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Land Use Effect on Milky Stork Habitat Selection in Matang Forest Reserve, Perak

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Abstract: The global Milky Stork population has undergone a rapid population decline with a current estimated population of 5500 individuals remaining worldwide. In Malaysia, Milky Stork populations have declined more than 90% over the last 20 years and less than five individuals being observed recently in Pulau Kelumpang and Pulau Trong, the last known Milky Stork habitats in the Matang Forest Reserve. GIS application is used to analyse the habitat selection of Milky Stork in the study area. 16 different stations have been choosing in this research and a three-parameter has been set which is land use, vegetation and food availability. From the results, the highest density of Milky Stork that can be found is at Pulau Gula and the lowest density of Milky Stork is at Pulau Kelumpang which is only 1 individual who was spotted. The result from this study also shows these birds are most likely to be found in the disturbed area especially aquaculture activity. This aquaculture activity has provided them with easy access to the food source. Research finding has shown that since the captive breeding birds program implemented by the Department of wildlife and National Park (DWNP), they are most likely has lost their ability to foraging food in the wild. Some of the staff in the DWNP Pulau Gula branch said that when it was rainy days, this bird will come to their building asking for food. The results also show that environmental factor like vegetation, food and climate does not have any effects on the density of Milky Stork. This situation is very contrary to previous studies that show these birds can get their food natural habitat.

Keywords: Milky stork, habitat selection, land use, vegetation, food, GIS

1. Introduction

The Milky Stork or its scientific name is Mycteria cinerea sp. is listed as endangered species because its population had decreased drastically. This lowering population is due to rapid loss of coastal area which is turn out it's their habitats. Milky Stork can be found in mangrove area along Peninsula Malaysia, Cambodia, island of Sumatra, Bali, Jawa, Sumbawa, Sulawesi, and Baton in Indonesia (Collar, et al., 2001). Some of their landscape habitat change due to a catastrophic event such as the tsunami in 2004 and cause loss of mangrove tree. In which, mangrove tree are used for nesting (Ismail and Rahman, 2012). The population of milky Stork has undergone a constant decline since the 1980s (Li et al,2006). Thus, identification of habitat selection for Milky Stork routine activity is important.

Milky Stork is a fine beautiful mighty waterbird and this bird is one of the tourist attractions. Having tourist in our country can help our economy and promote the beautiful and unique nature we have in Malaysia. Having people acknowledge the presence of this bird can also help us to conserve this vulnerable species from extinct by point out awareness in dangerous of decline number of the population this bird facing. This bird is also important to keep the ecology system in an equilibrium state. Having Milky Stork in tidal mudflat can control the population of marine

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species such as fish, crab, shrimps and mudskipper. Milky Stork existence in the mangrove ecosystem may reflect the ecosystem stability and balance in several aspects including the stability of the mangrove tree, as well as the trophic levels and the ecology of the mangrove forest (Ismail and Rahman, 2012).

In addition, the declining population also caused by human disturbance. As the population of people increase in the area, the more intense they hunting for Milky Stork. Local people hunting Milky Stork's egg, chick, adult for food and trade them in the market. In Indonesia, they destroyed mangrove forest for development in fish farms and tidal rice cultivation (Brickle, et al. 2015). This activity had formed a threat to Milky Stork as they lost their habitats. In Malaysia, people cut the mangrove trees for development and agriculture. They need to build a building, housing, chalet for tourism and aquaculture.

In Malaysia, currently, the population of wild Milky Stork can be found in Matang Mangrove Forest Reserve near Kuala Gula Perak (Ismail and Rahman, 2011). This mangrove forest has provided an opportunity for the Milky Stork Conservation Programme. Pulau Kelumpang in Matang, Perak is an important site associated with Milky Storks in Malaysia (Ismail and Rahman, 2011).The other reasons that lead to the declining number of Milky Stork are because of the conventional method provided by the Department of Wildlife and National Park (DWNP). They key in the data manually and sometimes they did not keep it updated. This method is not systematic and error in calculating the present population of Milky Stork can occur.

In this research, the Geographic Information System (GIS) is used to upgrade the observing method that the Department of Wildlife and National Park (DWNP) used. We will observe them and their preferences in the habitats to see what factors that make this bird choose that area. The monitoring of this birds population in their habitat will be aid with Geographical Information System (GIS) application. GIS application would allow recording of a base map with a geospatial referencing system such as longitude and latitude and then to add additional layers of other information (Gislounge, 2012, Justine, 2012) regarding the population, distribution and location of Milky Storks. With the exact location aid by the map and better analysis, the data that we will have will be more valuable.

When we have valuable data, we can conserve and preserve these birds more easily because we know what type of preference that these birds need for choosing their habitat. For example, with the aid of a map from Geographical Information System (GIS) analysis, we can determine the hot spot of these birds and where they can be found. From the map, we know which area needs to be protected, and preserve for these birds. We also can control the disturbance from local people activity from destroying and pollute the habitat of Milky Stork. In addition, we can help the next researcher to monitor and observing these birds easily because we have the exact location where Milky Stork can be found in Matang Mangrove Forest Reserve in Perak.

Geographical Information System (GIS) help people to understand animal movement, habits and distribution (Selkirk et al., 2002). GIS also was concluded as an analytical tool that providing the functionality to perform spatial analysis (Chang et al., 1992). GIS is made up of two types of data, spatial data and attributes data. Spatial data refers to all types of data objects that represent geographical space; it allows locating anything in the world. Attribute data is the additional information about a spatial feature. In the past GIS was more geographic but we now see it expanding to law enforcement, journalism, environmental, agriculture, national development, geology, telecommunications, network management, architecture and engineering (Longley, et al, 2007).

2. Methodology

2.1 Study Area

Matang Mangrove Forest Reserve in Perak, coordinate 100o 30.00' East 4o 55.00' North with 101,877-hectare was gazetted as a Permanent Forest Reserve in 1906 (Khairul,2012). Matang Mangrove Forest Reserve has been proven to act as an important site for coastal migratory waterbirds and a portion of migrant forest birds. Also, act as a natural barrier from the tsunami. The lakes at Pulau Kelumpang and Pulau Terong have been recognizing as the most important feeding, roosting and breeding area. Pulau Kelumpang has brackish water and weakly alkaline (pH 7.65 – 8.5) and high conductivity while Pulau Terong has less brackish water and its pH near neutral (pH6.73 – 7.6) and both lakes have a high nutrient level. (Li, Z. W. D., et al. 2006). These two lakes also depend on each other. We can see it when the lake at Pulau Kelumpang is dry, the birds will move to Pulau Terong to find food. (Li, Z. W. D., et al. 2006). The area of Matang Mangrove Perak is shown in Figure 1 below.

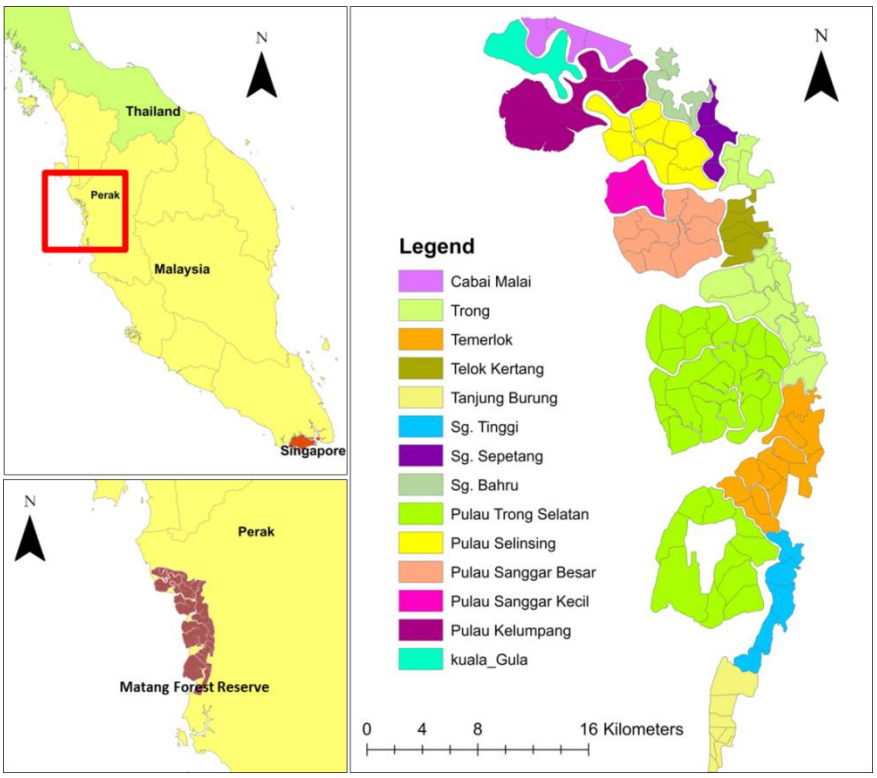

Fig. 1 - Matang forest reserve

The research was conducted at 16 different stations in Matang Mangrove Forest Reserve, Perak. This research was started on 26 November 2015 until 14 January 2016. The 16 different stations that we choose for this research are;

Table 1 - The twelve stations that we choose with their coordinates and the land use

Longitude	Latitude	Stations	Descriptions
282790.3	546207.32	Cabai Malai 1	Dry shrimp pond
284594.9	545605.79	Cabai Malai 2	Dry shrimp pond
285381.5	545328.16	Cabai Malai 3	Dry shrimp pond
286260.7	545790.87	Cabai Malai 4	Dry shrimp pond
281494.7	545929.69	Pulau Gula 1	Watery shrimp pond
281078.3	544911.72	Pulau Gula 2	Watery shrimp pond
281818.6	544865.45	Pulau Gula 3	Watery shrimp pond
282558.9	544171.37	Pulau Gula 4	Watery shrimp pond
281170.8	542089.16	Pulau Kelumpang 1	Seabass cage
279875.2	543384.76	Pulau Kelumpang 2	Seabass cage
277700.5	543060.86	Pulau Kelumpang 3	Seabass cage
281726.7	540099.49	Pulau Kelumpang 4	Seabass cage
282697.8	540423.39	Pulau Kelumpang 5	Seabass cage
282882.8	541626.45	Pulau Kelumpang 6	Seabass cage
283391.8	544356.46	Pulau Kelumpang 7	Seabass cage
282929.1	545559.52	Pulau Kelumpang 8	Seabass cage

The research area is a disturbed mangrove forest with local people activity such as aquaculture activity and housing development. Most of the stations that we observed the Milky Stork species have aquaculture activity surround them such as the Seabass cage and shrimp pond. At the research site, we found some vegetation along the Matang Mangrove Forest that is Rhizophora mucronata, Sonneratia alba and Avicennia spp. We also found some other birds species such as Leptoptilos javanicus and Brahminy kite and some migratory bird species that we found are Common sandpiper, Common redshank, Whimbrel and Common greenshank. They are all foraging their food.

Even though the mangrove forest is disturbed by human activity, there are some efforts from agencies to secure the mangrove forest area to their natural cycle. They try to replant the mangrove plant such as Bakau Minyak, Bakau Hitam and others. They also clear the land that they used for aquaculture such as shellfish farming to replant the mangrove vegetation.

2.2 Materials

Materials that we used for observation in this study as below:
a) Camera
b) Stationary
c) Notebook
d) GPS
e) Small motorised boat

Software that we used to analysed data in this study as below;
a) SPSS version 22
b) Geographical Information System (GIS)
c) Microsoft excel

2.3 Sampling and Collection Data

i. Determine the Parameter

In this research, the parameter that is taken is land use, vegetation, food availability and the density of Milky Stork. For land use, we have observed all the local people activities in that area and what type of activities are they. For vegetation, we were observed and identified all the vegetation that covered the area that we choose. For food availability, we identified what type of food that available at each station and how many types they are. Last but not least we have observed the density of Milky Stork at each of the stations and analyse how this parameter affects the distribution of Milky Stork.

ii. Observation along the River

Along with the river mouth and mudflat of Matang Mangrove Forest, we search and observe this bird at each of 16 stations. To have excess along the river, we wait until high tide occurs. This is because the boat cannot go deeper into the mangrove forest if it was low tide due to the shallow water. We start our observation along the river at 10 a.m. because at that time, the tide starting to increase. When we reach the stations, we will stop for a while to take the coordinate of the locations, observed the Milky Stork's behaviour and count them. The stations that we observed were active with aquaculture activity such as Shrimp Pond and Seabass Cage. There are four Shrimp's Pond and eight Seabass Cage. We also observed the vegetation, other animals and local people activity along the river. The data that we observed and collected are based on our parameter which is land use, food availability, and vegetation. All the data were recorded in the notebook.

iii. Observation along the Road Trip

For the road trip, we drive near the station that located side by side with the mangrove forest. We started to observe along the road trip at 1 p.m. after we finished the observation along the river. The stations that we went are the dry shrimp ponds. There are four dry shrimp ponds and those shrimp ponds were located near the residential area. These areas are full of people doing their daily activities. When we reach the destinations, we take the coordinate of the stations and count the birds again. We also observed the vegetation, local people activity and the land use on the land. All the data were recorded in a notebook.

iv. Primary and Secondary Data

In this research, we collect two types of data, primary and secondary data. The primary data is from our sampling research while the secondary data we collect from the Department of Wildlife and National Park (DWNP). We used data in the one-year range due to the range of our final year project only take one year.

Table 2 - The primary data

Data	Source	Year
The population of Milky Stork	Observation	2015-2016
Land Use	Observation	2015-2016
Vegetation	Observation and local people	2015-2016
Food Availability	Observation	2015-2016

Table 3-The secondary data

Data	Source	Year
Populations of Milky Stork	Department of Wildlife and National Park	2000-2009
Map	Forestry Department of Peninsular Malaysia	2008

v. Data Analysis

From the data that we obtain, we use SPSS version 22 to analyse to found out the significance of the data. For the coordinate that we get, we use it to map the location of the population distribution hotspot of the Milky Stork. GIS application help to interpret the data in mapping and statistical analysis.

3. Result and Discussion

3.1 Density of Milky Stork

Table 4 below shows the density of Milky Stork at each of 16 different stations with coordinates and the land activity at each of the stations.

Table 4 - Density of Milky Stork in 16 different stations in Matang mangrove forest area

Longitude	Latitude	Stations	Land Activity	Density Of Milky Stork
282790.3	546207.32	Cabai Malai 1	Dry shrimp pond	5
284594.9	545605.79	Cabai Malai 2	Dry shrimp pond	2
285381.5	545328.16	Cabai Malai 3	Dry shrimp pond	4
286260.7	545790.87	Cabai Malai 4	Dry shrimp pond	3
281494.7	545929.69	Pulau Gula 1	Watery shrimp pond	7
281078.3	544911.72	Pulau Gula 2	Watery shrimp pond	4
281818.6	544865.45	Pulau Gula 3	Watery shrimp pond	6
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281170.8	542089.16	Pulau Kelumpang 1	Seabass cage	1
279875.2	543384.76	Pulau Kelumpang 2	Seabass cage	1
277700.5	543060.86	Pulau Kelumpang 3	Seabass cage	5
281726.7	540099.49	Pulau Kelumpang 4	Seabass cage	2
282697.8	540423.39	Pulau Kelumpang 5	Seabass cage	3
282882.8	541626.45	Pulau Kelumpang 6	Seabass cage	1
283391.8	544356.46	Pulau Kelumpang 7	Seabass cage	3
282929.1	545559.52	Pulau Kelumpang 8	Seabass cage	1

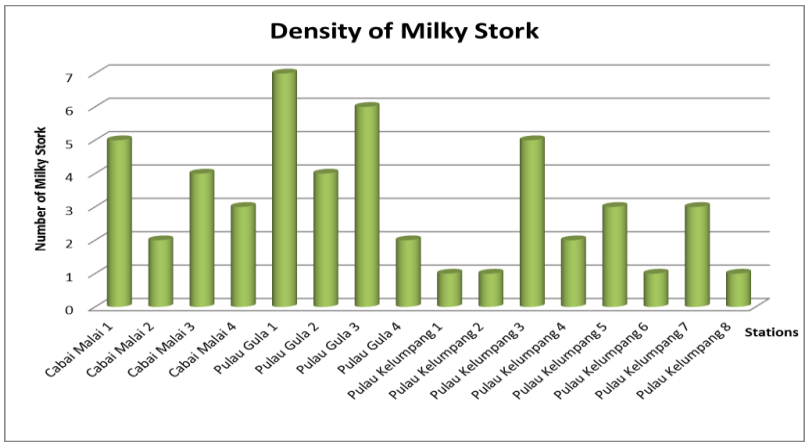

Fig. 2 - Number of Milky Stork based on sampling stations

From Table 4 and Figure 2, a total of 50 individuals of Milky Stork were observed in 16 selected stations in Matang Mangrove. From Figure 3 above; Pulau Gula 1 shows the highest number of individuals founds which are seven while Pulau Gula 3 shows six individuals while Pulau Kelumpang 3 and Cabai Malai 1 shows five individuals. At Pulau Gula 2, there are four individuals of Milky Stork were found. Cabai Malai 4, Pulau Kelumpang 5 and Pulau Kelumpang 7, there were three individuals found while at Cabai Malai 2, Pulau Gula 4 and Pulau Kelumpang 4 there are only two individuals of Milky Stork were found. The rest of the location which are Pulau Kelumpang 1, Pulau Kelumpang 2, Pulau Kelumpang 6 and Pulau Kelumpang 8 show the lowest number of Milky Stork found which one individual only.

3.2 Land Used Activity

Based on table 5 below, there is a list of activity that happened at each of the stations that we choose.

Table 5 - The density of Milky Stork and land use at each station

Stations	Land Use	Density
Cabai Malai 1	Dry shrimp pond	5
Cabai Malai 2	Dry shrimp pond	2
Cabai Malai 3	Dry shrimp pond	4
Cabai Malai 4	Dry shrimp pond	3
Pulau Gula 1	Watery shrimp pond	7
Pulau Gula 2	Watery shrimp pond	4
Pulau Gula 3	Watery shrimp pond	6
Pulau Gula 4	Watery shrimp pond	2
Pulau Kelumpang 1	Seabass cage	1
Pulau Kelumpang 2	Seabass cage	1
Pulau Kelumpang 3	Seabass cage	5
Pulau Kelumpang 4	Seabass cage	2
Pulau Kelumpang 5	Seabass cage	3
Pulau Kelumpang 6	Seabass cage	1
Pulau Kelumpang 7	Seabass cage	3
Pulau Kelumpang 8	Seabass cage	1

From table 5 above, we could see that all of the areas at the stations are active with aquaculture. These lands are already disturbed by human activity. The total number of the individual that can be found at Dry Shrimp Pond is 14. At Watery Shrimp pond, the total number of Milky Stork that can be found is 19 while at Seabass Cage 17 individuals can be found.

To assess the relationship between the land use and the density of Milky Stork at each of the stations, a K Independent Sample Test, under Nonparametric statistical analysis test using (SPSS Ver.22) was run to investigate if there is a significant difference in the relationship between the type of land use and the distribution of Milky Stork (Table 6). The land use was divided into three groups, Dry Shrimp Pond, Watery Shrimp Pond and Seabass Cage and each of the group was denoted as 1, 2, and 3 respectively (Table 7).

Table 6 - Descriptive statistics

	N	Mean	Std. Deviation	Minimum	Maximum
Density	16	3.13	1.893	1	7
Land Use	16	2.25	0.856	1	3

Table 7 - Kruskal-Wallis test

Land Use	N	Mean Rank
Dry Shrimp Pond	4	10.00
Watery Shrimp Pond	4	12.13
Seabass Cage	8	5.94

Table 8 - Test statistics

Chi-Square	Df	Asymp. Sig.
5.186	2	0.075

Based on Table 8, the significance value is 0.075. We fixed the significance value at $p<0.05$. There is no significant difference between the stations. Thus, the type of land use does not affect the distribution of Milky Stork.

3.3 Land Cover

Table 9 below shows the type of vegetation at each of the stations and the density of Milky Stork respectively.

Table 9 - Type of vegetation at each of 16 different stations

Stations	Type of Vegetations	Density
Cabai Malai 1	*Rhizophora mucronata,* and *Avicennia spp*	5

Cabai Malai 2	*Rhizophora mucronata*, and *Avicennia spp*	2
Cabai Malai 3	*Rhizophora mucronata*, and *Avicennia spp*	4
Cabai Malai 4	*Rhizophora mucronata*, and *Avicennia spp*	3
Pulau Gula 1	*Rhizophora mucronata*, and *Avicennia spp*	7
Pulau Gula 2	*Rhizophora mucronata*, and *Avicennia spp*	4
Pulau Gula 3	*Rhizophora mucronata*, and *Avicennia spp*	6
Pulau Gula 4	*Rhizophora mucronata*, and *Avicennia spp*	2
Pulau Kelumpang 1	*Avicennia* spp. and *Sonneratia alba*	1
Pulau Kelumpang 2	*Avicennia* spp. and *Sonneratia alba*	1
Pulau Kelumpang 3	*Avicennia* spp. and *Sonneratia alba*	5
Pulau Kelumpang 4	*Avicennia* spp. and *Sonneratia alba*	2
Pulau Kelumpang 5	*Avicennia* spp. and *Sonneratia alba*	3
Pulau Kelumpang 6	*Avicennia* spp. and *Sonneratia alba*	1
Pulau Kelumpang 7	*Avicennia* spp. and *Sonneratia alba*	3
Pulau Kelumpang 8	*Avicennia* spp. and *Sonneratia alba*	1

Based on Table 9, the surrounding area within the station vicinities was covered by mangrove vegetation such as Rhizophora mucronata, Avicennia spp. and Sonneratia alba. From Cabai Malai 1 to Pulau Gula 4, the stations are covered by Rhizophora mucronata and Avicennia spp while at Pulau Kelumpang 1 to Pulau Kelumpang 8; the stations are covered with Avicennia spp. and Sonneratia alba. At the stations that covered with Rhizophora mucronata and Avicennia spp, the total number of Milky Stork that can be found is 33 individuals while the total number of Milky Stork that can be found at the stations that covered with Avicennia spp. and Sonneratia alba is 17 individuals.

To assess the relationship between the type of vegetation and the density of Milky Stork at each of the stations, we run the Levene's Test (Independent sample t-test) statistical analysis test using (SPSS Ver.22). We divide the type of vegetation into two groups which is Group 1 and Group 2. Group 1 denotes Rhizophora mucronata, and Avicennia spp and Group 2 is denoted for Avicennia spp. and Sonneratia alba. We are suggesting two hypotheses;

Ho: The density of Milky Stork at each station depends on the type of vegetation.
Ha: The density of Milky Stork at each station does not depend on the type of vegetation.

Table 10 - Test of homogeneity of variances

Levene Statistic	Significant Value
0.312	0.586

Based on Table 10, the significance value is 0.586 which is higher than 0.05 shows that there are significant differences between distributions of Milky Stork and the type of vegetation. So, the null hypothesis is rejected. So, the type of vegetation does not affect the density of Milky Stork.

3.4 Food Availability

Table 11 below shows the food availability at each station and their number of type of food.

Table 11-The food availability at sixteen stations and their number type of food

Stations	Source Of Food	Number Type Of Food	Density Of Milky Stork
Cabai Malai 1	small fish	1	5
Cabai Malai 2	small fish	1	2
Cabai Malai 3	small fish	1	4
Cabai Malai 4	small fish	1	3
Pulau Gula 1	shrimp and small fish	2	7
Pulau Gula 2	shrimp and small fish	2	4
Pulau Gula 3	shrimp and small fish	2	6
Pulau Gula 4	shrimp and small fish	2	2
Pulau Kelumpang 1	molluscs, small fish and small crab	3	1
Pulau Kelumpang 2	molluscs, small fish and small crab	3	1
Pulau Kelumpang 3	molluscs, small fish and small crab	3	5
Pulau Kelumpang 4	molluscs, small fish and small crab	3	2
Pulau Kelumpang 5	molluscs, small fish and small crab	3	3
Pulau Kelumpang 6	molluscs, small fish and small crab	3	1
Pulau Kelumpang 7	molluscs, small fish and small crab	3	3
Pulau Kelumpang 8	molluscs, small fish and small crab	3	1

To assess the relationship between the availability of food and the density of Milky Stork at each of the stations, we run the linear regression statistical analysis test using (SPSS Ver.22).

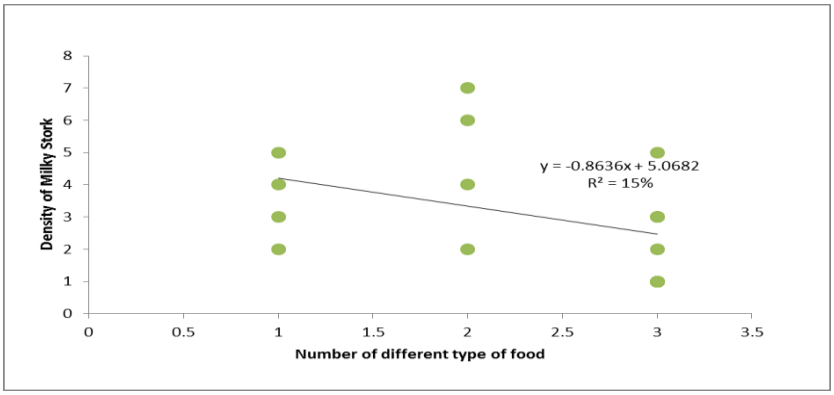

Figure 3-relationship between the number of different type of food available and density of Milky Stork in Matang Mangrove Forest

Based on Figure 3, it shows a weak relationship between the number of different type of food and the density of Milky Stork at each of the stations in Kuala Gula. The R2 value is only 15% and the adjusted R-value is -3.87%. These two values are not similar; thus the data gathered is not reflecting the actual whole populations of Milky Stork worldwide. We are suggesting two hypotheses:

Ho: Milky Stork chooses their foraging area based on the number of type of food that available in the area.
Ha: Milky Stork chooses their foraging area based on the abundance of food available in the area.

Table 12 - Table of Model Summary

R	R Square	Adjusted R Square	Significant F change
0.391	0.153	0.092	0.135

Table 13 - Table of ANOVA

Sum Of Squares	Mean Square	Significant value
8.205	8.205	0.135

Table 14 - Table of Coefficient

	Unstandardized Coefficients	Significant Value	95.0% Confidence Interval For B	
	B		Lower Bound	Upper Bound
Constant	5.068	0.002	2.271	7.865
Type of food	-0.864	0.135	-2.003	0.303

Based on Table 13 and Table 14, the significance value is 0.135 which is not significant as the value of significant is $p<0.05$. This shows that the number of different type of food does not successfully predict the number of Milky Stork. Based on Table 12, the value of R Square is 0.153, when we change it into a percentage it will be 15% which shows us the variance in the number of Milky Strok cannot be explained by the number of different type of food.

The beta value for the number of different type of food is – 0.5. This value shows us the slope for our variable is very small and closes to zero. The Confident Interval Value from this test is -2.003 and 0.303 which should be in the positive interval. Thus, the population studied in Matang Mangrove Forest does not reflect the whole population of Milky Stork in the world. With a significant value of 0.135, it shows us enough evidence to reject the null hypothesis.

As a summary, it shows that there is a weak relationship between the number of different type of food and the density of Milky Stork. The birds were observed not having specific food preferences but more to the abundance of food available. This is due to the changing of behaviour. Our observed Milky Stork is captive breeding. When they were reintroducing into the wild, they did not know how to find the food by themselves. They are more reliable toward human food and easy access to the food. And for next time, we should get more data and study more about this creature.

4.5 Geographical Information System Analysis

i. The Mapping of Population Distribution of Milky Stork

Figure 4 below show the map of the distribution of Milky Stork at 16 stations around Matang Mangrove Forest. Their stopover spot and hot spot are identified at Cabai Malai area, Pulau Kelumpang and Pulau Gula.

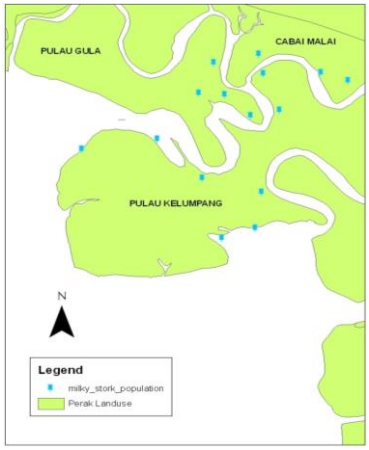

Fig. 4 - The map of the distribution Of Milky Stork around Matang Mangrove Forest

ii. The Mapping of Hotspot Area

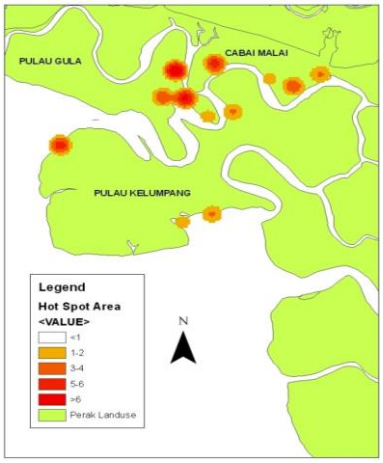

Fig. 5 - Hotspot area for Milky Stork

Based on Figure 5, it shows all the hotspot area for Milky Stork around Matang Mangrove Forest. To analyse, each level of hotspot we denote with different colours to differentiates each other. The hotspot area for Milky Stork with the highest density which is 7 individuals of Milky Stork was found at the Pulau Gula area. It is shown in Figure 6 below.

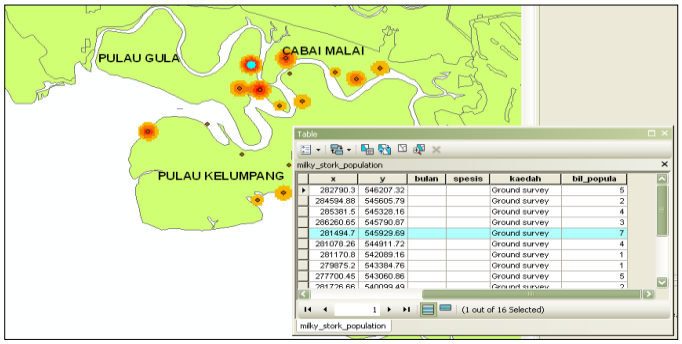

Fig. 6 - Hot spot area for the highest density of the distribution of Milky Stork

A few areas are identified that has the lowest density of distribution of Milky Stork which is only 1 individual of Milky Stork can be found at each of the stations and the stations are at Pulau Kelumpang (figure 7).

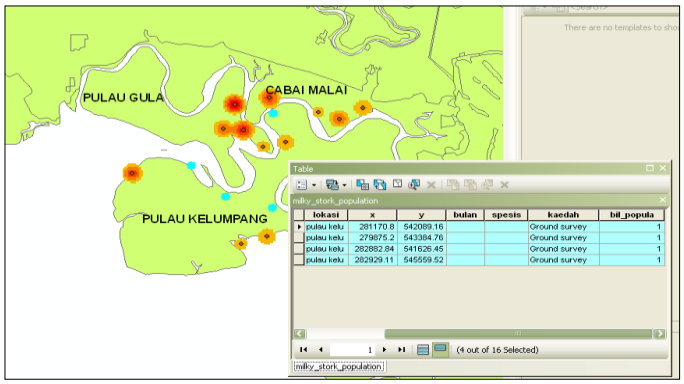

Fig. 7 - Hot spot area with the lowest density of distribution of Milky Stork

iii. The Mapping of Population Density

Based on figure 8 below, shows us the mapping of population density of Milky Stork around Matang Mangrove Forest. For each level of the interval of population density, we denote each of them with different colours to differentiate them.

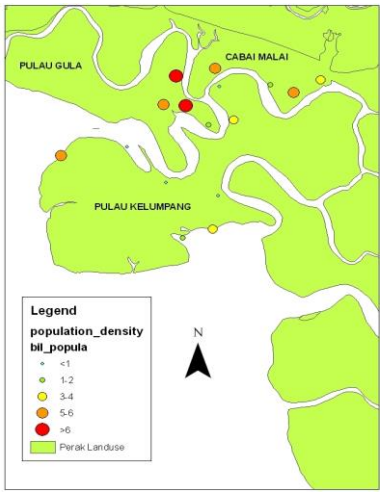

Fig. 8 - The mapping of population density of Milky Stork

By using a GIS application, we can produce an attribute table from the data. The attribute table is used to make the explanation of data in the map easily to analyse. In this analysis, we use ArcGIS 10.3 by using spatial analysis for identified the density distribution of the Milky Stork. In this case, we also use Kernel Density analysis under the spatial analysis tool in ArcGIS 10.3. From this application, the hot spot for Milky Stork, their distribution and density population also can be determined. Just like Figure 9 below. It shows us every single piece of data that we need to know such as their standard deviation value, mean value, and minimum and the maximum number of Milky Stork found around the Matang Mangrove Forest area.

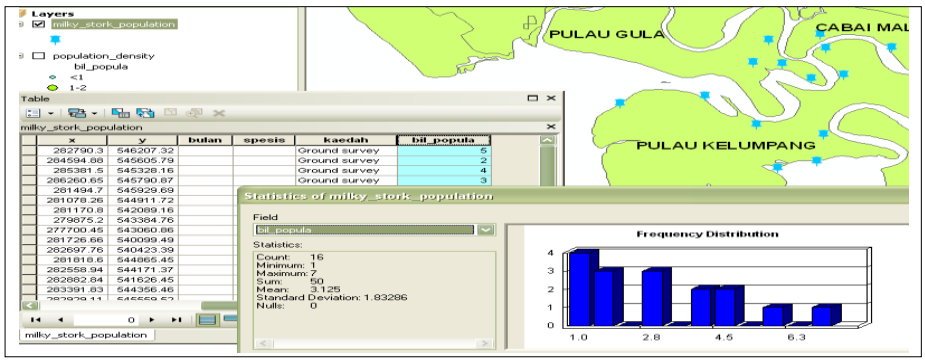

Fig. 9 - The mapping of population density of Milky Stork

5. Conclusion

In Matang Mangrove Forest, Perak, we found a total number of 50 individuals of Milky Stork around the area. This Milky Stork is from a captive breeding program and they are reintroducing back into the wild. We choose 16 stations to observe the Milky Stork and the stations were chosen based on the most Milky Stork can be found at Matang Mangrove Forest area. Their habitat is at mangrove forest because mangrove provides all the food they need and suitable habitat for breeding, feeding, nesting, and resting. The Milky Stork is essentially a coastal species favouring mangroves, mudflats and estuaries (Hancock et al. 1992), and also feeds on rice fields and fish ponds (Verheugt 1987). In the research area, there are three types of land use that we have observed which are Dry Shrimp Pond, Watery Shrimp Pond and Seabass Cage. All of the Milky Stork was found in the areas where there are human activities ongoing. They are rarely to be found in a pristine area. Their habitat is disturbed by aquaculture activities. Usually, these waterbirds are very sensitive towards human presence but nowadays they have built a tolerance towards human presence.

Based to Shepherd and Giyanto, 2009, they stated that the Milky Storks allowed fishermen within relatively close range, but they did not tolerate construction that was taking place at the river mouth during visits made in April and May 2007. This is maybe the results of captive breeding; during captivity, they become closer and comfortable towards human presence and no longer feeling afraid and protective.

From the data density of Milky Stork, we can see that the highest number of Milky Stork can be found at Watery Shrimp Pond. The second highest is at Seabass Cage and the lowest is at Dry Shrimp Pond. Even though the shrimp pond is dry and there still has the presence of Milky Stork, this is because; the shrimp pond still contains a lot of small fish and eels that can be the source of food for Milky Stork.

Furthermore, even though Matang Mangrove forest is a reserved forest, but there are too many aquaculture developments and human presence has disturbed the pristine area. All the aquaculture activities, fishing, boating, shell farming, development of houses and boat restaurant have disturbed their area. All these activities have affected the mangrove. Matang Mangrove Forest has been polluted by those activities by the residue oils from the boat, the logging of mangrove, the noises and the waste from the human. Based on F. Rahman et al., (2013), his team has analysed five surface sediment samples that come from Milky Stork foraging areas and the result shows that there is metal contamination in that area such as, Copper (Cu), Zinc (Zn) and Lead (Pb).

The stations that we choose there are three types of mangrove vegetation which is Rhizophora mucronata, Avicennia spp. and Sonneratia alba. The Milky Stork that we found does not rest on the tree. The trees that present in the area just only covered around the stations. Plus, there are also no records on nest found since the reintroduction program started. So the type of vegetation does not affect the distribution of Milky Stork. This is because, since these birds are from captive breeding, they did not know how to build their own nest as their nest in the cage is man-made. They have been captive since they are juvenile. The harsh conditions in the wild are not familiar to them for survival. So there is also a probability that the nest cannot be found because the bird already lost their behaviour to build the nest in the wild.

Mangrove vegetation is important for Milky Stork to breeding, nesting and resting. The mangrove species utilised for nesting include the Avicennia marina and Rhizophora apiculata. In Pulau Rambut, Java, most nests are built in Sterculia foetida (Imanudin & Mardiastuti 2003). The Milky Stork bred in mangrove vegetation and the egg laid on the nest was approximately one meter from the ground (Iqbal et al.,2008).

From the observations and inspections on the environment of all stations, Milky Stork in Matang Mangrove Perak shows their foraging behaviour with choosing food that easy to pick and not necessarily rich or abundance in choices. As we can see from the results, it had shown a weak relationship between different type of food and the density of birds at the stations. It shows that the variety of food is not the main attraction for Milky Stork and we can see from Table 13, a total high number of densities of Milky Stork foraging at Watery Shrimp Pond even though there are only two types of foods that available. There are also recorded by Iqbal et al, (2008), adult birds have been recorded taking large mudskippers (Periopthalmus), also small fish, snakes and frogs (Elliott 1992). They found two species of prawn Indian, white prawn Penaeus indicus and banana prawn P.merguensis and one clupeid fish species, Dussumier's thryssa Thryssa dussumieri in and around nests.

This behaviour arises because they are captive breeding. When they in captivity, they did not learn how to search for their food but instead the food was given to them. Based on Ismail et al, (2009), stated that captive birds are being fed 2 times a day during the non-breeding season and 3 times a day during the breeding season. The fish are given in the shallow water and also in 3 basins by the pool. The basin is used because they mixed the calcium with the fish and also to administrate other medication such as deworming and vitamin supplement. The vitamin would be lost if we were to put the fish in the water. These provisions are what make Milky Stork choose to invade human aquaculture activity because the foods are easy for them to get rather than to find by themselves in the wild.

Mapping that obtains from Geographical Information System analysis, we can see the hotspot of distribution of Milky Stork around Matang Mangrove Forest. From the map, we also can define the maximum and minimum density of Milky Stork. The maps are really useful, especially for the next experiment. It can be a guide for the other researcher to find the Milky Stork and contribute to helping the preservation and conservation of Milky Stork and their habitat in the next study. Based on the map, we also can see the habitat preference of Milky Stork and study more about their habitat.

Before this, there is not much research technology done on this bird except bio-logging that has been done to the captive Milky Stork in the ZOO. So with this new technique of technology, the study on Milky Stork can become worldwide and the data processing will be much more valuable. BirdLife International (2012) state that the population of Milky Stork is suspected to be decreasing at a slow to average rate due to hunting, egg collecting, human disturbance at breeding colonies, drainage and agricultural development. In Malaysia Milky Stork populations have decreased more than 90% over the last 20 years6, from over 100 individuals in 1984 to 10 in 2005, the last known Milky Stork habitats in the Matang Mangrove Forest, Perak, Malaysia (Ahmad Ismail et al,2011).

This research is a part to support the urgent need for Milky Stork in Malaysia for conserving the remaining birds from extinction. However, we are still lucky to have a large number of Milky Stork in captivity. Malaysian Zoological Society, Zoo Negara, Wildlife Department Malaysia and Universiti Putera Malaysia are part of the team that trying very hard to conserve and increase the number of Milky Storks in the wild, particularly in Kuala Gula. This research is also a part to help the Department of Wildlife and National Park to keep in track the number of Milky Stork and their hot spot for foraging and nesting.

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