SOFT RELEASE OF BARN OWL FROM NESTLINGS FOR THE PURPOSE OF RAT ONTROL

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ABSTRACT

Barn owl (Tyto javanica) is common throughout the oil palm plantations in Peninsular Malaysia. It's significant role in providing biological control of rodent pest is well established. However, in Sabah and Sarawak, local population of the owl is not particularly known. Therefore, several translocation programs have been implemented to establish sustainable barn owl populations in Borneo; with certain degree of success. Past experience has shown that introducing adult owls from their original residence in Peninsular Malaysia to Sabah and Sarawak were largely unsuccessful or would take longer time to become established in their new homes. In this introduction program a soft release approach was implemented for acclimatization purposes to ensure a promising success of introducing Barn owls in a plantation. In this study, three pairs of owlets of 17 days to 35 days old, were retrieved from their respective nest boxes in the field. The six owlets were secured from Felda Sahabat Lahad Datu, Sabah were translocated to Wilmar's Sapi Plantations in Telupid, Sabah where an aviary with newly furnished facilities are provided. The owlets were harvested from an established population in Lahad Datu, which originally brought in from the Peninsular Malaysia. The aviary is equipped with three feeding arenas (with individual nest boxes installed) and one holding area for handfeeding and treatment purposes. The six owlets are closely monitored and raised for six months where food intake, body weight and body measurements were recorded. The owlets were manually fed with rats supplied from the plantation twice a day, in small quantities and gradually increased in accordance with their growth in size. After six months of rearing, two Barn owls of 6.5 and 6.7 months old respectively were chosen for release based on their opposite sex and different parental origin for greater breeding fitness. Transmitters were attached on the body of the candidates for radio tracking and mapping of foraging area. The owls were released after being latched inside a nest box 100m from the aviary for 48 hours for acclimatization. The owls were radio tracked and radio fixes plotted to analyze the home range and exploratory behavior. The rearing of the first batch of the six owlets from nestlings was a success with zero fatality. This indeed contributed substantially to a successful step towards the establishment of the local barn owl nucleus population. Subsequent transfer of owlets has been planned and the second batch is now being fed and raised in the aviary for the next release.

Keywords: barn owl Tyto javanica, soft release, acclimitisation, oil palm plantation, nest boxes

INTRODUCTION

Rodents are one of the prominent pests in oil palm plantations. They are known to feed on the young stems in immature plant whereas in matured palms, they will feed on the fruits. The growth of young oil palms could be slowed down or much worst it could cause fatality to the trees (Musim Mas, n.d). According to Puan (2013), the three main rodent pest species in the oil palm plantation in Malaysia includes the house rat *Rattus rattus diardii*, ricefield rat *Rattus argentiventer* and Malayan wood rat *Rattus tiomanicus* (previously *R. jalorensis*). The rat's population increase rapidly in a short period of time as they reproduce very fast. Hence, it is prominent to keep the rat population in control (Woittiez *et al.*, 2016).

Barn owl (*Tyto javanica*) are mainly known as the most widely spread species of owls in the world that exist in every continent except Antarctica. In Malaysia, barn owls' population have increased and are established as common species in oil palms plantations (Rizuan *et al.*, 2016). Barn owls are effective in rodent control due to the combination of their behavioral characteristics and life history traits in which they can reproduce rapidly as the prey number increases. According to Martin, barn owls have high foraging efficacy and low territoriality in foraging ranges. Other than that, their density could be potentially manipulated by supplying the barn owls with nest boxes (Martin, 2009). The diet of barn owls is recorded to have mainly compromised of rats (99.8%) (Hafidzi *et al.*, 2003) which makes them one of the reliable and practical option to control the rodents' population in oil palm plantations. According to the Roundtable on Sustainable Palm Oil (RSPO) manual on best management practice, barn owls are encouraged to be practiced as biological control of rats in palm oil estate (Lim *et al*., 2012). Other than using the method of baiting with rodenticides, barn owls are used as a part of the integrated pest management (IPM) and was acknowledged as an effective predator of rats and is relied upon to control rats with encouraging results (Hafidzi *et al.*, 2001).

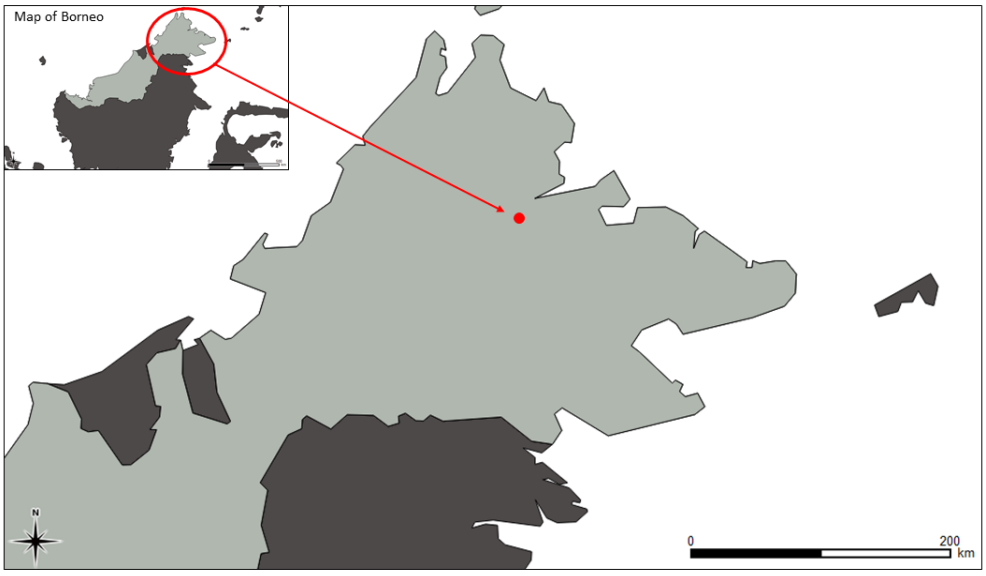
In this study, a soft release approach was implemented to ensure a promising success of introducing Barn owls in a plantation. Soft release is a method in which animals are being maintained in an enclosed area for acclimatization purposes at the release site for a certain period before releasing. Animals that are acclimatized will be more familiar to their environment especially on the local climate, surrounding landmarks and natural food (Olney *et al.*, 1994). According to Woodford *et al*. (1993), soft release is beneficial to the fact that it may act as a period of quarantine in which diseases of the release candidates can be detected. In addition to that, it will also provide time for the candidates to adjust which will aid them in surviving in the wild which includes foraging, locomotion and social interactions (Fyfe, 1978).
Introducing barn owls are one of the cheapest, safest and easiest way to control rodent's population. However proper research on releasing barn owls are still lacking therefore similar studies should be undertaken to improve proper introduction practice for Barn Owls into an oil palm plantation.

MATERIALS AND METHOD

Study Sites

This study was conducted in Wilmar's Sapi Plantations oil palm plantation estate, which is situated at Labuk region Telupid, Sabah (5.71965,117.37025).

Figure 1: Wilmar's Sapi Plantation (indicated as red dot) located in Labuk region, Sabah. The upper left insert indicates map of Borneo.



Barn Owls Rearing

Six owlets aging from 17 days to 30 days are secured from Sahabat Felda Lahad Datu and are transported to Wilmar's Sapi Plantation Labuk region where an aviary with newly furnished facilities are provided. The owlets were harvested from an established population in Lahad Datu, which originally brought in from the Peninsular Malaysia. The owlets are then situated in an aviary which are furnished with three separate feeding arenas with nest boxes installed and a holding arena for manual feeding and treatment purposes. The young barn owls are manually fed twice a day with rodents supplied from the plantation and are placed inside one nest box which are equipped with incubator lights to ensure a favorable temperature for the young chicks.
After the barn owls reached fledging state, they are separated in pairs and are placed in different feeding arenas. Live rodents which are supplied from the plantations are released inside the feeding arena during feeding session which enables the owl to gradually adapt and learn how to hunt their prey. At some cases, the rodents are put down and are placed inside the feeding arena to enable the barn owl to have familiarity and aid them to learn how to hunt their prey. Enrichments are also provided for the

barn owls to enhance their capability in hunting and aid to reduce stress which includes placing oil palm fronds inside the feeding arena to mimic the settings at the oil palm plantations. Husbandry wise, the feeding arena and nest box are sanitized and cleaned thrice a week to ensure a safe environment for the owls and to prevent them from getting any diseases. For record keeping, body weight and body measurements of the barn owls are recorded before their fledging state in order to monitor their health and growth.

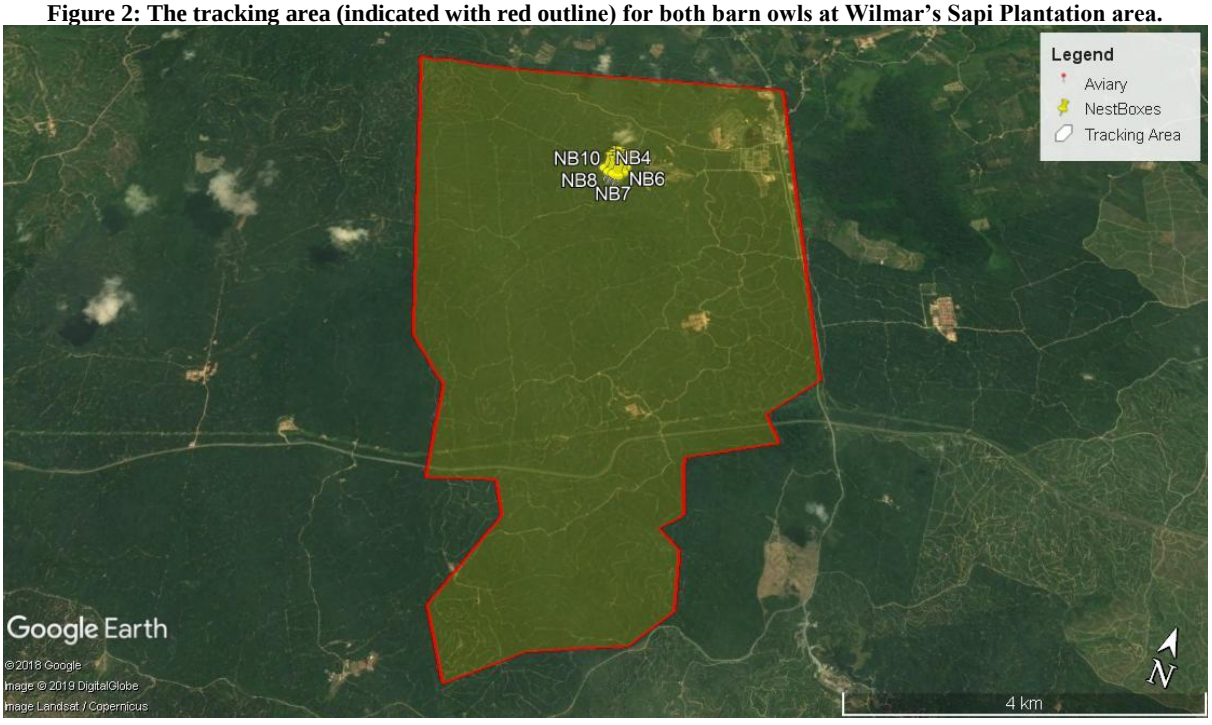
Soft Release

Two barn owls, BO539 (male) and BO540 (female) aging 6.5 and 6.7 months old respectively are chosen as the release candidates based on their opposite sexes and different parental origin for greater breeding fitness. The sexing of the barn owls is determined by inspecting the color of the underside of the body, underside of the wings, throat area and overall coloring of the back. Ten wooden nest boxes are erected in a circular arrangement 90-100m away from the aviary. The nest box (2 ft length x 2 ft width x 1 ft 8-inch height) is occupied with a hiding room with a partition for breeding which are suggested to give better occupancy and breeding result (Rizuan *et al*., 2016). The nest boxes are erected at higher ground with 17 feet maximum above the ground. According to Rizuan *et al*., wooden nest box offers well aerations ensuing in more stable and lower temperatures in a humid environment. The candidates are latched inside a nest box situated 100m from the aviary for 48 hours for acclimatization. The candidates are supplied with rodents daily before the release period. The release period is done during the evening as it is the greatest period to promote a favorable condition for the owls to hunt their prey and stayed in the "nest box zone" for quick box utilization (Rizuan *et al.*, 2016).

Radio Telemetry

The release candidates are tagged with radio transmitter upon release. According to Naim *et al.* (2012), radio telemetry is used to distinguish the locations of the owls in real time and define individual home range. In this study, a radio receiver Model TRX-48S (Wildlife Materials, Inc), with a frequency range coverage of 150.00-150.480 MHz is used. The candidates' transmitters (Wildlife Materials, Inc) are harnessed and mounted as backpacks and are pre-set to produce signals at unique frequencies. The frequency of the transmitter that are employed for this study are 150.334 MHz and 150.405 MHz for BO539 and BO540 respectively. A 3-element Yagi antenna is used as to detect the signals emitted by the transmitter. In addition to that, the 3-element Yagi antenna is suitable for the frequency above 140 MHz and for tracking on foot. According to Food and Agriculture Organization (2007), the Yagi has the best directional capability of all the common telemetry antennae. The position of the owl is determined on the ground by tuning the radio receiver to the chosen frequency and by ensuing the strongest signal. Each owl is followed for twelve nights, i.e from 0700 hrs to 1200 hrs and 1800hrs to 0100hrs.The radio locations of the owls are recorded in an hourly interval. The perimeter covered for tracking the barn owls are 27.2 km while the total area is 35.1 km^2.

Figure 2: The tracking area (indicated with red outline) for both barn owls at Wilmar's Sapi Plantation area.



Data Analysis

In calculating the home range and core area size, the method Minimum Convex Polygon (MCP) are used. The data collected are analyzed using BIOTAS which is known as an ecological software solution. The outcomes from the BIOTAS are multiplied with the actual distance on the ground to estimate the actual home range size of the barn owls. The MCP method generates the area of the polygon formed around the outermost employed method signify the range size and shape (Harris *et al*. 1990).

RESULTS

Home Range Size

The signals from both radio-tagged barn owls are successfully distinguished by the radio receiver. The barn owls are tracked for twelve nights between the month of March to April 2019. The radio fixes of BO 539 and BO 540 are 16 and 14 points respectively. The estimated home range and core area size of BO 539 and BO 540 are summarized in Table 1.1 and Table 1.2 respectively. The home range size is based on the calculations from 95% of the radio fixes. The home range sizes are assessed by using two methods (50% MCP and 95% MCP) which generated the following result.

Table 1.1 Home range of BO 539 (male).

	Perimeter (km)	Area (km^2)
50% MCP	0.98	0.06
95% MCP	11.10	6.69

Table 1.2 Home range of BO 540 (female).

	Perimeter (km)	Area (km^2)
50% MCP	0.65	0.02
95% MCP	11.18	4.05

For BO 539 (male), the estimated home range which is determined by using the 95% MCP method has the perimeter of 11.10 km and an area of 6.69 km^2. On the other hand, the estimated home range for BO 540 (female) based on the 95% MCP method has the perimeter of 11.18 km and an area of 4.05 km^2. The home range size of the male barn owl (BO 539) are noticeably higher than the female barn owl (BO 540) with a difference of 2.64 km^2 in terms of area. However, in terms of the home range perimeter, the female barn owl has higher perimeter with 11.18 km to the male barn owl with 11.10 km bearing a difference of 0.08 km. The home ranges delineated by the 95% MCP method are shown in Figure 3 and 4.

Figure 3: Home range (indicated as the yellow outline) of BO 539 in the study site, Wilmar's Sapi Plantations, using the 95% MCP method.

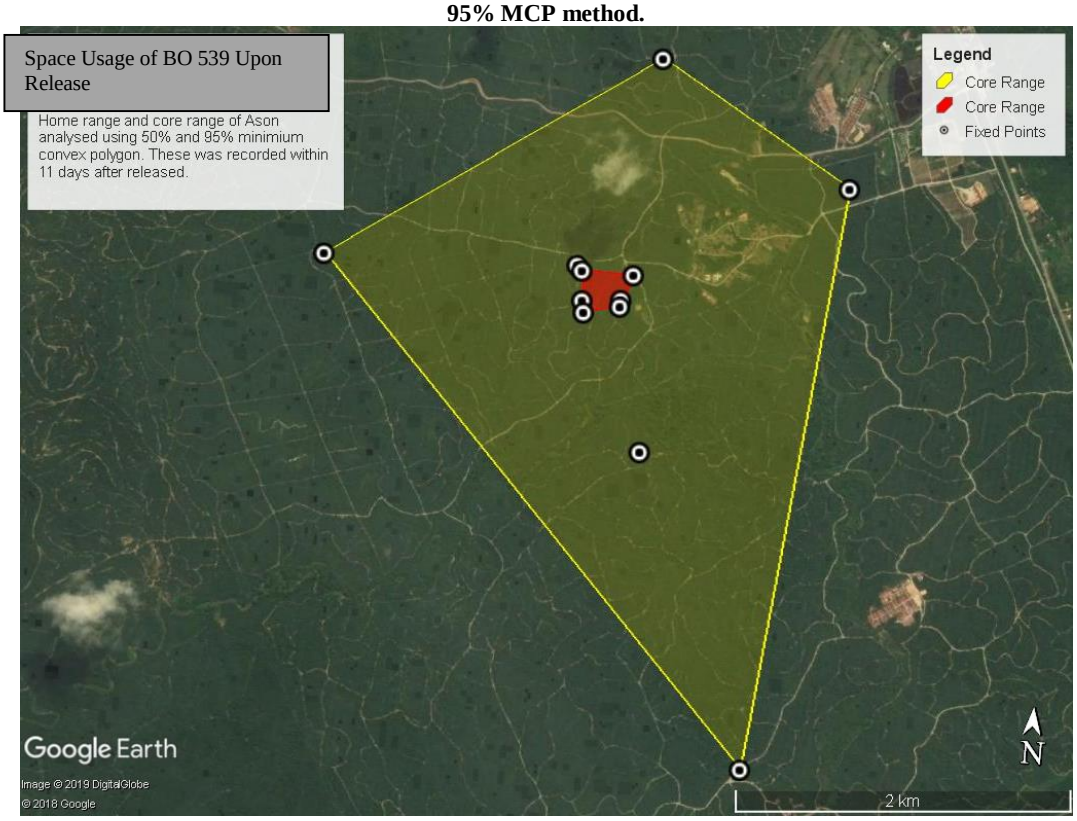
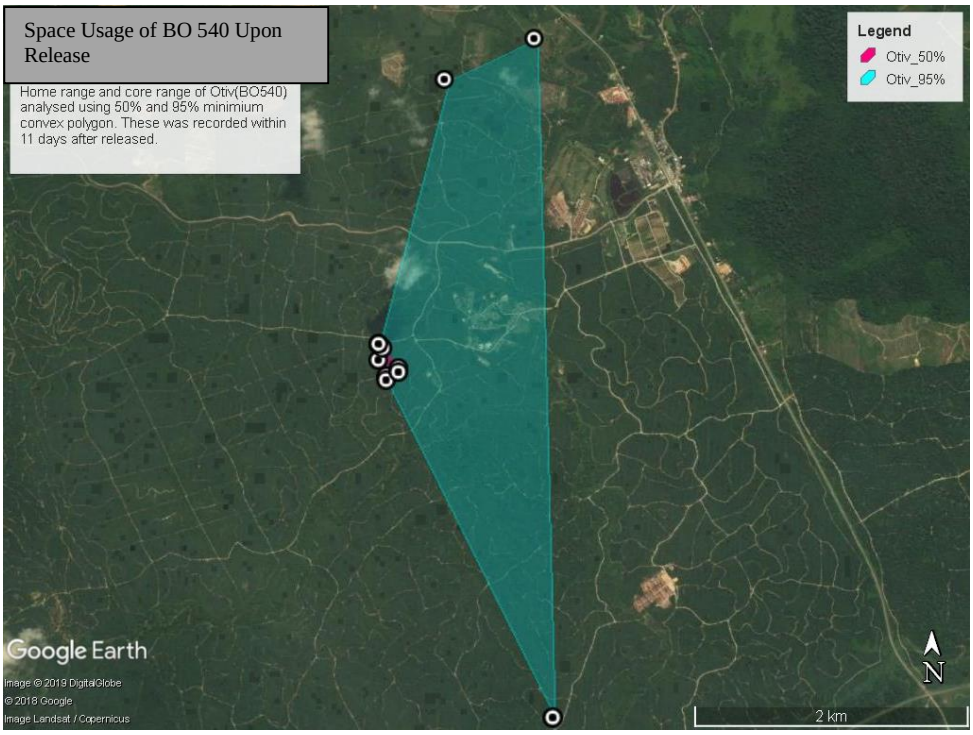


Figure 4: Home range (indicated as the blue outline) of BO 540 in the study site, Wilmar's Sapi Plantations, using the 95% MCP method.



Core Area Size

The outcomes of the core area sizes of the barn owls are shown in Table 1.1 and Table 1.2. For the male, the estimated core area based on 50% MCP method is 0.06 km^2 with a perimeter of 0.98 km. On the other hand, the female's estimated core area which are generated based on 50% MCP method is 0.02 km^2 with a perimeter of 0.65 km. Based on the data calculated, the male's core area size is 0.04 km^2 greater than the female core area size. Meanwhile, the perimeter of the core is size of the male barn owl is higher by 0.33km to the female barn owl. The core area size of both the barn owls by using the 50% MCP method are outlined in Figure 5 and 6.

Figure 5: Core Area (indicated as the red outline) of BO 539 in the study site, Wilmar's Sapi Plantations, using the 50% MCP method.

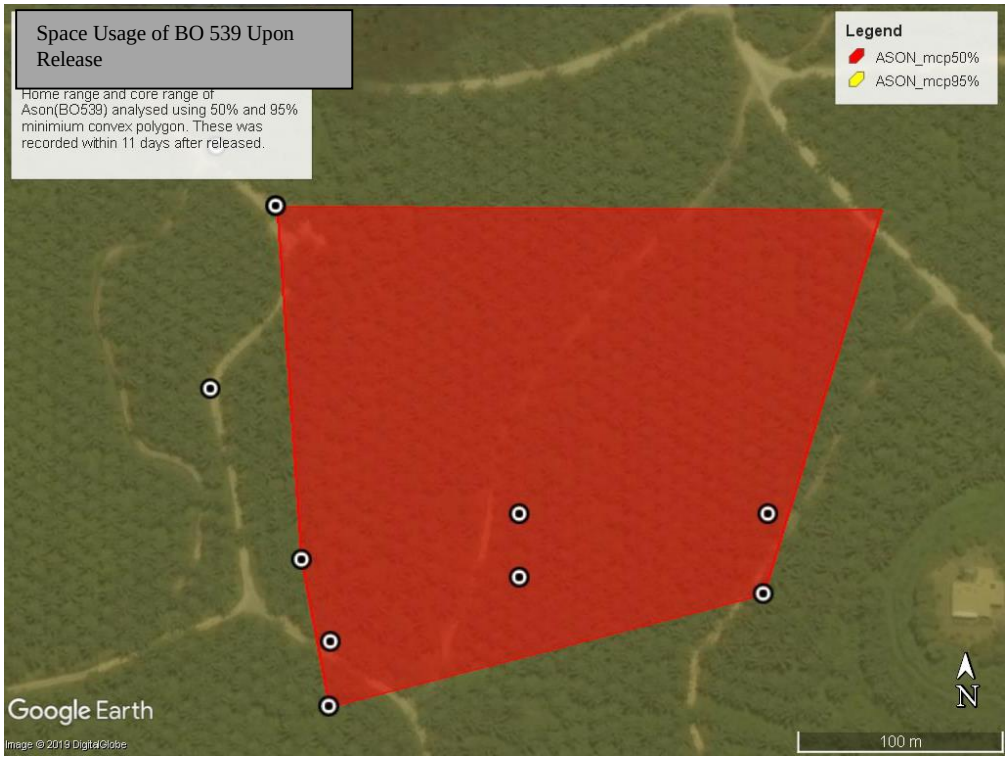
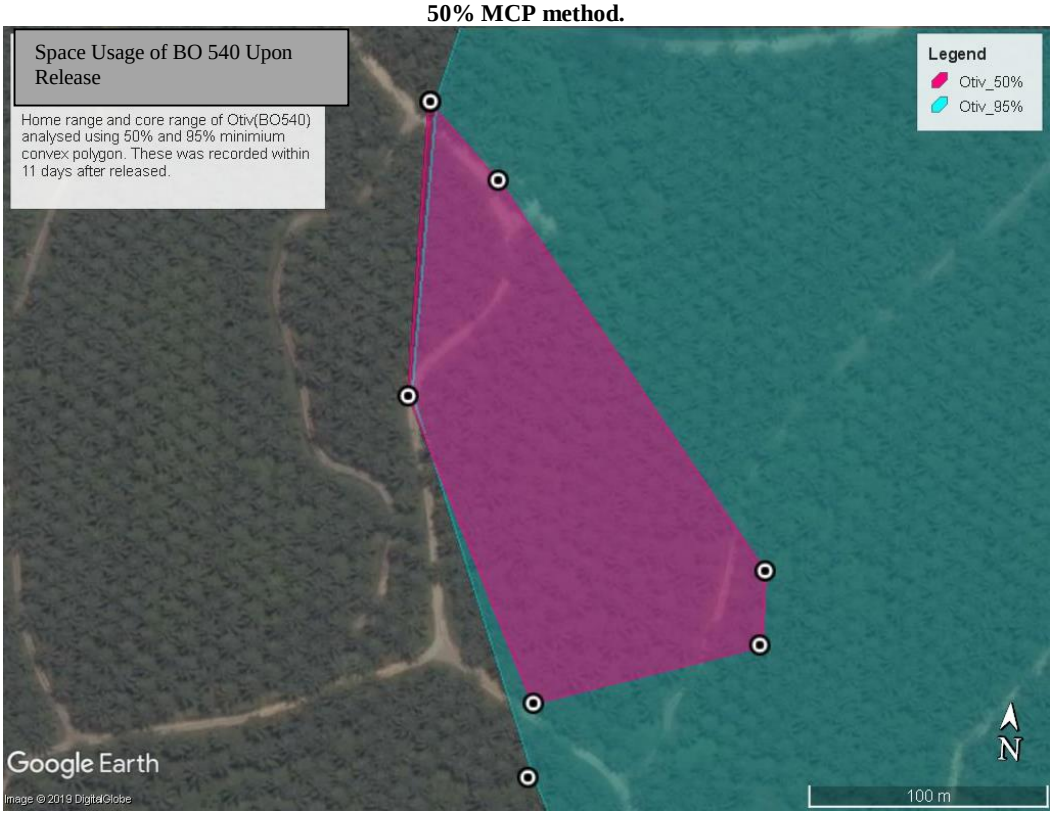


Figure 6: Core Area (indicated as the purple outline) of BO 540 in the study site, Wilmar's Sapi Plantations, using the 50% MCP method.



DISCUSSION

This study successfully reared two barn owls from nestling for eight months inside a fully furnished and well facilitated aviary with zero fatality. Constant monitoring on the growth and health of the barn owls contribute to a higher chances of a positive releasing process. Close rearing of the owlets is only done prior until fledging state to prevent further imprint with human. Although the owlets are initially retrieved as wild owls, they are reared in captivity for almost 8 months which potentially qualified them as captive animals. A study by Lockwood *et al.* (2005) suggested that captive animals are ought to be vulnerable because of their lack vital behavior skills such as predator avoidance. Other than that, captive animals may also have impaired hunting skills (Neuman *et al.*, 2013). In correspond to that fact, this study provides enrichments such as positioning palm fronds inside the feeding arena to mimic the oil palm estate situation is done to enable the owl to have a slight familiarity and acquire minimal skills to hunt with additional difficulties. The enrichments are also utilized to prevent the owls being stress in their captive environment. Albeit young captive barn owls are known to be not entirely fit and are inexperienced than wild barn owls, studies recorded by the Barn Owl Trust suggest that some inexperience released owls will become self-sufficient wild birds. This success is provided by ensuring an adequate amount of time for adaptation for captive barn owls upon releasing. In correspond to this study, a fully fledge barn owls are selected for release because they have the potential to fly faster and can learn to find their way around better.

By implementing a new approach of releasing which is by using the method of soft release with the aim of promoting acclimatization, a higher possibility of a successful release is depicted based on the outcome of this study. The result shown from the home range size shows an encouraging result from the soft release method as the home range pattern of the barn owls are steady and occupied the area not far from the release site. Barn owls are known to be not territorial, however having home range is prominent as it enables the barn owls to create a highly detailed 'mental map' of their home range (Barn Owl Trust, n.d). Based on this study a total of 14 and 16 radio fixes from BO 539 and BO 540 are collected respectively which are considered relatively few. According to Kenward (1987), at least 35 radio fixes are needed in wildlife radio tracking studies. The insufficient amount of radio fixes obtained from this study may affect the result of the home range direct or indirectly. The result of this study is recorded as an initial assessment and is continued as a part of an ongoing research.

The age of the barn owls released are 6.5 and 6.7 months old which are still in juvenile state. In most species, the home ranges of adults are significantly smaller in comparison to juveniles, which are mostly floaters and tend to move a lot looking for a site to settle down (Kenward *et al*., 1981). A study conducted by Thomsen *et al.* (2014) on the home range of adult barn owls resulted some of the smallest home-range reported for barn owls which range from a mere of 0.02 km^2 to 0.53 km^2. In addition to that, most adults are long-term residents of sites and may inhabit the best feeding areas, which thus result a smaller range than subadults, which requires to move widely (McFarland, 1991). Several studies had been done on releasing barn owls and are recorded to be success which includes the long-term release method where a pair of adult barn owl are release from a large rural building while they have young in their nest which took about seven months. Other than that, a Young Brood method in which half-grown owlets are placed inside a nest box in a rural building about one month before they fledge took about two months

before releasing (Barn Owl Trust, 1989). Based on these studies, it attests that short-term survival of birds released as young is better as the speed of their release is administered by the natural pace of their own physical growth. In correspond to this study, these juvenile barn owls are being released after being in captivity for 8 months which could contribute to their large home range as they are in the process of venturing their new habitat and are prone to be more curious to their new surroundings.

Based on this study, the male barn owl has higher home range area compared to the female barn owl. The high home range area of the barn owl illustrates a greater hunting activity compared to the females. In other studies which is done by Naim *et al.*, the home range sizes of female barn owls are recorded to be reliably larger than male barn owls which contradicts with the result of this study. According to Rolando (2002), in most studies the differences of home range between sexes turned out to be non-significant. Habitat wise, the study site of this research has a proximity with several riparian areas and housing complex. The minimal variety of habitats may affect the home range results of the released barn owls. However, a study by Ramsden (2010) suggested that, there are no correlation between the amount of good habitat and the level of owl activity.

Core areas are defined as areas which are often used more than any other areas and has the possibility of containing homesites, refuges and most reliable food sources (Ewer, 1968). By delineating core areas, it will be prominent in studying the interaction between the individuals and the environment (Samuel *et al.*, 1985). Based on this study, the male estimated core area is greater than the female by 0.04 km^2. The variations of core area size might be related to prey densities (Peery, 2000). According to Mace and Harvey (1983), the local movements which involved in food hunting is mainly to satisfy individual energy necessities. Individuals tend to move more when the food resources are scarce and will decrease their movements when food resources are abundant. Therefore, the availability of food resources, mainly their abundance and distribution, may suggestively control ranging behavior (Samuel *et al.*, 1985).

CONCLUSION

This study attest that applying a soft release method towards barn owls that are reared from nestlings could promote a higher possibility for the success of introducing barn owls in an oil palm estate. This also includes a long-term monitoring and close rearing of the nestlings until fledging state. The facilities and condition provided in the captivity is also prominent to the wellbeing and growth of the barn owls. Studies that are done on soft release method of barn owls are still lacking especially in Malaysia and could be done in order to verify the applicable existing methods. The outcomes of the home range data based on the released barn owls is a preliminary result from an ongoing research project. However, the follow up of these assessments is to provide further evidence that the soft release method is potentially a viable method for a success release program. These findings might be possible due to the differences in sex, food availability and age of the barn owls.

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