



Retrospective Video Analysis of Human-Directed Food Solicitation in Two Semi-Wild Rehabilitated Sumatran Orangutans (*Pongo abelii*) in Bukit Lawang, Indonesia

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Abstract

Interactions between tourists and semi-wild orangutans in Bukit Lawang may promote over-habituation and food conditioning, threatening both animal welfare and conservation. This study examined food solicitation behaviour in two rehabilitated female Sumatran orangutans, Mina and Jecky, using retrospective analysis of publicly available video recordings. Public videos were used because they allowed examination of individuals who were no longer accessible for direct observation, including Mina, who was reported missing in 2020. A total of nine records, recorded between 2009 and 2021, were analysed using focal-animal sampling and continuous behavioural recording. Behaviours were coded into operational categories: approach (AP), physical contact (PC), hand restraint (HR), try to bite (TB), and release after feeding (RF). Mina showed a relatively repeated pattern in which RF followed HR after tourists provided food in three of four analysed videos. In contrast, Jecky showed greater behavioural variation, and TB occurred more frequently in Jecky than in Mina. Overall, both individuals appeared highly tolerant of close human presence, and several interaction sequences were consistent with food-associated behavioural reinforcement. These findings suggest that repeated tourist feeding may contribute to altered human-directed behaviour in semi-wild orangutans and highlight the need for stricter management of human–orangutan interactions in Bukit Lawang.

Keywords: Habituation, conditioning, wildlife tourism

1. Introduction

The Sumatran orangutan (*Pongo abelii*) is endemic to northern Sumatra and is classified as Critically Endangered due to ongoing habitat loss, fragmentation, and hunting pressure (Singleton *et al.* 2017). In Bukit Lawang, Gunung Leuser National Park, semi-wild rehabilitated orangutans have become a major attraction for wildlife tourism since the establishment of rehabilitation activities in the 1970s (Rijksen 1974; Dellatore *et al.* 2014). Although this tourism provides educational and economic benefits, repeated interactions between tourists and semi-wild orangutans may also alter orangutan behaviour and increase conservation risks.

Semi-wild orangutans are individuals that have undergone rehabilitation and been released into forested habitat but still retain varying levels of tolerance toward humans and, in some cases, continue to depend on human-associated food sources (Russon 2008). Unlike true wild orangutans that actively avoid humans, semi-wild orangutans often approach tourists. This behavioural change is driven by a history of early-life captive care, associative learning during rehabilitation, and continuous reinforcement through food provisioning by tourists and guides (Purwoko *et al.* 2022). Behavioural changes under semi-wild conditions have also been reported in other primates living in human-influenced settings (Al Hakim *et al.* 2022). In Bukit Lawang, these animals

are frequently encountered by tourists, and despite regulations prohibiting feeding and direct contact, such interactions still occur. Repeated tourist feeding may encourage orangutans to associate humans with food rewards, thereby strengthening human-directed solicitation behaviour. Feeding-related behaviours in primates can become structured and repetitive, including food-processing sequences documented in Indonesian macaques (Ritonga *et al.* 2022; Hanifa *et al.* 2023).

Previous studies in Bukit Lawang and other primate tourism sites have documented the effects of feeding and close human contact on activity budgets, ranging behaviour, aggression, and disease risk (Dellatore *et al.* 2014; Macfie and Williamson, 2010; Orams, 2002). However, less attention has been given to the fine-scale sequence of behaviours shown by specific known individuals during direct tourist interactions. Such individual-level sequence analysis is important because it can help distinguish whether repeated human-directed behaviours are isolated responses or part of a more consistent learned pattern associated with food provision. This issue is particularly relevant in primate populations that are semi-provisioned or repeatedly exposed to anthropogenic food sources (Kshetri *et al.* 2023).

Among the orangutan population inhabiting the Bukit Lawang tourism zone, a rehabilitated adult female named Mina has gained a particular reputation, both among local guides and in online media, for

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her intense and prolonged interactions with tourists. Mina is not a purely wild orangutan. Estimated to have been born in the late 1970s, Mina was rescued from illegal captivity, brought to the Bukit Lawang rehabilitation centre, then released into the forest, and has since lived as a semi-wild individual who routinely interacts with tourists (Dellatore *et al.* 2014). Her behaviour is unique compared to other semi-wild orangutans: she approaches tourist groups, initiates sustained physical contact (holding hands, arms, or clothing), and actively maintains this interaction, even restraining the tourists' movements until food is provided. Another rehabilitated female, named Jecky, has been observed engaging in similar behaviour, who has the same background as a rehabilitation from Bukit Lawang. According to the INIJI Warrior website, Mina was reported missing from the area in 2020 and has not been seen since. Local authorities and tour guides suspect that she died naturally in the forest due to her very advanced age, estimated to be over 45 years at the time she was declared missing.

This study used retrospective video analysis to examine food solicitation behaviour in two semi-wild rehabilitated female orangutans, Mina and Jecky, in Bukit Lawang. Specifically, the study aimed to describe recurrent behavioural sequences during tourist interactions and to assess whether those sequences were consistent with habituation, food conditioning, and repeated learning.

2. Materials and Methods

2.1 Research Design

This study used a retrospective observational design based on publicly available online video recordings. Because the videos were recorded independently by tourists and not for research purposes, the study should be regarded as an exploratory case study rather than a controlled behavioural experiment. Nevertheless, retrospective video analysis offers a useful opportunity to examine the behaviour of identified orangutans that cannot be directly followed in the field. This approach allows the analysis of natural behaviour without the presence of researchers, which could alter the subjects' responses (Fehlmann *et al.* 2017).

2.2 Study Subjects and Location

The focal subjects of this study were two female Sumatran orangutans, Mina and Jecky. Mina is a semi-wild rehabilitated orangutan, estimated to have been born in the late 1970s, confiscated from illegal captivity, and released in the Bukit Lawang area, Gunung Leuser National Park, North Sumatra, Indonesia (Dellatore *et al.* 2014). Jecky, also a rehabilitated female, was included for comparison because she appeared repeatedly in public videos showing similar tourist interactions. The study was conducted in the Bukit Lawang tourism area, Bahorok District, Langkat Regency, North Sumatra, Indonesia.

2.3 Data Sources

The primary data consisted of nine publicly accessible videos uploaded to YouTube between 2009 and 2021. Videos were selected because they showed clear, direct interactions between identified orangutans and tourists in Bukit Lawang and allowed repeated behavioral observation from the moment the focal animal entered the frame until the interaction ended or the recording stopped. Videos were excluded if the focal individual could not be identified with reasonable confidence, if the interaction was too brief to code, or if substantial editing interrupted the behavioral sequence. Each selected video was watched repeatedly to confirm coding consistency before analysis.

The selected videos are listed below (Table 1), along with their uploader links and upload dates. These dates indicate when the videos became publicly available and do not necessarily reflect the exact recording date.

2.4 Focal Animal Sampling and Behavioral Event Coding

Behavioural data were collected using focal-animal sampling and continuous recording of all visible behavioural events observed in the orangutan during each video segment (Altmann 1974; Martin and Bateson 2007). The focal individual was observed from the moment it first entered the frame until it disappeared from view or the video ended. Each video was reviewed multiple times to identify and code visible behavioural events in chronological order. Behavioural categories were defined operationally before formal coding and are presented in Table 2.

2.5 Data Analysis

The analysis was descriptive and sequence-based. For each video, a chronological behavioural sequence was constructed using the coded events listed in Table 2. These sequences were then compared across videos to identify repeated patterns within and between the two focal individuals. Because the dataset was small and opportunistic, the analysis did not aim to test statistical causality, but rather to examine whether certain event combinations occurred repeatedly in ways consistent with habituation and food-associated behavioural reinforcement. Interpretation of habituation, food conditioning, and learned behaviour was guided by the criteria summarised in Table 3.

3. Results

3.1 General Characteristics of the Analysed Videos

A total of nine publicly available YouTube videos were analysed. Video duration ranged from approximately 1.5 to 6.5 minutes. Four videos featured Mina and five featured Jecky. All videos were recorded by tourists during trekking in Bukit Lawang

Table 1. List of YouTube videos analysed in the retrospective ethological study

Video	Name	Link	Upload Date
Vid 1	Mina	https://youtu.be/MwvpFJ-jJ8o?si=EaA3YPBvAOUu0uBB	26 July 2010
Vid 2	Mina	https://youtu.be/-Cxu5JSOANQ?si=fCX_xZvzkDCgfFog	17 Oct 2013
Vid 3	Mina	https://youtu.be/YE15CO65Rk8?si=HXfq8jLkHjYLIImvZ	14 Mar 2021
Vid 4	Mina	https://youtu.be/e4ww7gVZSYQ?si=TMc-CiAI0oKdQ3Uv	5 Apr 2012
Vid 5	Jecky	https://youtu.be/ompa1bX7EsQ?si=Ge78U4ePqgXvZ5qJ	3 Dec 2009
Vid 6	Jecky	https://youtu.be/ZVUXs1MY1qQ?si=jaYgiUcRo8zoWV2t	15 Feb 2016
Vid 7	Jecky	https://youtu.be/6vG9t2fmtc8?si=OnOMxci2GFe91kw4	16 May 2017
Vid 8	Jecky	https://youtu.be/-RsocUI0-fA?si=adgxaMXGNjwUqtro	27 May 2017
Vid 9	Jecky	https://youtu.be/VI-D1tGQ-ws?si=2lG4oe-bTfjhgX-	15 Feb 2012

Table 2. Behavioural codes and operational definitions

Code	Behaviour	Description
AP	Approach	The orangutan moves toward the tourist from a distance of more than two meters.
SS	Sitting Still	The orangutan sits motionless, showing no visible response to the tourist.
PC	Physical Contact	The orangutan touches the tourist's hand, arm, or clothing. This includes gentle touching, pulling, or attempting to climb onto the tourist's body.
TB	Try To Bite	The orangutan opens its mouth and directs it toward the tourist's hand, arm, or other body part, with or without contact. This code refers only to the visible action and does not by itself imply confirmed biting or inferred motivation.
HR	Hand Restraint	The orangutan firmly grasps the tourist's hand or wrist, restricting the tourist's movement
GO	Gaze Orientation	The orangutan visibly orients its head and eyes toward food held by a tourist or toward the tourist's face for approximately two seconds or more, insofar as this could be reliably determined from the video.
RF	Release after Feeding	The orangutan loosens or ends hand contact after receiving food from the tourist, within the same visible interaction sequence.
TPF	Tourist Provide Food	Tourist response: the tourist gives food to the orangutan.
TRS	Tourist Remain Still	Tourist response: the tourist remains motionless and does not attempt to free themselves.
TAR	Tourist Attempt Release	Tourist response: the tourist tries to pull their hand away or otherwise break the orangutan's grip.
TMA	Tourist Move Away	Tourist response: the tourist steps back or walks away after the interaction ends.

Table 3. Criteria for habituation, food conditioning, and learned behaviour

Indicator	Characteristic
Habituation	1. Low frequency of fear responses (no fleeing, no screaming, no fear-related threat). 2. Tolerance of close distance (<1 meter from tourists) 3. No avoidance behavior
Food Conditioning	1. Consistent relationship between hand restraint (HR) and food provision. 2. Contingent release, release of contact occurs only after food is given
Learned Behaviour	Repetition of the same pattern across interactions with different tourists (male, female, groups).

Table 4. Behavioral sequences of Mina and Jecky

Code	Individual	Behavioural Sequence	Characteristic Pattern
V1	Mina	GO-AP-PC-TPF-HR-PC-TPF-HR-RF-TMA	Repeats the cycle of contact, feeding, restraint twice before finally releasing.
V2	Mina	TPF-AP-PC-HR- TPF-PC-SS-TPF-HR	Three feeding events without release, the orangutan continues to restrain until the end of the recording.
V3	Mina	AP-PC-HR-TPF-HR-TAR-SS-GO-TPF-RF	Repeated restraint despite the tourist attempting to escape, waits for a second feeding, then releases.
V4	Mina	AP-GO-PC-HR-TPF-TB-TAR-RF	After being fed, the orangutan threatens to bite when the tourist tries to escape.
V5	Jecky	AP-PC-SS-TRS-TAR-HR-GO-TPF-RF	The orangutan is passive but restrains, the tourist tries to escape, the orangutan gazes, then releases after being fed.
V6	Jecky	GO-AP-PC-HR-TRS-SS-TB-TPF	Biting threat appears, the tourist provides food but the orangutan does not release until the end of the video.
V7	Jecky	AP-PC-TRS-HR-SS-TB-TPF-TRS-TPF-RF-TMA	Two feeding events with a biting threat at the beginning, then releases after the second feeding.
V8	Jecky	GO-AP-PC-HR-SS-TB-TAR-TB-TPF-HR-TB-TAR-TPF-TAR-HR-TB-TAR-TB-TPF-HR-TPF-RF-TMA	Long sequence with repeated biting threats, escape attempts, and multiple feeding events, the orangutan persists until finally releasing.
V9	Jecky	AP-PC-HR-TPF-TAR-TPF-RF	Short sequence contact restraint, two feedings, then release without threat.

Code abbreviations: AP = Approach, SS = Sitting still, PC = Physical contact, TB = Try to bite, HR = Hand restraint, GO = Gaze orientation, RF = Release after feeding, TPF = Tourist provide food, TRS = Tourist remain still, TAR = Tourist attempt release, TMA = Tourist move away.

and captured direct orangutan–tourist interactions without researchers present. Because the recordings were opportunistic and varied in angle and duration, they were treated as case-based observational material rather than standardised sampling units.

3.2 Behavioural Sequences and Recurrent Patterns

Table 4 summarises the behavioural sequences for each video and the characteristic patterns identified for each individual.

Mina showed a relatively repeated pattern involving approach, physical contact, hand restraint, food provision, and eventual release. In three of the four Mina videos, release occurred after food had been given. In contrast, Jecky’s sequences were more variable and showed more frequent TB occurrences. In some Jecky videos, food provision was followed by release, whereas in others the interaction continued without immediate release. These observations suggest greater consistency in Mina’s sequences than in Jecky’s, although both individuals showed repeated human-directed contact behaviour (Table 4).

3.3 Frequency of Behaviour Occurrence

Table 5 presents the frequency of occurrence for each behavioural code in Mina (4 videos) and Jecky

(5 Videos). The numbers indicate the total occurrences of each behaviour across all videos for each individual.

Table 5. Behavioural code frequencies for Mina (n=4) and Jecky (n=5)

Code	Behaviour	Mina (n=4)	Jecky (n=5)	Total
AP	Approach	4	5	9
SS	Sitting still	2	4	6
PC	Physical Contact	6	5	11
TB	Try To Bite	1	7	8
HR	Hand Restraint	7	8	15
GO	Gaze Orientation	3	3	6
RF	Release after Feeding	3	4	7
TPF	Tourist Provide Food	8	9	17
TRS	Tourist Remain Still	0	4	4
TAR	Tourist Attempt Release	2	6	8
TMA	Tourist Move Away	1	2	3

The overall frequency counts indicate that hand restraint occurred commonly in both individuals, whereas try-to-bite behaviour appeared much more often in Jecky than in Mina (Table 5). Release after feeding occurred in both individuals, but the sequence context differed between them.

These frequency differences should be interpreted cautiously, however, because they are based on a small number of opportunistic videos rather than on standardised observation sessions.

Discussion

The results show that both individuals, Mina and Jecky, have undergone habituation to human presence. No fear responses (screaming, fleeing, threatening) were observed in either orangutan. They tolerated very close distances (<1 meter) to tourists and never attempted to avoid them. This finding is consistent with the study by Dellatore *et al.* (2014), which reported that rehabilitated orangutans in Bukit Lawang spend up to 30% of their activity time with humans. As well as with the study by Tienda *et al.* (2022), which showed that habituation in primates is characterised by a decrease in fear responses and an increase in neutral responses toward humans.

Clear indications of food conditioning were identified in Mina. Mina consistently performed hand restraint (HR), firmly grasping the tourist's hand or wrist, and release occurred after food was provided. In three of Mina's four videos (V1, V3, V4), release of contact (RF) occurred after food was given. Meanwhile, in V2, Mina did not release even after being fed three times, continuing to restrain until the end of the video. According to Orams (2002), repeated feeding in a tourism context can cause an animal to learn to associate human presence with a food reward, thereby eliciting intense human-directed behaviour. Mina's case goes beyond simply the release occurring after food was provided; approaching tourists, she has learned that physically restraining tourists is an effective way to force food provision. This is a classic example of positive reinforcement, in which a specific behaviour (HR) is strengthened by a favourable consequence (receiving food).

Furthermore, Mina demonstrated learned behaviour through stimulus generalisation. The same pattern (AP-PC-HR-GO-RF) was applied to different tourists (male, female, group) without discrimination. This indicates that Mina does not respond to specific characteristics of particular individuals but has generalised that all tourists are potential food sources (Orams 2002).

Although Mina and Jecky are both rehabilitated female orangutans, Jecky did not exhibit a consistent pattern of hand restraint (HR) and did not always release after being fed (V6). Jecky displayed try-to-bite (TB) behaviour more frequently (7 times) than Mina (once), but without a consistently conditioned release pattern. Differences in age and length of exposure to tourists may influence this difference. Mina was older (28 years old in 2007) than Jecky (11 years old), and thus had a longer history of interactions. The longer an individual receives positive reinforcement, the more strongly the behavioural pattern becomes established (Orams 2002). Primates react very differently to the

presence of humans depending on their individual histories and previous experience with humans (Tienda *et al.* 2022). These innate temperamental differences significantly influence both the speed at which an individual learns to respond to humans and the strength with which that behaviour becomes established. The strong human tolerance observed in Mina and Jecky is consistent with broader primate evidence showing that behaviour in semi-wild conditions is shaped by human presence and anthropogenic disturbance (Al Hakim *et al.* 2022).

The findings of this study have serious implications for orangutan conservation and wildlife tourism management in Bukit Lawang. The behaviour of Mina and Jecky demonstrates that illegal feeding (although prohibited) has created dependency and structured aggressive behaviour. This aligns with the warning of Dellatore *et al.* (2014) that unregulated tourism can alter natural behaviour, restrict ranging, and increase the risk of conflict. The present findings are also broadly consistent with concerns from other semi-provisioned primate systems, where human-associated food access can alter normal activity patterns and strengthen dependence on people (Kshetri *et al.* 2023).

Furthermore, the risk of disease transmission from humans to orangutans increases sharply with direct physical contact. (Köndgen *et al.* 2008) warned that the close phylogenetic relationship between great apes and humans facilitates pathogen transmission. In the videos, tourists are seen directly touching orangutans' hands and arms, and food is given hand-to-hand. The findings of this study reinforce the recommendation of Macfie and Williamson (2010) that great ape tourism in the wild should shift from direct interaction models to viewing-only models. Tourist education, guide training, and strict enforcement of regulations are urgently needed. If feeding cannot be completely stopped (due to already established dependency), it should at least be managed in a controlled manner at designated sites (feeding platforms) under strict protocols.

This study has several limitations. The number of videos was limited (9), and their durations were short (1.5–6.5 minutes), thus precluding a complete description of the full behavioural repertoires of Mina and Jecky. Camera angles were uncontrolled, and some behaviours may not have been clearly recorded. Because Mina has been reported missing and presumed dead, follow-up observations are not possible. Despite these limitations, this study illustrates how publicly available videos can be used for retrospective behavioural sequence analysis, particularly when subjects are no longer accessible for direct observation (Nelson and Fijn 2013).

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and background of the orangutans Mina and Jecky in Bukit Lawang, which served as the basis for subject identification in this study. The authors also extend their appreciation to the owners and uploaders of the YouTube videos who voluntarily recorded and shared the interactions between orangutans and tourists. These recordings served as the primary data source that enabled this retrospective ethological study.

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