UNIVERSITI PUTRA MALAYSIA

BEHAVIOURAL PATTERNS AND ACTIVITIES OF NEWLY-INTRODUCED BLACK SWAN TO OPEN LAKE ENVIRONMENT IN PUTRAJAYA WETLANDS

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BEHAVIOURAL PATTERNS AND ACTIVITIES OF NEWLY-INTRODUCED BLACK SWAN TO OPEN LAKE ENVIRONMENT IN PUTRAJAYA WETLANDS

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CERTIFICATION

It is hereby certified that we have read the project entitled "Behavioural Patterns and Activities of newly-introduced Black Swan to open lake environment in Putrajaya Wetlands" by Maisarah Binti Amran and in our opinion is satisfactory in terms of scope, quality, and presentation as partial fulfillment of the requirement for the course VPD 4999 – Final Year Project.

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DEDICATION

This study is dedicated to my loving and supportive parents, Amran Bin Sharif and Hawa Mohd Nasir, my siblings, my supervisor, Prof. Madya Dr. Lokman Hakim Bin Idris, as well as all my friends that were involved directly or indirectly during the completion of the project. Thank you everyone.

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This project could not have been possible without the support of my family, my cats and my friends. Your advice and encouragement have helped me throughout the completion of the project. Thank you once again to everyone.

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ABSTRAK

Abstrak daripada kertas projek yang dikemukakan kepada Fakulti Perubatan Veterinar untuk memenuhi sebahagian daripada keperluan VPD 4999 – Projek Tahun Akhir.

CORAK TINGKAH LAKU DAN AKTIVITI ANGSA HITAM BARU YANG DIPERKENALKAN KEPADA PERSEKITARAN TASIK TERBUKA DI TAMAN WETLAND PUTRAJAYA

oleh

Maisarah Binti Amran

2023

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Penyelia bersama: Dr. Tengku Rinalfi Putra Tengku Azizan

Persekitaran hidup baru mempunyai pengaruh penting dalam kajian tingkah laku spesies burung air. Corak tingkah laku dalam pergerakan, mencari makan, berehat, pembersihan diri dan aktiviti sosial memberikan gambaran yang terperinci dalam mengenal pasti tindak balas terhadap persekitaran hidup yang berbeza dan mengenalpasti potensi risiko pemangsa. Terdapat kurang penyelidikan tentang penyesuaian tingkah laku Angsa Hitam yang dilahirkan di tasik dalam persekitaran tanah lembap kerana terdapat jumlah yang terhad bagi spesies burung air yang berkaitan di negara ini. Oleh itu, objektif kajian ini adalah untuk

menerangkan corak tingkah laku dan interaksi sosial Angsa Hitam dengan spesies burung lain dalam persekitaran tasik terbuka di Wetland Putrajaya. Jadual masa perlakuan Angsa Hitam jantan dan betina direkodkan untuk enam kategori tingkah laku. Data yang dikumpulkan terdiri daripada pemerhatian selama 30 minit pada waktu pagi, petang dan petang untuk tempoh dua minggu. Secara keseluruhan, aktiviti utama yang dijalankan oleh kedua-dua Angsa Hitam ialah berehat (35%), diikuti dengan pembersihan diri (22%), mencari makan (17%), tingkah laku lokomotif (15%), tingkah laku sosial (7%) dan tingkah laku lain yang tidak termasuk dalam kategori utama (4%). Di samping itu, interaksi intraspesies dan interspesies Angsa Hitam telah berlaku pada minggu kedua pemerhatian di kawasan tasik tengah di mana corak tingkah laku ini menunjukkan tempoh penyesuaian sosial Angsa Hitam dalam persekitaran hidup baharu. Penemuan keadaan ini menunjukkan bahawa tingkah laku semula jadi yang dipaparkan dalam persekitaran tasik terbuka boleh membantu menilai corak tingkah laku biasa Angsa Hitam semasa tempoh penyesuaian dan memberikan bantuan dalam pengurusan spesis burung lain seperti itik di masa yang akan datang.

Kata kunci: *Corak tingkah laku, persekitaran tanah lembap, Angsa Hitam, interaksi sosial*

ABSTRACT

An abstract of the project paper presented to the Faculty of Veterinary Medicine in partial fulfilment of the course VPD 4999 – Final Year Project.

BEHAVIOURAL PATTERNS AND ACTIVITIES OF NEWLY-INTRODUCED BLACK SWAN TO OPEN LAKE ENVIRONMENT AT PUTRAJAYA WETLANDS

By

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2023

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New living environment has an important influence in the behavioural study of the waterbird species. The behavioural patterns in locomotion, foraging, resting, self-maintenance and social activities provide a better insight in identification of responses towards different living environment and recognition of potential predator risk. Research about the behavioural adaptation of lake-born Black Swan in the wetland environment is less present due to limited amount of the related waterbird species in the country. Thus, the objective of this study is to describe the behavioural patterns and the social interaction of Black Swan with other bird species in the new open lake environment at Putrajaya Wetlands. The time budgets of a male

and female Black Swan were recorded for six categories of behaviour. The data collected comprised of 30 minutes observation in the morning, afternoon and evening for two weeks. Overall, the major activity carried out by the Black Swan was resting (35%), followed with self-maintenance (22%), foraging (17%), locomotive behaviour (15%), social behaviour (7%) and other behaviour that were not included in the main categories (4%). In addition, the intraspecies and interspecies interaction of Black Swan had occurred during the second week of observation at the central lake area; indicating the social adaptation period in the new living environment. The findings indicated that the natural behaviours displayed in the open lake environment can help to evaluate the normal behavioural patterns of Black Swan during the adaptation period and provide assistance in the management of other species such as duck species in the future.

Keywords: *Behavioural patterns, wetland environment, Black Swan, social interaction*

CHAPTER 1

INTRODUCTION

Black swan is a waterbird that originated from Australia and can acclimatize well in the wetland areas. The different characteristic of native Australian Black Swan when compared to other native white swans of Europe and North America is through the presence of black plumage on their body (Karawita et al., 2023). The age groups of Black Swan can also be identified whereby the first-year group will have gray plumage, dull bill color, and black tips at their primaries (Marchant and Higgins, 1990). The black tips on some of the primaries will be kept in second-year group and the adult group will have black plumage with pure white primaries (Kraaijeveld et al., 2004).

The black swan are typically active during the day and identified as herbivorous waterbirds that mainly feed on vegetation available both on the water and pastures (Kissane, 2019). Black swans are also territorial and monogamous which means they remain with their solitary pairs. At their natural habitat, the breeding period will start at the age of 2 to 4 years. The hatching of cygnets will be present in every month except for November where the peak of hatching is during March–April and August– September (Coleman, 2014) in Australia.

The general behaviour during their lives in the wetland area usually consists of locomotion such as walking and swimming; resting such as floating on water and standing on land; self-maintenance such as preening and bathing; and foraging for feeding, grazing and drinking.

The adaptation of black swans in a new environment after in captivity is less observed and there may be instances where the socialization with other swans and birds can affect the productivity of the previously-captive black swans. Therefore, the behavioural study is important to identify the general and abnormal behaviour displayed by the swans during their adaptation period. In addition, detailed and thorough observations on the behaviour of animals can allow a better understanding of their requirements, preferences, disapproval and internal conditions (Mench and Mason, 1997). Hence, the objectives of this study are:

(i) To describe the behavioural patterns of Black Swan in the new open lake environment

(ii) To identify the social interaction between Black Swan and other waterbirds

CHAPTER 2

LITERATURE REVIEW

2.1 Wetland environment

According to Rajpar et al. (2018), the wetland environment is directly and indirectly required for the continuity and existence of the waterbird species. The wetlands contain high availability of vegetation and extensive food resources that enable various migrants and resident waterbird species to operate a mixture of activities (Rajpar & Zakaria, 2013). Thus,

the adaptation of waterbird in the wetlands becomes an indicator for the quality and health of ecosystem (Peron et al., 2013).

2.2 Black Swan

The Black Swan, *Cygnus atratus*, is native and largely resides in the wetland of Australia before being introduced to New Zealand in the 1800s (Miers & Williams, 1969) that results in an abundant number of the species. In present days, black swan has remained as native species to both Australia and New Zealand and some of the species are introduced to other parts of the world. According to Karawita et al. (2023), the special feature of black plumage is unique to the species compared to the white swans that originated from Europe and North America which made them distinctive and easy to identify.

The differentiation between genders in black swans can be identified through the distinction of heavier and longer-necked male swans when compared to their female swans. As for age, according to Kraaijeveld et al. (2004), the adult swans will have black plumage with pure white primaries compared to the second-year swans that reserve black tips on certain primaries, and the first-year group will have gray plumage, dull bill color, and black tips at their primaries (Marchant & Higgins, 1990). Meanwhile, cygnets will have greyish colour on the body as they have not fully developed the black colouration.

Black swans as waterbirds mainly reside in wetland environments and play an important role in maintaining the ecosystem (Green & Elmberg, 2014). In their natural habitat, they are the only large grazer of intertidal seagrass meadows and undergo breeding season depending on the climate of the living habitat. According to a study by Coleman (2014) in southeast Queensland, Australia, the average age of first pairing and breeding was 3 years for both males and females during the 6-year research. Coleman (2014) also discussed that the breeding behaviour and hatching success rate of black swans depends on the management and suitability of the climate condition in the respective living environment. According to Braithwaite (1977), black swan is one of a small number of Anatidae that have males aiding in incubating the eggs during the breeding season. Hence, full information and understanding in black swan behaviour are still lacking and further research need to be made for further study.

The information of adaptation of Black Swan in a new open lake environment is less known and not fully understood. It can be developed by understanding the behavioural patterns and activities of black swans in their natural environment. The behavioural study is important to determine potential stressors or conditions that can make them unable to live in their new habitat.

2.3 Behaviour in Black Swan

2.3.1 Locomotive behaviour

Black Swan are the waterbird species that have the adapted feature for aquatic living environments. The locomotion for Black Swan consists of swimming, flying and walking according to previous study by Payne et al. (2012). The feet placement for swimming behaviour is toward the end of the body which includes paddling movement that allow for forward body movement. For walking behaviour, the feet will be located under the body's center of gravity. This different type of adaptation on land and water enables the black swan to enhance their movement and carry out the normal routine in other activities such as foraging, resting and socializing behaviour.

2.3.2 Foraging behaviour

According to Sibley et al. (2013), larger bodied geese and swans tend to be herbivores and thus, the foraging behaviour is directed towards plants. Foraging behaviour of waterbird species including Black Swan consist of grazing, feeding on water surface by submerging bill and neck or upending and drinking. Previous research revealed that early morning and before dusk was the most concentrated period for foraging activity (Bowler, 1996) compared to the afternoon period where low foraging activity can be detected (Wood et al., 2020).

Another research by Dos Santos et al. (2012) showed that static intensive grazing indicates absence of disturbance near the swans while grazing behaviour while swimming indicates occurrence of disturbance near the black swans. The movement between grazing activity can

assist in identifying potential stressors in their surroundings and the suitability of their living condition.

2.3.3 Resting and self-maintenance behaviour

In the study by Payne et al. (2012), the resting behaviour of black swans involves standing or sitting on land, and floating on the water surface. According to several studies involving other types of waterbirds, resting is also one of the behavioural activities that made up the highest proportion in the time budget. This is because resting allows them to conserve energy and maintain well-being. According to Wang et al. (2015), the resting behaviour of waterbirds can be affected by factors such as disturbance, water availability, food abundance and shelter condition.

Self-maintenance behaviour is focused on completing specific tasks for the maintenance of the individual's physical condition and for black swan, the behaviour consists of preening, bathing and stretching of legs and wings. Preening activity can be described as action involving fluffing of feathers and combing with bills to maintain cleanliness and ensuring the feathers are neatly arranged. This is because according to Wlodarczyk (2017), the feathers need to be maintained properly as it is required for adequate insulation and flight function. In addition, well-preened feathers are also used for effective social communication which is shown through the plumage display by pairs of black swans.

2.3.4 Socializing behaviour

The social behaviour of black swans according to Sibley et al. (2013) is aimed to exchange information to another individual and this consists of vocalization and agonistic behaviour. The vocalization of birds may range from low to high frequency and the vocal signals may deliver information regarding the size, identification and motivation of the sender depending on various levels of reliability (Searcy & Nowicki, 2005).

As for the agonistic behaviour of black swans, it can be characterized by the distinct display of arched and curved neck posture with head directed downwards and simultaneously fluffing of feathers with wings positioned over the body in an arched manner. This category may also include aggressive behaviour such as pecking activity during access to limited resources such as food or preferred breeding or resting locations. (King 1973; Amat 1990; Pelligrini 2008).

2.4 Behavioural adaptation of Black Swan in a new environment

For this study, the behavioural patterns and activities of black swan in a new open lake environment will be further identified and allow for identification of possible stressors and modification needed to improve their living condition. This is because behaviour can indicate the primary response of animals towards environmental changes. In addition, behavioural observation of species in their natural environment can also provide knowledge about their

requirements, adaptation and inner condition that are crucial for their health and well-being (Munday & Rose, 2022).

CHAPTER 3

MATERIALS AND METHODS

3.1 Study site and sample population

The study site for this research was at Putrajaya Wetlands, Putrajaya, Malaysia. Putrajaya Wetlands Park area covers 197.2 hectares and becomes the main habitat for various aquatic animals. The park is also the largest man-made freshwater wetland in Malaysia and the Tropics. With this environment setting, the waterbird species such as Mallard, Egyptian geese, Pelican, White Chinese geese and Black Swan were able to reside and adapt to the wetlands environment that are similar to their natural habitat.

Two samples consisting of a male and female black swan were taken from the quarantine area as both of the swans were previously kept captive for breeding period. The research was focused on the adaptation of black swans in the new open lake environment after they are released from captivity to allow for adaptation in the wetland area.

3.2 Data collection

Behavioural observations of the Black Swan were conducted for 14 days in the month of September. Based on the information from previous literature by Payne et al. (2012), an ethogram of six main behaviours was created. The data was collected with a single researcher's observations while the description of behaviour was referenced and added from previous literature.

Table 1. Description of various behaviour of Black Swan according to five main categories and one additional category.

Behaviour	**Description**
Locomotion	Moving to another place by swimming in the water (paddling with its legs), flying or walking (moving on land with its legs)
Foraging	Seeking feed by feeding or grazing on water surface and drinking water
Self-maintenance	Preening by cleaning the feathers using the bill or bathing by diving underwater and re-emerge onto the water surface
Social	Displaying behaviour associated with other swans/birds such as vocalization and agonistic behaviour
Resting	Sitting on land or floating on water without any other activities

Others	Other type of behaviours that are not included in the categories

Focal sampling method was implemented to observe the pair of Black Swan that had been newly-introduced into the open lake environment. The observations were recorded at 5-minute intervals in a one-hour period which resulted in total of 30-minutes observation for each session. All sessions were conducted in the morning (08:00-09:00), afternoon (11:00-12:00) and evening (16:00-17:00). A pair of binoculars was used for careful examination of the behaviour of Black Swan during their active and inactive states.

The weather condition was also recorded using Weather application from Google to observe the effect of temperature towards the behaviour of Black Swan. The resting and feeding areas were also observed to identify the effect of location with the behavioural pattern of Black Swan. Other observations also include the interaction of Black Swan with human visitors, conspecifics and heterospecifics socialization.

3.3 Data Analysis

For this study, all data was recorded in Microsoft Excel spreadsheet. The data were analysed by calculating the average percentage for the frequency of each behaviour and comparison was made based on average between weeks, average between genders and average between sessions (for each swan).

CHAPTER 4

RESULTS

Overall result shows that most activity carried out is resting behaviour (35%) while followed by self-maintenance behaviour (22%), foraging behaviour (17%), locomotive behaviour (15%), social behaviour (7%) and other activities (4%).

As for the comparison between weeks, **Figure 1** shows that the first week of observation has a higher mean percentage of locomotion, foraging and social behaviours compared to the second week of observation. However, resting and self-maintenance behaviour are lower on the 2nd week of observation compared to the first week of observation.

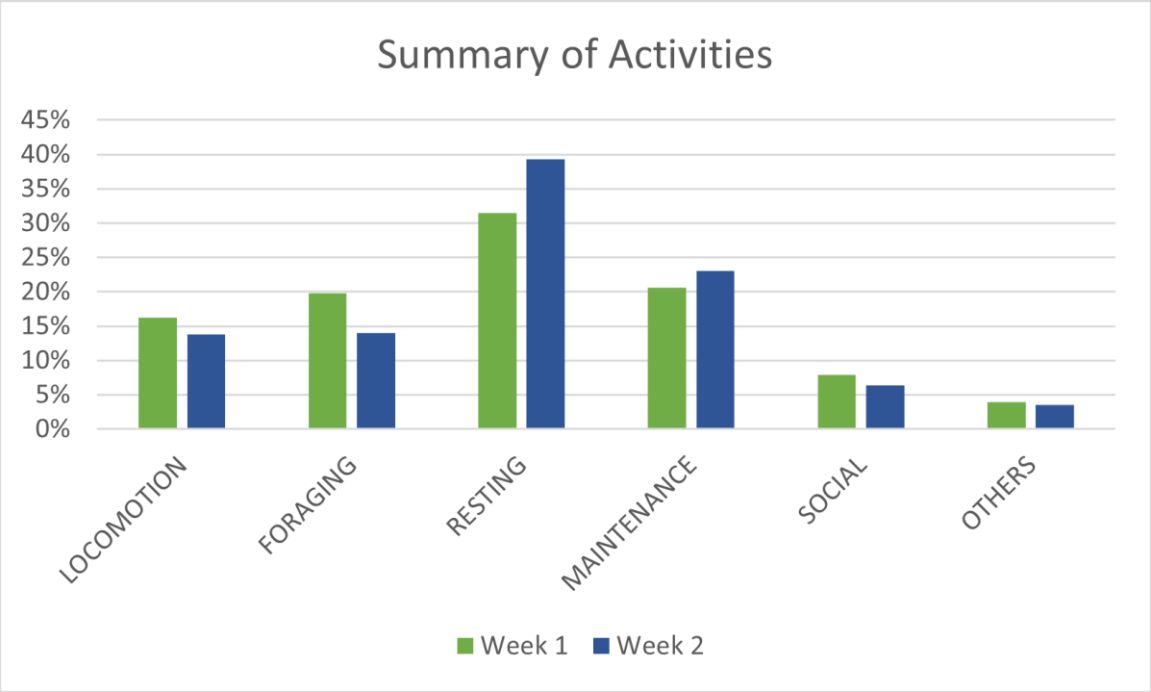

Figure 1: Summary of activities between weeks

As for the comparison between sexes in **Figure 2**, the mean percentage of behaviours are not significantly different.

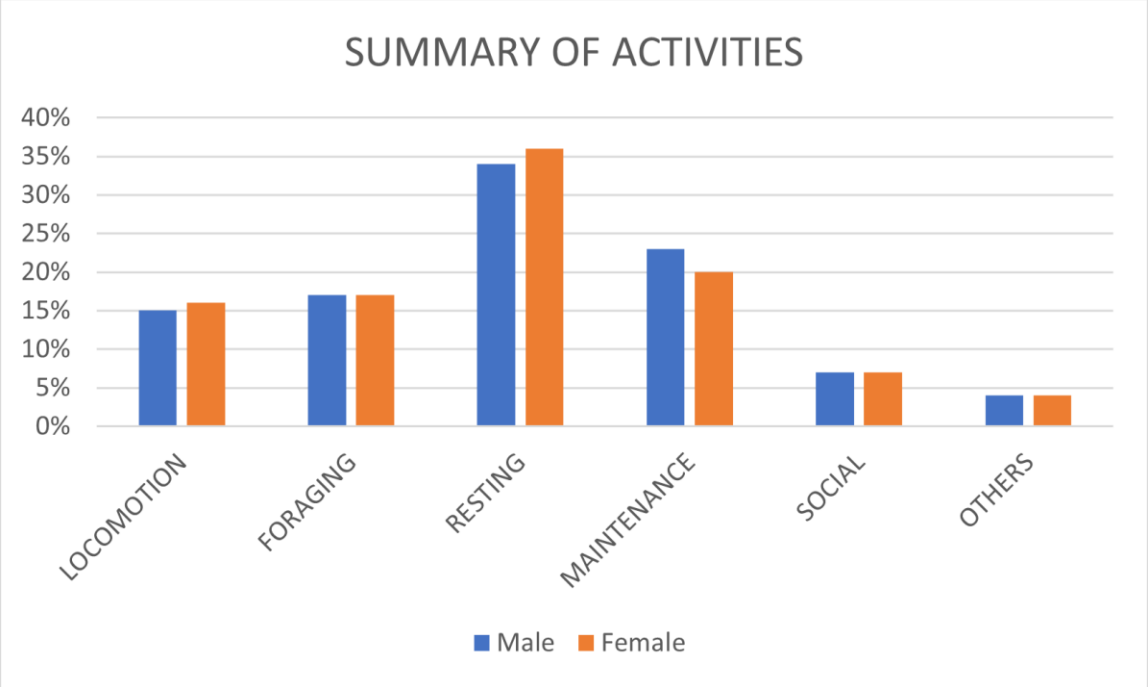

Figure 2: Summary of activities between male and female

Looking into finer details, the behaviours of male swan during morning, afternoon and evening sessions vary between sessions as shown in **Figure 3** where resting behaviour were carried out the most in the daily routine.

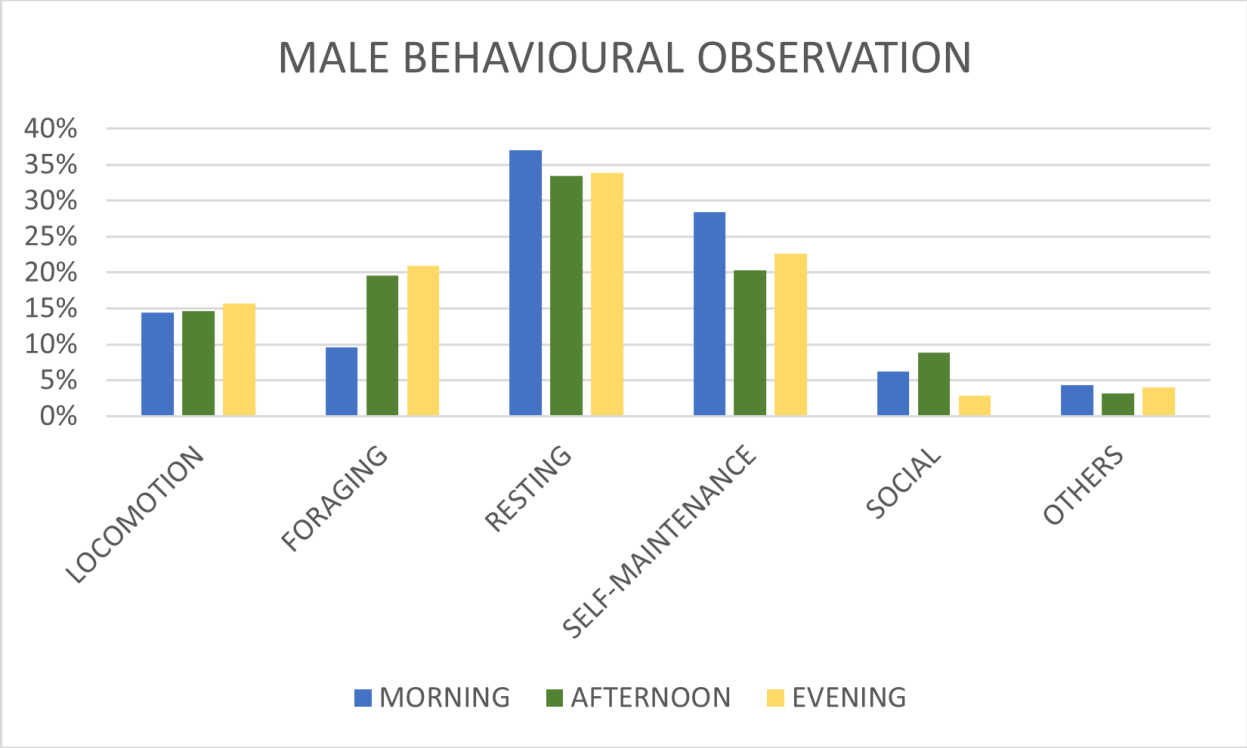

Figure 3: Daily activity pattern of male Black Swan during the behavioural observation

Furthermore, this pattern also applies to female black swan as shown in **Figure 4** where resting behaviour was also performed the most compared to other type of behaviour.

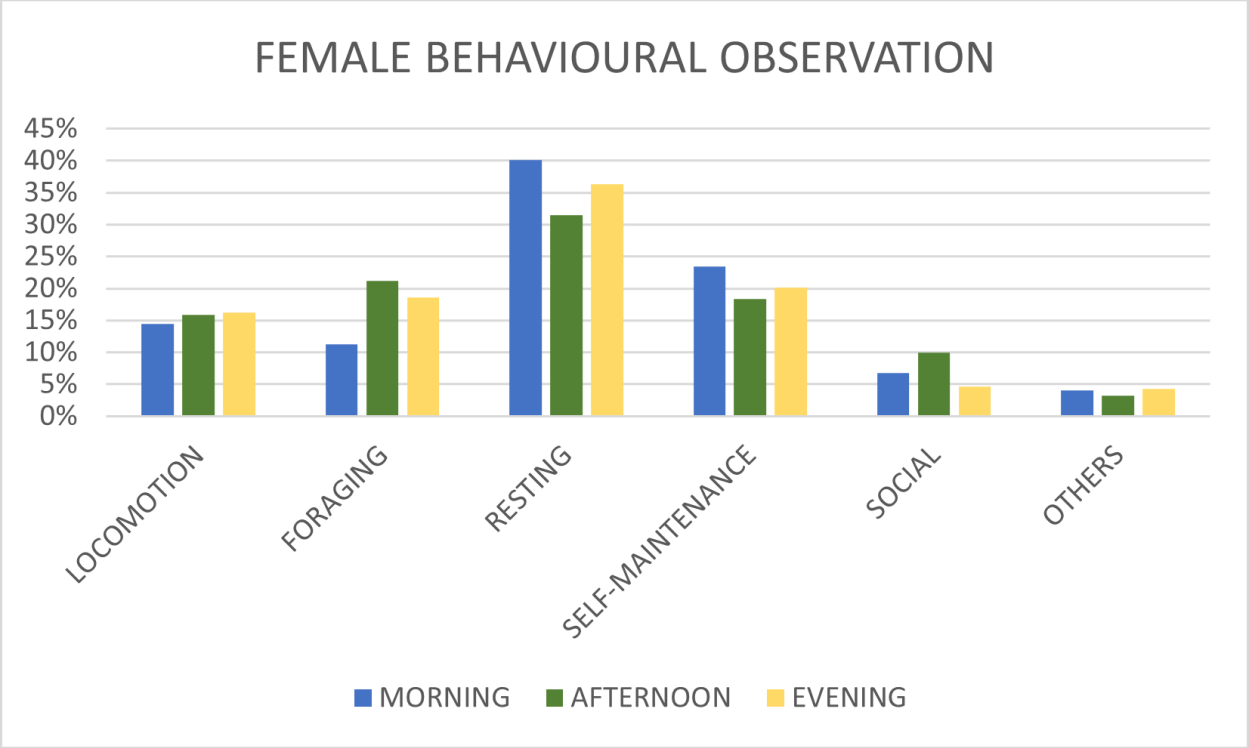

Figure 4: Daily activity pattern of female Black Swan during the behavioural observation

One of the noticeable behaviour during the observation period was the vocalisation behaviour during presence of humans or noise in the environment. The black swans were observed to be vocalizing when there was human presence nearby. The black swan also vocalized when other birds were nearby their surroundings and engage in aggressive behaviour if the birds were disturbing their resources such as food or living area. In the first week of observation, the black swans tend to isolate themselves from the other flock of black swans but start to engage in social behavior during the second week of observation. For the interaction of black swans with other birds, they were able to live together without engaging in aggressive behaviour except during feeding and resting periods.

CHAPTER 5

DISCUSSION

5.1 Overall time budget

According to Payne et al. (2012), black swans spent most of their diurnal time with foraging, locomotion, resting and self-maintenance and least social interactions. The overall result for behaviour of black swan in this study was similar to the research by Payne et al. (2012), as the majority of activities carried out also comprised four main activities involving foraging, locomotion, resting and self-maintenance behaviour. Social behaviour was less performed by the swans compared to other main behaviour while other types of behaviour such as stereotypic behaviour was also observed.

5.2 Effect of time on behaviour

In the first week of observation, the black swans spent more time on locomotion, foraging and social behaviours. This pattern may be due to their adaptation period in a new environment which caused more engagement in active activities. After proper adjustment in the new environment was carried out, more time was spent on resting and self-maintenance behaviour which can be observed during the second week of observation.

5.3 Effect of sex on behaviour

As for the behavioural patterns between male and female black swan, there was minor difference between the activities carried out. This pattern may be due to the lifestyle of black swans which generally live in pairs and perform similar activities with different frequency. As there was a lack of study in the comparison of behavioural activities between male and female black swans, another study was referenced for different species of swan where Wlodarczyk (2017) explained that the daily pattern of resting in Mute swans is different in both sexes while foraging and activities involving movement did not depend on the sex of the bird. Therefore, the effect of sex in the behavioural patterns of black swans was indistinguishable when newly-introduced into the new environment.

5.4 Effect of sessions on behaviour

For the male black swan, the most noticeable changes between morning, afternoon and evening sessions were foraging behaviour where the involved activities gradually increased into evening observation which ended at 5.00 pm. This pattern can also be noticed in Wlodarczyk (2017) where the foraging activity of Mute swan increases from 3 am to 3 pm or 5 pm before being reduced until late evening. The similar pattern was performed due to swans' diurnal characteristics which caused them to be more active during the day and reduced their activity by evening to reserve the energy.

For resting and self-maintenance behaviour, both swans display a similar pattern that involves reduction from morning to afternoon and gradually increases when approaching evening. Wlodarczyk (2017) also found a similar pattern in his study whereby the resting behaviour of Mute Swan declined from sunrise to midday and gradually increased approaching evening. This is because both behaviours have a high tendency to appear interchangeably during the day (Dwyer 1975; Dopfiner et al. 2009).

5.5 Effects of human presence and behaviour of Black Swan

The visitor number during the adaptation period of black swan in the new environment did not have a significant impact on their behaviour. However, the vocalization behaviour will be performed when there is human presence nearby their surroundings. The short gap between human and black swan in approximately 1 meter distance had caused discontinuation of all activities due to recognition of potential threats. According to Payne et al. (2012), the distance between human disturbance and the animal will produce different responses. Therefore, the interaction between human presence and black swan need to be further observed to identify the safe range of distance for the welfare of the waterbirds in their natural environment.

5.6 Effects of conspecifics and heterospecifics interaction in Black Swan

The social behaviour of black swan between species depended on the environmental conditions, habitat availability and the overall population density in that particular area. During the observational study, both black swans isolated themselves from other flocks of swans and started interacting only at the 8th day of observation. This condition occurred due to the adaptation period that was required to fully adjust in the new environment and the social hierarchy of the group.

For heterospecifics interaction of Black Swan with other waterbirds species, there were presence of agonistic behaviours during feeding and resting period. This condition can be explained by Peimann and Robinson (2010) research, where they stated that individuals provided with similar resources have more tendency to display aggression. The aggression involved pecking behaviour led to avoidance in other waterbirds and this behaviour was only present during feeding time. This is because the display of behaviour can allow them to gain and maintain access to the valuable resources (King 1973; Amat 1990; Pellegrini 2008).

CHAPTER 6

CONCLUSION

This study revealed the suitable amount of time for the adaptation period of black swans to adjust in their new environment. The activities carried out during the period were also similar to their activities in natural habitat and the activity-patterns were more diverse compared to published data on their general behaviour. It is also important to note that the social interaction between the same and different species of waterbirds play a major influence in determining the adaptability of black swans in their new environment. This study has produced information on the behavioural patterns and activities of newly-introduced black swan in the open lake environment of Putrajaya Wetlands and can serve as the baseline guidance for future management of other waterbirds species.

CHAPTER 7

RECOMMENDATION

In future studies, there are a few recommendations that can improve the behavioural study of black swans. One of the improvements that can be made is by increasing the number of sample because the individual observation of black swan in this study is inadequate to form a general understanding on the topic. Other recommendation can also include providing a better standardized detail in forming the ethogram as there is limited information on the baseline of potential stress level in black swan. A range of frequency of each behaviour need to be included for identification of normal behaviour and abnormal behaviour that is caused by stressors in their surroundings. Hence, it is important to gain more information on the behaviour of black swan before performing further observational studies.

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APPENDICES