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Current Status of the Milky Stork Re-introduction Programme in Malaysia and Its Challenges

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Abstrak: Kertas kerja ini membincangkan status terkini Program Pelepasan Semula Burung Upeh di Malaysia dan cabaran yang dihadapinya. Walaupun program ini telah berterusan selama hampir tujuh tahun, terdapat banyak cabaran baharu timbul akibat konflik antara pelaksanaan dasar pemuliharaan dan pembangunan yang berlangsung di Kuala Gula. Oleh itu, populasi burung upeh sukar untuk menyesuaikan diri kerana habitat sedia ada untuk bersarang dan mencari makanan sering terganggu oleh aktiviti antropogenik di samping peningkatan pencemaran di kawasan tersebut. Selain itu, kekurangan latihan yang sesuai kepada burung upeh dalam kurungan sebelum aktiviti pelepasan turut melambatkan proses penyesuaian populasi burung tersebut di habitat yang baru. Beberapa cadangan telah dikemukakan bagi membantu meningkatkan keberkesanan program pengenalan semula ini. Cadangan tersebut termasuk penambahbaikan kaedah latihan yang diberikan kepada burung di dalam kurungan, penambahbaikan keadaan dan persekitaran kandang sedia ada, perlindungan kepada hutan bakau yang masih ada, pembangunan zon penampan bagi mengurangkan kadar pencemaran yang semakin meningkat di kawasan tersebut, pemantauan rapi populasi yang telah dilepaskan dan mengekalkan sokongan berterusan serta kesedaran orang awam. Memandangkan aktiviti antropogenik yang berterusan boleh memberi kesan terhadap status Kuala Gula sebagai kawasan perlindungan burung yang penting, penekanan yang menjurus kepada mencapai pembangunan mampan di seluruh kawasan Kuala Gula perlu diberi perhatian.

Kata kunci: Burung Upeh, Pelepasan, Pemuliharaan, Ekologi, Malaysia

Abstract: This review discussed the current status of the Milky Stork Re-introduction Programme in Malaysia and the challenges it faced. Although it has continued for almost seven years, more challenges appeared as time elapsed mainly due to the arising conflicts between the implementation of conservation policy versus the development projects in Kuala Gula. Hence, the released population is struggling to adapt mainly due to the reduction of suitable habitat for nesting and disturbed foraging areas by the continuous anthropogenic activities. Furthermore, the lack of appropriate training among captive storks prior to being released also slows the adaptation of the birds in their new habitat. The increasing pattern of pollution in the area is also highlighted. Several suggestions were given to help improve the current re-introduction programme. These include

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improvements to the captive training method, improvement of the existing enclosure's condition and environment, protection of remaining mangrove forest, creation of a buffer zone to mitigate the increasing pollution level in the area, close monitoring of the released population, and maintaining continuous support and awareness among the public. Considering the ongoing anthropogenic activities that may impair the status of Kuala Gula as an important bird sanctuary, emphasis should be given to achieve sustainable development throughout the area.

Keywords: Milky Stork, Re-introduction, Conservation, Ecology, Malaysia

INTRODUCTION

Captive breeding population plays an integral part in the overall effort to recover an endangered species (Tudge 1992). Although re-establishment of the population can be a long-term process, taking many years to succeed, captive breeding and introduction activity is still being practiced to conserve wildlife (Kleiman *et al*. 1994). According to the International Union for Conservation of Nature/Species Survival Commission (IUCN/SSC 2013) re-introduction is defined as the intentional movement and release of an organism inside its indigenous range from which it has disappeared as a result of human activities or natural catastrophes. One example is the re-introduction activity involving the Milky Stork (*Mycteria cinerea*) population in Malaysia. The species is predominantly coastal, inhabiting mangroves and adjacent swamps and has been listed as a vulnerable species due to rapid population decline throughout its ranges (BirdLife International 2013). The species has become extinct in several countries including Thailand and Cambodia and are decreasing in Indonesia and other places (Robson 2002). In Malaysia alone, the number has decreased significantly to no more than five individuals in the wild (Ismail *et al*. 2010). This species was once scattered in the peninsular ranging along the west coast area (Robinson & Chasen 1936; Gibson-Hill 1949) but now is restricted to the area of Matang Mangrove Forest in Perak.

Kleiman *et al*. (1994) suggested that for a self-sustaining viable population to exist following its re-introduction there must be an intact functioning ecosystem. It is further stated that several criteria should be considered prior to the re-introduction to ensure the success of the programme. Although some of them were not fulfilled, the re-introduction of the captives was still conducted as a means to study the birds' behaviour and ecology in their natural habitat. This was also possible due to the positive and stable population growth of the captive-bred population in Zoo Negara which supplied the birds for the programme (Ismail *et al*. 2011). Thus, several challenges are expected particularly those related to the alteration of certain behavioural traits from prolonged captivity, human imprinting and low density of con-specifics (Sarrazin & Barbault 1996). Nevertheless, the opportunity to understand the ecological processes that lead to the establishment and recovery of the species are compelling and important to any future re-introduction efforts. This paper highlights the current status of Malaysia's Milky Stork re-introduction, its challenges, and suggests several measures to help improve the programme.

Milky Stork Releasing and Breeding Activities

Prior to the releasing activity, the Milky Stork population undergoes a captive breeding programme in Zoo Negara, which started in 1987 (Ismail & Rahman 2012). Following its success, the first re-introduction was carried out in Kuala Selangor Nature Park (KSNP) in 1998 with 10 captive-bred individuals. Comprising over 200 hectares of coastal land and mangrove swamps, KSNP is one of the important passing routes for migratory birds during their annual migration. Few nesting attempts were made by the stork's population in the KSNP but no successful outcome was recorded. The captives were then released into the wild in May 2003 after the cage's roof was damaged by a storm (Sebastian & Sebastian 2005). Furthermore, due to financial constraints, the programme was ended in 2005. Later in 2007, another re-introduction programme was carried out in Kuala Gula Bird Sanctuary in Perak. As the main stakeholders, Zoo Negara (under the management of the Malaysian Zoological Society) and the Department of Wildlife and National Parks (DWNP) are responsible for the continuation and success of the programme. Zoo Negara's main role is to gradually supply a total of 150 captive-bred Milky Storks to Kuala Gula which started in early March 2007. The Milky Storks are being continuously sent in small batches, usually 5–8 individuals per batch and this is subjected to the availability and total number of the population in captivity. On the other hand, the DWNP's tasks are to monitor and protect the birds in accordance with the existing legislations and wildlife protection acts. To date, about 50 Milky Storks have been released in Kuala Gula between the year 2007 and 2014.

Kuala Gula is home to a number of resident waterbirds including the endangered Lesser Adjutant (*Leptoptilos javanicus*) as well as the Milky Stork population. It is also one of the important stopovers for migratory shorebirds. Since the first releasing activity, there have been many attempts to breed by the population but only few were successful. Initially, the key problem faced by the population was mainly due to direct and indirect disturbances from human and predators such as Brahminy kite, long-tailed macaque, water-monitor lizard, etc. Moreover, closer inspection of the nests built during the early releasing activity revealed that many were either incomplete, abnormally proportioned or had insufficient use of nesting materials, and some were too small compared to the female's relative body size.

A total of four chicks had been successfully hatched and reared in the wild following the re-introduction. The first successful breeding was recorded in early April 2010 with two chicks successfully reared from a total of five eggs laid. The second one was in mid June 2013 also with two chicks successfully reared from a total of eight eggs laid. However, the recent breeding activity of the storks in 2014 has not been successful due to indirect disturbance by human in the nesting area. The nests were built on trees that are close to a busy road. In a study conducted by the authors between 2010 and 2014, nest abandonment was found to be the highest in areas near such activity. The study closely monitored the population's breeding activity and found out that up to 60% of the cases in which nest abandonment occurred were due to the results of human disturbances and intervention i.e. noise, hunting, deforestation in nearby

mangrove, etc. The remaining 40% was due to other factors like weak nest structure, predation, extreme weather, etc. Kuala Gula is one of the hotspots in the northern region for local tourists. Hence, selection of nesting location is very important as the breeding activity could be disturbed easily due to its proximity to human activity.

It is viewed that the Milky Stork requires extensive tract of tall trees for nesting purpose (Li *et al*. 2006). Throughout this study, the Milky Storks had utilised a number of tree species including *Avicennia* spp., *Rhizophora* spp., *Sonneratia alba,* and *Leucaena leucocephala*. Normally, the heights of the trees selected for nesting were between 8–10 m (Yatim 1989) and some could reach up to 14 m, with the diameter at breast height (dbh) up to 1.6 m. This suggests that tall and mature mangrove trees are one of the important requirements for nesting by the Milky Stork. However, a recent survey conducted in November 2014 revealed that approximately 28.35 ha of the mangroves along the coast of Kuala Gula have been felled to give way to aquaculture activity (Rahman & Ismail 2014). Unfortunately, many of the areas cleared were once associated with the Milky Stork's foraging activity (Fig. 1). Such activity will further lead to the reduction of available nesting trees and the materials needed for nest building which could negatively affect the long term survival of the released population. Currently, there are at least 22 individuals that can still be seen in Kuala Gula, including the 4 juveniles that were reared in the wild. The fate of the remaining individuals is still unknown and it is possible that some of them have already dispersed or moved out of Kuala Gula. Evidently, urgent action is needed to conserve the remaining population.

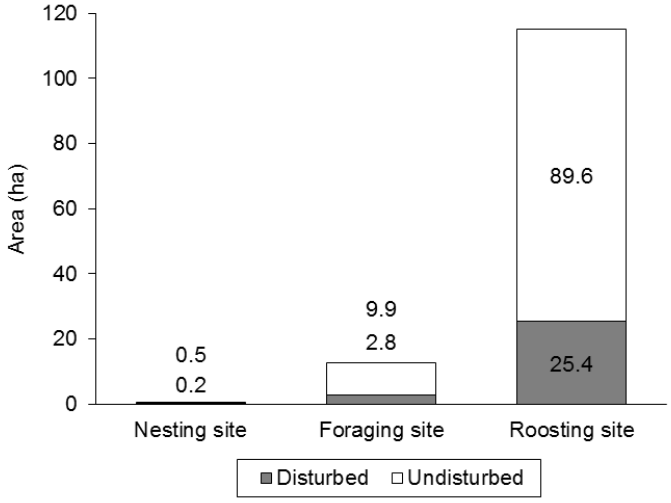

Figure 1: The size of area used by the Milky Stork population (disturbed vs undisturbed) as surveyed in 2014.

Milky Stork Foraging Activity and Frequency

Figure 2 shows the percentage of visits made by the stork's population in different foraging areas between 2011 and 2012. A study was conducted by the authors between 2011 and 2012 to understand the Milky Stork's foraging habitat utilisation. The birds were followed to their respective foraging areas and their activity was recorded. Some of the important findings were highlighted in this paper. In general, visit frequency varies between the sites studied and certain areas were only utilised during the breeding period. In the early phase of the release activity (July to October 2011), the Milky Stork's visits to the release centre were much higher compared to other foraging areas, 44% to 47% of the times. Eventually, an increase in the number of visits to the shrimp farms was recorded, with 42% to 83% of visits (November 2011 to December 2012). An active shrimp pond usually last for three months before it dries up and is re-used again. As the pond's water level drops and its bottom is exposed, it attracts the Milky Storks and other waterbirds to forage on the remaining or left over shrimps. Thus, during harvesting period, the number of feeding visits made by the storks to the centre was significantly lower compared to non-harvesting season as the birds will stay near the ponds for most of the times. In addition, few individuals will not leave the area after harvesting period ends and continue to forage along the brackish water nearby. As more land-based aquacultures are developed in Kuala Gula, the stork population could take advantage of such activity for acquiring food. The use of man-made structures such as the shrimp farms as an extension to normal foraging grounds can be advantageous as it would provide temporary relief to the waterbirds (Kloskowki *et al*. 2009). However, prolonged exposure to anthropogenic activities could also have a negative impact on the population in the long term. Moreover, the uncontrolled land reclamation could lead to the population's over-reliance on aquaculture activities and could also affect the migratory shorebirds that use the area as a stopover. Further studies are required to highlight this matter.

Pollution Status and Pattern in Kuala Gula

The recent deforestation and reclamation of Kuala Gula's mangroves could also affect the quality of its aquatic habitat. For instance, Kuala Gula was once known for its pristine condition with low contamination input from its land (Lomoljo *et al*. 2009, 2010). However a recent study conducted in the Milky Stork's foraging areas revealed that the continuous development of Kuala Gula's coastal area is contributing to the increase in the level of trace metals that could be harmful to the waterbirds population (Rahman *et al*. 2013). Furthermore, at least 50% of the anthropogenic inputs studied were attributed to the ongoing land reclamation for fisheries and aquaculture industries throughout the area. Although the contamination that occurred was site-specific and localised, with the recent development and pattern of anthropogenic activities in the area, other parts of Kuala Gula mangroves will most likely be affected too. Hence, this would lower the overall quality of the habitat in the future. Metal contamination in the waterbirds community has been well-discussed and some of the problems include thinning of eggshells, premature hatching, and deformities in the young

(De Luca-Abbot *et al*. 2004; Horai *et al*. 2006; Ayas 2007; Kim & Koo 2007). Thus, the pollution level in Kuala Gula needs to be continuously monitored as part of the effort to conserve the released Milky Stork population and other birds in general. In addition, studies on the birds' diet quality should be considered to highlight the potential risk that they could be facing in the future.

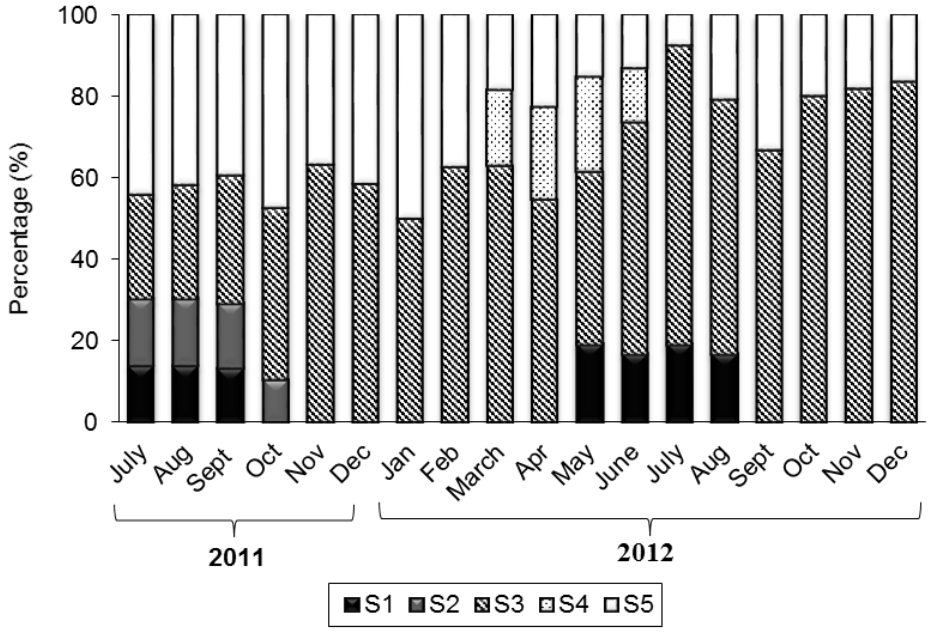

Figure 2: Percentage of foraging visits made by the released Milky Storks between 2011 and 2012.

Notes: S1 - jetty area; S2 - drainage; S3 - shrimp ponds; S4 - intertidal mudflats; S5 - release center.

The Use of Biologging to Study the Re-introduced Population

Studying a free-roaming waterbird can be very hard. Thus, telemetry and tagging science have been employed to assist field biologist and scientist in behavioural and ecological studies. Recent advances in the technology and models used in bio-logging have helped revolutionise ecological studies which permits observation beyond the standard or conventional measurement methods (Bograd *et al*. 2010). Bio-logging allows for continuous monitoring of unrestrained free-ranging animal in their own environment which eliminates laboratory artifacts and the need to remove animals with reproductive potentials from their population (Cooke 2008). Ismail *et al*. (2012) tried to use the bio-logging technique to study the captive stork population in Zoo Negara between 2010 and 2012. Both the techniques and devices i.e. digital loggers were tested on the captives to develop the best placement and to identify important behaviors of the species for future studies. They concluded that few adjustments and improvements are required

before it can be fully-applied to the re-introduced population. These include the need to use the appropriate techniques for logger deployment and its recovery, as well as the design of the device used and its recording capacity. Furthermore, the data obtained during the study had allowed for the development of an algorithm for data compression that could help in a long-term monitoring activity. Although bio-logging science has been widely used to study marine animals including seabirds, its application is still new in developing countries like Malaysia. Thus many challenges are expected before appropriate knowledge and techniques can be employed by our scientists. In general, there are still much information required on the behaviours, habitat utilisation and the daily challenges faced by the population to support any serious conservation measures. Nevertheless, the benefits that one could gain from bio-logging science to gain deeper understanding on the birds' behaviour and ecology should be explored.

Public Awareness and Support

A preliminary survey was conducted by Ismail *et al*. (2010) to determine the public's awareness and perception towards the reintroduction programme. Out of the 60 respondents, more than half of them were aware of the programme either through formal or informal communication with the staffs supervising the project. This is particularly true for those living close to the release centre. However, all of the respondents did not feel that they are responsible for the success of the programme at that time. Another survey with an equal sample size conducted between 2013 and 2014 showed that the public was more informed and aware of the Milky Stork presence (more than 95% of the respondents surveyed). Some locals even acted as informants of the population's whereabouts and activities which made monitoring and protection of the Milky Storks easier. Although the waterbirds in general are regarded as pest or threat to the aquaculture industry as they prey on aquaculture products, the losses are actually relatively low compared to other causes of mortality such as diseases, accidents, and poor water quality (Kushlan & Hafner 2000). As the Milky Storks foraging areas also comprise of extensive shrimp farms throughout Kuala Gula, regular meetings with shrimp farmers or workers helped to educate them and raise their awareness on the importance of protecting the released population. In addition, continuous engagement with the public including tourists by researchers during the research activity and visits they made to the release centre also had similar impact. Therefore, continuous engagement of the staffs and researchers with the public also played an important role as part of the integrated efforts to conserve the reintroduced population.

Suggestions to Improve the Current Re-introduction Programme

According to Ismail *et al*. (2010) almost all of the individuals sent to Kuala Gula were at a very young age, between 1–3 years old. One of the reasons for the selection of young individuals is to avoid losing the birds as they are less mobile and unlikely to leave the area. As for their ability to breed, the population has been reported to achieve sexual maturity at the age of 3 years old (Yaacob

2008). However, considering the prolonged time spent in captivity as well as the lack of experience of the population prior to release, their adaptation can be very slow in the new environment. In addition to that, the population was also continuously exposed to and fed by humans during their conditioning phase in Kuala Gula which could further delay their adaptation process after being released. As the wild Milky Stork population in the country is close to extinction, captive source is used as a last resort for the reintroduction. However, artificial selection in captive environments has been found to erode the genetic basis for morphological, physiological, and behavioural traits resulting in the captive-born individuals unable to perform correct behaviour in a given situation or not performing well enough to survive in the wild (Miller *et al*. 1999; McPhee 2003). Thus, emphasis should be given to develop specific skills that are important to the population's survival.

Based on past experiences and available reports, the following suggestions could help improve the Milky Stork re-introduction programme:

1. Improvement of the captive training method
   There is a need to improve the current approach or technique used to train captives during conditioning or pre-release phase. These include: a) predator avoidance (recognition and aversion) to help develop appropriate anti-predator behaviour; b) locomotion and fitness training, whereby according to Reading *et al*. (2013) most animals from a captive environment receive insufficient exercise and opportunities to develop appropriate level of fitness they require after release. In addition, most mortality occurred during the period immediately after release due to lack of fitness while simultaneously facing challenges of avoiding predation and learning about the new environment (Miller *et al*. 1990). Therefore, providing appropriate stimuli to increase the captives' fitness is very important prior to their release especially if the space of the enclosure is small; and c) developing appropriate foraging skills among the captives by developing or promoting desired skills that are necessary to forage efficiently in the wild. However, little information on the bird's biology and ecology are available at the moment. Therefore we encourage more researchers from different backgrounds to collaborate among themselves, focusing their efforts on studying endangered species like the Milky Stork.
2. Improvement of the enclosure's condition and environment
   Another important aspect that needs to be improved is the enrichment of the enclosure's environment by incorporating natural trees for perching and nesting as well as the inclusion of a natural foraging ground i.e. mudflat area for the birds to better adapt to the new environment. This will work in tandem with the previous training given to the Milky Stork population so that they can forage independently and effectively after being released. However, the current enclosure used during the conditioning phase may not be sufficient to sustain a large number of captives. Thus, a bigger enclosure is required and if possible, a new one

should be built farther from the current anthropogenic activities in Kuala Gula.

3. Use of a skilled individual as a model to promote the correct social setting
   Prolonged time and generations in a captive environment increases the degeneration of behaviour skills which reduce the survival rate of the reintroduced population (Kraaijeveld-Smit *et al*. 2006; Shier & Owings 2006). In addition, it was found that learned behaviours often degrade faster than genetic diversity during captivity (May 1991; Alberts 2007). Thus, the use of a skilled individual or a group of them as a model to promote the correct social setting among the captives can be considered.
4. Protection of the remaining mangrove forest
   Another serious concern is that with the ongoing development pattern in Kuala Gula, the availability of undisturbed areas may be inadequate to sustain the increasing number of populations in the future. Although the stork population may be able to take advantage on the massive aquaculture activity in the area, the same thing may not apply for their breeding. Therefore, the remaining undisturbed foraging areas and the mangroves should be protected as not to restrict the bird's nesting and foraging activities in the future.
5. Establishment of buffer zones
   There is also a need to create buffer zones to help mitigate the negative impacts from continuous anthropogenic activities and increasing pollution causing activities along Kuala Gula coastal area.
6. Maintaining public support and awareness
   Engagement with the public i.e. giving talk, seminar, exhibition, and other related awareness programmes should be done continuously to ensure consistent support and the long-term success of the re-introduction programme.

To summarise, the challenges currently faced by the programme stem from several reasons which include: (1) conflicting interest over the promotion of capital development versus conservation matters; (2) lack of pre-release preparations of the subject; (3) increasing pollution threats from anthropogenic activities; and (4) few studies conducted to understand the bird's behaviour and ecology after release. The importance of the Kuala Gula habitats to the released Milky Stork population as well as other resident and migratory birds should be included in Kuala Gula's conservation framework. The above suggestions may help tackle some of the main problems that are currently faced by the programme. However, for a long-term solution, more engagement from local scientists to conduct integrated studies as well as support from the authority and the public are required. Emphasis should also be given on achieving biodiversity sustenance rather than aggressive economic development throughout Kuala Gula to maintain its status as one of the important bird sanctuaries in the country.

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