
Short Communication

The use of camera traps in Malaysian rainforests**MOHD-AZLAN J.**

Department of Zoology, Faculty of Resource Science and Technology, Universiti Malaysia Sarawak, 94300, Kota Samarahan, Sarawak.

School for Environmental Research, Charles Darwin University, 0909, Darwin, Northern Territory, Australia. email: azlan@cdu.edu.au

INTRODUCTION

Camera trapping is not a new tool in wildlife science. It was invented in the late 1890s, before being first used in the field in 1913 (Sanderson & Trolle, 2005). In recent decades, it has been widely used throughout the world, with an annual increment of 50%. The results of these studies have been published in internationally recognized journals (Rowcliffe & Carbone, 2008). Due to the increasing number of wildlife studies, over 100 camera traps of various brands and types are now available in the international markets. In Malaysia, the use of camera traps for surveying wildlife has increased drastically. More recently, the camera traps have been used for surveying and estimating tiger densities (Kawanishi & Sunquist, 2004; Mohamad & Darmaraj, 2009), examining activity patterns of large mammals (Laidlaw & Shahrudin, 1999; Wong *et al.*, 2004; Mohd-Azlan & Sharma, 2006), general wildlife surveys (Laidlaw *et al.*, 2000; Numata *et al.*, 2004; Mohd-Azlan, 2006; Gimán *et al.*, 2007), cryptic animal surveys (Wells *et al.*, 2005; Mohd-Azlan & Sanderson, 2007), and foraging ecology (Miura, 1997; Matsubayashi *et al.*, 2007). Thus, the main objective of this paper is to discuss the use of camera traps in Malaysian rainforest, promote discussion among local researchers who are

currently engaged in this technique and to provide recommendations to meet local needs.

Reasons for using camera traps

Despite the fact that tropical rainforests are known for its high biodiversity and species richness, the scarcity and/or the cryptic behavior of some of the species have resulted in scarcity of information about these species. The tendency of many rainforest species to avoid humans on existing tracks (where most transect surveys are done) is well known (Griffiths & Van Schaik, 1993; Duckworth *et al.*, 2005). These conventional methods include surveys on the footprints, dung, calls, live-trapping, den counts and direct observation (Rabinowitz, 1993). All these surveys are usually performed along transects and in the past they were the preferred method by government departments and scientists in Malaysia. However, walking along transects to observe terrestrial mammals in tropical rainforests can be extremely challenging and the different abilities of the observers to detect and recognize the species may lead to a bias during data collection. This increases the likelihood of animals fleeing unobserved. In the past, transect surveys have been the major method used by government departments and scientist to describe diversity and density of mammals for various purposes, including environmental impact assessment, as this is a

Keywords: camera trapping, tropical rainforest, Malaysia

cheap and fast way of obtaining information. Presence-absence survey using transects lines or logging tracks may not yield substantial evidence of species diversity. Thus, if any survey were to be conducted without considering these factors a bias trend could be expected in most wildlife surveys in Malaysia.

In dense tropical rainforest, camera traps are useful to detect cryptic species, estimating abundances using individual recognition and, recently, without individual recognition. A good image from the camera trap is undisputable, as to the presence of a certain species, when compared to interview or conventional survey methods. The utilization of camera traps has revealed the presence of secretive rainforest dwelling species, which have been overlooked by the application of the conventional applied transect surveys (Karanth *et al.*, 1999; Gonzalez-Esteban, 2004; KFBG, 2002). The Bornean bay cat, *Catopuma badia* was thought to be extinct in Sarawak until the utilization of camera trap provided much needed proof of its presence (Mohd-Azlan & Sanderson 2007). Difficult terrain and remoteness of survey area especially in Borneo may also suggest the usage of this technique. Changes in staff and park rangers with different level of experience in wildlife survey may also have an adverse effect on the results, especially on wildlife monitoring. Thus, the use of camera traps may reduce these bias. Furthermore, camera-trapping is a non-invasive method, which makes the trapping and handling of rare and threatened species unnecessary. Although cameras are usually set up to study selected target species the large amount of photos from other wildlife species also provides insightful information (Kawanishi & Sunquist, 2003; Mohd-Azlan & Davison, 2006 of the existing fauna).

The majority of density estimation using camera traps has involved cat species, relying on individual recognition from coat patterns (Karanth & Nichols, 1998; Kawanishi &

Sunquist, 2004) and to a lesser extend morphological features of tapirs (Trolle *et al.*, 2008). Since the use of mark-recapture application in camera trappings studies, species without individual recognition have been under-represented in current camera trapping investigation while the highest advance has resulted in models of occupancy (MacKenzie *et al.*, 2002) and population size (Royle & Nichols, 2003) that can estimate fundamental detection probabilities using camera trapping data (Rowcliffe *et al.*, 2008). In addition to this, the Royle-Nichols Model allows the definition of abundance in species where individuals cannot be identified (Royle & Nichols, 2003). With appropriate sampling design and randomization of camera placing, wildlife density can now be estimated with confidence even without the need for individual recognition which allows this technique to be used for a wider variety of species in Malaysian rainforest (Rowcliffe *et al.*, 2008).

DRAWBACKS

Despite these advantages of camera-trapping in wildlife studies, researchers and conservationists should be cautious in interpreting results and identifying observed species. Animals misidentified due to poor picture quality or unfavourable angles of the animals on the photographs resulted in some hasty conclusions. The detectability of a species can be influenced by various factors such as abiotic, biological, or anthropogenic which include weather, seasonality, topography, biological rhythms, and sampling methods (O'Connel *et al.*, 2006). The failure to photograph a certain species does not necessarily mean that the animal is absent, but the lack of evidence might suggest that the animal is rare (Sanderson & Trolle, 2005).

In contrast to a dry temperate climate, where the conventional camera-traps usually can be used without major problems, the tropical

rainforests with their high relative humidity are a major challenge for these models. Excessive moisture can cause the film to expand and causing it to stick and unable to rewind. Battery leakage due to humidity has always been fatal to the infra red sensor circuits, which increases the repair and maintenance cost. There have been many modifications tested to reduce damage to the film, such as inserting silica gels and regular attendance to reload films. Many field biologists using this technique have confronted numerous challenges and frustrating experiences where their cameras were smashed by elephants or stolen. Armoring the camera-traps to prevent elephant damages as suggested by Grassman *et al.* (2005), could be used in areas accessed by vehicle but may not be practical in areas such as Taman Negara where great area can only be covered by foot as these protective mechanisms are heavy. There have been several instances where cameras have been smashed, showing signs of sabotage by poachers within protected areas (Mohd-Azlan & Lading, 2006). Cameras equipped with high ASA rolls and set not to emit flash during the day might reduce detection by poachers in day time. Even the expensive ASA 800 and 1600 film produces heavy grains with only reasonable print quality in the tropical rainforest. Trees where cameras will be mounted needs to be carefully selected, as trees used by pigs or tapirs to scratch may disrupt the camera setting. There are also several instances where spiders, termites and ants have built webs or nests in front of the infra red sensor cavity, which have reduced the sensor's functionality and resulted in gaps in data collection.

Most field research is bound to tight budgets and resources. Imported camera traps are expensive and often used for mega projects involving a flagship or charismatic animal, as these projects have more potential to generate funds. Maintaining a camera in the field for a long period also involves substantial cost. Even though Carbone *et al.* (2001) suggested a

minimum of 1000 trap-nights is required to record cryptic animals, a substantially higher number of trap nights is needed to obtain a comprehensive species list (Giman *et al.*, 2007). Silveira *et al.* (2003) suggested from his studies in southern America that camera traps could be useful for rapid monitoring surveys as the species richness curve reached a plateau on the 32nd day by using 29 cameras. This is not plausible for Malaysian scenario. Silveira *et al.* (2003) conducted their study on a flat grassland habitat, whilst Mohd-Azlan (2006) needed 16 months with approximately 4600 effective trap nights to reach a plateau in the species accumulation graph in a secondary forest in Peninsular Malaysia. Not all species can be detected in a short time frame but this cannot be guaranteed even in a long-term study, thus a plateau may not necessarily means that all the cryptic species have been detected. Camera spacing and survey area have little influence on the total species detected. Survey effort is the main factor determining the number of recorded species (Tobler *et al.*, 2008). Thus, a very large number of cameras will be needed to increase the detection probability and effective trap night for rapid surveys.

Camera trapping exercises are currently being conducted throughout the country without a centralised database system. Camera trapping projects in Malaysia almost always involve collaboration with international agencies such as Conservation International, Cat Action Treasury, Global Canopy Programme, WildCRU, University of Oxford, Smithsonian Institute, Tokyo University of Agriculture, University of Florida, University of Michigan, Wildlife Conservation Society and World Wide Fund for Nature. These organizations collaborate with local government agencies and most federally funded public universities in Malaysia. Local timber companies and private natural resource managers are also collaborating with international agencies conducting camera trapping censuses in

Malaysia for various objectives including timber certification and to promote eco-tourism. In view of this, there is an urgent need to administer and monitor these activities in Malaysia to promote research priority areas and for related government agencies to gain access to data which could be used for regional conservation planning.

RECOMMENDATIONS

A standard protocol or operating procedure for general wildlife census needs to be established at the national level, which is suited to local needs and the environmental setting. Minimum efforts and design need to be determined based on habitats in Malaysia, as various habitats have different expected diversity and vegetation complexity.

Collated data from camera traps requires standardization (Kawanishi, 2002) and needs to be maintained by a central database system where research and data from camera trapping are co-coordinated, managed and enhanced by appropriate government authority. Even though this recommendation seems rather ambitious it is relatively easy to achieve. Currently research permit is required to conduct field research in Malaysia according to three different Acts, Enactments, and Ordinance representing Peninsular Malaysia, Sarawak and Sabah respectively. It is also important to highlight the poor coordination and lack of requirement of local authorities within states in Malaysia for researchers to submit complete report at the end of the study. Reporting procedures throughout Malaysia need to be standardized where researchers are required to submit basic presence data. Once this is mandatory then a central agency should be fed with survey databases from all the States. Such reporting procedures have been practiced in many countries including Australia. This information can later be used to understand the complexity of rare species (Mackenzie *et al.*, 2005), as

camera trapping on focal species frequently results in auxiliary data. However, where co-authorship and local partnerships exist, information extracted from this source need to be approved by the researchers, appropriately credited, as this has implications for funding agencies.

There is an urgent need for the relevant government department to provide special attention to camera trapping surveys by encouraging such activities and highlight areas that require census and establish priority lists, rather than depend on international proposals to work on specific charismatic species. The establishment of a local manufacturer who could provide services to meet local conditions and reduce freight, insurance and sometimes overseas GST cost is needed. Related government agency should lead this program under the Small Medium Entrepreneur Scheme where the government provides technical and financial support to local entrepreneur. The related government departments should invest in camera traps and running this exercise.

Higher Learning Institutions should also take the lead role in establishment of a formal local support group where regular conference and workshop are held to support local camera trapping census. This experience can be shared among local and international scientists for the advancement of research in tropical rainforests.

In conclusion, camera trapping seems like a promising tool to study wildlife in tropical rainforest even though much work is needed to understand the structural complexity of the tropical rainforest and hence the complexity in running the statistical analysis of data obtained. Results from camera trapping must be carefully interpreted to avoid unprecedented decision on natural resource management. It is suggested that with a clear aim and objectives, camera trapping is encouraged to complement conventional wildlife survey methods (e.g.

distance sampling). In addition, young local researchers need to be exposed to the classical methods and techniques to avoid being completely dependant on camera traps. It is of paramount that the Federal and Sate government take a lead role in promoting camera trapping and maintaining a comprehensive database system.

ACKNOWLEDGEMENTS

I am thankful to Faculty of Resource Science and Technology, Universiti Malaysia Sarawak, SFC, SFD, CAT, Engkamat Lading and Jim Sanderson for their support in camera trapping projects in Borneo. I am also grateful to Beau Austin for his help on the manuscript. I thank two anonymous reviewers for their valuable comments on earlier drafts on this manuscript.

REFERENCES

- Carbone, C., S. Christie, K. Conforti, T. Coulson, N. Franklin, J.R. Ginsberg, M. Griffiths, J. Holden, K. Kawanishi, M. Kinnaird, R. Laidlaw, A. Lynam, D.W. Macdonald, D. Martyr, C. McDougal, L. Nath, T. O'Brien, J. Seidensticker, D.J.L. Smith, M. Sunquist, R., Tilson & W.N. Shahrudin. 2001. The use of photographic rates to estimate densities of tigers and other cryptic mammals. *Animal Conservation* 4(1): 75-79.
- Duckworth, J.W., C.M. Poole, R.J. Tizard, J.L. Watson & R.J. Timins. 2005. The jungle cat *Felis chaus* in Indochina: a threatened population of a widespread and adaptable species. *Biodiversity and Conservation* 14: 1263-1280.
- Giman, B., R. Stuebing, N. Megun, W.J. Mcshea, & C.M. Stewart. 2007. A camera trapping inventory for mammals in a mixed used planted forest in Sarawak. *The Raffles Bulletin of Zoology* 55(1):209-215.
- Grassman, L.I.J., M.E. Tewes & N.J. Silvy. 2005. Armoring the Camtraker® camera-trap in a tropical Asian forest. *Wildlife Society Bulletin* 33(1):349-352.
- Griffiths, M. & C.P. Van Schaik. 1993. The impact of human traffic on the abundance and activity periods of Sumatran rain forest wildlife. *Conservation Biology* 7(3): 623-626.
- Gonzalez-Esteban, J., I. Villate & I. Irizar. 2004. Assessing camera traps for surveying the European mink, *Mustela lutreola* (Linnaeus, 1761), distribution. European. *Journal of Wildlife Research* 50: 33-36.
- KFBG. 2002. Press release: Camera-trap Photos of an Endangered Spotted Linsang: An Exciting Find for KFBG Conservationists at Cenwanglaoshan, Guangxi. Kadoorie Farm and Botanic Garden.
- Karanth, K.U. & J.D. Nichols. 1998. Estimation of tiger densities in India using photographic captures and recaptures. *Ecology* 79 (8): 2852-2862.
- Karanth, K.U., M. Sunquist & M. Chinnappa. 1999. Long-term monitoring of tigers: lessons from Nagarahole, pp. 114-117. In: Seidensticker, J., Christie, S. and Jackson, P. (eds.). *Riding the tiger: Tiger conservation in human dominated landscapes*: Cambridge University Press.
- Kawanishi, K. 2001. Standardized data management system for camera-trapping studies in Malaysia. *Journal of Wildlife and Parks* 19: 75-88.
- Kawanishi, K. & M.E. Sunquist. 2003. Possible new records of fishing cat from Peninsular Malaysia. *Cat News* 39:3 IUCN, SSG.
- Kawanishi, K. & M.E. Sunquist. 2004. Conservation status of tigers in a primary rainforest of Peninsular Malaysia. *Biological Conservation* 120(3): 329-344.
- Laidlaw, R.K., M.T.A. Rahman & Z. Zainal. 2000. Large mammal survey in Krau wildlife reserve. *Journal of Wildlife and Parks* 18:75-106.
- Laidlaw, R.K. & W. Shahrudin. 1999. Activities Patterns of the Indochinese tiger (*Panthera tigris corbetti*) and prey species in Peninsular Malaysia. *The Journal of Wildlife and Parks* 16:127-134.
- MacKenzie, D.I., J.D. Nichols, G.B. Lachman, S. Droege, J.A. Royle & C.A. Langtimm. 2002. Estimating site occupancy rates when detection probabilities are less than one. *Ecology* 83: 2248-2255.
- Mackenzie, D.I., J.D. Nichols, N. Sutton, K. Kawanishi & L. Bailey. 2005. Improving inferences in population studies of rare species that are detected imperfectly. *Ecology* 86(5):1101-1113.
- Matsubayashi, H., P. Lagan, N. Majalap, J. Tangah, J.R.A. Sukor & K. Kitayama. 2007. Importance of natural licks for the mammals in Bornean inland tropical rain forests. *Ecology Research* 22(5):742-748.
- Miura, S., M. Yasuda & L. Ratnam. 1997. Who steals the fruits? Monitoring frugivory of mammals in a tropical rain forest. *Malayan Nature Journal* 50: 183-193.
- Mohamad, S.W. & M.R. Darmaraj. 2009. A general guide to camera-trapping large mammals in tropical rainforests, with particular reference to Tigers (Published report). WWF Malaysia, pp. 37.
- Mohd-Azlan, J. 2006. Mammal Diversity and Conservation in a Secondary Forest in Peninsular Malaysia. *Biodiversity and Conservation* 15: 1013-1025.
- Mohd-Azlan, J. & G.W.H. Davison. 2006. Camera trapping birds in Secondary forest in Peninsular Malaysia. *Malayan Nature Journal* 57(4): 359-368.
- Mohd-Azlan, J. & E. Lading. 2006. Camera trapping and conservation in Lambir Hills National Park. *The Raffles Bulletin of Zoology* 54(2): 469-475.

- Mohd-Azlan, J. & D.S.K. Sharma. 2006.** The diversity and activity patterns of wild felids in a secondary forest in Peninsular Malaysia. *Oryx* 40(1): 1-6.
- Mohd-Azlan, J. & J.G. Sanderson. 2007.** Geographic distribution and conservation status of the bay cat *Catopuma badia*, a Bornean endemic. *Oryx* 41(3): 394-397.
- Numata, S., T. Okuda, T. Sugimoto, S. Nishimura, K. Yoshida, Quah Eng Seng, M. Yasuda, K. Muangkhum & M.N. Nur Supardi. 2005.** Camera trapping: a non-invasive approach as an additional tool in the study of mammals in Pasoh Forest Reserve and adjacent fragmented areas in Peninsular Malaysia. *Malayan Nature Journal* 57 (1) 29-45.
- O'Connell, A.F., N.W. Talancy, L.L. Bailey, J.R. Sauer, R. Cook & A.T. Gilbert. 2006.** Estimating site occupancy and detection probability parameters for meso- and large mammals in a coastal ecosystem. *Journal of Wildlife Management* 70(6):1625-1633.
- Rabinowitz, A. 1993.** *Wildlife field research and conservation training manual*. The Wildlife Conservation Society. New York, pp. 281.
- Rowcliffe, J.M. & C. Carbone. 2008.** Surveys using camera traps: are we looking to a brighter future?. *Animal Conservation* 11:185-186.
- Rowcliffe, J.M., J. Field, S.T. Turvey & C. Carbone. 2008.** Estimating animal density using camera traps without the need for individual recognition. *Journal of Applied Ecology* 45:1228-1236.
- Royle, J.A. & J.D. Nichols. 2003.** Estimating abundance from repeated presence-absence data or point counts. *Ecology* 84:777-790.
- Sanderson, J.G. & M. Trolle. 2005.** Monitoring Elusive Mammals. *American Scientist* 93:148-155.
- Silveira, L., A.T.A. Jacomo & J.A.F. Diniz-Filho. 2003.** Camera trap, line transect census and track surveys: a comparative evaluation. *Conservation Biology* 114:351-355.
- Tobler, M.W., S.E. Carrillo-Perceguei, R. Leite Pitman, R. Mares & G. Powell. 2005.** An evaluation of camera traps for inventorying large- and medium-sized terrestrial rainforest mammals. *Animal Conservation* 11 (3): 169 - 178.
- Trolle, M., A.J. Noss, J.L.P. Cordeiro & L.F.B. Oliveira. 2008.** Brazilian tapir density in the Pantanal: a comparison of systematic camera-trapping and line-transect surveys. *Biotropica* 40 (2): 211-217.
- Wong, T. S., C.W. Servheen & L. Ambu. 2004.** Home range, movement and activity patterns, and bedding sites of Malayan sun bears *Helarctos malayanus* in the Rainforest of Borneo. *Biological Conservation* 119: 169-181.
- Wells, K., A. Biun & G. Gabin. 2005.** Viverrid and herpestid observations by camera and small mammal cage trapping in the lowland rainforests on Borneo including a record of the Hose's civet, *Diplogale hosei*. *Small Carnivore Conservation* 32: 12-14.