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CAN SECONDARY INFORMATION INFORM ABOUT POPULATION TRENDS OF CARNIVORES IN BORNEO?

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ABSTRACT. — Effective methods for estimating occurrence and abundance of carnivores are limited and often expensive in labour or equipment. Conducting interviews about wildlife species, including carnivores, is a common tool used in Borneo and throughout Southeast Asia to investigate species distribution and understand their conservation status. Such surveys are appealing because of perceived savings in time and equipment; however, biases in amount of available information, miscommunications about species of interest, and species misidentification can result in errors of unknown magnitude, rendering results of at least some surveys suspect. Hence, it becomes difficult to disentangle accurate from inaccurate information. Studies are needed to investigate the variation in effectiveness of interview surveys. Also better guidance is needed to clarify under which conditions secondary surveys can be used with confidence, and for which particular audience. Until the factors that bias results are identified and, where possible, accounted for, the main use of secondary surveys for carnivores and other difficult to identify or rarely encountered species will be to help develop a dialogue between people that reside or work in conservation project areas and the investigators working on such projects. Secondary surveys may also serve as a tool to help identify hypotheses to be addressed in studies with strong experimental designs.

KEY WORDS. — data accuracy, interview, local communities, species occurrence, survey

INTRODUCTION

Many carnivores are cryptic, nocturnal, occur at low densities or inhabit dense vegetation. Therefore, surveys of their distribution and other aspects of conservation status are difficult using most of the conventional wildlife survey methods (Mathai et al., 2010). Reliable information on wildlife status helps managers make informed decisions concerning their conservation. Whether to invest scarce resources and time in surveying can be a difficult decision for managers and while it has been argued that expenditures on determining the presence of a potentially viable population is a prerequisite to management (Chadés et al., 2008), this is an extreme stance with potentially limited application. While improved understanding is useful for management, to suggest that no management should occur without having demonstrated the presence of a potentially viable population overlooks that conservation resources are finite. There is a strong argument whether to use available resources for demanding studies to gain knowledge on threatened species or conservation implementation. This is particularly the case because: 1) assessing whether a species' population is viable/non-viable requires comparatively less resources; 2) assessing each species' status in sufficient detail to infer its level of viability in the area in question is highly demanding of resources for carnivores; 3) in Borneo there are, and will continue to be, few cases where resources are directed only to one species and other species present are not considered; and 4) many protected areas are not effectively addressing the most obvious, basic threat-related activities such as general compliance with hunting and habitat laws. Situations where individual species are already afforded much

priority in resource deployment (e.g., species at high risk of extinction such as the Sumatran rhinoceroses, *Dicerorhinus sumatrensis*) warrant the best available tools for clarifying their status, and investing in resources to guide their conservation management. Therefore, monitoring of wildlife is often inconsistently carried out in most protected areas of Southeast Asia. While there is continued debate over how best to allocate limited resources between interventions (e.g., changing the situation) and surveying (e.g., documenting the situation), there is no doubt that when survey is undertaken, it should use methods best suited to deliver the information needed under the resources available.

The urgency for appropriate survey methods to be used is heightened by high rates of deforestation in Southeast Asia, especially on the island of Borneo (Brook et al., 2003; Bradshaw et al., 2009; Miettinen et al., 2011). A rapid assessment method that produces reliable information on the conservation status of these species would be very useful. In Borneo, secondary information has been used for various research purposes such as understanding a species distribution and population trends (e.g., clouded leopard [*Neofelis nebulosa*; Rabinowitz et al., 1987]; Sumatran rhinoceros [Meijaard, 1996]; bay cat [*Catopuma badia*; Meijaard, 1997]; tiger [*Panthera tigris*; Meijaard, 1999]; ethno-zoology [Mohd-Azlan & Faisal, 2006]; bay cat [Mohd-Azlan & Sanderson, 2007]; wildlife inventory [Mohd-Azlan, 2004]; flat-headed cat [*Prionailurus planiceps*; Wilting et al., 2010]; orangutan [*Pongo pygmaeus*; Meijaard et al., 2011]; flying fox [*Pteropus vampyrus*; Harrison et al., 2011]). In all these, surveyors did not record the species directly (e.g., sighting, camera-trapping) or indirectly (e.g., signs), but on the authority of someone else: usually villagers, hunters, protected area personnel or local government staff. Such methods are desirable because of low operational costs and ease of training. However, just because such methods are desirable, does not mean they are reliable.

A somewhat related issue is that many surveys for particular species or issues use methods which generate information about other poorly-understood species. Increasing in popularity, camera traps provide incidental information of non-target species. Auxiliary information from this method is often uncontested and available (Mohd-Azlan, 2009). The bay cat was once thought extinct in Sarawak, Malaysia, before being photographed in the state (Dinets, 2003). Such incidental records have been used to investigate the distribution and ecology of secretive species in this region (e.g., Grassman et al., 2002; Rompaey & Mohd-Azlan, 2004; Meijaard et al., 2005; Baird, 2006; Duckworth et al., 2006; Mohd-Azlan & Davison, 2006; Wilting et al., 2010). Such collations offer a valuable source of information for these species, but by definition, arise through post-hoc opportunities. These records on their own do not provide sufficient information to meet the needs of conservation management of such species. Moreover, direct observation methods, including camera-trapping, are expensive and time-consuming as compared to secondary observations, and have their own challenges regarding accurate species identification (e.g., Meijaard et al., 2006). The rest of this contribution discusses the use of secondary information (a form of indirect information) in the conservation survey and monitoring of Borneo's carnivores. Such information may be incidental (e.g., revealed during discussion with village collaborators during a camera-trap survey) or the primary method of the survey itself. The focus of this paper is to demonstrate its potential use as the primary method and discuss some of the limitations involved.

BENEFITS OF SECONDARY INFORMATION

The major reasons for use of secondary information in carnivore surveys are the perceived time and cost savings, and to provide a direct forum to discuss conservation issues with local people. For example, to obtain information on threats such as hunting or to understand the local perception about certain species.

Gathering respondents' information can be completed rapidly; generally requiring only 3–4 days per community (village, operations camp or other group of people) to obtain the information; and if 6–8 communities are visited, may require only 3–4 weeks. No other survey method is reasonably expected to profile the carnivore community of an area of Borneo, typically of tens to hundreds of square kilometers, in such a short period. Therefore, it is important to consider if interviews can be used to effectively survey carnivore communities, and if not, what their limitations are.

Interview surveys are generally less expensive than primary field research because no costly equipment is needed, and information can be gathered from people who have collective knowledge about relatively large and sometimes remote areas in which they work. For example, a large survey in interior Borneo, involving nearly 7,000 interviews in 687 villages, reported a total cost of US$221,000 (including all salaries, fees, travel, and equipment), yielding reported orang-utan presence and relative encounter estimates from a total area of 101,107 km^2 (Meijaard et al., 2011).

Perhaps the most compelling reason for their use is that interviews require the genuine participation of local people. Most conservation initiatives in Southeast Asia depend crucially on local community involvement (Rautner et al., 2005). Conducting interviews with local people on wildlife and showing respect for their knowledge create good entry points for conservationists to build awareness and support for local conservation efforts.

LIMITATIONS OF SECONDARY INFORMATION

There are also several disadvantages of using secondary information for research. For example, secondary data are at high risk of error because a host of factors lead some interviewees to deliberately or unintentionally provide incorrect information (e.g., social desirability bias; Fisher, 1993). As one of the many factors, some respondents' views may reflect the situation from several years ago. While this

is valuable information for identifying temporal trends, if not distinguished it can lead to an inappropriate assessment of species (e.g., their distribution, abundance, human use of the species, threats, and trading price). Another potential disadvantage is that secondary information on the species in question may not be sufficiently available (in extreme cases, not at all) to allow meaningful conclusions to be drawn (for example, where a species occurs only or predominantly in areas not visited by people). However, in these situations limited data may be useful for developing questions about species distributions that can refine future surveys using secondary information or other techniques.

Sources of error can be categorised into errors in information content (e.g., when the interviewee misinforms the interviewer deliberately or inadvertently) and errors in communication (e.g., when the information communicated by the interviewee is misunderstood by the interviewer, or the interviewer's question is misunderstood by the interviewee). Errors of recorded identification can arise either through the respondent not being able to distinguish species in question from one another or that interviewers misinterpret the respondents or the information provided by respondents. Errors in information content include incorrect identification at the taxonomic level under discussion, and forgetfulness by the interviewees' regarding where or when sightings took place and their frequency.

Errors in information content include different forms of social desirability bias. This is a systematic error caused by respondents providing dishonest answers to project a favourable image of themselves relative to prevailing social norms (Fisher, 1993). Social desirability could involve suppression of information for fear that external perception of an area's wildlife value will lead to enhanced protection measures, exaggeration of an area's wildlife value to please the interviewer or ill-considered, rapid responses to bring an interview to a close as soon as possible. In Borneo, people generally are willing to talk about species they frequently hunt, such as bearded pig (*Sus barbatus*) and sambar deer (*Rusa unicolor*) but most people are less interested discussing obscure or less frequently encountered animals (Mohd-Azlan, pers. obs.). These people also may be concerned that providing correct, precise, information to 'officials' may in some unforeseen circumstances lead to future problems. A social desirability bias could be especially common when questions are asked about sensitive topics, like illegal hunting. Survey techniques, such as randomised response techniques (St. John et al., 2010), exist that reduce such social desirability biases. Anonymous self-completion of questionnaires have also been shown to reduce social desirability bias in some contexts (Groves et al., 2004), but does not necessarily circumvent the problem of erroneous species identification.

Additional errors in communication include the failure for the interviewer and interviewee to limit the topic of discussion to a specific time and place, so that information from a wider area or a longer time period is used in the answer. Also, failure to ensure that the interviewer and interviewee are talking about the same taxonomic unit may occur, as well as failure of the interviewer to record all information provided, or to record it incorrectly, when a discussion becomes enthusiastic. Individuals who have filmed lengthy interviews and watched the results while reviewing notes taken at the same time have noted that errors or omissions occur, sometimes leading to shifts in the main conclusions as a result (e.g., Robichaud et al., 2010). Related to these temporal biases is the difficulty for respondent's data to accurately estimate change in abundance of a species over time. Although these trends are commonly reported as valid (Skalski et al., 2011; Ward-Paige et al., 2011), there are few studies where accuracy of abundance or trend data based on human perception were assessed.

Errors in communication can be reduced substantially by use of appropriate personnel as interviewers, but errors in information content are far more difficult to reconcile. The latter include errors and associated biases of species identification, which are common in surveys among diverse wildlife taxa (Graham et al., 2004; Belant et al., 2006; Lozier et al., 2009). For example, only 4,885 out of 6,973 (70.1%) interviewees living alongside orangutans could reliably identify that species, as well as the vaguely similar looking red langur (*Presbytis rubicunda*) and gibbon (*Hylobates* spp.; Meijaard et al., 2011). Presumably, species identification accuracy would be considerably lower in smaller, nocturnal, and more elusive species. For example, the carnivore community in Borneo is rich and possibilities for confusion in identifying species seem likely. The sun bear (*Helarctos malayanus*) is the only bear species on Borneo and, provided care is taken in selecting interviewers and interviewees, is unlikely to be confused with any other species, although binturongs (*Arctictis binturong*) or even Sunda stink-badger (*Mydaus javanensis*) could be mistakenly identified. Every other Bornean carnivore species is, however, somewhat similar in form and coloration to at least one other Bornean carnivore. Hence there is potential for confusion during discussion at the species level. With some groups, notably otters (Lutrinae), but also mongooses (Herpestidae), it seems implausible that credible species-level secondary information could be collected except in exceptional circumstances, given the difficulties experienced surveyors have in identifying species from either skins in museum collections or actual field sightings.

Many studies of identification error have used primary survey techniques (e.g., Fitzpatrick et al., 2009; McClintock et al., 2010; Balestrieri et al., 2011); however, the principles and effects of errors on resulting data interpretation are just as applicable to secondary surveys. Additionally, although many surveys emphasise false positives, the effects of false negatives can be equally important (Hanson, 2011), especially for rare species (Balestrieri et al., 2011), when considering the limited available resources for additional surveys or conservation efforts. Some species identification errors can also be reduced by broadening the discussion taxon to include aggregates of species. For example, it may not be necessary to gather information separately for each of the four otter species potentially occurring in Borneo at any site. However, if the four otter species are aggregated as a single discussion

taxon, it is likely that reliable information can be gathered provided precautions are followed in use of the technique.

Interview surveys involve people and knowledge, interest, ability, and skill of both interviewee and interviewer can introduce bias. Some potential interviewees are likely wholly unsuitable, and nearly all potential interviewees have weaknesses of information in some areas. Thus, the suitability of the interviewees and stakeholders should be assessed based on the objective of the study. Preliminary tests can help identify appropriate interviewees (e.g., based on job, use of forest resources, gender etc.) in the community and also build trust by spending more time with respondents. Unless a method is used to randomly select interviewees and objectively test their reliability (e.g., Meijaard et al., 2011), a good interviewer needs to be able to select suitable interviewees and determine where there might be weaknesses in information received.

Some potential interviewers will never be able to gather reliable information, because interpersonal skills vary among people. However, training and experience can improve an interviewer's abilities. Although interviewing may seem a short-cut method, the skills required are more demanding than for primary survey methods. The surveyors have to understand not only the animals and habitats under investigation, but also the perceptions and thought processes of the people they are interviewing. This requirement alone is rarely understood, judging by the many wildlife status reports containing obvious errors based on surveyor's recording of their perceptions of local information. An extreme example was a report seen by EM, which included the dugong (*Dugong dugong*), a marine mammal, in a species list based on interview surveys in a central Borneo highland area, without the report questioning its listing. Therefore training of interviewers should be organised in a planned and coordinated effort before each census is carried out (Fowler & Mangione, 1990).

Finally we note that despite various forms of bias in interview-based studies, local reports of species presence which are not recorded by any other method may not be in error. It is in fact very difficult to prove that a species claimed to be present is not (Sanderson & Trolle, 2005; Mohd-Azlan, 2009). Therefore, common-sense approaches are needed such as the inherent implausibility of any particular claim. This can be difficult to implement in areas with fauna as little known as Borneo's; surprising results are not necessarily errors.

WHERE INTERVIEWS MAY BE SUITABLE

Wherever possible, direct methods that provide verifiable information should be used. Often these are too expensive. The use of interviews is therefore attempting to obtain credible information in situations where the alternative is no information. Well-gathered interview information cautiously interpreted is superior to no information. In one class of information, however, interviews may be the only available method: assessing recent trends in conservation status (e.g., population and distribution). In such cases, the surveyor has no opportunity to assess past populations directly, and archived information from the recent past is rare or non-existent in most areas (e.g., Turvey et al., 2010). Therefore, collating the recollection of interviewees may offer the only information on past status other than prediction and assumption, which are themselves based on unverifiable assumptions. In such situations, information on recent population trends and distribution of rare species can be very useful to inform and guide conservation interventions. This highlights the importance of developing credible methods for conducting interviews and collecting secondary information.

Although interview surveys can potentially be used in understanding population trends, there are few verified examples of their efficacy. One example of the inaccuracy of interview surveys for understanding population trends is for American martens (*Martes americana*) and fishers (*M. pennant*), two mustelid species occurring in Michigan, USA. The American marten is legally trapped for its fur during December each year and following each harvest, each trapper completes a survey form which includes whether the trapper believes the marten population is increasing, stable, decreasing, or unknown (Frawley, 2003, 2008). From surveys completed during 2000 and 2007, 80% of trappers in both years believed the marten population were stable or increasing; with 41% and 43% stating the population was increasing, respectively. In contrast, formal population estimates of this same population indicated the population had declined by 33% from 2000–2007 (Skalski et al., 2011). Although less complete, a more extreme example exists for fishers. Fishers in Michigan, USA, are trapped during the same harvest season as martens. The fisher population between 2000–2007 has apparently declined about 75% (J. J. Millspaugh et al., unpublished data), yet in 2007, 18% of trappers believed the population was increasing and 47% thought the population was stable. Only 25% of trappers believed the fisher population was in decline, this during an almost unprecedented population crash. In this case, the effectiveness of interviewees in estimating trends of carnivore species abundance appears limited. Few, if any of the individuals surveyed in Michigan depend on hunting or trapping as a primary means of income or survival. However, the area of Michigan where marten and fisher trapping occurs is heavily forested with low human population density. People in this area rely heavily on natural-resource based industries (e.g., logging) for their livelihood, and hunting and trapping are important recreational activities. We note that in the Michigan example, American trappers might have had vested interest in under-reporting population declines, which might not necessarily be different with people interviewed about Bornean carnivores, who could introduce their own personal bias towards particular species trend.

VERIFICATION OF SECONDARY INFORMATION

Conservation management would be better served by moving the debate about interview-based surveying from "is it a good method or isn't it?" to "under what circumstances is

it potentially a method of choice and how can its potential biases be minimised?" As a general guideline, interview surveys involving hunted animals are probably best in areas where legal restraints on hunting are low, where hunters do not see possibilities that the information they convey may curtail their hunting freedom, and in areas where one or two people gather the data and are resident over a long period of time (J. W. Duckworth, pers. comm.). More broadly, interview results will be at high risk of error if the interviewers are not fluent in the local language and customs of the interviewees. At every possible opportunity, interviewers should observe pets, remains of dead animals, and photographs held by the interviewees to help reduce uncertainties over identification. Additionally, information can be verified through having more than one stakeholder confirming the same information.

Various secondary information sources are available to the surveyor, including: 1) information gained from wildlife authorities such as hunting licences issued, reports of animals killed as pest, and reports of confiscated live and dead animals. Increasingly, these include photographic documentation with locations verified to the extent possible; 2) information gained from local hunters and villagers who enter forests for any reason about hunted animals and species observed during other activities in the habitat of interest; 3) information gathered from local bush meat traders on the origin of animals obtained (which is often difficult to establish and, when apparently established, difficult to check), how the animals were hunted (techniques; reported information can often be verified with marks on the animals themselves), market price of the animals, animal parts that are consumed and for what purpose (food, ornamental, medicine, etc.); and 4) information gathered from protected area staff who are not themselves experienced wildlife surveyors. A major challenge here relates to validation of spatial information and ensuring the interviewees separate their perceptions of spatial heterogeneity that may be biased due to factors such as unequal staff presence in different parts of the protected area with genuine patchiness in species distribution.

FUTURE DIRECTIONS: THE NEED FOR VALIDATION

For secondary information to be a credible form of data, more studies are required on its reliability and limitations. Being widely used does not provide evidence that it is effective. For many years, an expensive pugmark census was undertaken in India to monitor tigers. It took many years of vocal denouncement by those who questioned its reliability, and the loss of entire tiger populations from some key protected areas, to force a general acceptance that it produces no information of value to wildlife management (Karanth et al., 2003).

The single most astonishing aspect of interview studies (not just those specific to Bornean carnivores) is the scarcity of studies assessing the reliability of data gathered (but see Meijaard et al., 2011). Discounting aspects of truthfulness, which requires cautious interpretation and in some cases may be insuperable, the method has widespread inherent weaknesses based upon usually untested assumptions. Examples of untested survey assumptions include: 1) the interviewee divides the natural world into named forms broadly congruent with biologists' classifications; 2) the interviewee can recognise such named forms from photographs or other illustrations or local names; and 3) the interviewee will keep a running total in their minds of local status of each such named form.

The appropriateness of these assumptions is, mostly, not difficult to explore. People representative of the interviewees should be routinely investigated (as individuals) to establish how they classify wildlife. This can be done by providing dozens of exhibits (photographs, preserved parts, and sound-recordings of animals; plaster casts of tracks; photographs of faeces; and other signs) and asking them to group the exhibits into 'species' and provide the name(s) that they use for each group. Exhibits should realistically reflect field encounters. For example, photographs should include some animals partly obscured, poorly lit, and/or blurred. Moreover, species almost certain not to be present but broadly similar in appearance should be included among the exhibits (for Bornean carnivores, candidate species would include non-Bornean congeners of Bornean species). Because local people are unlikely to be aware of morphological variation within and between similar-looking species, care must be taken to find out whether interviewees note something unusual about the appearance of non-Bornean congeners compared to animals they encounter locally. No pattern should be apparent to the interviewee in terms of numbers or types of exhibits per species. Their number and proportion among forms should vary considerably, otherwise decisions on assignment to type may be made based not on characters discerned in the exhibit. Such investigations of classification and nomenclature should be replicated for each survey area using different people in a village, different villages within an ethnic group, and different ethnic groups within the area. Care is needed in extrapolating results from any particular area and field of enquiry into different situations. The experience of such investigations should help indicate potential risks in assessments revealing low-risk lines of enquiry and give improved context for interpretation of future interviews with people represented by the pilot interviewees. This level of effort to assess interviewees' reliability to identify species would be analogous to training them to be para-taxanomists or ethno-zoologists. Subsequent discussions would be more comparable to research coordinators compiling data from local survey specialists. This level of investigation negates the initial appeal of interviews but may ultimately be necessary, particularly for species difficult to identify and rarely encountered.

We are unaware of any study verifying the efficacy and accuracy of interviews for carnivores in Southeast Asia using this approach. Based on unstructured interview surveys in northern Southeast Asia, it is difficult to believe that smaller Bornean carnivores would be surveyable with much confidence in the results except for a few species like Malay weasel (*Mustela nudipes*; visually very distinctive)

and small-toothed palm civet (*Arctogalidia trivirgata*; vocally very distinctive).

In Indo-China region, the consistency of use of local names between ethnic groups (who may be from entirely different language groups) is, as would be expected, low. More surprising is that the same name in the same language may be used by even adjacent villages of the same ethnic group for different species, even when both species are present in both areas (J. W. Duckworth, pers. comm.). Testing for consistency to indicate name and picture assignment is therefore useful. The sun bear is an obvious species where communication may be possible without inadvertent confusing the biological species involved. This leads to a very important recommendation during actual interviews (as opposed to pilot surveys), which should be a general requirement for reducing assumptions. Rather than the interviewer asking the interviewee whether 'Species X', as defined by a picture or a name, occurs, it is better to ask the interviewee to describe, within the general 'carnivore' animal, how many forms occur, the appearance and habits of each, and the local name of each. The interviewee can then make the associations, based on information provided, as to the plausible biological identity (identities) of each form, and the confidence of each linkage. Studies on timber trees in Indonesia have shown too low consistency in the use of local-language names for species to make a dictionary-approach to interview surveying acceptable (Wilkie & Saridan, 1999).

Verbal information should be supplemented wherever possible with viewing of exhibits within the village, such as hunters' trophies, captives, and photographs in more affluent areas, which are indicated by the interviewee to be examples of the type under discussion. Pictures or other exhibits should only be shown by the interviewer after the interviewee has exhausted their own store of knowledge. Once exhibits are shown, it becomes impossible to separate what information presented by the interviewee is drawn from his/her own experience and what consciously or subconsciously comes from the image. In many cases the interviewer showing carnivore pictures will add little or no accuracy or validity to the results of the interview, despite the superficial appearance of credibility (because it is easy for someone to point at a picture and say this lives here). The level of subconscious assumption among interview-based surveys is shown by the abundance of reports of interview surveys which state that local people reported, e.g., yellow-throated marten, (*Martes flavigula*) or sunda stink-badger. Often, it is impossible that they can have reported yellow-throated marten or Sunda stink-badger, as they do not speak English, and these names do not exist in their own language. Pointing at a picture in Payne et al. (1985) and saying 'this one lives here' may be what they did and the linkage that the species is present is made by the interviewer based on the assumptions given above. Similarly, an interviewer that correctly listens to village accounts of each species and makes the identification based on characters given, is misrepresenting the information received to say that, e.g., yellow-throated marten was reported: the informants reported an animal which the interviewer identified as yellow-throated marten.

Local people's classification of species may not be particularly congruent with western scientific classification systems (e.g., it may not have as fine a resolution or a species may have multiple names). Similarly, interviewers need to avoid the tendency to "correct" the corpus of information from any given interview. The weakness of typical interviews that present a long list of species, with usually only elementary discussion about each, often based around a picture book, is well shown by their use in Lao PDR; a country which until recently had no mammal (or bird) books comprehensive of species and limited to those in the country. Thus, interviewers tended to use those from adjacent Thailand (Lekagul & McNeely, 1977; Lekagul & Round, 1991, respectively). This was revealing because many interviewers knew too little about wildlife to realise that a whole suite of Sundaic animals found in southern Thailand do not occur in Lao PDR (perhaps the only one newly found in recent decades to do so, the striped rabbit genus *Nesolagus*, merited a paper in *Nature* [Surridge et al., 1999], because of the magnitude of the surprise). These animals were then erroneously included by the surveyors in the list of species reliably reported by local people. The listing of such species in the reports demonstrates that the body of species-based information in these reports is questionable. If more informed surveyors eliminate obvious errors, leaving a list that comprise only plausible species, this denies the reader the opportunity to appreciate the weaknesses of the method. Indeed, a list comprising only species reasonably likely to be in the survey area gives tacit support to the reliability of the technique. In essence, the raw results have been in such cases filtered by the surveyors' perceptions. Where local statements fit expectations, they are included; where they do not, they are ignored. It would be more appropriate (and probably more useful) simply to generate predictive lists of species present based on habitat, geographical location and human factors. Borneo had the first modern field guide to mammals in any part of Southeast Asia (Payne et al., 1985), and it remains an excellent identification guide. A negative side-effect is that because it contains only species living in Borneo, its use during interviews cannot alert surveyors to the difficulties of picture-based interviews. Uncritical exponents of the method should attempt some interviews using a book such as Francis's (2008) field guide to the mammals of mainland Southeast Asia and consider the results of these interviews based on the 'recognition' of images presented. A focus on tracing specific encounters, preferably first-hand (e.g., by the interviewee) and deriving dates, locations, and most importantly, style of contact (field sighting, trapped animal, sign observation, etc.) can reduce the tendency of interviewers to generalise based on few encounters or second-hand knowledge. The process of recalling detail often leads to early statements in an interview being changed.

CONCLUSIONS

Interviews about wildlife species presence, often including carnivores, are a common tool undertaken in Borneo, as with elsewhere in Southeast Asia, to understand their local conservation status. It has obvious conservation benefits

when the interviewees comprise groups of people likely to be important stakeholders in a project's conservation interventions (e.g., villagers or protected area staff). Moreover, it is seen by many as a quick and inexpensive method to gain this information, with the implication that such information is reliable enough to be useful. However, unlike a typical scientifically credible method, it remains poorly tested (in Borneo as elsewhere in Southeast Asia and the world) whether as typically used it has sufficiently low margins of error to be useful. Such testing needs to be undertaken as a matter of urgency. These results would likely demonstrate that it has limitations largely unrecognised or at least ignored by most of its proponents. Equally important, it would give valuable insight into how to employ the method to minimise the generation of unreliable information. Many people do not consider the possibility that some information is likely to be erroneous, and those that do but still wish to use such information are forced to filter it through common sense (e.g., it seems implausible that anyone who does not regularly handle live or dead otters could reliably identify otters to species in Borneo) and opportunistic experience (e.g., a hunter associating a dead animal in their possession with a picture in a book of a given species). This is astonishing considering the resources in aggregate used for interview surveys across Southeast Asia. Until credible testing of the reliability of such surveys is undertaken, the utility of the method must remain in question. Any individual programme of testing cannot be considered representative of all situations in which interviews may be used, and therefore many subsequent surveys will likely need to conduct a preliminary study to refine the topics of interest to minimise error. This does not mean that most information generated from interviews will be false; only that some may be and there is no obvious way to separate the accurate information.

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