

# GLOBAL RE-INTRODUCTION PERSPECTIVES

*Re-introduction case-studies from around the globe*



**Edited by  
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**Cover photo:** Clockwise starting from top-left:

- Formosan salmon stream, Taiwan
- Students in Madagascar with tree seedlings
- Virgin Islands boa

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## Supplementation of the black and white ruffed lemur population with captive-bred individuals in the Betampona Reserve, eastern Madagascar

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### Introduction

The black and white ruffed lemur (*Varecia variegata*) is the largest member of the family Lemuridae, weighing 2.5 - 4 kg, and also the most frugivorous. It is characterized by its thick black and white fur, especially around the neck, hence the common name ruffed lemur. According to the latest IUCN Red List assessment the black and white ruffed lemur is classified as Endangered. As with all lemur species it is listed in Appendix I of CITES, Class A of the African Convention and is protected by Malagasy law, although this legislation is impossible to enforce. It is threatened mainly by loss of habitat, but also locally by hunting. The loud and raucous “roar/shriek” chorus of this species is one of the characteristic and most dramatic sounds of the Malagasy rain forest. The supplementation project described here was undertaken by the Madagascar Fauna Group (MFG) in the Betampona Reserve, a 2,228 ha fragment of low altitude rain forest some 40 km north west of Toamasina in eastern Madagascar. The reserve is a completely isolated “island” and prior to the project the resident population of black and white ruffed lemurs was estimated at 35 - 40 individuals (Welch & Katz, 1992).

### Goals

- Goal 1: To assess the ability of captive-bred black and white ruffed lemurs to adapt to a wild existence.
- Goal 2: To attempt to re-enforce the small, isolated resident wild population at Betampona of approximately 35 - 40 individuals (Welch & Katz, 1992) and reduce the risk of inbreeding depression.



Black & white ruffed lemur

© David Haring/DULC



Students with native & clove tree seedlings grown in the MFG tree nursery

- Goal 3: To contribute to the protection and conservation management of this lowland rainforest reserve.
- Goal 4: To serve as a model for future lemur re-introductions.

### Success Indicators

- Indicator 1: Successful adaptation to the natural habitat: Survival for one year or more without supplementary feeding and/or successful reproduction.
- Indicator 2: Successful contribution to the wild population: Integration into wild groups and successful reproduction with wild

individuals.

### Project Summary

Prior to the project a population simulation modeling exercise was undertaken indicating that the small population of *Varecia* at Betampona would benefit from the addition of a small number of individuals from the captive population (Seal, 1997). Candidates for release were carefully selected on the basis of a number of criteria to ensure that only behaviorally fit individuals took part in the release program, and also that these individuals were genetically surplus to the captive population (Britt *et al.*, 2004). All individuals were subjected to rigorous veterinary screening prior to selection. Release sites at Betampona were selected on the basis of detailed botanical survey work. Surveys in areas already occupied by the resident *Varecia* were used to determine if the necessary abundance of key food plant species was available in proposed release areas (Britt *et al.*, 2004). The project worked closely with the Ministère des Eaux et Forêts, Madagascar's CITES management authority, to arrange the import and re-introduction of the animals to be released. The Association Nationale pour la Gestion des Aires Protégées (ANGAP) provided technical support concerning research proposals and reserve management. Three releases were carried out - one in November 1997 (3 males, 2 females), the next in November 1998 (1 male, 3 females) and the final release in January 2001 (3 males, 1 female). Intensive post-release monitoring was undertaken until January 2002, this involved the collection of behavioral and habitat use data during all-day follows. Additionally, data were collected from the resident population to allow assessment of the adaptation of the released animals. A number of scientific publications resulted from this research. After January 2002 the data collection ceased, but monitoring of the released animals continues to the present by trained MFG personnel.

Table 1 below summarizes the pre- and post-release histories of the animals released at Betampona. Three of the released lemurs (23%) are still surviving in the reserve and five (38.5%) successfully integrated with the resident wild

**Table 1. Summary of pre- and post-release histories of captive-bred *Varecia variegata* released at Betampona**

I.D.	Date of Birth	Institution	Release Date	Post-Release survival (months)	Observations
M1	04/24/85	DULC	10/11/97	35	Bred with F1 producing single infant in 1998 and triplets in 1999, one surviving. Victim of Fossa predation.
M2	03/31/93	DULC	10/11/97	Surviving	Integrated with wild group. Bred with wild female, producing one offspring in 2002 and one in 2006.
M3	04/14/96	DULC	10/11/97	8	Died of malnutrition.
M4	04/29/91	LA Zoo	25/11/98	23	Victim of Fossa predation.
M5	05/07/99	DULC	18/01/01	62	Disappeared in 2004.
M6	05/13/00	DULC	18/01/01	Surviving	Integrated with wild female (possible father of one offspring in 2006)
M7	05/13/00	DULC	18/01/01	Surviving	Integrated with wild female (possible father of one offspring in 2006)*
F1	04/08/86	DULC	10/11/97	32	Bred with M1 producing single infant in 1998 (did not survive) and triplets in 1999, one surviving. Victim of Fossa predation.
F2	04/03/91	DULC	10/11/97	3	Victim of Fossa predation.
F3	05/01/93	WCS	20/11/98	3	Disappeared in 1999.
F4	05/01/91	Hogle Zoo	25/11/98	23	Transferred to captivity due to poor adaptation in 2001.
F5	05/01/91	Hogle Zoo	25/11/98	19	Victim of Fossa predation.
F6	05/02/93	Santa Ana Zoo	18/01/01	32	Bred with wild male in 2002, producing twins. Possible victim of Fossa predation.
DULC = Duke University Lemur Center, North Carolina; WCS = Wildlife Conservation Society, St. Catherine's Island, Georgia. * Either male could have fathered infant born in 2006.					

population without requiring supplementary feeding. Five of the released lemurs (38.5%) have successfully reproduced post-release and three (23%) are believed to have bred successfully with the resident wild population (yet to be confirmed genetically, but behavioral data are compelling), thus contributing to the wild *Varecia* gene pool at Betampona.

Despite a mortality rate of 69%, the releases have been a success. The abilities to survive beyond one year without provisioning, to reproduce successfully, and to integrate with the wild population have been demonstrated by some of the

released lemurs. Most significantly successful breeding with the resident population has been achieved, making a contribution to the wild *Varecia* gene pool at Betampona. In conclusion, it has been demonstrated that captive bred black and white ruffed lemurs can adapt to a wild existence, although losses will be high, and integration with the wild population will be a lengthy process. However, once integration is achieved successful breeding with the wild population can occur. The next stage of this project is to verify the genetic contribution presumed to have been made to the resident population by the released lemurs through the collection of blood samples. There are no plans for any further releases but the fate of the surviving released lemurs will continue to be monitored by the MFG.

## Major difficulties faced

- Predation by fossa (*Cryptoprocta ferox*) - five (possibly six) of the 13 animals released were killed by fossa.
- Loss of weight and condition during the austral winter - this led to the death of one released animal and the adoption of a program of supplementary feeding with commercial primate diet during the winter months. In addition a non-invasive system of monitoring body weight was employed for the third release group. This involved suspending a wire basket from a Pesola® scale and encouraging the lemurs to enter the basket with bananas.
- Failure of radio-collars - this led to the total loss of two animals and the loss of a third for over a year - male 2 was subsequently discovered by chance integrated into a wild group.
- Migration from the release sites and primary forest into degraded habitats - in the initial stages of the first two releases several individuals had to be located and recaptured outside the reserve limits and returned to their release site.
- Poor adaptation by the second release group - these animals were reliant on supplementary feeding throughout. Their apparent reluctance to range far meant that they did not encounter sufficient natural food sources. We attempted to remedy this by gradually moving feeding sites away from the release site but with little success. The decision was finally made to remove the last remaining female to captivity after the loss of other group members to fossa predation.

## Major lessons learned

- Integration and reproduction with the resident population does not occur quickly with the release method employed. This may compromise the survival of released individuals by limiting their opportunities to learn adaptive behaviors (e.g. predator avoidance, coping with seasonal fluctuations in climate and food availability) from their wild conspecifics.
- It appears that males of this species emigrate from their natal group (White *et al.*, 1993). Given the successful integration and presumed reproduction with wild females by males 2, 6 and 7, it is suggested that a more effective strategy for reinforcing small, isolated populations of this species would be the release of young males in locations peripheral to wild groups. The general lesson here

is that the social system of the species being released needs to be taken into account when developing a release strategy.

- Captive bred black and white ruffed lemurs are particularly vulnerable to predation by fossa (*Cryptoprocta ferox*). In the course of the intensive monitoring phase of the release program (4.5 years) none of the wild study group (n = 10) was lost to predation. No realistic method of training captive bred *Varecia* to avoid predation has yet been devised. The best option would be to encourage rapid integration of released animals into wild groups (see first bullet above), where they could learn predator avoidance strategies directly from their wild conspecifics.
- Free-ranging experience during early development appears to increase the likelihood of successful adaptation post-release.
- Free-ranging experience does not necessarily increase the likelihood of survival until integration with wild groups occurs (due to third bullet point above).
- During the austral winter, supplementary feeding is necessary for the released *Varecia* due to loss of weight and condition at this time. However, this no longer becomes necessary once released animals are fully integrated into wild groups.

## Success of project

Highly Successful	Successful	Partially Successful	Failure
	√		

## Reasons for success/failure:

- Five individuals survived beyond one year without supplementary feeding.
- A number of individuals have interbred with wild population (2 males and a female), thus contributing to the wild gene pool.
- Overall protection of the reserve improved as a result of the permanent presence of project personnel, improving the chances of persistence of other lemur species, e.g. indri and diademed sifaka and the entire low altitude rain forest ecosystem through public awareness training in bordering villages and an active reforestation scheme.

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