

LETTERS TO THE EDITOR/CHAIRS

The most endangered extant rhino species is now on the verge of extinction

Dear Editor and AsRSG Chair,

Re: The most endangered extant rhino species is now on the verge of extinction

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In a letter to the Editor Payne et al. (2019) stated “At some time in the very near future a point will be reached when the sheer technical and logistical inability to capture and translocate the last rhinos from remote sites, coupled with the reproductive condition of all those remaining

rhinos still able to mate, and bureaucracy among the indecisive decision-makers, will together conspire to condemn the 20-million-year-old genus *Dicerorhinus sumatrensis* to inevitable extinction.” The inability of humans in the last quarter of the twentieth century to critically assess field data and collaboratively determine science-based conservation strategies to avert the extinction of the Sumatran rhinoceros is the underlying cause of the dire status of the species today. The Sumatran rhino story holds lessons for many parties, not the least for the IUCN and its SSC specialist groups. This follow-up letter provides a historical overview and shows how international systems in place have failed the most endangered extant mammal genus, and that the onus now rests with Indonesia to prevent its extinction.



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Historical decline and early warnings

In prehistoric times, the Sumatran rhinoceros's range extended from north-eastern India and southern China through mainland Southeast Asia to Borneo and Sumatra. Over the past few thousand years, its range contracted markedly from north to south. A century ago, the species persisted only in low population densities, isolated, declining clusters (Payne 2022). Hubback (1939) warned that the species was "on the threshold" of extinction due to a lack of breeding.

In 1960, commissioned by the Survival Service Commission (SSC) of IUCN and based on field visits, Lee Talbot (1960) highlighted that the few remaining Sumatran rhinos had little chance of finding mates. (The SSC became the Species Survival Commission in 1980). Successful captive breeding of the Greater one-horned rhinoceros (*Rhinoceros unicornis*) in the 1950s prompted attempts to capture Sumatran rhinos. Ten Sumatran rhinos were captured in Riau in 1959, but the sole male escaped. While the Bogor, Basel and Copenhagen zoos each received a single female rhino, the rest were released back into the forest (Skafte 1964). Surveys four years later found that their habitat had disappeared (Milton 1963).

The World Wildlife Fund (WWF), in its first report, 'The Launching of a New Ark', proposed the establishment of reserves to bring together scattered animals, and a few years later, the SSC called the species a "cause for very grave anxiety" (Scott 1965). However, no actions were taken.

The first serious attempts to prevent the extinction of the Sumatran rhinoceros

Thomas Foose, the conservation coordinator of the American Association of Zoological Parks and Aquariums (AAZPA, now AZA), invoked captive breeding to prevent the extinction of the Sumatran rhinoceros, arguing that "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 ensure long-term survival. In contrast, a captive

programme could provide significant advantages against these problems" (Foose 1983).

By then, three endangered large herbivores—the European bison (Pucek et al. 2004), Przewalski's horse (King et al. 2015), and Arabian oryx (IUCN SSC Antelope Specialist Group 2017)—had been rescued from certain extinction through captive breeding and collaborative management. Most striking in those recovery efforts was the absence of bureaucracy, of rules to prevent cross-border exchange, of mainstream conservation NGOs, of stakeholder consultation, and of plans drawn up by supervisory institutions.

Following Foose's proposal, SSC convened an "Ad Hoc meeting on Sumatran rhinoceros" in Singapore in 1984 (Scott 1984), where opposing viewpoints emerged. Schenkel (the Chair of the Asian Rhino Specialist Group, AsRSG) was against any form of capture. While van Strien's (1985) study showed that there were several tens of Sumatran rhinos in Aceh, Sumatra, with a reasonable breeding rate, this finding provided false hope that similar sites might exist elsewhere, and that protection from poaching might allow a population recovery. It is now evident that this study area contained the only remaining cluster of Sumatran rhinos that was potentially viable at that time. It is the only one that still exists, although now as a much smaller cluster. All other Sumatran rhino clusters that existed in 1984 have been extirpated (Havmøller et al. 2015; Payne 2022).

The possibility of capturing Sumatran rhinos from protected areas (PAs) for captive breeding was not raised explicitly—most present knew this was not up for negotiation. In this, we can see a common human cognitive bias: for managing a critically endangered mammal, whether or not those mammals live in a PA is often irrelevant. The boundaries of those areas were based on what was possible at the time of their establishment in the context of human society, and do not necessarily bear any relevance to whether or not the habitat will be adequate to allow the recovery of a depleted population of a particular species (Kretzschmar et al. 2016; Payne 2022).

One problematic disagreement at the 1984 meeting was whether captured rhinos should stay in their country of origin. However, the fundamental disagreement was over whether or not to capture. An agreement was eventually reached to form a captive metapopulation, but through the capture only of 'doomed' individuals, those whose future long-term viability or contribution to the species' survival is

determined to be unsatisfactory. This conservative position, however, left many potential breeding animals in the wild, thereby excluding them from captive breeding.

The 1984 Singapore meeting marked a distinct shift in perspective from that seen from the late 19th century until the 1960s, exposing a sharp dichotomy in the wildlife conservation world that remains even today. The dichotomy in thinking is: either create PAs, leave animals in the wild, list the species as entirely protected in legislation, establish field teams to reduce poaching, and promote ‘awareness’; or, devise and implement a metapopulation programme that includes habitat management and captivity to recover numbers by maximizing reproduction.

Between 1984 and 1994, forty Sumatran rhinos were captured in Sumatra, Peninsular Malaysia and Sabah (Borneo), and sent to eight captive facilities in Indonesia, Malaysia, USA and UK (Rookmaaker 2019). Many of them were too old, injured, or infertile to contribute to breeding in the absence of assisted reproductive technology.

Reproductive problems in wild and captive populations

In 1986, one of the earliest females taken into captivity was found, shortly after capture, to have inactive ovaries and a uterine tumour, suggesting a lack of breeding in the wild (Furley 1987). Ultrasound examinations of captive rhinos subsequently revealed that most of the Peninsular Malaysian females had uterine cysts and tumours (Schaffer et al. 1994). By 1999, reproductive pathology had become prevalent in all female Sumatran rhinos in captivity (Schaffer et al. 2001); yet, this issue had never received serious attention from people designated as experts in official circles. Much later, Schaffer et al. (2020) found that among Sumatran rhinos, both captured and captive-born between 1986 and 2018, only three females were without reproductive aberrations. Despite the high occurrence of reproductive problems in rhinos from all capture locations, this issue was not discussed in the AsRSG meetings but instead dismissed as a “Malaysian problem” (JP, MA and KD, personal observations, Miller et al. 2016).

Of the Sumatran rhinos captured for the captive breeding programme (1984–1995), only one pair (Emi and Ipuh) produced offspring at the Cincinnati Zoo. Importantly, this was made possible only through human intervention and intensive management. Every Sumatran rhino female that produced offspring in captivity (Emi, Ratu, Rosa and Delilah) needed synthetic progesterone to maintain their first pregnancy and stop a cycle of abortion. For captive breeding to succeed as a means of preventing the extinction of large mammals, it is essential to capture young, fertile animals. For the Sumatran rhino, this need was undermined from the beginning, and followed thereafter by a refusal by designated experts to address the problem of reproductive pathology.

Even by the early 2000s, only a few Sumatran rhino experts understood that the Sumatran rhino’s greatest issue was not poaching and habitat loss, but the failure of small residual clusters to reproduce in the wild.

Misconceived *in situ* protection and the lost opportunities for preventing extinction

By 1994, two main issues had become apparent for the Sumatran rhinoceros: reproductive pathology and declining wild clusters. This applied to both Indonesia and Malaysia. However, from the early 1990s onwards, the numbers of rhinos in each cluster were repeatedly overestimated by government staff and NGOs alike, being based not on verifiable data but on optimistic guesses. Efforts by a few individuals to present an accurate picture went unnoticed. For example, a 1995 survey conducted by one of the authors (ZZZ) across Peninsular Malaysia under a Global Environment Facility (GEF) funded project counted fewer than 30 individuals, which was well below official estimates (Zainuddin 1995). In addition, there was an all-too-common tendency to lump the numbers within separate clusters as if they represented a contiguous, viable population. This false confidence allowed senior decision-makers to believe that existing PAs were sufficient for preventing the Sumatran rhino’s extinction.

Influential voices in wildlife conservation, notably Alan Rabinowitz, argued strongly against captive propagation and in favour of enhanced *in situ* protection of wild rhinos (Rabinowitz 1995). The 1995 GEF-funded project, “Indonesia and Malaysia

Conservation Strategies for Rhinos in Southeast Asia", was a significant additional push against captive breeding, emphasizing capacity building and local human benefits rather than the species' immediate reproductive needs. The project objective was "To enhance the conservation of biodiversity in Indonesia and Malaysia by providing technical training, operational support, and a long-term funding strategy to improve the effectiveness, sustainability and benefits (to local, national, and global human communities) of protection and management programmes for the Southeast Asian rhinoceros". This set the scene for many subsequent endangered species programmes, where a few necessary actions perceived as risky by decision-makers were substituted with human benefit objectives.

Both Foose and van Strien, regarded as key international experts on Sumatran rhinos, initiated the founding in the late 1990s of the Sumatran Rhino Sanctuary (SRS) in Way Kambas NP, Sumatra, a lifeline for the species. However, the broader opportunity to create a captive metapopulation was never pursued or institutionalised. International aid, although instrumental in keeping the SRS running and achieving five births from 2000 to 2025, tended to favour projects of questionable conservation value. Rhino Protection Units (RPUs), in particular, continued to consume large sums of money after 2000 with unclear results, while necessary high-priority efforts, such as capturing fertile animals for breeding, were abandoned.

‘Sumatran Rhino Crisis Summit’ and aftermath

In early 2013, one of the authors (KY) scoured all existing literature on wild Sumatran rhinos and collated information from experts at known Sumatran rhino sites, concluding that almost all the numbers presented in available reports were unreliable guesses. No information could be gleaned to back up any of the numbers quoted, and there were likely fewer than 100 Sumatran rhinos in existence. This was the stark conclusion of the Sumatran Rhino Crisis Summit in April 2013. Initially conceived in Sabah in 2012 as a gathering to draw the attention of advisers and

decision-makers to the dire status of the Sumatran rhino and secure buy-in from international parties and the Government of Indonesia (GoI), the idea of a 'crisis summit' was lost by the time it convened. Instead, it was subsumed into an ongoing IUCN process of international meetings on Asian rhinos in general.

At the heart of the Summit were population viability assessments (PVA) prepared by the IUCN SSC Conservation Breeding Specialist Group. The analysis for wild Sumatran rhinos indicated that to have high confidence in population survival, at least 20 fertile individuals were needed in one area, with a roughly even sex ratio and one calf born to each female rhino every four years (Lees 2013). With the possible exception of one area in the Leuser Ecosystem, no such population existed after the 1950s. Modelling of a captive population provided an even bleaker picture (Putnam 2013). Putnam stated in her report, "Given the reproductive problems seen in the current captive Sumatran rhinoceros population, there is an 85%–98% probability that the captive population will go extinct in 50 years if no additional wild-caught (fertile) animals are brought into captivity. To reduce the captive population's extinction probability below 10%, approximately 16 adult wild-caught fertile rhinoceroses need to be transferred into captivity and either be managed globally or as two populations with an interbirth interval of three years." The implication of this assessment is clear and should have formed the basis for the only possible way forward to prevent the extinction of the Sumatran rhino—namely, to capture fertile wild rhinos, wherever they may be located, in the hope that at least 16 could be found. Yet, the recommendations in this assessment have never been endorsed or promoted by any major international conservation organization.

The Crisis Summit resulted in a Sumatran Rhino Emergency Plan (Anon. 2013) and a draft Emergency Plan Framework prepared by IUCN, both of which were submitted to the GoI in July 2013. Instead of highlighting a small number of clear policy decisions that were needed to address the situation, based on the PVAs (Lees 2013; Putnam 2013), and the proven success of the SRS model at Way Kambas NP, which in 2012 had resulted in the first captive birth of a Sumatran rhino in Indonesia, the Emergency Plan introduced the ideas of 'intensive protection zones' and 'intensive management zones' (Havmøller et al. 2015). In our opinion, there were numerous disjointed recommendations on information gathering

and rhino detection (involving a vast and unnecessary camera-trapping effort), protection, infrastructure, monitoring and awareness-raising. The 1984 ad hoc meeting was repeated in 2013, but the direction recommended was even less clear than before.

Unfortunately, following the Crisis Summit meeting, the Sumatran rhino expert circle became even more fragmented. The most egregious split was evident at a workshop conducted in February 2015 in Indonesia, at which another PVA for the Sumatran Rhino was conducted (Miller et al. 2016). Key experts were excluded, essential PVAs of Lees (2013) and Putnam (2013) were ignored, and assumptions from unverified sources about rhino numbers, sex ratios and fertility, along with the inclusion of irrelevant factors, to reach erroneous conclusions, including: “for the foreseeable future the viability of all remaining rhino populations will depend on complete protection from poaching” and “Reproductive pathology occurred in Malaysian populations in low populations” (sic).

Subsequently, divergent conservation factions emerged, with one advocating to retain the status quo methods, albeit with rhinos captured and released into massive forest zones, with minimal management and no assisted reproductive technology. The other prioritising assisted reproductive technology. Attempts to create an international collaborative programme bore no fruit and ended in 2019, when the last two Sumatran rhinos in Malaysia died.

Were institutions, experts, and decision-making approaches fit for purpose?

In our opinion, despite decades of institutional involvement, efforts to save the Sumatran rhino have suffered from policy missteps and resistance to proven interventions. Generally, IUCN policy and positions can be susceptible to disproportionate influence by large, risk-averse institutions such as governments and NGOs, while dissenting expert voices are ignored, sending confusing signals to government officials who must make the final decisions on next steps. Additionally, different specialist groups may

not always agree on vital issues. This is rooted in the fact that the far-reaching outcome of the 1984 meeting was ultimately determined by the opinions expressed in September 2014, when IUCN experts recommended against the use of assisted reproductive technology for the Sumatran rhino and instead proposed camera trapping, habitat manipulation, and enhanced anti-poaching efforts. The One Plan approach to endangered species advocated by the IUCN SSC Conservation Planning Specialist Group was undermined because the vital elements of captive breeding and assisted reproductive technology, both essential in the case of the Sumatran rhino, were either not supported or rejected by mainstream NGOs and other advisers (Havmøller et al. 2015; Payne and Yoganand 2017).

While the problem for Africa’s rhinos is mainly how to reduce poaching of relatively large populations, involving species whose propagation is not a significant problem, the challenges for Sumatran rhinos are very different. It involves acting to boost the numbers of a nearly extinct species facing reproductive isolation, where captive management of the remaining rhinos is crucial. There are also numerous differences in viewpoints among stakeholders, including private individuals, scientific advisory committees and NGOs, about how to avoid extinction. Several African nations have a long history of wildlife management involving active interventions and private interests. Indonesia and Malaysia have no such background.

Although knowledge of the species surged after initial captures in the 1980s, by 2017, even well-established capture methods were made unnecessarily complicated through consultations with numerous uninformed participants.

The role of cognitive biases

Shifting baseline syndrome (Soga and Gaston 2018) was one of the contributing reasons why the need to bring Sumatran rhinos together under a single recovery programme was not sufficiently recognized from the 1984 Singapore meeting onwards. Although those involved were aware of the species’ endangered status, the survival of only a few scattered individuals since the 1930s—which signals an advanced stage in the extinction trajectory—was not fully grasped.

Additionally, several cognitive biases, including

the availability, avoidance, and confirmation biases, have contributed to the misconception that habitat loss and poaching are the main problems to address. Also, there was a misperception that the capture and breeding actions were risky. All forms of technical work involved in Sumatran rhino management are already well-perfected and of low risk. However, the decision-makers opted to sidestep decisive actions, possibly due to the fear of being criticised or to avoid controversy.

How would we like this to end?

Short of a radical turnaround, the genus will likely be functionally extinct (with no breeding occurring in the wild) by around 2040 and totally extinct in the wild by around 2060. However, if Indonesia brings its last remaining Sumatran rhinos under a single expert-managed programme and works to maximise birth rate, there is a last, slim chance to prevent this extinction.

Indonesia could change the extinction trajectory by, i) placing an experienced large herbivore veterinarian in charge of the SRS; ii) involving proven experts in Sumatran rhino capture, translocation and reproduction irrespective of their nationality; iii) do everything possible to reduce birth interval and increase birth rate for all captive females, at least by removing young individuals from their mother as soon as weaning is done; iv) capture some rhinos from Aceh, targeting young animals and where logistics is easiest, and managing them where it is most appropriate for optimal reproduction; and v) continue work on assisted reproductive technology and biobanking.

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