

Two cases of mother–infant cannibalism in orangutans

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Abstract Observations of ape cannibalism have to this point been limited to chimpanzees (*Pan troglodytes*) where it is associated with infanticide and consumption by unrelated individuals (Watts and Mitani, *Primates* 41(4):357–365, 2000). Here we report for the first time observations of two unrelated female Sumatran orangutans (*Pongo abelii*) cannibalizing the remains of their infants on different occasion, a behavior never before reported in any ape species. The two orangutans were wild-born rehabilitated individuals, and had been reintroduced to an area hosting a largely unregulated primate tourism industry and experienced restricted ranging conditions. Though it is possible that this is a strategy to regain energy and nutrients or a result of individual history, comparative data suggest that this is an aberrant behavior which may be linked to environmental stressors within the area.

Keywords Cannibalism · Orangutan · Reintroduction · Stress · Primate tourism

Introduction

Cannibalism is a rare event in primates, with observed cases documented in only a few species, including: chacma baboons (*Papio ursinus*) (Palombit et al. 2000), common marmosets (*Callithrix jacchus*) (Bezerra et al. 2007), snub-nosed monkeys (*Rhinopithecus bieti*) (Xiang and Grueter 2007), blue monkeys (*Cercopithecus mitis stuhlmanni*) (Fairgrieve 1995), and thick-tailed bushbabies (*Galago crassicaudatus umbrosus*) (Tartabini 1991). Of the great apes, chimpanzees (*Pan troglodytes*) alone had thus far been observed engaging in cannibalism (Bygott 1972; Watts and Mitani 2000), with cannibalism inferred in gorillas (*Gorilla beringei beringei*) through infant remains found in the feces of two unrelated individuals (Fossey 1976, cited in Goodall 1977). Mother–infant, or filial, cannibalism is more common in both nonprimate species and primate species living under stressful laboratory conditions, such as galagoes (Rohwer 1978; Tartabini 1991).

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Methods

Field studies took place within Gunung Leuser National Park, Sumatra, Indonesia. The site, Bukit Lawang (03°32.770'N, 098°07.000'E), hosted a rehabilitation project from 1972 to 2001, until alternative facilities were developed in Sumatra. Throughout the time the rehabilitation project was running, Bukit Lawang was and still remains host to a wildlife tourism industry centered on the orangutans. Although it is forbidden to touch, feed or

disturb the orangutans, such practices have (Rijksen and Meijaard 1999) and still do occur in the forest for the enjoyment of tourists. Observations reported here constituted part of a larger study on the behavioral health of these orangutans. The data reported are from observations collected from 22 May to 31 July 2007. Focal animal sampling with continuous recording (Altmann 1974) was conducted from dawn to dusk (sleeping nest to sleeping nest). The cannibalistic mothers were two adult reintroduced, or semiwild females, Edita and Ratna, who were both confiscated from the pet trade. Approximate ages at rescue and at the time of the observed events are included in Table 1.

Results

Edita, at the time of 23 years of age, had her 12-month-old infant die in the forest of Bukit Lawang on 21 May 2007. She carried and protected the corpse with her for 7 days, and came into contact with two conspecifics, both of whom showed no interest in the corpse. Both before and after consumption began, Edita would remove and inspect the corpse which she carried slung around the back of her neck, occasionally emitting a whimper vocalization. On the eighth day Edita began consuming the remains of the infant. By this point most of the body had decomposed in the rainforest climate, with only the backbone and limbs remaining. She was observed eating in nine bouts, ranging from 1 to 13 min. At one point she dipped a portion of the corpse into a tree hole filled with water and then ate from it. Edita encountered no other orangutans beyond her own accompanying juvenile offspring, 8-year-old Sepi, who was on two occasions observed begging, and eventually allowed to consume a portion both times through passive food sharing. The corpse was consumed in its entirety over three consecutive days.

The second observation took place less than a month later in an unrelated 20-year-old female, Ratna, whose 7-month-old infant died in the forest on 9 June 2007. Neither mother was within any observable proximity of the other since the first instance of cannibalism occurred, with consumption beginning with Ratna on 13 June 2007. Similarly, little of the body remained, with the head and most of the body missing. Three observed bouts, ranging from 7 to 9 min occurred on a single day (Fig. 1 and also see video clip available as online supplementary material). Ratna was not heard to emit any vocalizations, and on four occasions was seen swinging the corpse from her foot whilst sitting atop a branch. She chewed and consumed the soft tissue, spitting out the bone material (with a small portion, believed to be the clavicle, recovered). During the final bout, she was observed taking the corpse into her mouth, and then mixing with insects sucked out of a termite nest taken from the ground. She continued to carry the remains for the remainder of the day until building and entering a night nest 2 h 50 min later. Ratna no longer had the corpse when she exited her nest the following morning, thus she either discarded or consumed all that remained.

Causes of death remain unknown in both cases, but Ratna's infant was observed to have appeared unwell and unresponsive a few days before death. There was no evidence that either of the mothers harmed or killed their own infants.

Discussion

Cannibalism of infants in primates is generally associated with infanticide by unrelated individuals, where it appears that the primary intent is only to kill from infanticide and not cannibalism (Hrdy 1974). Instances of killing competitors' infants have been reported for both adult males (e.g., chacma baboons: Palombit et al. 2000) and, though to a lesser extent, adult females (e.g., chimpanzees:

Table 1 Information regarding the cannibalistic reintroduced orangutans

Orangutan	Date confiscated	Age at confiscation	Age at birth of offspring	Offspring	Sex	Date of birth	Interbirth interval	Alive	Date of death	Age at death
Edita	5 Sep 1988	5	10.24	Heppy	Male	1 Dec 1993	–	N	12 Mar 1998	4.28
			15.72	Sepi	Female	28 May 1999	5.49	Y	–	–
			22.72	Saprol	Male	27 May 2006	7	N	21 May 2007	0.98
Ratna	2 Feb 1991	4	10.88	Moneter	Male	20 Dec 1997	–	N	12 Mar 1998	0.22
			12.83	Desmel	Male	1 Dec 1999	1.95	N	16 Jun 2000	0.54
			14.37	Silvia	Female	15 Jun 2001	1.54	N	21 Dec 2002	1.52
			16.25	Sukajulu	Male	6 May 2003	1.89	N	Unknown	±1
			18.50	Agustin	Male	3 Aug 2005	2.25	N	9 Dec 2005	0.35
			19.80	Hatta	Male	21 Nov 2006	1.3	N	9 Jun 2007	0.55



Fig. 1 Ratna engaging in mother–infant cannibalism

Townsend et al. 2007; marmosets: Bezerra et al. 2007) in a variety of primate species. Individuals may benefit by cannibalizing their victims to gain nutritional and energetic benefits (Fox 1975). However it makes little evolutionary sense for orangutan females to kill their infants, nor is there any evidence that this happened here. It is possible that cannibalism may be a strategy to allow females to regain energy by consuming infants that have died, as cannibalism is more likely to occur under such conditions of low availability of alternative foods, crowding of conspecifics, or fear of starvation (Nishimura and Isoda 2004). However, none of these predicted conditions for cannibalism to occur were taking place, and there was an abundance of fruiting trees at the time of these events. The entire population also has access to two supplementary provisioning sessions per day (generally milk and bananas), hosted by the national park office, in addition to any unscheduled illegal feedings through the tourism industry, with extra food often given to females with infants. It may be possible that females were consuming the carcasses to obtain trace nutrients that would not be available from plant material, though such cannibalistic behavior has never before been seen in any other orangutan population. Meat consumption has been reported among wild orangutans, though infrequently, and is considered to be opportunistic feeding rather than active hunting, upon relatively easy targets (e.g., the greater slow

loris, *Nycticebus coucang*; Utami and Van Hooff 1997). Although this hypothesis cannot be refuted with the data here, this also seems unlikely due to the absence of data of female primates consuming their own infants under natural conditions.

Another possibility may be that the females became accustomed to meat eating while in captivity, which resulted in them viewing their infants' corpses as a part of their diet. Diet prior to rescue cannot be confirmed, so it cannot be refuted that the animals had consumed meat regularly. However, the typical diet given by those holding orangutans in captivity consists of simple rice and fruit (Utami and Van Hooff 1997). Further, given that wild orangutans and many other primate species consume meat (e.g., chimpanzees, baboons), yet do not commit filial cannibalism, it seems unlikely that the inclusion of meat in the captive diet would impact this.

The lack of any previous observations of mother–infant cannibalism in any great ape species suggests it unlikely that this is a normal part of their behavioral repertoire. Orangutans have the longest interbirth interval of any primate, and the mother–infant bond is very strong (Galdikas and Wood 1990); here, both mothers carried and protected their dead infants, a behavior not atypical for many species of primates (Shopland and Altmann 1987). However for them to have engaged in filial cannibalism, in our opinion, the most plausible explanation is that this is aberrant behavior.

Ex-captive orangutans are exposed to considerable traumas and periods of social isolation (Rijksen and Meijaard 1999). Early social deprivation could impair cognitive development (Stoinski and Whiten 2003), thus it is possible the cannibalism is an extension of this. Reintroduced orangutans must substantially alter their behaviors and withdraw from any dependence on humans to be able to return to natural life in the forest (Russon 2002). This can be compromised by maintained contact with humans, which unfortunately is still a regular occurrence in the study site as a result of uncontrolled tourism developments. There is instead accumulating evidence of higher than normal infant (<3 years) mortality: 56% from 1988 to January 2009, amongst offspring born to rehabilitant mothers (Dellatore 2009). This is an extremely high infant mortality rate as compared with that of wild Sumatran orangutans, which has been estimated at a mean range of 0.5–6% occurring over 30 years in the Ketambe forest research station (Singleton et al. 2004). However, in the Sepilok Orangutan Rehabilitation Centre there is also a high rate of infant mortality reported: 57% (Kuze et al. 2008).

Potential causes to consider include poor mothering skills that could have resulted in poor nutrition and inadequate care for offspring. Two out of three of Edita's, and

all six of Ratna's offspring have died (Table 1), with average age at death being 1.1 years. Thus it is possible that these rehabilitant orangutans are incompetent in raising offspring. However both mothers exhibited feeding proficiency, with Edita being observed consuming 72 different forest species, and Ratna 42 different species, over the course of this study. Also both were seen to carry and protect their infants before and after death, thus it does not appear they were impassive to their own progeny.

Another possibility is disease, though whether naturally occurring or due to human/tourist presence is unknown. As is often the case, cause of death in free-ranging populations such as these remains unknown, as any health problems are often not noted until the effect becomes apparent, so that the cause could be one of any number of factors (Wallis and Lee 1999), all of which is further complicated with difficulties in acquiring the corpse so that a post mortem examination can be conducted. Though it is difficult to determine the absolute cause, in many documented cases there is a strong probable disease transmission link between humans and primates (Quammen 2007). Previous studies have shown that primate populations in close proximity to humans have higher prevalence levels of parasitic infection than those not exposed (reviewed in Wallis and Lee 1999); it is thus possible that these semi-wild orangutans, with regular contact with humans and time spent on the ground (Dellatore 2009), are contracting illnesses that prove fatal to their infants.

Other populations of reintroduced orangutans have been subject to long-term study, and none have yet reported cannibalism. However, in Bukit Lawang, not only cannibalism, but filial cannibalism, was observed to have occurred twice in a 1-month period, in separate individuals who were not seen to have interacted in the interim period. Thus it seems there are outside causes to consider in this population of orangutans. Mothers cannibalizing their deceased infants has been linked to stressful and artificial environmental conditions in other primates [e.g., galagoes (Tartabini 1991) with only one published case in the wild of filial cannibalism reported in a population of baboons (Goodall 1977)]. The orangutans are experiencing disturbed environmental conditions as the population's ranging behavior is artificially restricted and there is a heavy tourist presence in the area, which has been associated with disruptions in behavior and poor reproductive success (Dellatore 2009). Previous studies in nonhuman primates have shown that infant mortality can be an indicator of the impact of tourism on the population (Berman et al. 2007), thus this may be seen as a serious issue to consider for Bukit Lawang. Orangutans may be particularly sensitive to disturbances during development or within the environment, which may lead to abnormal maternal behavior such as treating offspring as consumable resources.

To conclude, we cannot reject the hypotheses that these cases of mother–infant cannibalism stemmed from attempts at nutritional gain or past history. Three of the four species of great apes have now been said to engage in cannibalism. Though when considered in the context of comparative behavioral data from other orangutan populations and primate species, environmental disturbance seems the most likely causal factor in these cases of filial cannibalism. However, it is acknowledged that this may be a complex behavior with the underlying causes being multifactorial. With tropical forests shrinking by the day (FWI/GFW 2002), and Sumatran orangutans listed as critically endangered (IUCN 2008), this can be taken as yet further call to retain as many undisturbed, free-living populations in the wild as possible.

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