

CAPTIVE PROPAGATION OF SUMATRAN RHINOCEROS

A Proposal

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BACKGROUND

The Asian two-horned rhino (Dicerorhinus sumatrensis) may be the most gravely endangered of the five surviving species of this family (Table 1). Although the total population estimated for the Javan rhino (Rhinoceros sondaicus) is lower, its situation seems more sanguine because of an active program of protection by conservationists (WWF 1981-82). Moreover, the Javan is not the only representative of its genus. Rhinoceros also includes the Indian (R. unicornis) which is at least superficially similar to the Javan despite some ecological differences (Groves 1967). In contrast, the Sumatran rhino is the sole survivor of a formerly more successful genus and is considered representative of a primitive type from which other extant rhinos may have evolved (Groves and Kurt 1972).

Information available from recent and reliable reports on the distribution of surviving Sumatran rhinos is summarized in Tables 2 and 3 and Figures 1 and 2. Numbers are precariously low and the decline continues inexorably. Both Borner (1979) and Flynn & Abdullah (1982) document the disappearance of rhinos from areas of former occurrence, even of moderate abundance, during the last ten years. One by one, the last remnants are being lost.

Even where rhinos do and will survive in natural habitats, populations may be so small and fragmented as to be genetically unviable. Such populations tend to lose the genetic diversity vital to enable species to adapt to constantly changing environments. The gene pool becomes a collection of gene puddles. Population biologists have advised that a genetically effective population (N_e) of 500 may be necessary for long term survival of a species (Franklin 1980, Soule 1980). A number of population biologists believe even this number may be too few.

Moreover, loss of genetic diversity and vitality is not the only problem. Small populations are vulnerable to extinction from other types of perturbations such as natural disasters, demographic stochasticity, etc. (Shaffer 1981).

In the case of the rhinos, there is yet another, probably greater threat. Poachers may be the final executioner. Unless sanctuaries can be secured against poachers, there is no hope for this species in the wild.

For the Asian two-horned rhino, there are several sanctuaries and populations that might be preservable in the wild because they are large enough to accommodate a genetically viable number of animals and because they can probably be protected from poachers and development (Borner 1979; WWF 1981; Andau and Payne 1982; Flynn and Abdullah 1982; M. Kahn and N. Van Strien, personal communication). The five most probable places (designated by asterisks in Table 2) are: Gunung Leuser and perhaps Kerinci/Seblat in Sumatra; Endau Rompin and Taman Negara in Western Malaysia; and the Silabukan Forest Reserve in Sabah.

The other surviving rhinos are fragmentally distributed over the range of the species in remnants of usually one to five animals, frequently in areas with poor protection. These remnants cannot contribute to the survival of the species because:

- (1) the groups are too small to be viable genetically or even to permit reproduction.
- (2) the animals cannot be protected from poachers or their habitats from development for purposes other than wildlife preservation.

As many as 25% of the surviving rhinos may occur as such remnants or isolates (Table 3).

There seem to be two alternatives that might enable these animals to be redeemed as far as perpetuation of the species is concerned:

- (1) translocation into the larger populations and protectable sanctuaries,
- (2) capture for captive propagation.

Translocation is the more attractive alternative to many conservationists because it seems more natural. However, there can be formidable risks and limitations with translocation (Andau and Payne 1982; Caldecott and Kavanagh 1983):

- (1) So little is known about the biology of this species that many biological problems could occur.
 - (A) Introduction of new animals into an established population could be disruptive of the social order.
 - (B) Many areas may already support the carrying capacity of rhinos under current conditions.

- (C) Rhinos may not remain in the new habitat. Repatriation is a persistent problem with many attempted translocations.
- (2) There is great uncertainty about the stability and security of many potential repositories for the translocated animals. Indeed, the translocation could actually attract poachers.
 - (3) Opportunities for genetic management, perhaps vital to survival of the species, would be restricted.

Although a few populations of Sumatran rhino can hopefully be preserved in the wild, it may still not be possible to maintain large enough numbers to insure long term survival. Successful protection of the major sanctuaries and populations designated in Table 2, an objective of a considerable uncertainty, could probably produce, at most, a total of 1030 rhinos. These estimates are predicated on the area of the sanctuaries that can probably be protected and a maximal density of 1 rhino/20 km² suggested by the ecological studies of Van Strien (personal communication) and Flynn (personal communication). None of the separate populations enumerated in Table 2 could constitute a genetically effective number of 500 considered by many geneticists as essential for long term survival. If interactively managed to constitute a single population biologically through carefully regulated exchanges of animals periodically, these separate demes might be viable genetically. However, in the wild, N_e 's are usually well below the actual population. N_e is not simply the total number of animals in the population. Genetically effective size depends on the mating system and other reproductive patterns of the population. N_e can vary anywhere from a tenth to twice the actual number of animals in the population. In the wild, an N_e less than half the total number of animals might not be exceptional. Thus, even with some attempt at genetic management, the N_e of wild populations that could be protected may be below the threshold for long term viability. The subdivision of the rhino population into several demes might compensate somewhat, but the number of the different populations would still be low. Moreover, it cannot be overemphasized that protection of these populations and sanctuaries in the wild is likely to be an ever increasing challenge.

In contrast, a captive program for the Sumatran rhino could provide significant advantages against these problems. Presumably, animals would be easier to protect from poachers. More importantly, a captive population could be managed to maximize its N_e . By carefully regulating the reproduction of rhinos (i.e. who mates with whom and how many offspring each animal produces in a lifetime) the N_e of a captive population could actually be greater than the number of animals maintained. Finally, recent advances in reproductive technology (artificial insemination, embryo

transplantation, gamete storage) could perhaps productively be applied to the Sumatran rhino. Research is already under way in the AAZPA on white, black, and Indian rhinos.

Thus, the potential of a captive population of several hundreds managed to maximize its genetically effective size could be a vital reservoir to reinforce and replenish the wild stock until or unless larger reserves could be secured in the wild. Survival of the Sumatran rhino (and many other species) may well depend upon an interactive system of both wild and captive populations.

The possible importance of a captive population is not a new idea. At least as early as 1959, the potential of a captive population to preserve the species was recognized (Anderson 1961). In that year, an expedition was sponsored by the Copenhagen, Basel and Bogor Zoos to collect rhino along the Siak River in Sumatra. Ryhiner and Skaftø conducted the operation.

Ten rhinos were collected in an unprotected area. Estimates of the local population at that time was 40-60 rhinos. Unfortunately, only one male was among the ten collected and he escaped. A female was consigned to each of the three zoos, the other six were released. Of the three placed in zoos, the animals at Bogor and Basel both died in 1961. The female at Copenhagen survived until 1972 when it succumbed to vandalism. Perhaps even sadder than the abortive results of this well intentioned endeavor is the fact that a survey by Borner in 1975 discovered no evidence of rhino in the same Siak River area where in 1959 the species was described as plentiful and the 10 were actually collected. Borner concluded the Sumatran rhino had been exterminated in this region. (Borner 1979)

In 1976, Borner, who had conducted an extended study of the rhino all over Sumatra for IUCN/WWF and the Indonesian Government (Borner 1979), prepared a proposal for establishment of a captive population founded by remnant individuals and groups of Sumatran rhino with virtually no hope of surviving in their habitat and hence of contributing to the perpetuation of the species. Naturally, this proposal was very knowledgeably and thoroughly prepared. Implicitly, the Borner proposal had the moral support of WWF and IUCN. The proposal was circulated to several zoos. Unfortunately, none of the individual institutions could provide the commitment of resources and leadership to implement this project. So the proposal expired and Borner moved onto other assignments in Africa where he still is located.

The current initiative by the American Association of Zoological Parks and Aquariums (AAZPA) on Sumatran rhino commenced in 1981 with the formal inception of the Species

Survival Plan and the appointment of an AAZPA Conservation Coordinator. The AAZPA is the professional organization of the approximately 175 zoos and aquariums in the United States and Canada. Conservation has been established as the highest objective of the AAZPA. Collectively, the AAZPA represents many resources (technical and financial) that can be utilized for conservation. Indeed, the realization is emerging that individual zoos, regardless of how big or how good, are very limited in what they can contribute by themselves to conservation. Species can be preserved in captivity only if the various collections of a species can be managed as biological populations to insure the genetic diversity and demographic stability vital for long term survival. It is only through collective and coordinated efforts that zoos can manage populations and generate resources on a scale sufficient to save species. Consequently, the AAZPA has embarked upon a Species Survival Plan (SSP), and attempt to develop scientific and coordinated programs to propagate and preserve endangered species in captivity.

Naturally, the family Rhinocerotidae is receiving the highest priority of the SSP. Four of the five species representing all of the extant genera have been designated for the SSP: black, white, Indian, and Sumatran. (The Javan has not been designated because limitations of space and resources allow the AAZPA to develop viable programs for only four types of rhino. Since all four species are endangered, the decision has been to select one representative of each genera.) Programs for the black, white, and Indian are already very successfully in progress. However, the most endangered rhino is the Asian two-horned. The AAZPA strongly believes captive propagation can be beneficial, perhaps vital, to the survival of this species. Hence the AAZPA is very interested in participating in the development of a captive propagation program.

Through 1981 and 1982, preliminary explorations toward this objective were conducted by correspondence and conversations with various scientists and officials interested and involved with the Sumatran rhino. Particularly important were early contacts with wildlife officials and scientists in Sabah.

Basically, a few rhinos (30-40) are estimated to survive in Sabah. The largest concentration seems to be in the Silabukan Forest Reserve. However, there are evidently a number of rhinos inhabiting areas around Silabukan on the Kretam/Dent Peninsula that will be converted to agriculture (Area 2 on Figure 2). Additional rhinos evidently occur elsewhere in Sabah outside protectable sanctuaries. Wildlife officials in Sabah (Andau and Payne 1982) have strongly recommended these animals be collected for a

captive population and have tentatively invited the AAZPA to assist in development of this effort.

Extensive discussion of the proposal to establish a captive population and program occurred at the IUDZG Rhino Symposium in London, August 1982. In attendance were representatives of major zoos around the world as well as many field conservationists including members of both the SSC Asian and African Rhino Groups and SSC Chairman Dr. Grenville Lucas. There was general agreement that a captive program would be a constructive, if not crucial, contribution to preservation of the Sumatran rhino. The sole qualification placed on the proposition was that only animals outside the main sanctuaries and populations be considered candidates for the captive programs.

To explore further the possibilities of developing a program for captive propagation, a reconnaissance was conducted in S.E. Asia from mid-April to mid-June 1983 by Dr. Thomas J. Foose, AAZPA Conservation Coordinator, and Mr. William Zeigler, General Curator of the Metrozoo-Miami and a member of AAZPA'S Wildlife Conservation and Management Committee. The purpose of the trip was to visit as many officials, scientists, and sites as possible to reconnoiter the feasibility and desirability of a captive propagation project. The itinerary included the Philippines, Sabah, West Malaysia, Singapore, and Indonesia.

In the Philippines, there were consultations with Tony Parkinson, Field Director of the Tamaraw Project and a preeminent trapper of larger mammals in tropical forests. In Sabah, there was extended conferral with Patrick Andau (Assistant Chief Game Warden), Dr. John Payne (WWF-Malaysia), Dr. Clive Marsh (Sabah Foundation), and many other local conservationists both in the governmental and private sectors. There were also visits to a number of areas where isolated rhinos that might be candidates for capture are reported to exist. In West Malaysia, the principal contacts were Mohammed Kahn and his staff, notably Khairiah Bte Mohd. Shariff and Louis Ratnam. There were also substantive discussions with the staffs and officials of Zoo Negara and the Wildlife Department Zoo in Malacca. A number of rhino habitats were explored in West Malaysia but mostly in the main sanctuaries. In Singapore, there were discussions with the staff of the zoo about the project. In Indonesia, much time was devoted to visits with Dr. Nico Van Strien concerning the project as well as with other scientists and officials concerned with rhino conservation in Indonesia including the staff of the Jakarta Zoo and members of the Indonesian Zoo Association.

The results of this reconnaissance were very positive. Much support was discovered for the concept of a cooperative attempt to develop a program for captive propagation of

Sumatran rhinos. Similar responses have been received from a number of other persons with recent interest and involvement with this species and its conservation : Widodo Ramono, Dr. Marcus Borner, Rodney Flynn, Dr. Andrew Laurie. Further, although difficult, the reconnaissance in the field and the consultations with Tony Parkinson have been encouraging about the actual feasibility of capture. Based on these considerations, a preliminary proposal has been formulated for a specific plan of action to develop a project on captive propagation of Asian two-horned rhino. This proposal represents a synthesis of input from all of the persons consulted especially the officials and scientists in S. E. Asia.

PROPOSED PLAN FOR CAPTIVE PROPAGATION PROJECT
ON SUMATRAN RHINO

1. The Asian two-horned rhino is one of the most endangered species in the world. Probably fewer than 400 survive in all of the S.E. Asia. Over half of these animals occur in relatively large groups within established sanctuaries. But many others occur in small and fragmented groups of 1 to 5 animals. It seems unlikely that these remnants can contribute to the survival of the species because:
 - A. they are too small and isolated to be viable genetically;
 - B. they occupy areas where their habitat will be developed for other purposes or the animals actually lost to poachers.

2. Viable alternatives for these remnants would be:
 - A. translocation into the larger populations and protected sanctuaries;
 - B. capture for captive propagation.Captive propagation may be preferable at this time because of the advantages it can provide compared to the uncertainties about the viability of translocation. However, it must be emphasized that the primary purpose of the captive propagation will be to reinforce the efforts to preserve this species in the wild.

3. Therefore, the AAZPA, through its SSP Sumatran Rhino Propagation Group, proposes to develop a cooperative project with the Wildlife Departments of Sabah, West Malaysia, and Indonesia for captive propagation of Asian two-horned, or Sumatran, rhinoceros.

4. The project would be developed under the auspices and oversight of the IUCN SSC Asian Rhino Specialist Group. Indeed, the project would optimally be a part of an international strategy for conservation of the rhino that:
 - A. designates certain sanctuaries as the main objectives for protection in the wild and
 - B. identifies other isolated animals for captive propagation.

5. It would also seem advantageous for the project to be developed in the context of the association of South East Asian Nations (ASEAN) which is increasingly attempting to coordinate conservation as well as many other activities. Under the present proposal, four of the five ASEAN nations could be directly involved in the project. Rhinos would be collected and propagation attempted in Malaysia and Indonesia. Singapore possesses an excellent zoo that optimally should be one of the S.E. Asian facilities where rhinos would be

placed. The Philippines could contribute through the services of Tony Parkinson who is considered by many to be the most qualified candidate to be actual trapper of Sumatran rhinos and who currently is engaged by the Presidential Commission for the Conservation of the Tamaraw. Only Thailand is not presently proposed for participation. However, there are reports that some rhinos may still survive in Thailand. Certainly, the possibility of Thailand's participation is not precluded and eventually could be beneficial.

6. Animals collected for the captive program would derive only from the population remnants with no prospect of contributing to survival of the species. No animals would be collected from the main populations and preservable sanctuaries. However, perhaps 25% or more of the animals believed to survive represent genetically unviable and/or imminently imperiled remnants. Such remnants occur in all three areas proposed for the project: Sabah, West Malaysia, and Sumatra.
7. There would be an attempt to collect a total of 6 to 12 pairs of rhino from Sabah, West Malaysia and Indonesia combined over a 5-year period. To be viable for long term propagation, and adequate number of animals must be obtained for the foundation of the captive population. Of course, even one pair in captivity would be a start. However, population biology suggests 6 to 12 pairs of animals are normally necessary to insure a sufficient sample of the genetic diversity of the wild populations. In the case of the Sumatran rhino, it seems also important to pursue as many geographic sources of founder stock as possible. The species has been so decimated in the wild that no one area is likely to provide the genetic diversity or simple numbers advisable to found a captive population.

A logical arrangement would therefore be to collect 2 to 4 pairs of rhino each from Sabah, West Malaysia, and Indonesia.

8. However, logistics and chance are likely to be more important influences than logic on the proposed project. It is very unlikely that animals will be collected in such convenient sequences as pairs. Indeed, it is not certain rhinos can be successfully captured at all.

The AAZPA is under no delusion that capture of Sumatran rhinos will be anything but formidable. It will be costly! It is estimated that 1.5 million dollars will be required for the first 3 years of the project. But preliminary explorations have been encouraging on the