conservation actions

7.1. Prevent further declines: ensure the security of existing important sites.

Of the presently occupied significant sites none receive legal protection, although 2 are effectively protected by current management practices (islands which

are not legally protected but preserve the existing habitats on the islands) and can be considered to be secure (La Passe marsh on Silhouette and the marshes on Fregate). The remaining 5 sites (Anse Forbans, Beau Vallon, Anse Royale on Mahé; Cerf and Grande Anse on La Digue) could all be secured through voluntary agreements with land owners. Such agreements should seek to preserve current areas of wetland habitat. Potentially important sites are all effectively protected (Grande Barbe – Silhouette, North and Anse Kerlan – Praslin) or include significant areas with legal protection (Mare Soupape – La Digue).

7.2. Investigate potentially significant sites.

The extensive pools and streams in the Lemuria golf course at Anse Kerlan, Praslin should support a significant terrapin population. The habitat is suitable for both species and food is abundant. It is not known if any terrapins survived the development of the area. The presence of terrapins should be investigated, if they are located the population sizes should be determined. If terrapins are not present they should be reintroduced. Small numbers of terrapins may survive in the remaining isolated pool at Amitie which could be managed as a source population.

7.3. Restore Mare Soupape

The water lettuce and water hyacinth dominating the Mare Soupape on La Digue should be removed. Attempts to eliminate these plants in the past have had temporary success but have not been carried out without sufficient thoroughness. Complete physical removal is required and this needs repeating to ensure that all the plants have been removed. Successful eradication was achieved at Amitie on Praslin in the 1990s and this approach should be used on La Digue. It is also desirable to remove water lettuce from all marshes where it is present. This would prevent recolonisation of the most important sites.

7.4. Increase populations to over 250

Populations should be increased to over 250 reproducing adults in the short term and ultimately to over 1,000 adults. Current significant populations are restricted to approximately 60 *P. castanoides intergularis* and 50 *P. subniger parietalis*. Identification or establishment at Anse Kerlan on Praslin would result in some 140 and 300 terrapins respectively based on population density and site area. Restoration of the Mare Soupape through water lettuce removal could increase the populations to 960 and 810 respectively. With the establishment of new populations at Grande Barbe (Silhouette) and North island populations could rise to 1,480 *P. castanoides intergularis* and 1,110 *P. subniger parietalis*.

It is recommended that the following reintroductions take place:

Grande Barbe – this area provides a large area of suitable, secure habitat for both species.

North island – this area is suitable for a relatively large population of *P. subniger parietalis*.

The release site at Grande Barbe is considered to be suitable for a re-established