PROPOSAL

THE ESTABLISHMENT OF A CONSERVATION BREEDING PROGRAM FOR JAVAN WARTY PIG (*Sus verrucosus*)

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EXECUTIVE SUMMARY

The Javan Warty Pig, *Sus verrucosus*, is an endangered wild pig species endemic to Java and associated offshore islands (Indonesia). Population numbers remain unknown and habitat destruction in the form of transformation of natural forest into production forest and hunting have been the main causes for the decline of the species. Today, the animal lives in a very small fragmented habitat and under intense pressure for its survival. The population survey conducted in 2003/2004 and the International meeting on the strategy for conserving the Javan Warty Pig in 2006, both recommended the establishment of a captive breeding program of Javan Warty Pigs in Indonesia for the ultimate purpose of re-introduction. The output of the project would be the availability of enough genetically sound captive *Sus verrucosus* which can be used for a re-introduction program, as well as for studying the biology of this poorly known species, whereas the long term aim of the project would be to establish a viable, free ranging population in parts of the historical distribution area of the species. Simultaneously with the development of captive breeding, a molecular study needs to be done as there are no data available to distinguish pure *S. verrucosus* from hybrids of *S. verrucosus* and the widespread wild boar *S. scrofa*. This proposal is the second phase in the development of the program, involving the actual conservation action, after the first phase “Study on the population survey” was conducted and completed in 2003/2004.

INTRODUCTION

The Javan Warty Pig *Sus verrucosus* is an endangered pig species endemic to Java and associated offshore islands. It probably evolved on Java in the Early Pleistocene, or almost two million years ago. Hardjasamita (1987) traces back its ancestry to several older species found on Java, while Randi *et al.* (1996) found that it split off from its nearest living relative, the bearded pig *S. barbatus* from elsewhere in the Greater Sunda Islands between 2 and 5 million years ago. The species is therefore relatively ancient, and is a good example of the unique Javan fauna. The two recognized subspecies are *S. v. verrucosus* from Java and Madura—although Blouch (1993) and Semiadi & Meijaard (2004) thought it to be extinct on Madura—and *S. v. blouchi* from Bawean Island, 150 km off the northeast coast of Java (Groves 1981).

On Java, *S. verrucosus* is sympatric with a sub-species of the wild boar, *S. scrofa vittatus*, which is widely distributed elsewhere in the region. Olivier (1925) mentions that in West Java *S. verrucosus* and *S. scrofa* were both common, and that they occurred in similar habitats from coastal to montane forests, though van Balen (1914) stated that they occurred only on lower slopes. However, more recent studies, e.g. Blouch (1988; 1993) indicate that the two species avoid each other and attained their highest densities where the other species was absent. Olivier (1925) also suggested that *S. verrucosus* was the more common species away from human habitation.

Blouch (1988) conducted a wide-ranging survey of *S. verrucosus*, which also included Bawean Island, but excluded Madura where the species was already presumed extinct owing to the virtual denudation of that island (J. MacKinnon, pers. comm.. to W. Oliver). He found that *S. verrucosus* was not found above 800 m a.s.l., and its preferred habitat was extensive areas of lowland secondary vegetation, particularly teak plantations in Central Java characterizes by a mixture of trees and grasslands with clumps of bush and heavily disturbed forest. *S. scrofa* on the other hand can be found at all altitudes in most habitats, and seems to be far more adaptable than *S. verrucosus*.

CURRENT CONSERVATION STATUS

S. verrucosus was feared to be nearly extinct in the late 1970s, but a small population was found in 1981 on the forested slopes of Mt. Penanggungan near Tretes, East Java (Whitten *et al*. 1996). The 1982 survey by Blouch located several more populations across Java, and he reported diverse threats to the species' survival, such as hunting and poisoning. Still, Blouch (1988) concluded that the future of *S. verrucosus* was relatively safe. However, Blouch and Groves (1990) pointed out that hybridization between *S. verrucosus* and *S. scrofa* posed an unknown, but potentially serious threat, primarily to the survival of the former species.

Since the political upheaval in Indonesia between 1996-1998, the teak forests of Java, which are important *S. verrucosus* habitat have come under increasing threat from illegal logging. Teak theft has been reported from all over Java (e.g Jakarta Post, August 15, 2001; August 22, 2001; August 27, 2001; and Chicago Tribune, July 08, 2001). The state-owned forest company PT Perhutani claimed to have lost US$ 49 million worth of teak trees in 2000 because of widespread theft from its forestry concessions in Java (Jakarta Post, June 09, 2001). It is yet unclear how this timber poaching has affected the *S. verrucosus* populations, but the few available data indicate a decline and severe fragmentation of the few remaining wild populations.

In 2000, *S. verrucosus* was up-graded as "Endangered" in the International red list (IUCN 2000). The IUCN/SSC Action Plan (Oliver, 1993) accorded the species very high conservation priority, and stressed the urgency of implementing relevant conservation measures – including the survey in 2004. Until now, there has been no follow-up to the conservation recommendations given by Blouch (1988) and Oliver (1993).

The latest report (Semiadi & Meijaard 2004 & 2006) indicated that hunting, mainly as means of controlling agricultural pest, and the loss of suitable habitat are the major threats. The decrease of the population has started 10 years ago and keeps continuing. This situation resulted in highly fragmented small populations at present. Pig hunters generally use fire guns and hunting dogs, and some people use poison or snares. In rural areas, there appears to be little awareness of the population status of the pig. The difficulty in distinguishing between *Sus scrofa* and *Sus verrucosus* results in hunters killing these both species indiscriminately. Also there is a serious lack of knowledge on many aspects of biology, ecology and reproduction of this animal.

Following the first phase of the program (2003-2004) under the title "The Rapid Assessment of the Current Conservation Status and Future Management Needs of the Endangered Javan Warty Pig (*Sus verrucosus*)" and following the "Rapid Assessment of Prospective Habitat for a Re-introduction program" some key-points have been recommended :

(a) establishment of a "Verrucosus Breeding Centre (VBC)" is a priority

(b) the molecular profile of pure and hybrid *Sus verrucosus* and *Sus scrofa* should be established

(c) a protocol should be developed during the molecular study, that will be used as a standard protocol for identification of any wild pigs for the "Verrucosus Breeding Centre"

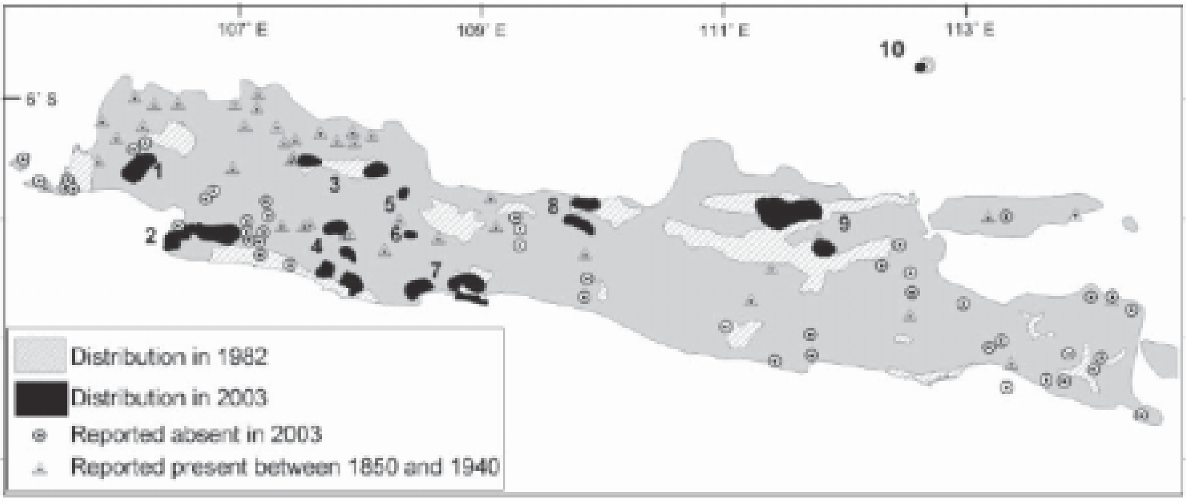

Figure 1. The distribution of *Sus verrucosus* between 1850 to 2003 (Semiadi & Meijaard 2006).

SIGNIFICANCE OF THE PROPOSED PROJECT

The IUCN/SSC PPHSG Action Plan (Oliver, 1993) categorized the species as 'known to be at risk or vulnerable', because of its restricted distribution and/or limited ecological tolerance, threats of habitat destruction, hunting pressure, and inadequate representation in reserves.

The IUCN Species Survival Commission listed *Sus verrucosus* as 'Endangered', which means that it faces a very high risk of extinction in the wild in the near future because of population reduction over the last 10 years, severe population fragmentation, and a continuing decline in extent of occurrence, number of subpopulations, and number of mature individuals (IUCN, 2000).

The recommendation of the AZA Taxon Advisory Group has also indicated the importance of an *ex-situ* conservation program as something that needs to be evaluated (Holland 2001).

Figure 2. Sub-adult male wild caught Javan Warty pig moved from Semarang (Central Java) to Cikananga Species Conservation Centre in March 2007 (Photograph: Walter Schulz).

PROJECT OUTPUT, AIM & OBJECTIVES

The output of the project would be the availability of a sufficient number of genetically viable captive *Sus verrucosus,* that can be used for a re-introduction program, as well as for studying the species' poorly known biology.

The long term aim of the project would be to establish a viable, free ranging population within the historic distribution area of the species.

The objectives of the project would be :

a. to safeguard the long term survival of the species

b. to maintain natural biodiversity in conservation areas on Java

c. to promote local awareness about this unique endemic species on Java

d. to improve scientific knowledge on the biology and ecology of the species

PRIORITY TASKS:

A. Molecular Study (Year 1)

The ability to genetically identify *Sus verrucosus* and its hybrids with *S. scrofa* remains central to the establishment of captive breeding for the Javan Warty Pig. This problem needs immediate response so that any animals used for the breeding project are genetically pure *S. v. verrucosus*. Samples will be collected from wild pigs (*verrucosus* & *scrofa*) from Indonesian Zoos and analyzed for their molecular profile. Once the protocol is well established, it will be used for checking all future founders for the breeding program.

The Molecular study includes the following aspects:

1. Identify the DNA profile of pure and hybrid *Sus verucosus* and *Sus scrofa*
2. Identify the degree of inbreeding in the Surabaya Zoo population, regardless of its status (genetically pure vs. hybrid)
3. Initial sampling will be collected from Indonesian zoos using materials originated from blood, hairs and biopsy (has already partly happened)
4. Additional sampling will be obtained from wild pigs from the regions of East, Central and West Java, as well as from museum and trophy specimens through Ancient DNA analysis
5. One Indonesian scientist will be trained during the development of the molecular protocol and to review the possibility in conducting the protocol using the laboratory facilities available in Indonesia.

Time schedule:

1. Collection of additional *verrucosus* and *scrofa* (and possibly hybrid) samples from zoos by April-June 2009.
2. Conducting live capture in Indonesia and DNA checking using the molecular protocol from June 2009 onwards

B. Establishment of the Sus Verrucosus Captive Breeding Centre (Year 1-5)

As stated above, the primary goal of the captive breeding program is to reduce the risk of extinction by establishing a genetically viable *ex-situ* population which can be used for re-introduction, for *ex-situ* breeding in zoos, as well as a source for scientific investigations on the species' biology.

Population management will be conducted as follow:

1. The initial captive population will be managed in Indonesia with all wild caught founders remaining in Indonesia, as per Indonesian Law
2. The minimum number of founders aimed for will be 6 pairs
3. The genetic purity of all founders will be tested using the molecular data as mentioned above
4. The number of offspring will be managed to retain genetic variation according to the minimum value that will be set up in consultation with Population Management experts of the International Zoo community
5. Creation of a "Javan Warty Pig Conservation Consortium" and Stud Book
6. The five years target of the project is 25-50 captive born offspring
7. The establishment of two additional breeding colonies, at Surabaya Zoo and at Singapore Zoo within 2-3 years due to their expertise in managing endangered Asian wild pig species
8. The distribution of 25% of the offspring (F1 and onwards) on breeding loan for the creation of additional insurance colonies to national and international zoos
9. The establishment of a sound re-introduction program according to IUCN guidelines

Figure 3. Partial view of one of four enclosures for Javan Warty Pig at Cikananga Species Conservation Centre covering a total of one hectare (Photograph: Walter Schulz, December 2007).

Steps of action:

1. Selection of an appropriate captive breeding facility: Achieved in June 2007, when the 14 Ha Cikananga Wild Animal Rescue Center in Sukabumi, West Java, which already has most of the necessary facilities was selected and approved by The Indonesian Institute of Sciences (LIPI)
2. Construction of a the first 4-sections of the captive breeding facility: Achieved in December 2007 with funding from Los Angeles Zoo and ZGAP (München, Germany). Four interconnected enclosures totaling approximately one hectare have been fenced and foundation of the fences re-enforced with rocks and concrete to a depth of 60 cm. During December 2007-June 2008 smaller interconnected holding pens have been added to each pen and food plants (i.e cassava) have been planted out in enclosures to supply parts of the animals nutritional needs, thereby reducing food costs and encouraging natural feeding behaviour. The four enclosures now available are intended for two breeding groups, allowing for vegetation recovery through a rotational system.
3. Funding permitting, another two hectares of enclosures will be completed by July 2009
4. Obtain three pairs of founders until May 2009: Partly completed with the acquisition of 3.1 animals by Mai 2008
5. Obtain another three pairs until May 2010
6. Start life capture no later then June 2009
7. Commence breeding and conduct biological studies on the captive animals (May 2009), with the focus on behaviour, reproduction and other physiological aspects .
8. Establish the “Verrucosus Breeding Center” as a public education program, either as a visiting site or centre for information through the distribution of leaflets, books or other means.

STAKEHOLDERS

All stakeholders as individuals or institutions will acknowledge the Consortium in any publications or public presentations.

Figure 4. From left to right: Indonesian biologist Mochamad Indrawan, CSCC Director Resit Sözer and LIPI large mammals expert Gono Semiadi inspecting the completion of warty pig enclosure at CSCC (Photograph: Walter Schulz).

Table 1: Time schedule

2008	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Obtaining founders (locals)			X									
Sampling captive *Sus verrucosus*				X	X							
Maintenance of captive stock			X	X	X	X	X	X	X	X	X	X
Obtaining founder (Ragunan Zoo)												X
Construction of facilities (1 ha)											X	X
2009												
Obtaining founders (Surabaya Zoo)			X									
Trapping of wild *Sus verrucosus*						X	X	X				
Maintenance of captive stock	X	X	X	X	X	X	X	X	X	X	X	X
Breeding							X	X	X	X	X	X
Construction of facilities (2 ha)				X	X	X	X					

BUDGET

Initial funding for completion of first one hectare of enclosures, acquisition and transportation of first four Javan Warty Pigs to a CSCC and maintenance of the pigs at CSCC from March 2007 to March 2008 totalling US$ 7,000 was kindly provided by Los Angeles Zoo and ZGAP (München, Germany).

Table 2: Budget for the Captive Program of Javan Warty Pig

	Item	number	unit	price/ unit	Total (Rupiah)	Euro's
Renovation existing pens (phase 2 for 2 ha)						
(Building material)	rocks	96	M^3	100,000	9,600,000	
	Cement	120	sacks	40,000	4,800,000	
	Sand	8	trukload/5m3	800000	6,400,000	
	Steel	28	bars @ 11m	19,000	532,000	
	PVC pipe	4	4"	95,000	380,000	
(Labour)		198	man-days	35,000	5.88,000	
				Sub-total	*21,712,000*	*1,973.82*
Manpower	Keeper	24	months	1,000,000	24,000,000	2,181.82
	1 vet	24	part-time	1,000,000	24,000,000	2,181.82
Feed (10 pigsx24 month)	10 pigs	10x24	Per month/ pig	180,000	43,200,000	3,927.27
	Transport (food purchase)	104	weekly	100,000	10,400,000	945.45
Veterinary care (2 years)	medicine	2	package	2,750,000	5,500,000	500.00
	anaesthesia	2	package	2,000,000	4,000,000	363.64
	laboratory	10	package	1,000,000	10,000,000	909.09
Awareness program		1	package	3,000,000	3,000,000	272.73
Pig acquisition from private & Indonesian zoos		7	Animal	2.750.000	19,500,000	1,772.73
Live capture (Coordination & Supervision, 1 person)		2	Month	800.000	1,600,000	145.45
Live capture (local labour & equipment)		2	Month	4.500.000	9,000,000	818.18
Live capture (Transportation of animals to CSCC)					3,500,000	318.18
Institutional fee CSCC		24	month	700.000	16,800,000	1,527.27
				TOTAL	196,212,000	17,837.46

1 EU= Rp. 11,000

Table 3: Moleculer study

No.	Item	Rupiah	Volume	Sub-total	EU
A	Molecular Study to identify founder animals (by LIPI staff)				
	Daily subsistence allowance				
1	Per diem, analysis in Indonesia (1 person,- 4 months)	1,800,000	4	7,200,000	654.55
2	Sample collection (1 person, 2 months)	1,000,000	2	2,000,000	181.82
					0.00
	Sub-total				0.00
	Transportation, Lodge & Others				0.00
1	Transport during Tissue collections (West, Central & East Java) (*covered by LIPI)				0.00
	(2 people,)	0		0	0.00
2	Lodging & Food (2 people,) (*covered by LIPI)	0		0	0.00
3	Veterinary drugs, tranquilizer	3,000,000		3,000,000	272.73
	Sub-total				0.00
	Molecular work (Indonesia)				0.00
1	Laboratory chemicals (primers, extraction, pcr, gel, marker lader)	12,000,000		12,000,000	1,090.91
2	Laboratory disposable	3,700,000		3,700,000	336.36
3	International shipping (*completed, paid by LIPI)	0		0	0.00
	Sub-total				0.00
B	**Collections (LIPI & CSCC)**				0.00
1	Surabaya 2 people				0.00
	Lodging & Transportation (*completed, paid by LIPI)				0.00
2	Cikepuh 2 people				0.00
	Lodging & Transportation	4,000,000		4,000,000	363.64
			TOTAL	31,900,000	2,900.00

Table 4: Totals

	Rupiah	Euro	US $
Animal Management & Acquisition	196,212,000	17,837.46	23,083.76
Molecular study	31,900,000	2,900.00	3,752.94
GRAND TOTAL	228,112,000	20,737.46	26,836.71

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