Factors influencing stereotypic behaviours of animals rescued from Asian animal markets: A slow loris case study

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ABSTRACT

Illegal wildlife trade has devastating effects on wild populations in Southeast Asia, made evident from the rising numbers of threatened species found in rescue centres. The prevalence of slow lorises (Nycticebus spp.) in trade allows for the first time, a study of the response of wild-caught strepsirrhines to a captive environment following a period of non-existent welfare. Many animals confiscated from trade arrive at rescue centres with mental and physical defects and regularly perform stereotypic behaviours. Our study assessed the prevalence of stereotypic behaviour in three species of Indonesian slow lorises ($n = 90$) at a Ciapus Primate Centre in Java, Indonesia. We surveyed all slow lorises present, three times a night, every night, over a four-week period and recorded every time a slow loris exhibited stereotypies. We described the stereotypic behaviours witnessed and attempted to predict the occurrence of this behaviour. 33% of animals observed exhibited at least one of three forms of stereotypy – pacing, rocking head, circling. We examined extrinsic and intrinsic factors including sex, species, length of time in captivity, cage size and group composition to highlight stereotypic predictors. A logistic regression analysis revealed that 21.9% of variability in the presence of stereotypies could be explained by sex composition and number of conspecifics sharing an enclosure. Through experimenting with different size and sex composition of groups and distance to neighbouring groups, occurrence of stereotypies may be reduced. Numerous other factors not tested for, including a genetic predisposition to coping with life in captivity, could be responsible for these behaviours. As stereotypies in zoo-living lorises are rare, the brutal conditions of the trade may also play a major role in their prevalence in this study.

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1. Introduction

Illegal wildlife trade in Southeast Asia poses a serious threat to many species. Seizures by enforcement officials from hunters and traders ensure a steady flow of wild animals being admitted into rescue centres throughout the region (Nijman et al., 2010). From their period in the trade to arriving in a rescue facility, these wild animal confiscates are subjected to environments radically different from those in which they would normally reside. Any stress caused by these environments may be supplemented by injuries, malnutrition and human handling. These factors have been known to trigger the manifestation of certain novel behaviours never before displayed in the wild (Carlstead, 1998).

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In captivity, levels of low welfare may be at the root of abnormal behavioural patterns such as abnormal aggression, over-grooming, appetitive behaviours, inappropriate social interactions and stereotypies (Novak et al., 2006). Stereotypies are described as behaviours that are repetitive and invariant in form, with no apparent function, for example, pacing, rocking and somersaulting (for a review on stereotypies see Mason, 2006). Occurrence of stereotypies may be high in captivity, but rarely observed in wild free-ranging animals (Hogan et al., 2010).

Illegal wildlife trade for pets, food and medicines is causing a different class of animals to experience captivity, many of which arrive at rescue centres with mental and physical defects owing to the insufficient care and housing conditions during trade (Nekaris et al., 2010). One group of animals that are particularly impacted by the wildlife trade are the slow lorises (Genus: *Nycticebus*) (Svensson and Friant, 2014). Stereotypies are not common in this genus; Tarou et al. (2005) reported that only 15.4% ($n = 15$) of *Nycticebus* across 48 institutions displayed stereotypic behaviours.

Little is known about the ecology and behaviour of Indonesian slow lorises in the wild (Nekaris et al., 2014). Information yielded from studies indicates lorises have large home ranges of up to 35 ha (Nekaris and Bearder, 2011) and spend large proportions of their activity budget engaged in active behaviours (Wiens and Zitzmann, 2003). They can travel over 2 km per night (Nekaris, 2014). Despite previously being labelled as solitary animals (Charles-Dominique, 1977), researchers have revealed regular social encounters between lorises with sleeping groups of up to seven individuals, and substantial overlapping of territories usually of a single male, female and their offspring (Nekaris, 2006). Lorises are exudativores and their diet comprises plant gum, floral nectar and animal prey such as insects (Starr and Nekaris, 2013). Slow lorises have specialised dentition to gouge the bark of trees to elicit the production of gum (Nekaris et al., 2010).

The effects of low welfare levels during the wildlife trade on Indonesian slow lorises are likely to elicit adverse behaviours, especially when considering such a wide ranging, highly active and social animal. As many slow lorises have their teeth removed by traders to avoid biting humans or other lorises in transit (Nekaris et al., 2010), this process may also have ramifications on their ability to feed on preferred foods. The prevalence of this genus in trade allows for the first time, with a large sample size, a study of the response of wild Indonesian slow lorises to a captive environment, and to use statistical models to predict when stereotypies are more likely to develop and in what setting.

The objective of this study is to test the hypotheses that certain extrinsic factors will increase the occurrence of stereotypic behaviours. We predict higher incidences of stereotypies in slow lorises housed in smaller cages; in unnatural social groups; and with larger numbers of conspecifics. We relate these conditions to length of time in captivity, teeth condition, and place of origin.

2. Methods

2.1. Study site

We conducted the study at Ciapus Primate Centre (CPC), International Animal Rescue, West Java, Indonesia (6°39′47″S, 106°43′42″E). CPC is located on the edge of the Gunung Halimun-Salak National Park and housed 99 Indonesian lorises including *Nycticebus javanicus* ($n = 41$), *N. coucang* ($n = 42$) and *N. menagensis* ($n = 7$) during the time of the study. The lorises are kept in semi-natural enclosures ranging in size from $8\,m^3$ to $156\,m^3$ (Table 1). Lorises are grouped according to species, but not according to sex or age. Groups are formed by a process of socialialisation where new individuals are placed in an adjoining cage for a period of time and interactions are monitored. If interactions are amiable, the individual will be placed in the group and monitored for a week. If extreme or exessive aggression is observed the loris will be separated again and tried in a different group. Only a few individuals cannot be socialised into groups and have to be kept separate because of aggression. Each cage is minimally equipped with nest boxes and weaved bamboo tubes for sleeping, feeding trays and other feeding enrichment devices, substrates (both live and dead) for climbing and water containers. Enclosures are illuminated with dim red lighting on a rotating schedule and provisioned with enrichment on a weekly basis. Slow lorises are given three main feeds and two enrichment feeds per night. The area is restricted from visitors.

2.2. Data recording

As part of the pre-release phase in a reintroduction programme underway at CPC since January 2010 (Moore et al., 2014), we systematically monitored CPC's captive slow lorises. During the six-month behavioural scan sampling period, we became accustomed to the types of stereotypies exhibited, thus, were aware of what constituted this mode of behaviour. For 30 days in November 2010 we observed 90 of the 99 lorises at the rescue centre for one hour, three times a night at 21:00, 00:00 and 03:00 h, and recorded any stereotypic behaviour displayed. All individual lorises displaying abnormal behaviours were identified and recorded. We set up five vantage points where observers could scan numerous cages at once and observed the lorises from these points for 20 min at each point. This period allowed time for any slow lorises initially disturbed by the presence of the observers to resume their normal behaviours. We excluded nine animals receiving medical treatment from the study. We measured each enclosure, and recorded the species, number of individuals and sex ratio in each. Using data from medical records provided by CPC we also noted the date when each slow loris had arrived at the centre, their place of origin, and condition of the teeth.

2.3. Data analysis

We used non-parametric Chi-squared tests to analyse the demographic data owing to the presence of nominal and categorical data. We used a forward-stepwise, binary logistic regression model in order to predict possible causes