R E P O R T

AN EVALUATION OF THE UTILITY OF CAMERA TRAPS IN MONITORING GIANT OTTER POPULATIONS

Rob PICKLES[1], Veronica ZAMBRANA[2], Bill JORDAN[1], Isla HOFFMANN-HEAP[3], Adriana SALINAS[2], Jim GROOMBRIDGE[3], Paul van DAMME[2]

[1]Institute of Zoology, Zoological Society of London, Regent's Park, London, NW1 4RY, United Kingdom. e-mail: rsapickles@hotmail.co.uk
[2]Asociacíon FaunAgua, 5263 Cochabamba, Bolivia
[3]Durrell Institute of Conservation and Ecology, Marlowe Building, University of Kent, Canterbury, Kent, CT2 7NR, United Kingdom

(received 7th July 2011, accepted 5th September 2011)

Abstract: Monitoring populations of giant otter, *Pteronura brasiliensis*, poses unique challenges. Important information such as sex, reproductive status, home range size and pack composition are often difficult to obtain during a short field season with limited observers. We conducted a pilot study on the use of camera traps to assist in monitoring a population of giant otters in the Bolivian Amazon. We found that while fewer individuals were resolved using camera traps than by direct observation, they were useful in complementing the observation approach to resolve pack membership and greatly facilitated the identification of the breeding pair. Camera traps were useful in resolving latrine activity patterns, the results of which are presented here.
Key words: Giant otter, camera trap, individual identification, population monitoring.

INTRODUCTION

The giant otter is an endangered species with a widespread distribution throughout many different habitats of South America (Carter and Rosas, 1997). While populations in some parts of the range have begun to recover from the population crash in the last century (Tomas et al., 2000; Recharte and Bodmer, 2009), threats to the survival of the giant otter are increasing elsewhere (Duplaix et al., 2008). Monitoring both recovering and declining populations poses logistical difficulties as well as the potential of causing stress to the animals, which can lead to failed reproductive efforts (Schenck, 1996).

Giant otters form packs usually from two to twelve strong, typically comprising a breeding pair, subadult young from previous litters and unrelated adult immigrants (Duplaix, 1980; Staib, 2005). They are diurnal, active from first light, typically resting during midday on cleared banks, known as 'campsites', and are active until dusk (Duplaix, 1980). The social structure of giant otter packs has been studied extensively in Manu by Staib (2005) and Groenendijk et al. (2006). However we still understand very little about the ultimate reasons for monogamy and alloparental care in this species, or the reasons for the complex latrine behaviour.

Biologists have been quick to capitalize on the small, relatively cheap, lightweight camera trap units in a waterproof housing initially developed by the hunting industry. They have been used both for estimating species distribution and abundance (Karanth and Nicholls, 1998; Rowcliffe et al., 2008) as well as determining patterns of activity and behaviour (Bridges et al., 2004; Maffei et al., 2005) without the need to directly observe the target species. The use of camera traps in monitoring giant otter populations was first suggested by Utreras and Pinos (2003), in which they used Camtrakker equipment with 35mm film set up on otter latrines in Ecuador. The potential of these units was restricted by the problems inherent with film loading cameras in the tropics, namely the growth of mould and the necessity of developing the photographs, a time consuming process. The development of digital technology now allows storage of many thousand photographs in each unit with the ability to instantly view the images in the field, leading to the potential of a much more flexible and opportunistic approach to camera trapping when targeting foal packs.

As part of an investigation into the spatial organisation and relatedness among packs along a river, we assessed the utility of using camera traps in the photographic identification of giant otters. We tested three different camera trap models on four different packs and compared the quality of data obtained from camera traps with direct field observation. Research was conducted on the Rio San Martin in the Bolivian Amazon. The giant otter population in this river has expanded following near extirpation during the pelt hunting of the last century (van Damme et al., 2002), and sections of the river have been surveyed for giant otters by Asociacíon FaunAgua from 2004 to 2008. The river holds approximately 90 animals divided among 15 packs on the main stream and three others in the tributaries San Joaquin, Orince and Blanco immediately upstream of the community of Bella Vista (Zambrana Rojas, 2007).

METHODS

Three researchers spent 43 days recording membership of the giant otter packs of the Rio San Martin. Direct observations of packs took place both from boats and field hides. Researchers used two Canon 400D digital SLRs with 500mm and 300mm lenses and a Sony handicam video recorder. Researchers were split between two boats and were tasked with recording different focal packs. We focused on using the camera traps to assist in recording membership, activity and home range of four key packs.

Two Reconyx R45 camera traps were selected due to the model's fast 'wake-up' time and rate of image capture (up to 3 frames per second). Extreme III compact flash cards were used capable of holding either 2GB or 4GB. Traps were triggered by a PIR motion sensor and were mounted with an infrared LED illuminator. Camera setup was as follows: Medium image quality; no firing delay; extremely high sensitivity. We also used a Stealthcam I230IR and Moultrie I40. Both these models were selected to take 10 second bursts of video footage.

Each trap was fixed to a tree or stake on the edge of a latrine. We found it useful to carry several pre-cut stakes firstly as there is often an absence of suitable trees for attachment due to the frequently dense nature of latrine undergrowth and secondly, this avoids undue machete work and trampling on the latrine, reducing the impact of human presence. Due to the giant otter's low profile, a low camera position (approximately 50cm above the ground) performed better at recording throat patterns. Following trap erection, the latrine was doused thoroughly with water flung by paddles from the canoe in order to dampen the smell of human presence.

Camera trapping was opportunistic as we were restricted by the distance from camp, which had to be travelled to check the cameras and the number of cameras. We attempted to maintain cameras on active latrines, requiring a judgement of the pack's movements. If a latrine with a camera on had not been used for three days, the camera was moved to a different latrine.

RESULTS AND DISCUSSION

Comparison of camera trap models

While colour images from the Moultrie camera were of good quality, and its triggering speed reasonable, its down-time meant that over a minute's worth of recordings would be lost between capture events, leading to far fewer throat markings being recorded. The one particular advantage of the Moultrie model is its inbuilt laser, which is extremely useful for angling the correct setup. Stealthcam performed poorly, producing very grainy footage and suffering the same problem of a mandatory minute lag time between firing bouts and a slow wake-up speed. By contrast, the Reconyx models produced an image of higher clarity, with a much faster triggering speed and lack of downtime. The Reconyx takes 6x C cell batteries and by the end of the fieldwork after six weeks, battery power was still at 50%.

Comparison of camera trap data with direct observation

In total, 2hrs 40 minutes of giant otter footage from 4 packs was recorded on latrines using camera traps over the course of the fieldwork. This footage comprised 17 visits and led to the identification of 16 individuals. While most of the pack members were identified by direct observation, three of them were only identified by camera traps on latrines. The camera traps also recorded several incidences of investigation of latrines by individuals from outside the pack, something which wasn't directly observed.

Information recorded by the camera traps

Average time spent on the latrine was extremely short, 70% of visits were under 10 minutes in duration (Fig. 1). This highlights the importance of fast triggering time on the camera trap to avoid losing these briefer visits. Two activity peaks were observed- between 8:00 and 12:00 and then between 14:00 and 18:00 (Fig. 2).

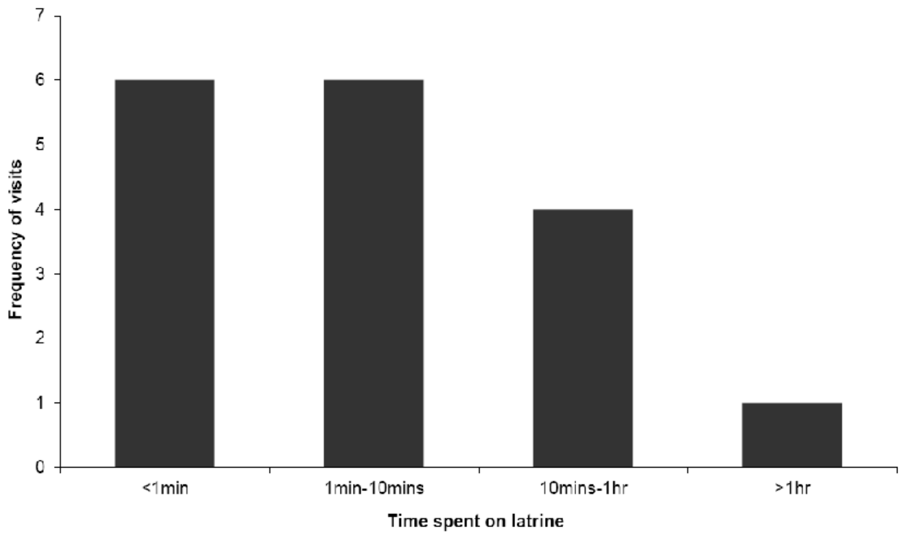

Figure 1. Duration of latrine visits

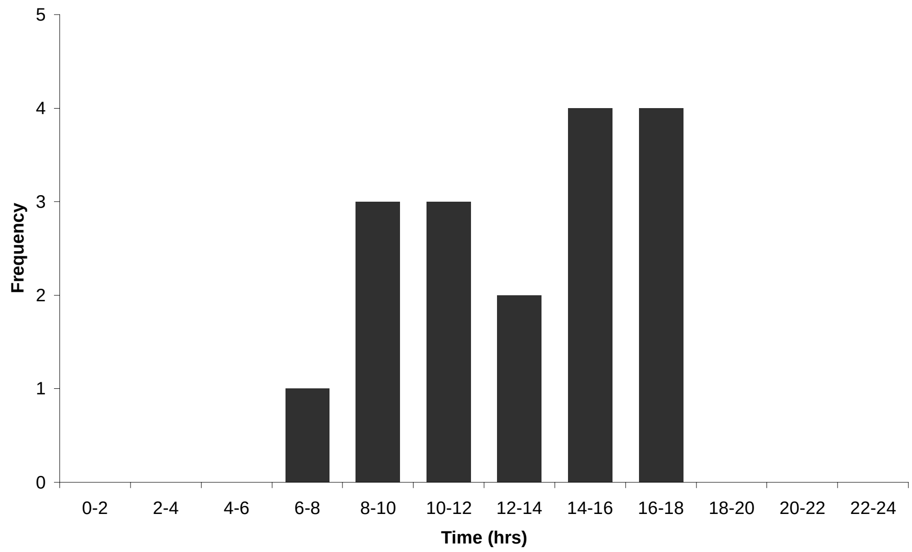

Figure 2. Time of day of visit over 24 hours.

Camera trap images enabled the identification of the reproductive pair for three packs and identification of the breeding female for the fourth. Objective sexing of individuals is extremely important when considering pack social dynamics. While males tend to be heavier than females with thicker necks and broader heads (Duplaix, 1980; Sykes-Gatz, 2005), the variation within each sex means that this rule cannot be relied on for accurate sex determination. Visible genitalia in camera trap images provide a more objective method. However we found that males can often be misidentified, as a protruding anal gland from an otter can often resemble testes. Similarly, a cautionary note must be made regarding lactation. It can be easy to mistakenly assume the presence of multiple lactating females in a pack when two females with visible teats are seen. However, once a female has been suckled, her teats will remain long and visible years after the event (Sykes-Gatz, 2005; Groenendijk, pers. comm.). The lactating female often has more obvious turgid teats (Fig. 3).

Figure 3. Lactating female with a full udder and enlarged teats (left) and male with visible scrotum (right)

Juveniles (six months to one year old, Sykes-Gatz, 2005) are extremely difficult to identify in brief observations made by boat as they rarely periscope and are kept to the periphery by the rest of the pack. Furthermore the distinction between juvenile and sub-adult (one to two years) can be problematic in the field. Despite the fact they

rarely appear on latrines, we recorded the presence of three juveniles from 2 different packs using camera traps and obtained good neck markings from these individuals.
On three occasions camera traps were instrumental in resolving the extent of packs' home ranges. Home range was defined as lying between the furthest points on the river in which the pack was recorded. Camera traps left on active latrines lying midway between two packs resolved ownership of the latrines, resulting in home range extensions in these three cases.

Disturbance to animals and reaction to the camera traps

We noticed very little reaction to the trap's presence. On four occasions the otters initially approached cautiously and appeared to smell in the direction of the camera. However, following this behaviour they continued with their latrine activities. Despite the fact that giant otters have been observed to grapple and break branches and saplings on their latrines, the camera traps were never investigated or interfered with. All models tested used red LEDs to illuminate in low light conditions. We noticed no reaction from the giant otters to the red light and suggest that models with red light rather than white light be used whenever camera trapping with these animals. We found camera trapping to be a far less invasive way of monitoring pack composition than by direct observation, which led to higher levels of stress and on two occasions, den changes. While giant otters encountered in the river by canoe will often periscope and present throat markings directly to the camera, it is believed that the "periscoping" behaviour results from a stressful situation and can interrupt the current daily activities of the pack.

Non-target species occurrence

Of the 48 triggering events, 31 were due to non-target species. These were predominantly the grey-necked woodrail, *Aramides cajanea*, (29%), dove sp (16%), ocelot, *Leopardus pardalis*, (13%), and curassow sp (10%). Interestingly Jaguar, *Panthera onca*, and giant anteater, *Mymercophaga tridactyla*, were also recorded investigating the latrines and coprophagy of giant otter spraint by common opossum, *Didelphis marsupialis*, was filmed on two occasions. Sun basking on more open latrines by the rufescent tiger heron, *Tigrisoma lineatum*, consumed a large amount of memory in single triggering event, highlighting the need for large capacity CF cards.

Limitations of camera trapping

Not every individual otter in the pack is likely to be easily recorded on the latrines. In particular, juveniles frequently appeared relegated to the periphery and were rarely recorded during a bout of activity. Furthermore camera traps are not cheap pieces of field equipment. For example, the Reconyx models used in this study cost $450 each. This cost has to be weighed against the level of information required from the study. If the aim of the study is to obtain a simple abundance estimation, then these costs are unlikely to be justified. However, if there is an ongoing monitoring program in which individuals are tracked from year to year, and information such as age class and body condition are important, then this method of data capture and its associated cost may be a worthwhile investment of resources.

CONCLUSION

We found that even using a small number of camera traps greatly increased the speed with which pack membership could be resolved. While the number of individuals identified in the camera traps was less than that recorded from direct observation, this method was particularly useful in delivering information on sex, age and reproductive status not easily available from direct observation. Furthermore, the quality of the images obtained was often superior and the camera traps provided extra detail of throat markings to complement photographs taken directly. More importantly, camera trapping appears to be less invasive than direct observation and has the potential to deliver important information on the role latrines and scent marking play in this unusual social mustelid.

REFERENCES

Bridges, A S., Vaughan, M.R., Klenzendorf, S. (2004). Seasonal variation in American black bear *Ursus americanus* activity patterns: quantification via remote photography. *Wildlife Biology* **10**: 277-284.

Carter, S.K., Rosas, F.C.W. (1997). Biology and conservation of the giant otter *Pteronura brasiliensis*. *Mammal Review* **27**: 1-26.

Duplaix, N. (1980). Observations on the ecology and behaviour of the Giant river otter, *Pteronura brasiliensis*, in Suriname. *Rev. Ecol. (Terre Vie)*, 34: 496-617.

Duplaix, N., Waldemarin, H.F., Groenedijk, J., Evangelista, E., Munis, M., Valesco, M., Botello, J.C. (2008). *Pteronura brasiliensis*. In: IUCN 2010. IUCN Red List of Threatened Species. Version 2010.4.
[www.iucnredlist.org. Downloaded on 10 Jan 2011}

Groenendijk J and Hajek F. (2006). *Giants of the Madre de Dios.* Ayuda Para Vida Silvestre Amenazada- Sociedad Zoologica de Francfort. Lima, Peru

Karanth, K.U., Nichols, J.D. (1998). Estimation of tiger densities in India using photographic captures and recaptures. *Ecology*. **79**: 2852–2862.

Maffei, L., Noss, A.J., Cuellar, E., Rumiz, D.I. (2005). Ocelot (*Felis pardalis*) population densities, activity and ranging behaviour in the dry forests of eastern Bolivia: data from camera trapping. *Journal of Tropical Ecology* **21:** 349-353.

Recharte, M., Bodmer, R. (2009). Recovery of the endangered giant otter *Pteronura brasiliensis* on the Yavari-Mirin and Yavari Rivers: a success story for CITES. *Oryx*, **44:** 83-88.

Rowcliffe, J.M., Field, J., Turvey, S., Carbone, C. (2008). Estimating animal density using camera traps without the need for individual recognition. *Journal of Applied Ecology* **45:** 1228-1236.

Schenck, C. (1996). Vorkommen, Habitatnutzung und Schutz des Riesenotters *Pteronura brasiliensis* in Peru. PhD thesis: University of Munich.

Staib, E. (2005). Eco-etologia del lobo de rio (*Pteronura brasiliensis*) en el sureste del Peru. Ayuda Para Vida Silvestre- Sociedad Zoologica de Francfort: Lima, Peru.

Sykes-Gatz. S. (2005). International Giant Otter Studbook Husbandry and Management Information and Guidelines. (Husbandry and Management of the Giant Otter *Pteronura brasiliensis)*, 2nd Edition) Zoologischer Garten Dortmund.

Tomas, W.M., Lima Borges, P.A., Florez Rocha, H.J., Sa Filho, R., Kutchenski, F. Jnr., Villafaine Udry, T. (2000). Potencial dos rios Aquidauana e Miranda, no Pantanal de Mato Grosso do Sul, para a conservação da ariranha (*Pteronura brasiliensis*). Anais do III Simpósio sobre recursos naturais e sócio-econômicos do Pantanal. Empresa Brasileira de Pesquisa Agropecuaria (Embrapa)-Pantanal, Corumbá, Brasil.

Utreras, V., Pinos, L. (2003). Camera trap use for studying giant otters (*Pteronura brasiliensis*) in the Yasuní Biosphere Reserve, Ecuadorian Amazon. *IUCN Otter Spec. Group Bull.* **20**: 69-71.

van Damme, P., Wallace, R., Swaenepoel, K., Painter, L., Ten, S., Taber, A., Gonzales Jimenes, R., Saravia, I., Fraser, A., Vargas, J. (2002). Distribution and population status of the giant otter *Pteronura brasiliensis* in Bolivia. *IUCN Otter Specialist Group Bulletin* **19:** 87-95.

Zambrana Rojas, V.D. (2007). Distibucion y estado poblacional de la lontra (*Pteronura brasiliensis*) en los rios Blanco y San Martin (Cuenca del Rio Itenez). Undergraduate dissertation, Universidad Mayor de San Simon, Cochabamba.

RÉSUMÉ

EVALUATION DE L'UTILITE DES PIEGES PHOTOGRAPHIQUES POUR LE SUIVI DES POPULATIONS DE LOUTRES GEANTES

Le suivi des populations de loutres géantes, *Pteronura brasiliensis*, pose des défis uniques. Des informations importantes telles que le sexe, l'état reproducteur, la taille du domaine vital et la composition du groupe sont souvent difficiles à obtenir au cours d'une saison de terrain et un nombre d'observateurs très limités. Nous avons mené une étude pilote sur l'utilisation des pièges photographiques afin d'aider à la surveillance d'une population de loutres géantes d'Amazonie bolivienne. Alors que moins d'individus sont détectés en utilisant les pièges photographiques que par l'observation directe, les appareils sont utiles pour compléter l'observation visuelle et permettent ainsi de préciser les membres d'un groupe mais aussi de faciliter l'identification des couples reproducteurs. Les pièges photographiques ont enfin été utiles pour la compréhension de l'activité autour des latrines dont les résultats sont présentés ici.

RESUMEN

EVALUACIÓN DE LA UTILIDAD DE FOTOTRAMPAS EN EL MONITOREO DE POBLACIONES DE NUTRIA GIGANTE

El monitoreo de poblaciones de nutria gigante (*Petronura brasiliensis*) presenta desafíos únicos. Información de relevancia como el sexo, el estatus reproductivo, el tamaño de las áreas de uso y la composición de la manada son indicadores difíciles de obtener durante una temporada corta con un número de observadores limitado. Conducimos un estudio piloto sobre el uso de fototrampas para ayudar al monitoreo de una población de nutrias gigantes en el Amazonas Boliviano. A pesar que utilizando las fototrampas se obtuvo una cantidad menor de individuos comparado con la observación directa, la información así obtenida fué muy útil en complementar el método de observación para differenciar los miembros de la manada y facilitó ampliamente la identificación de las parejas reproductoras. Las fototrámpas fueron así mismo útiles para establecer los patrones de comportamiento en las letrinas cuyos resultados son presentados aquí.