

Short Note

Current Status of the Milky Stork Captive Breeding Program in Zoo Negara and its Importance to the Stork Population in Malaysia

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The Milky Stork, *Mycteria cineria* Raffles 1822 (Ciconiiformes: Ciconiidae), can be found in restricted parts of Southeast Asia, being principally in Cambodia, Malaysia and throughout Indonesia, with vagrant status in Vietnam and Thailand. Within Malaysia it has the status of rare to local resident in the Peninsular Malaysia¹. Around 50-70 years ago Milky Storks could be found scattered in Peninsula Malaysia from the coasts of Kedah, Perak, Selangor, Malacca and Penang^{2,3}, whilst in East Malaysia they were also reported to have existed with the status of rare and much localized⁴. However, the global Milky Stork population has undergone a rapid population decline with a current estimated population of 5500 individuals (minimum) remaining worldwide⁵. In Malaysia Milky Stork populations have declined more than 90% over the last 20 years⁶, from over 100 individuals in 1984 to 10 in 2005 and less than five individuals being observed recently in Pulau Kelumpang and Pulau Terung⁷, the last known Milky Stork habitats in the Matang Mangrove Forest, Perak, Malaysia.

The Malaysian government has the intention to increase the Milky Stork numbers and to this end several actions have been taken, such as a Milky Stork captive

breeding and reintroduction program. With the support from both government and non-government agencies (i.e. PERHILITAN, Malaysian Zoological Society, Zoo Negara, Malaysian Nature Society, etc.) the first actual captive breeding and reintroduction program was done between 1998 and 2004 in Kuala Selangor Nature Park. The effort however had failed due to several problems and constraints as highlighted by Malaysian Nature Society⁸. The program continues today in Kuala Gula, Perak. Before such initiative was taken, the captive breeding program in Zoo Negara was given less priority in solving the Milky Stork issue. Successful individuals hatched and reared were mainly for the purpose of multiplication, exhibition and exchange exercise between zoos. Therefore, not until sometimes after the first reintroduction in Kuala Selangor does Zoo Negara focus on the captive breeding for conservation purposes. Regardless, captive breeding is viewed as one of the important components in the project and, therefore, its contribution and the future of Milky Stork breeding programs in the Zoo Negara should be evaluated and highlighted.

This paper aims to analyse and report the Milky Stork breeding program in Zoo Negara and its success. Data on Milky

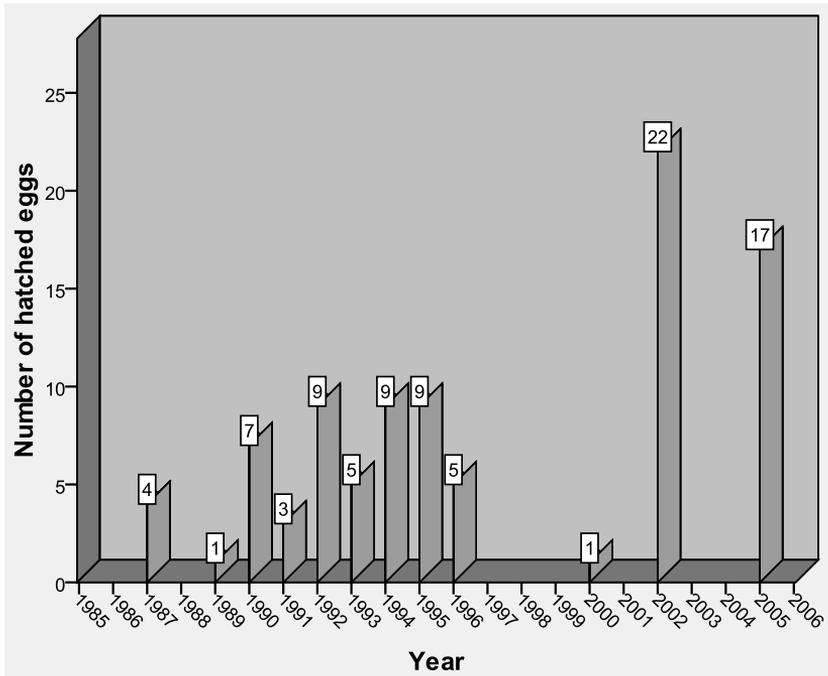


FIGURE 1. Successful egg hatch (total numbers) for the Milky Stork in captivity from 1987 to 2005.

Storks in Zoo Negara were obtained from available records kept at Zoo Negara, updated until the year 2005. Besides the hatching records, information from the Zoo Keeper and literature related to Milky Storks in Zoo Negara were also analysed. Based on the breeding activity of Milky Storks in captivity, the captive population of Milky Storks can be increased by captive breeding if proper planning is executed, but data on the successful reintroduction of the species back to the wild is absent. We also highlight the potential important of this captive breeding program in repopulating wild Milky Stork population, the threats that the released captives might face and the need of specific studies to improve the current attempts at the conservation of Milky Storks in Malaysia.

The first five males and five females in Zoo Negara were obtained from Singapore and Johor Zoo in 1987. Six more adults, with at least three females were introduced

in subsequent years from San Diego Zoo and Rotterdam Zoo. The first successful nesting was recorded in 1987⁹ when two pairs of three-year-old birds nested and one pair hatched two clutches of two chicks and the surviving chicks later continued to breed. Records from Zoo Negara give more insight with four males and four females Milky Storks successfully producing 19 chicks within 2 years since 1990. However, according to previous records and observations by the Zoo-keeper, not all the chicks survived. Only 48% of the chicks reached their adulthood and continues to breed. Most deaths occurred as the result of swollen joints and leg deformities. Malnutrition due to unbalance diet given may have been the possible cause for this. Other reasons included nest disturbance or collapse of the nest tree structure that caused the eggs or chicks to be dumped to the ground, incorrect chick feeding and the weakening of pair bonds due to egg

manipulation and artificial egg incubation period. Another aspect that is important is inbreeding. Genetic studies including molecular sexing studies on Milky Stork were carried out recently but the results on inbreeding are still under investigation^{10,11}.

Figure 1 summarizes the available records of yearly total for Milky Stork eggs hatched in captivity in Zoo Negara. Since 1987, 10 individuals were reared in a cage of 30 m x 30 m x 14 m and from these the captive population has increased to more than 100 individuals beyond 2005. During the first 10 to 20 years in captivity, the poor documentation on bird growth, survival and improper labelling means the detailed information on the breeding success is not available. This poor documentation was probably due to early function of Zoo Negara as an exhibition and education centre. Only recently has Zoo Negara become more active in education, research and conservation. Moreover, with the limited cage size and available space in Zoo Negara, the excess numbers of Milky Storks were used in exchange programs with both local and international zoos as part of a conservation program. A total of 47 Milky Stork individuals were produced between 1990 and 1996 with minimum of 3 and maximum of 9 successfully hatching chicks each year. However, no data for the number of chicks that hatched from 1997 to 1999 inclusive is available. The birds were probably left to breed in the cage and records were not made during this period. The years 2002 and 2005 show the two highest numbers of chicks hatched at 22 and 17 respectively, with a total of 39 individuals recorded. Breeding activity was reported to continue until the present day and proper records have been kept as a priority only after 2005. Every birds hatched in Zoo Negara will be marked and have

their own record on date of hatch, early growth rates and health. This information is very important for further breeding and reintroduce programme. Nevertheless, the past experience of the last 23 years of breeding captive Milky storks in Zoo Negara has led to improved handling methods and artificial nest support construction, chick rearing methods and so on giving a great aid to future captive breeding programs here or elsewhere.

The Milky Stork captive breeding program aims to re-establish the lost population of Milky Storks in Malaysia by re-introducing the captives into a new environment. This then requires a suitable location capable of supporting the released birds in terms of shelter, food, breeding grounds, low parasite, predator risks and other threats. Many of these aspects can be suitably met and controlled in specific conservation sites. Matang Mangrove Forest is one of the proposed ideal sites for the release program in Peninsular Malaysia. Further study, however, is needed to address the importance of managing and conserving specific habitats that play an important role for these birds. In the meantime, Zoo Negara will play a role as the main Milky Stork supplier for this program to meet its objectives. With the current population trend, (high number of breeding adult birds aged 5 years and above) the number of Milky Storks in Zoo Negara is expected to increase within the next few years. As the Zoo Negara supply the Milky Storks, it should maintain a healthy number of the birds in its possession. However, these are fairly considerably genetic bottlenecked and inbred and so new out bred breeding stock should be introduced and introgressed into these stocks at the zoo as soon as possible and then expanded from there.

From what we have discussed, based on the increased number of birds, Milky Storks can be successfully bred in captivity, even though with minimal effort as shown in Zoo Negara during the early period. In contrast, the significant decrease in the wild population size and distribution patterns of Milky Storks since 1989 suggests not only that habitat protection alone is not sufficient and a reintroduction from captive stock is likely to be required. In contrast to the decline in wild populations, the number of captive breeding individuals in Zoo Negara has increased from 10 to more than 100 individuals in 2005. We therefore conclude that not only it is possible to breed Milky Storks in captivity, but that the decline in wild Milky Stork populations is attributed to the ecological and anthropogenic factors in which they were found and is more than just habitat destruction, including disturbances, poaching^{6,12} and other environmental hazards that then affect worldwide Milky Stork populations.

One such threat is that of increasing contamination of the ecosystem that may cause long-term visible effects only. Many studies have reported that the coastal environment along Peninsula Malaysia has the potential to be or already is contaminated by heavy metals, TBT, pesticides, organochlorine compounds and other hazardous chemicals¹³⁻¹⁶ that are known to be toxic and cause health problems to coastal birds¹⁷⁻²⁰. The role of mangrove destruction in the decline of coastal birds has also been described elsewhere^{12,21}, with the mangrove forest being felled for many reasons including aquaculture. Indeed, aquaculture, when situated in mangroves, negatively affects the mangrove ecosystem by destroying the area through the cutting and logging of mangrove trees and has been associated

with the widespread destruction of mangrove forests, especially in Asia²²⁻²⁴. Milky Stork populations have thus indirectly been threatened by the uncontrolled expansion of the aquaculture industry. Therefore, responsible authorities should continuously monitor Malaysia's coastal activities.

Other threats to introduced populations, as per wild birds, would include poaching of eggs or adults, disease, predation, hybridisation with other stork species, inability to correctly hold and defend breeding territory or hunt for food (following captive breeding) and susceptibility to disease or poor mating characteristics and low fecundity associated with inbreeding and low genetic variability.

In terms of reintroductions, Matang Mangrove Forest is viewed as a suitable Milky Stork habitat because the area is protected, systematically managed and sustainably harvested. At least 26.4% of the forest is protected for biodiversity conservation, erosion mitigation, research and education, recreation, local community's needs and settlement²⁵. More areas may need to be changed and documented to be protected areas, especially those with important value to Milky Stork populations, since the global Milky Stork population could suffer the same fate as its counterpart in Malaysia. Therefore, Milky Stork captive breeding programs, especially close to their natural habitat, need to be established and continued aggressively so that the Milky Stork population in the wild can be increased, albeit preferentially without serious genetic bottlenecks. If what has been practiced in Zoo Negara with the lessons learned worked well in new cage set ups elsewhere, then the Milky Stork breeding programs could be no problem, subject to establishing and then maintaining

a more out bred initial breeding stock. However, more studies on the breeding (i.e. genetic, resistance and behavioural aspects) are needed in the near future. With proper planning, Milky Stork conservation in Malaysia can be a good model if succeed.

In addition to captive breeding a successful reintroduction and or population supplementation program requires successful reintroduction of captive bred birds into the wild. However, currently little is known about the success of Milky Stork introductions using captive bred individuals. Escapees from Zoo Negara were observed to join a local Painted Stork (*Mycteria leucocephala*) population and were recovered later suggesting they may remain near the release site if it is suitable, but this still remains to be established. However, as mentioned, information of their susceptibility to disease or predation, and ability to select and defend suitable territory, nest sites and hunt for food, as well as fecundity and breeding success compared to wild species is unknown, as is the changes, if any, in the risk of cross-species hybridisation.

Likewise, although habitats conservation is well understood, the actual demands per pair on the area, specific habitat requirements and connections between them (meta-population) to support the released birds are unknown.

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