



Feasibility of using scent-Bbaited hair Ttaps to monitor carnivore populations in Peninsular Malaysia

Authors: Hedges, Laurie, Marrant, Damian S. , Campos-Arceiz, Ahimsa, and Clements, Gopalasamy Reuben

Source: Tropical Conservation Science, 8(4) : 975-982

Published By: SAGE Publishing

URL: <https://doi.org/10.1177/194008291500800407>

BioOne Complete (complete.BioOne.org) is a full-text database of 200 subscribed and open-access titles in the biological, ecological, and environmental sciences published by nonprofit societies, associations, museums, institutions, and presses.

Your use of this PDF, the BioOne Complete website, and all posted and associated content indicates your acceptance of BioOne's Terms of Use, available at www.bioone.org/terms-of-use.

Usage of BioOne Complete content is strictly limited to personal, educational, and non - commercial use. Commercial inquiries or rights and permissions requests should be directed to the individual publisher as copyright holder.

BioOne sees sustainable scholarly publishing as an inherently collaborative enterprise connecting authors, nonprofit publishers, academic institutions, research libraries, and research funders in the common goal of maximizing access to critical research.

Short communication

Feasibility of using scent-baited hair traps to monitor carnivore populations in Peninsular Malaysia

Laurie Hedges^{1,2*}, Damian S. Marrant³, Ahimsa Campos-Arceiz² and Gopalasamy Reuben Clements^{1,2,3,4,5,6}

¹Rimba, 4 Jalan 1/9D, 43650 Bandar Baru Bangi, Selangor, Malaysia

²School of Geography, University of Nottingham Malaysia Campus, Semenyih 43500, Selangor, Malaysia

³Centre for Tropical Environmental and Sustainability Science and School of Marine and Tropical Biology, James Cook University, Cairns, Queensland 4870, Australia

⁴Center for Malaysian Indigenous Studies, Universiti Malaya, 50603 Kuala Lumpur, Malaysia

⁵Kenyir Research Institute, Universiti Malaya Terengganu, 21030 Kuala Terengganu, Malaysia

⁶School of Science, Monash University, 46150 Selangor, Malaysia

*Corresponding author. E-mail address: laurie.hedges@gmail.com

Abstract

Non-invasive genetic sampling is increasingly being used for monitoring mammalian carnivore populations. However, environmental conditions in the tropics challenge researchers' ability to collect samples. We present the results of a preliminary study on the feasibility of using scent-baited hair traps for population monitoring of mammalian carnivores in Peninsular Malaysia. Stations were baited using either fatty acid scent or male cologne applied to hair traps. Video camera traps were also used to monitor carnivore reactions to the scent stations. We recorded 19 visits by seven carnivore species over 764 camera trap nights. Cheek-rubbing and scent-marking behaviour was recorded only for single individuals of two species: the Malayan tiger (*Panthera tigris jacksoni*) and clouded leopard (*Neofelis nebulosa*). This study suggests that scent-baited hair traps hold some promise for ecological issues requiring DNA analysis in Peninsular Malaysia. Additional research is needed to develop its full potential for conservation monitoring of large carnivores.

Keywords: conservation; wildlife corridor; camera-trapping; attractant; lure; hair trap

Received: 11 June 2015; Accepted 24 July 2015; Published: 14 December 2015

Copyright: © Laurie Hedges, Damian S. Marrant, Ahimsa Campos-Arceiz and Gopalasamy Reuben Clements . This is an open access paper. We use the Creative Commons Attribution 4.0 license <http://creativecommons.org/licenses/by/3.0/us/>. The license permits any user to download, print out, extract, archive, and distribute the article, so long as appropriate credit is given to the authors and source of the work. The license ensures that the published article will be as widely available as possible and that your article can be included in any scientific archive. Open Access authors retain the copyrights of their papers. Open access is a property of individual works, not necessarily journals or publishers.

Cite this paper a: Hedges, L., Marrant, D. S., Campos-Arceiz, A. and Clements, G. R. 2015. Feasibility of using scent-baited hair traps to monitor carnivore populations in Peninsular Malaysia. Tropical Conservation Science Vol.8 (4): 975-982. Available online: www.tropicalconservationscience.org

Disclosure: Neither Tropical Conservation Science (TCS) or the reviewers participating in the peer review process have an editorial influence or control over the content that is produced by the authors that publish in TCS.

Introduction

Non-invasive genetic sampling is fast gaining popularity [1,2] for wildlife population monitoring [e.g., 3]. However, in tropical rainforests, the relatively low densities of carnivores and humid conditions prevent consistent genetic sampling, such as from scats, due to low detection rates and the rapid decay of usable DNA [4,5].

Scent-baited hair traps have been proposed as a possible non-invasive technique to obtain genetic samples [6,7]. Responses to olfactory stimuli are actively induced, making detection of cryptic species more efficient and less dependent on environmental conditions that could alter their detectability (e.g., thick vegetation obscuring samples) [8]. Two studies have successfully obtained hair samples using this method in rainforest environments in the neo-tropics for Felidae, Canidae, Mustelidae, Procyonidae, Mephitidae and Didelphidae [9,10], and for dingoes, *Canis dingo*, in the Wet Tropics of Australia (D. Marrant, unpublished data).

Scent-baited hair-trapping can provide useful population data such as the genetic diversity of individuals within a carnivore population, without necessarily detecting every individual in the population [e.g., 11]. These insights may be vital to the conservation of threatened carnivores. For example, in habitats fragmented by roads, hair traps have already been used to provide useful information on carnivore gene flow [e.g., 12]. Despite the theoretical advantages, several studies using this method have been unsuccessful or ineffective in monitoring or even detecting the target species, even where they are known to be present in the landscape [e.g., 13].

Peninsular Malaysia is home to 28 species of terrestrial mammalian carnivores [14], and habitat loss and illegal hunting threaten many of these species with extinction [15]. While population estimates, necessary to determine conservation status, have been obtained for some carnivore species using camera traps, (e.g., tiger *Panthera tigris*; [5], and leopard *Panthera pardus*; [16]),

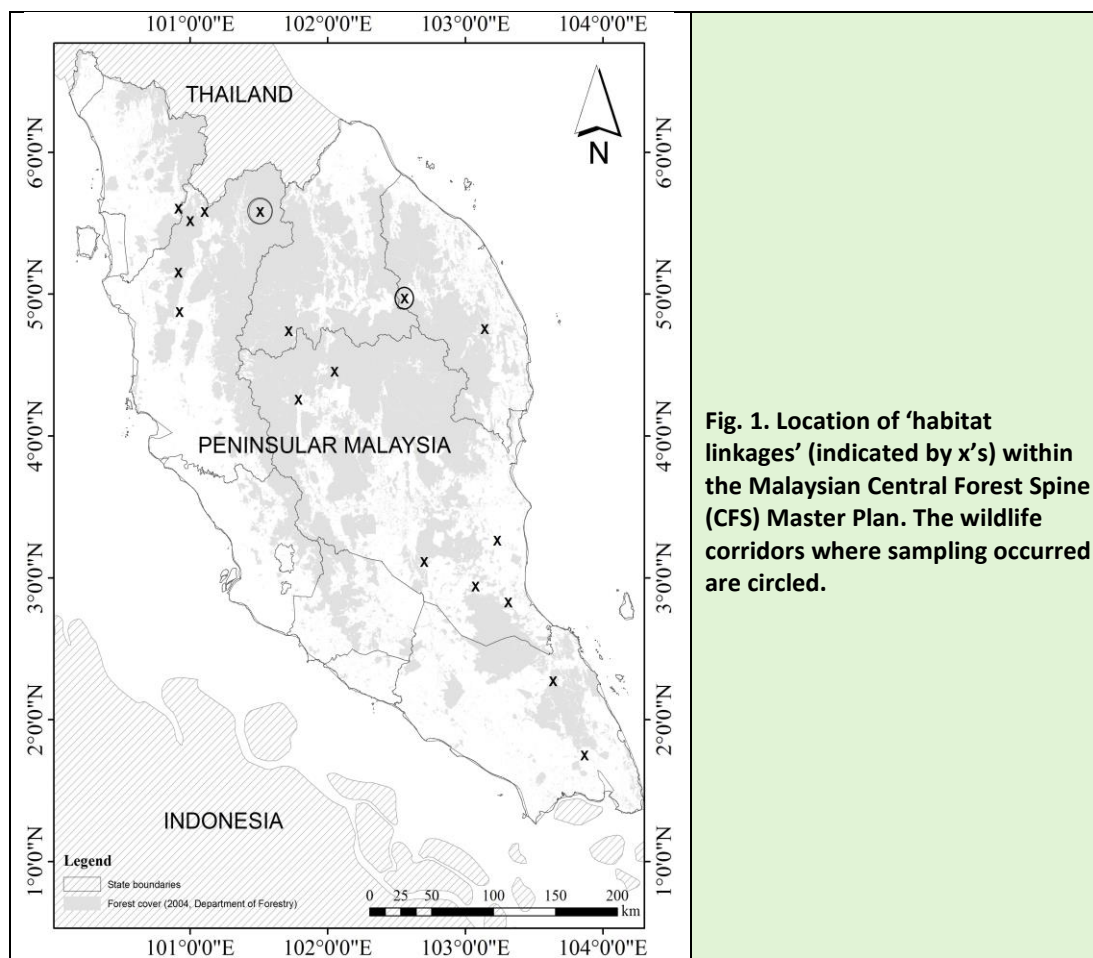
many other species have not been similarly studied. This is perhaps due to a lack of natural markings allowing identification of individuals.

Here, we investigate the feasibility of using scent-baited hair traps to collect hair samples of carnivores in the tropical rainforests of Peninsular Malaysia.

Methods

Study area

We conducted our study in two wildlife corridors, also known as habitat linkages (Primary linkage 2 – N5° 35.198' E101° 29.115' [189 km²] and primary linkage 7 – N5° 01.004' E102° 32.236' [150 km²]), delimited (but not formally established) by the Federal government to ostensibly connect larger forest complexes to one another [17]. The former is located in the State of Perak and the latter is in the State of Terengganu (Fig. 1). Both linkages contain lowland-hill dipterocarp forests that have been selectively logged in the past, and both are fragmented by roads, logging, and infrastructure development. Sampling was conducted between October 2012 and October 2013, with a break during the wet season (approximately December to February in the western study site and December to March in the eastern study site).



Hair trap designs

We used two different hair trap designs. The first trap consisted of a plywood board with a plastic boot-scraper mat attached to the top of it. A hole in the bottom of the board, beneath the mat, contained a perforated plastic packet containing cotton wool balls, onto which either 5 ml of Fatty Acid Scent (recipe from United States Department of Agriculture; synthesised by D. Marrant) or 10 pump sprays of male cologne (Hypnôse TM; Lancome, Paris) were applied. The second trap differed only in that there was no plywood board beneath the mat.

For the first design we attached traps to the ground to target Dholes (*Cuon alpinus*), the only canid known to be present in the landscape; studies conducted on other canids such as Dingoes (*Canis dingo*) in Australia successfully obtained hair samples using this design [18, D. Marrant, unpublished data]. For the second design, we attached traps to trees (Fig. 2), targeting six known felids in the landscape: the Malayan tiger (*Panthera tigris jacksoni*), leopard (*Panthera pardus*), clouded leopard (*Neofelis nebulosa*), golden cat (*Pardofelis temminckii*), leopard cat (*Prionailurus bengalensis*) and marbled cat (*Pardofelis marmorata*). The rationale for placing traps on trees was to prevent the traps from appearing as 'foreign ground objects' to felids, and to facilitate cheek, head, and neck rubbing, which are commonly observed scent-marking behaviours in felids [19,20]. A blank compact disc (CD) was added approximately 10-30 cm above the scent packet as a visual attractant [sensu 21].



Fig. 2. An example of one of the scent-baited hair traps used in the study, designed to target felids.

In order to document the rubbing behaviour of carnivores, video camera traps (Model Trophy Cam; Bushnell[®], Missouri) were attached to tree trunks ~50 cm above ground level and between 2-5 m from the center of the trail. The camera traps were set to record 60-second-long videos upon triggering, with an interval of 1 second between consecutive videos. Instead of adhering to a stringent inter-trap distance for camera trap placement, sites for camera traps were chosen based on large carnivores having been already detected by two previous camera trap studies [5, 22]. Within each site, hair traps were placed along trails where detection probabilities for large mammals are known to be high (*i.e.*, animal trail, ridge or old logging road [*e.g.*, 5]). A total of 35 hair traps were placed, 23 in Linkage 2 and 12 in Linkage 7, over a time period spanning 764 camera trap nights (Table 1). More traps were placed at the former linkage due to resource limitations in the latter linkage.

Table 1: Species captured on camera at the scent-baited hair traps, the degree of effort used for each trap type.

* *These occasions featured rubs on the hair traps by the species.*

Trap type	No. of traps	Combined effort (days)	Carnivore detections	Occasions where carnivores visibly attracted to scent
Canid traps	6	72	common palm civet – 1 golden cat – 2 leopard – 2	leopard – 1
Felid traps	24	615	sun bear – 6 clouded leopard – 3 tiger – 2 banded linsang – 2	clouded leopard – 1* tiger – 1* sun bear – 1

Results

Rubbing behaviour

There were only two successful rubs from two carnivore species, one from a male Malayan tiger (*Panthera tigris jacksoni*; Fig. 3, in primary linkage 2 using the second trap design) and one from a male clouded leopard (*Neofelis nebulosa*; in primary linkage 7 using the second trap design). The clouded leopard individual rubbed the tree at the exact location where the scent packet had been placed (the packet and mat had been removed by elephants before this). Hair was retrieved from the station at which the tiger rubbed. On two occasions, male clouded leopards were detected at a station, but no rubbing behaviour was recorded. On one of these occasions, the individual appeared to display a negative reaction to the CD, which caused it to run in the opposite direction to which it had been traveling. A leopard was also detected on two occasions at the same station during the period when scent stations were placed on plywood boards on the ground. On the first occasion, the leopard sniffed the scent trap but moved on. On the second occasion the individual appeared to ignore the traps.



Fig. 3. An adult male tiger 'cheek rubbing' on one of the hair traps in the study.

Discussion

Our preliminary results indicate some potential for scent-baited hair traps to obtain hair samples of large carnivore species. However, it remains to be seen whether they can serve as effective monitoring tools for carnivores, especially in landscapes such as Peninsular Malaysia where elephants pose a serious obstacle to the function of these traps.

We recorded positive rubbing responses from two carnivores (*i.e.*, the Malayan tiger and clouded leopard). However, two (male) clouded leopard individuals did not display rubbing responses. It is possible that either they did not detect, or were not attracted to the Fatty Acid Scent. Alternatively, male tigers display territorial marking behaviour (which includes cheek rubbing) more frequently when females are in oestrus [19]. Such behaviour challenges the implementation of capture-recapture population monitoring due to the possibility of imperfect detections.

Surveys using scent-baited hair traps have achieved some success in obtaining samples from Canid species (*e.g.*, [8]. Our inability to detect dholes (and other animals) was likely due to their rarity in our landscape [5, 22, 23]). However, there is a possibility that dholes simply did not detect the odour. We applied only 5 mL of attractant to the ground lure because canids may be repelled by, or cautious of, strong olfactory stimuli [24]. Alternative lures or 'traditional', more pungent attractants such as rotten meat or fish oil, may more effectively attract dholes to the vicinity of the trap. Animals which travel to investigate the 'call lure' would move into the range of the 'trap lure' and hopefully interact with the hair trap [*e.g.*, 25]. As the attractiveness of lures can also vary with season and location [25, 26], further work is required to determine whether our lack of dhole detection was an artifact of our sampling regime.

Implications for conservation

More systematic survey designs are needed to assess the full potential of this technique for non-invasive monitoring of carnivores in Peninsular Malaysia. Currently, scent-baited hair traps may only be able to provide complementary information related to genetic diversity, such as whether populations are genetically isolated from one another. In turn, this could inform and assess conservation management interventions of threatened carnivore species in tropical rainforests.

Acknowledgments

GR Clements thanks the Economic Planning Unit (Permit no: 3072) from the Prime Minister's Department and the Department of Wildlife and National Parks (HQ and Terengganu) for granting research permits, as well as the Department of Forestry (Terengganu) for granting permission to enter the forest reserves in Kenyir. We are indebted to financial support from James Cook University Graduate Research Scheme (GRC), Universiti Malaya Research Grant (GRC), James Cook University Postgraduate Research Scholarship (GRC), University of Nottingham Malaysia Campus Faculty of Science Scholarship (LH), Mohamed bin Zayed Species Conservation Fund (LH, GRC), Kay Arnold and Ian Mellsop (LH, GRC), and the Ah Meng Memorial Conservation Fund (ACA). This project would also not be possible without our indigenous field assistants and many friends and volunteers (<http://myrimba.org/donors>).

References

- [1] Waits, L. P. 2004. Using noninvasive genetic sampling to detect and estimate abundance of rare wildlife species. In: *Sampling Rare or Elusive Species: Concepts, designs, and techniques for estimating population parameters*. Thompson, W. L. (Ed.), pp. 211–228. Island press, Washington D.C.
- [2] Eggert, L. S., Maldonado, J. E. and Fleischer, R. C. 2005. Nucleic acid isolation from ecological samples—animal scat and other associated materials. *Methods in enzymology*, 395:73-87.
- [3] Mondol, S., Karanth, K. U., Kumar, N. S., Gopalaswamy, A. M., Andheria, A. and Ramakrishnan, U. 2009. Evaluation of non-invasive genetic sampling methods for estimating tiger population size. *Biological Conservation* 142:2350-2360.
- [4] Kawanishi, K. and Sunquist, M. E. 2004. Conservation status of tigers in a primary rainforest of Peninsular Malaysia. *Biological Conservation* 120:329-344.
- [5] Darmaraj, M. R. 2012. Conservation and ecology of tigers in a logged-primary forest mosaic in Peninsular Malaysia. Ph.D. thesis, University of Kent.
- [6] Reiger, I. 1979. Scent rubbing in carnivores. *Carnivores* 2:17-25.
- [7] Kendall, K. C. and McKelvey, K. S. 2012. Hair collection. In: *Noninvasive Survey Methods for Carnivores*. Long, R. A., MacKay, P., Ray, J. and Zielinski, W. (Eds.), pp. 141-150 Island Press, Washington D.C.
- [8] Ausband, D. E., Young, J., Fannin, B., Mitchell, M. S., Stenglein, J. L., Waits, L. P. and Shivik, J. A. 2011. Hair of the Dog: Obtaining Samples From Coyotes and Wolves Noninvasively. *Wildlife Society Bulletin* 35:105-111.
- [9] Castro-Arellano, I., Madrid-Luna, C., Lacher Jr., T. E. and León-Paniagua, L. 2008. Hair-trap efficacy for detecting mammalian carnivores in the tropics. *Journal of Wildlife Management* 72:1405-1412.
- [10] García-Alaníz, N., Naranjo, E. J. and Mallory, F. F. 2010. Hair-snares: A non-invasive method for monitoring felid populations in the Selva Lacandona, Mexico. *Tropical Conservation Science* 3:403-411.

- [11] Proctor, M. F., Paetkau, D., McLellan, B. N., Stenhouse, G. B., Kendall, K. C., Mace, R. D., Kasworm, W. F., Servheen, C., Lausen, C. L., Gibeau, M. L., Wikkinen, W. L., Haroldson, M. A., Mowat, G., Apps, C. D., Ciarniello, L. M., Barclay, R. M. R., Boyce, M. S., Schwartz, C. C. and Strobeck, C. 2012. Population fragmentation and inter-ecosystem movements of grizzly bears in western Canada and the northern United States. *Wildlife Monographs* 180:1-46.
- [12] Henry, P., Miquelle, D., Sugimoto, T., McCullough, D. R., Caccone, A. and Russello, M. A. 2009. In situ population structure and ex situ representation of the endangered Amur tiger. *Molecular ecology* 18:3173-3184.
- [13] Anile, S., Arrabito, C., Mazzamuto, M. V., Scornavatta, D. and Ragini, B. 2012. A non-invasive monitoring on European wildcat (*Felis silvestris silvestris* Schreber, 1777) in Sicily using hair trapping and camera trapping: does scented lure work? *Hystrix, the Italian Journal of Mammalogy* 23:1-5.
- [14] Francis, C. M. 2008. *A field guide to the mammals of South-east Asia*. New Holland Publishers, London.
- [15] Sodhi, N. S., Koh, L. P., Brook, B. W. and Ng, P. K. L. 2004. Southeast Asian biodiversity: an impending disaster. *Trends in Ecology and Evolution* 19:654-660.
- [16] Hedges, L., Lam, W. Y., Campos-Arciez, A., Rayan, D. M., Laurance, W. F., Latham, C. J., Saaban, S., Clements, G. R. 2015. Melanistic leopards reveal their spots: Infrared camera traps provide a population density estimate of leopards in Malaysia. *The Journal of Wildlife Management* (in press).
- [17] Department of Town and Country Planning & Department of Forestry 2012. *Central Forest Spine: summary of master plan for ecological linkages*. DTCP, Kuala Lumpur, Malaysia.
- [18] Stephens, D. 2011. The molecular ecology of Australian wild dogs: hybridisation, gene flow and genetic structure at multiple geographic scales. PhD Thesis. University of Western Australia, Perth.
- [19] Smith, J. L. D., McDougal, C. and Miquelle, D. 1989. Scent marking in free-ranging tigers, *Panthera tigris*. *Animal Behaviour* 37:1-10.
- [20] Mellen, J. D. 1993. A comparative analysis of scent-marking, social and reproductive behavior in 20 species of small cats (*Felis*). *American Zoologist* 33:151-166.
- [21] McDaniel, G. W., McKelvey, K. S., Squires, J. R. and Ruggiero, J. F. 2000. Efficacy of lures and hair snares to detect lynx. *Wildlife Society Bulletin* 28:119-123.
- [22] Clements, G. R. 2013. The Environmental And Social Impacts Of Roads In Southeast Asia. PhD Thesis, James Cook University, Australia.
- [24] Turkowski, F. J., Popelka, M. L. and Bullard, R. W. 1983. Efficacy of odor lures and baits for coyotes. *Wildlife Society Bulletin* 11:136-145.
- [25] Hunt, R., Dall, D. J and Lapidge, S. J. 2007. Effect of a synthetic lure on site visitation and bait uptake by foxes (*Vulpes vulpes*) and wild dogs (*Canis lupus dingo*, *Canis lupus familiaris*). *Wildlife Research* 34:461-466.
- [26] Martin, D. and Fagre, D. B. 1988. Field evaluation of a synthetic coyote attractant. *Wildlife Society Bulletin* 16:390-396.