Project Update: October 2023

Project summary
This study aims to assess the threat posed by anticoagulant rodenticides and other pesticides commonly used in oil palm plantations to non-target wildlife. The study will utilise barn owls (*Tyto javanica javanica*) to assess pesticide exposure pathway to rodent-consuming predators. Rodenticide and pesticide residue levels in barn owls will be analysed non-invasively from barn owl carcasses, fresh pellets and non-viable eggs. Rodenticides and pesticides in high residue concentrations and found in a high number of individuals would indicate overuse of compound. Following this, necessary steps can be taken to reduce hazardous pesticide use to prevent exposure to non-target animals.

There are two primary study sites: an oil palm plantation in Peninsular Malaysia and one in Sabah, Borneo Malaysia. To date, the field data collection in Peninsular Malaysia has concluded. The field data collection in the second site in Sabah is estimated to begin in October 2023, providing there are no further delays with our research permit approval from the local wildlife department. The study site for the barn owl population in Peninsular Malaysia was carried out in Jengka 24, Pahang (3°88' N, 102°53' E). The barn owl population here has long been established and studied, and though there is yet to be a complete census of the population, barn owls are reportedly common in the oil palm plantations.

Three sampling sites were selected in Jengka 24; two were immature oil palm areas and one site was a multi-crop cultivation area bordered by a mature oil palm area. Sampling was carried out at Jengka from January 2022 and though it was expected to last till December 2022, sampling had to be extended to May 2023 to ensure a sufficient sample size. The next phase of the research, field sampling at the second site in Sabah, is expected to begin in October 2023. The following is a summary of the data that has been collected at the first project site according to the study objectives.

Project Objectives and Findings To date

Objective 1: Barn owl carcass detection
Roadside surveys and monitoring inside plantations were carried out to detect barn owl carcasses. Roadside surveys were carried out along a primary road and covered an approximate distance of 42 km; the stretch of road selected was bordered almost exclusively by oil palm plantations. Surveys were conducted 2-4 times a week, alternatively at 0500-0600 hours and 0800-0900 hours.

A total of eight barn owl corpses were collected from Jengka; consisting of two owlets collected from nest-boxes, three adult owls found as roadkill and two adult owls found inside nest-boxes (Figure 1). Post-mortem analysis was carried out on the carcasses and livers and muscle tissue were collected and stored in a -15C freezer to be analysed later in Universiti Sains Malaysia (USM) for pesticide residue.

Feather samples were also collected from live barn owls for pesticide residue analysis. Moulted primary feathers were collected in nest-boxes and feathers were plucked from live birds when the opportunity was available. Fresh pellets found inside nest-boxes were also collected for pesticide residue analysis. Additionally, addled, broken and abandoned barn owl eggs were also collected for pesticide residue analysis. A

total of 108 egg samples were obtained from Jengka, Pahang. After measurements were taken, the egg contents and eggshell were separated. Egg contents (including foetuses), eggshells, feathers and pellets were stored in a -15C freezer to be analysed later in USM for pesticide residue.

Figure 1: Barn owl carcasses found. Left: Adult barn owl killed in a vehicular collision. Right: Barn owlet found dead likely due to starvation.
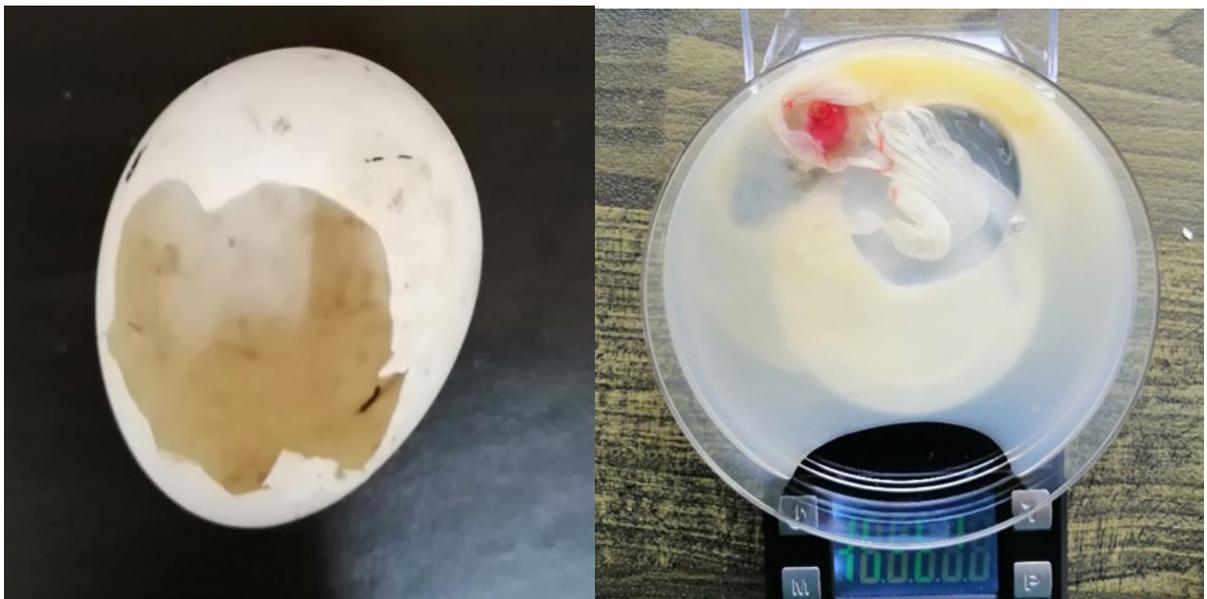
Figure 2: Barn owl eggs collected for pesticide residue analysis. Left: cracked eggshell. Right: abandoned egg contents.

2) Community engagement
To date, 165 respondents have been interviewed to assess the knowledge, awareness and perception (KAP) of plantation workers and local residents towards barn owls. Respondents were asked on general knowledge questions, and their attitude towards barn owls were assessed based on a Likert scale. They were also questioned on the general perception of barn owls, such as whether they are perceived as helpful biological control agents or bad omens. Additionally, the questionnaires included questions to assess the knowledge of the respondents on rodenticide and pesticide use and risk to non-target wildlife.

Our group also managed to carry out several barn owl education programmes in Jengka. We carried out an education programme in a primary school to educate

children on barn owls and their role as biological control agents (Figure 3A). In March 2023 we participated in the Malaysian National Conference on Urban Pests (NCUP) 3.0 in Putrajaya, Malaysia, where we attempted to spread awareness on the threat of secondary poisoning of rodenticides to non-target animals, specifically barn owls (Figure 3B). Additionally, we carried out a program to educate and spread awareness on the role of barn owls as biological control agents in paddy fields and smallholder oil palm plantations (Figure 3C).

Figure 3: Education and awareness programmes carried out to spread awareness on barn owls and their role as biological control agents. Left: Educational program aimed at primary school children. Right: BORG booth at NCUP 3.0 conference in Putrajaya. Below: Organizers and BORG members at an education and awareness program aimed at paddy field farmers and oil palm smallholders.

3) Pesticide exposure to other non-target species (additional objective)
Other species, namely mammals, found during roadkill surveys were also collected in order to assess the presence of pesticides and levels of residues in other non-target species. Samples that were too flattened (i.e., internal organs exposed and flattened on the road) were not picked up for dissection in the lab. Gross post-mortem dissection was carried out on collected samples, and liver and muscle tissues were collected and stored. Livers and muscle tissue were collected from: 20 civets (18 palm civets

and two Malay civets), eight squirrels, two leopard cats, one monitor lizard and one slow loris. Liver and muscle samples were stored in a -15C freezer for upcoming pesticide residue analysis.

Civets, leopard cats and slow lorises are protected species in Malaysia and to the best of our knowledge, there has yet to be a study on pesticide exposure to these species. Civets and leopard cats have been reported to consume rats in oil palm plantations and so, like barn owls, these species are at high risk of secondary exposure to rodenticides. It is hoped that pesticide residue analysis of these species can shed light on pesticide exposure to non-target species and reinforce the concept of utilising barn owls as bio-monitor species against pesticides, especially rodenticides, in oil palm plantations.

Brief work plan for the remaining part of the project

Activity	Site	2023	2024		2025
		Oct-Dec	Jan-Sep	Sep-Dec	Jan
Barn owl carcass detection	Oil palm plantation at Sahabat, Sabah, Malaysia	X	X		
Collection of fresh pellet, feather and abandoned egg (for pesticide residue analysis)		X	X		
Wildlife carcass detection		X	X		
KAP survey of community towards barn owls		X	X		
Pesticide residue analysis of samples	Laboratory at USM, Penang, Malaysia			X	
Final report writing	USM, Penang, Malaysia				X