

Assessing the welfare of coconut-harvesting macaques in Thailand

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Abstract

Pig-tailed macaques are used by coconut farmers in Southeast Asia to harvest coconuts. We assessed the welfare of northern pig-tailed macaques *Macaca leonina* involved in coconut harvesting in southern Thailand. We interviewed 89 coconut farmers in three provinces focusing on quantifying basic demographics of this trade, i.e., species, where the macaques were sourced, diet, sex, and age. Independent from the interviews, we assessed the welfare of 158 working macaques through direct observations using the 'five domains' criteria. Based on our scoring system, the mean welfare score of 4.8 out of the maximum 12 points indicates a need for improvement. Overall, we found good agreement between the interviews data and the welfare assessments. The most important individual welfare modifications required for working macaques to obtain a good level of welfare that benefits both the farmers and macaques include: providing access to conspecifics, adding opportunities to hide from stressors, and increasing the freedom of movement. This study highlights the individual welfare concerns and necessity of legislative changes regarding working macaques and other working animals of wild origins.

Keywords: animal exploitation, conservation, ethnoprimatology, *Macaca leonina*, threatened, wildlife trade

1. Introduction

Evidence of humans reaping the benefits of employing animals to harvest food sources points to its beginning in the Neolithic period approximately 12,000 years ago (Driscoll et al., 2009). This arguably mutualistic relationship between working animals and humans largely facilitated the rapid growth of humankind (Wilson, 2003). By exploiting the harvesting power of working animals, humans achieve increased harvest rates, decreased time dedicated to labour, and increased nutrient acquisition (Driscoll et al., 2009). Research suggests that animals comprise about 50% of the world's total agricultural harvesting power (Wilson, 2003). Most of these animals, including cattle, horses, goats, pigs, and sheep, have undergone the process of domestication via selective breeding for several thousands of years (Driscoll et al., 2009). However, some working animal species, despite working alongside humans on a daily basis for an extended period of time, do not demonstrate the same level of domestication (Chatkupt et al., 1999; Sponsel et al., 2009; Xiaodie, 2005). Two of the oldest examples of training wild animals to harvest food sources include falconry (using birds of prey to capture small animals for recreational hunting) in China up to 3,000 years ago (Kenward, 2009; Xiaodie, 2005) and fishing with cormorants in Southwest China 1,000 years ago (Hoh, 2000). By contrast, logging companies in Thailand originally began using Asian elephants *Elephas maximus* to extract timber from dense forests in the 1800s (Chatkupt et al., 1999), while coconut harvesting using macaques has occurred in Thailand for at least a century (Sponsel et al., 2009). Although some captive wild animals appear tolerant of humans and are thus deemed 'tame', it is important to note that without having their breeding controlled by humans, these animals are not truly domesticated (Driscoll et al., 2009). While the individual welfare of domesticated working animals has been previously investigated, analysed, and documented (Duncan, 2005; Pritchard et al., 2005; Swann, 2006), the impacts on the welfare of working animals of wild origins remains relatively unexplored.

Coconut harvesting using northern and southern pig-tailed macaques (*Macaca leonina* and *M. nemestrina*) occurs throughout Thailand, Malaysia, and Indonesia (Azis et al., 1980; La Rue, 1919; Sponsel et al., 2009; Winograd, 2015). Both species are considered globally threatened (northern pig-tailed macaques as Vulnerable and southern pig-tailed macaques as Endangered), with decreasing populations (Boonratana et al., 2020; Cheyne and Eudey, 2020). Within Thailand, the Wildlife

Conservation and Protection Act B.E. 2562 (2019) provides domestic protection for both species of pig-tailed macaques. While removing macaques from the wild, trading, and possessing them without permits are illegal, macaques are kept in the open and farmers and owners speak freely about them. Of the current threats facing these two species, extraction from the wild to meet the demand for coconut harvesting is perhaps the least documented. Sponsel et al. (2009) estimated that several thousand pig-tailed macaques are kept for coconut harvesting in southern Thailand alone.

To obtain the macaques, coconut farmers extract juveniles from the wild between the ages of one to two years to commence training (Bertrand, 1967; Malaivijitnond et al., 2012). Collectors obtain them by either baiting a wooden box or shooting the mother (Sponsel et al., 2009). Training of coconut harvesting macaques is performed through positive punishment using tight leashes and whips (Bertrand, 1967). As a whole, the process of harvesting, training, working, and retiring macaques has serious and largely undocumented welfare implications. For instance, many macaques work for 6 to 8 hours per day, during which they harvest between 500 and 1000 coconuts (Sponsel et al., 2009; Malaivijitnond et al., 2012). Macaques are often aggressive towards their handlers and others. Owners chain macaques on short leashes to curtail high aggression when they are not working. When males reach full maturity, at the age of around seven, they reportedly are frequently too aggressive for their owners to continue handling them and they may be released back into the wild (Bertrand, 1967). In 2020, People for the Ethical Treatment of Animals in the United Kingdom (PETA UK) published a report detailing the poor welfare of pig-tailed macaques used to harvest coconuts in Thailand. The report summarised the inadequate living conditions, extremely demanding workdays, abusive training practises, and poor mental health of the monkeys observed, however, systematic studies providing quantitative and qualitative data on the topic to evaluate the present situations are lacking. While PETA provided a preliminary overview of the welfare violations occurring within this practise, we systematically quantify the number of macaques affected, describe the severity of these welfare violations, examine potential negative effects on wild populations, illustrate the cultural context, and offer solutions to improve the ethical shortcomings of using macaques for coconut harvesting.

Here, we report on the individual welfare status of pig-tailed macaques used to harvest coconuts in southern Thailand. We quantify the age, sex, numbers, origins from which macaques were sourced, diet,

and housing. We assessed the welfare status using the ‘five domains’ of animal welfare approach (Mellor et al., 2009). The core considerations of this framework include: nutrition, environment, health, behaviour, and mental state; which primarily focuses on the freedom to express natural behaviours and freedom from fear and distress (RSPCA, 2021).

2. Methods

2.1 Study site selection

We have worked on the ecology and conservation of northern and southern pig-tailed macaques in various parts of Thailand intermittently since 2011 (Malaivijitnond et al., 2012; José-Domínguez et al., 2015; Moyes et al., 2016; Siriwat et al., 2019). Coconut picking appears to be concentrated in the upper southern provinces, where the 62% of all Thai coconuts plantations areas are located in 3 provinces; Surat Thani, Chumphon, and Prachuap Khiri Khan (Fig. 1; Wongsamuth, 2015). Therefore, we decided to conduct our research in these three provinces, specifically in districts where we have previous experience of working; Bang Bai Mai district in Surat Thani, Bang Mak district in Chumphon, and Bangsaphan district in Prachuap Khiri Khan (Fig. 1).

2.2 Data collection

We collected data in the first half of 2019. Because of our previous research in the area we knew of several coconut farmers that used macaques, and these were visited first. We then located additional coconut farmers by using snowball sampling (Newing, 2011). Interviews and observations were conducted at private residences and in coconut plantations. Interviews ranged from five to twenty minutes, and we did not provide monetary compensation for participating. At each farm we made observations on the pig-tailed macaques that were present, five minutes each for every macaque. We aged the macaques as follows; infants 0-1 years old, juveniles 1-4.5, adolescents 5-9, and adults 9 or older (Oi, 1990).

2.3 The five domains

We assessed and collected data on the following variables pertaining to the ‘five domains’ of animal welfare: Nutrition (diet), Environment (i.e., appropriate shelter), Behaviour (i.e., the ability to engage in species-specific behaviours) and Mental State (i.e., no evidence of abnormally high

stress/fear), excluding Health (Botreau et al., 2007; Mellor et al., 2009). We did not assess Health (Mellor et al., 2009), but we did not observe any monkeys with obvious malnourishment, injury, or disease. We scored nutrition based on access to water and fruit, and we scored shelter according to the amount of coverage from environmental conditions, hiding opportunities, substrate composition, and opportunity to perch (Buchanan-Smith et al., 2004). Perches included any materials that allowed for raised sitting off the ground, including the following observed environmental items: wooden beams, tree stumps, tires, boxes, suspended ropes, trees, concrete fixtures, and barrels. The ability to engage in species-specific behaviours was scored by considering the allowance for freedom of movement, interaction with conspecifics, and the ability to engage in foraging behaviours. We assessed mental state by noting the presence of any stereotypic behaviours, including pacing, head-turning, abnormally high human-directed fear or aggression, self-biting, self-clasping, hair-plucking, self-masturbation, (Lopresti-Goodman et al., 2013; Mallapur and Choudhury, 2003) and back-flipping.

2.4 Welfare scoring system

To quantify the welfare status we developed an independent scoring system to create welfare scores for each individual macaque observed. We coded all variables as present (1) or absent (0) except substrate and diet. Substrate fell into six categories as observed: grass, dirt, metal, gravel, coconut husks, and concrete. Diet included the five most frequent interview responses, including rice, fruit, processed food, milk, and fresh vegetables. Human food included cooked or fried vegetables, snack foods, yogurt, stir fry noodles, and curry dishes as reported. We grouped each variable based on the following categories: housing (including the presence of a hiding spot, perch, grass substrate, shade, and a built shelter); diet (access to food and water); the ability to express natural behaviours (conspecific presence, no physical restraint due to a leash or chain, and the presence of enrichment); and mental condition (no evidence of abnormal repetitive behaviours).

We assigned an overall score for each individual based on the number of variables that met appropriate standards within each category. An individual could obtain a minimum score of 0 for all variables and a maximum of 12; 2 in diet (1 point for the presence of water, 1 point for fruit incorporated in the daily feeding regimen); 5 in housing (1 point for each of the following being present: acceptable substrate, perch, ability to hide, shade, and shelter); 4 in natural behaviours (1 point for each: acceptable

freedom of movement (no leash), conspecific presence, opportunity for physical conspecific interaction, and daily provision of enrichment), and 1 in mental condition (1 point for the absence of stereotypic behaviours). Therefore, a case in which all welfare measures were appropriately met would achieve a maximum score of 12. We present means \pm one standard deviation of the mean. We did not handle any animals and all procedures complied with the Oxford Brookes University Code of Practise for Research Ethics for Research Involving Human Participants. Permission to conduct this project was authorised by the National Research Council of Thailand (permit number: 6763113).

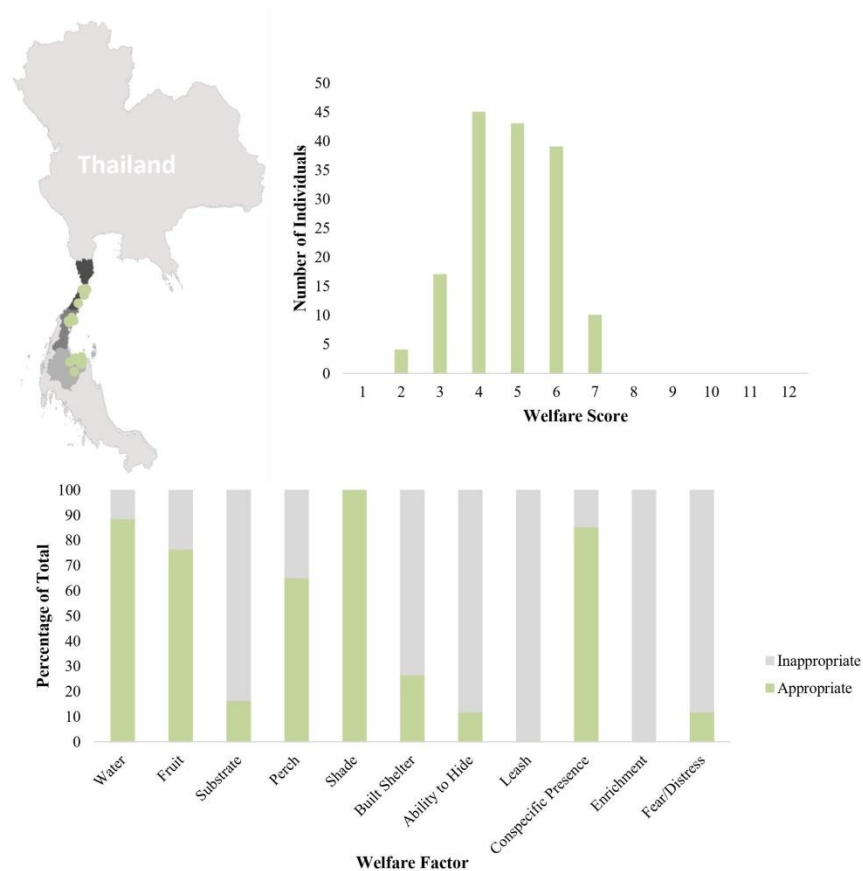


Figure 1. From top left, clockwise: (1) Thailand with the study locations in Prachuap Khiri Khan (dark grey), Chumphon (medium grey) and Surat Thani (light grey) provinces; (2) distribution of welfare score frequencies (out of 12) observed in 158 northern pig-tailed macaques *Macaca leonina* used for coconut harvesting; (3) scores of eleven welfare factors.

3. Results

We interviewed 89 people (26 in Surat Thani, 36 in Chumphon, 27 in Prachuap Khiri Khan). Collectively, the interviewees owned 266 male macaques (95%) and 13 female macaques (5%). The mean number of macaques owned at one time per farmer was 3.0 ± 2.9 individuals ($n=88/89$ owners). Most farmers commuted to coconut farms with their macaque(s).

All of the macaques were northern pig-tailed macaques, except one juvenile identified as a hybrid between northern and southern pig-tailed macaques. The species identification of northern and southern pig-tailed macaques and the hybrid followed Malaivijitnond et al. (2012). All macaques lived outside next to the owner's place of residence. The mean age of macaques when acquired by farmers was 2.6 ± 1.6 years old ($n=80$), ranging from 4 months to 8 years. Macaques were purchased as juveniles ($n=43/80$), as infants ($n=25/80$), or as adolescents ($n=12/80$). Farmers indicated that macaques work for 10 to 12 years and retire at around 14 to 15 years of age. When macaques are too old to work, farmers either keep them as pets ($n=51/84$), sell or give them to others ($n=20/84$) or simply release them ($n=13/84$). Nine interviewees reported that their macaque died between 15 to 20 years of age.

Macaques were frequently reported as being aggressive (72/89 farmers) and only five explicitly stated their macaques were not aggressive (these were mostly young macaques or females). Four farmers had large scars from macaque bites on their forearms and ankles that had required medical intervention. Coconut farmers sourced macaques from other farmers ($n=56/86$), from the wild ($n=19/86$), or monkey schools or other captive facilities ($n=11/86$). Farmers stated that macaques sourced from the wild are obtained by either baiting a large net or cage trap with food items. The farmers reported that macaque collectors typically only remove male macaques when they are between the ages of one to three years. Older males and females are released back into the wild.

We scored 158 out of the 279 macaques on individual welfare. The mean welfare score was 4.8 ± 1.2 (range from 2 to 7) out of the 12-point maximum (Fig. 1). Although we did not formally assess health, the majority of macaques observed demonstrated good body condition (not obese or emaciated) and did not suffer from visible wounds or physical debilitations. All the macaques had access to at least partial shade ($n=158$), two-thirds had access to a perch ($n=103/158$), a tree ($n=109/158$), and/or shelter ($n=42/158$). A barrel ($n=19/158$) was the only structure that offered an opportunity to hide (Fig. 2). We did

not observe any macaques that were provided with enrichment, and many demonstrated fear and/or distress during observation (n=139/158). Almost all macaques were tethered on a leash (n=157/158) consisting of a metal ring around the neck with either a rope or chain attached that allowed limited movement. Leashes were short (typically 1 metre or less), thus precluding physical interaction between macaques where farmers owned multiple individuals (n=135/158). A small number of farmers (n=23/89) had sliding leashes with a metal ring that moved along a horizontal rope, which allowed for a slightly increased range of movement. Most macaques were kept on the ground (bare ground n=105/158, grass n=26/158, concrete or gravel n=22/158). The remainder (n=5/158) were kept on metal bars or coconut husks. A majority of macaques showed signs of abnormal repetitive behavior. Most (n=139/158) were observed pacing, seven macaques showed signs of self-biting, self-clasping and hair-plucking, one was self-masturbating, and one was repetitively back-flipping. The diet was reported to be boiled rice (n=146/158), fruits (n=121/158), milk (n=64/158), fresh vegetables (n=19/158), or human food leftovers (n=42/158). Most had access to water (n=140/158).



Figure 2. Housing for coconut-picking northern pig-tailed macaques *Macaca leonina* observed at coconut farmer residences in southern Thailand: A) barrel providing hiding opportunities; B) a single juvenile macaque in a small cage without water; C) juvenile macaque on a concrete substrate with no opportunities to hide or climb; D) juvenile macaque tied to a tyre without opportunities to hide or climb.

Information provided by the farmers indicated that macaques worked seven days per week for ~6.5 hours per day, taking breaks only at the same time of the farmers themselves. Each day, the macaques typically climbed more than 50 coconut trees and harvested between 500-1,000 coconuts. Many farmers reported that macaques got tired during the workday and the farmers that owned more than one macaque used one until the animal showed signs of exhaustion and then subsequently worked the other one(s). Farmers indicated that the macaques became too hyperactive or aggressive if they did not work every day. Ways to reduce aggression included physically beating or removing canines. Again, according to the farmers, macaques rarely attacked the owner, but attacks on other members of the community were frequent. Farmers used positive punishment to handle the macaques (i.e., the application of punishment to discourage undesired behaviours, including yanking the leash and shouting commands). We did not observe a single case of positive reinforcement (reinforcing desirable behaviours by administering rewards).

3. Discussion

Our study details the demographics and evaluates the welfare status of coconut harvesting northern pig-tailed macaques in southern Thailand. Overall, working macaques involved in the coconut trade achieved a welfare score of 4.8 out of 12 points. Similar to our findings, the PETA UK (2020) report mentioned the extraction of macaques from the wild, daily physical abuse and exploitation, constant restriction of movement via leashes, presence of abnormal repetitive behaviours, and barren housing conditions. The diet we observed was comprised mostly of inappropriate processed foods (Ofstedal et al., 1991; Albert et al., 2013; Ruppert et al., 2018).

Factors including physical restraint, inability to interact with conspecific(s), demonstration of fear and distress, presence of enrichment, the ability to hide, and adequate shelter/substrate were among the lowest-rated variables on appropriateness. Additionally, the overall mental state of the macaques indicated a largely negative or neutral state, as no behaviours directly indicating a positive mental state were observed. The lack of social stimulation, sensory input, environmental complexity, and overall poor-quality diet likely increases frustration in these captive macaques and further contributes to the high incidence of abnormal repetitive behaviours observed in the present study. The presence of these

behaviours often indicates extremely poor welfare. Similar to those demonstrated by pet primates removed from their mothers during infancy, these behaviours often manifest as abnormally high aggression, abnormally repetitive behaviours performed to decrease high levels of stress (i.e. pacing), and mental illness symptoms including PTSD (Lopresti-Goodman et al., 2013). While improving the welfare standards may be seen as in the best interest of both the macaques and the coconut farmers, as healthier macaques may increase agricultural output (Hemsworth and Coleman, 1998), it is ethically questionable using macaques in this manner to begin with.

While most macaques in our study were in the presence of conspecifics, none were able to physically interact. Infants comprised the second-largest age category (31%) of the reported age when purchased, indicating that over 30% of these individuals did not experience a normal maternal upbringing. For highly social animals like pig-tailed macaques, the absence of normal social interactions during infancy (i.e. grooming, play, and asserting/accepting dominance displays) often leads to an increase in self-directed aggression, aggression directed towards others, and the inability to behave normally in social situations (Rommeck et al., 2011). Depriving young macaques of social interactions during this critical learning period inhibits the development of skills necessary to survive independently, i.e. foraging and self-defence (Mallapur and Choudhury, 2003). Additionally, these aggressive behaviours may be further exacerbated by frequent human presence (Honest and Marin, 2006) or the psychological trauma associated with being captured from the wild at a young age (Mallonee and Joslin, 2004).

Almost all macaques observed interacting with their owners demonstrated an abnormally high level of fear, e.g. laying on their stomach, fear-grimacing, and frequent vocalising, presumably due to the fear-based style of establishing dominance and daily mistreatment. The training strategy itself may also contribute to the high rate of aggression in working macaques. Using positive punishment as a training strategy suppresses the undesired behaviour instead of eliminating it completely, which often creates a fear that becomes generalised to other undesirable behaviours. This response increases the tendency to use aggression as a coping mechanism (Skinner, 1938).

Achieving good animal welfare involves the incorporation of the following qualities: 1) mimicking the natural environment on a functional level to ensure proper opportunities for the expression of species-specific behaviours (Fraser, 2009; Kagan and Veasey, 2010) and 2) ensuring the individual has a good

amount of control and choice in the environment (Boissy et al., 2007). None of these objectives were achieved in the macaques we observed. Notably, a few farmers acknowledged that preventing their macaques from engaging in species-specific behaviours had negative outcomes. For example, some stated that macaques exhibit increased aggression because they are denied mating opportunities and that they cannot be released into the wild due to a lack in the skills required to forage, defend themselves, and behave normally within a troop.

Pig-tailed macaques are protected under the Wildlife Conservation and Protection Act B.E. 2562 (2019) and the Cruelty Prevention and Welfare of Animal Act B.E. 2557 (2014) in Thailand. Despite these legislative texts, which state that the 'type, kind, character, condition, and age' of the animal must be taken into consideration upon ownership, no specific regulations regarding captive breeding or environmental requirements (e.g., housing, diet, and activity level for working animals) to own these animals in conditions that promote good welfare currently exist (Schmidt-Burbach et al., 2015). A similar legislative dissonance is also present for keeping working animals of other originally wild species in Thailand, e.g. working elephants. Driscoll et al. (2009) state that domestication occurs when a set of physiological and psychological qualities are met, including: high tolerance of close proximity to humans, adaptation to a poorer quality diet, more frequent reproductive cycles, and maintaining physical characteristics from infancy into adulthood. Although humans have a long history with working animals, coconut harvesting macaques have worked alongside humans for just 100 years (Sponsel et al., 2009), with only 13% of all coconut farmers in the present study indicating sourcing macaques through captive breeding.

Although pig-tailed macaques harvest less coconuts per day than humans (according to several farmers interviewed, macaques harvest 1,000 coconuts whereas humans harvest 2,000 coconuts), using macaques is arguably safer (Sponsel et al., 2009). With the help of the macaques, who climb up each tree while attached to a long lead, the farmers can stand farther away from the tree to avoid falling coconuts. The trade-off between potential injury from falling coconuts or potential disease transmission and likely injury from aggressive macaques, however, is something to consider. Making adjustments to individual welfare at farmer residences and creating distinct categories of welfare criteria for both domesticated and wild working animals respectively are imperative to improve the welfare of working

macaques kept in captivity. Promoting public awareness of the poor welfare of working pig-tailed macaques may also function as a successful strategy in reducing the economic profits obtained from using macaques to harvest coconuts or increasing incentive for farmers to improve working macaque welfare to appeal to the consumer concerned about poor animal welfare. With less economic value attributed to the macaques, fewer coconut farmers would ultimately choose to use macaques as their primary coconut collection method (or more coconut farmers would want to improve their macaques' welfare).

4. Conclusions

We found that the species-specific needs of the pig-tailed macaques kept for coconut-harvesting purposes were largely not met. These needs, in short, primarily include: the ability to engage in social interactions with conspecifics, to move freely and unrestrained, and housing that provides the ability to hide from stressors. Additionally, no legislation currently exists to ensure that these needs are satisfied to promote a higher standard of living conditions and better animal welfare to occur while these animals stay in domestic care. From our work, it follows that at least three strategies must be enacted to improve the individual welfare of working pig-tailed macaques and other working non-domesticated animals: 1) adapting national legislation to include the specific needs of wild animals (cf. Dorloh, 2017), 2) making improvements that both enable and encourage the expression of species-specific behaviours in macaques, and 3) raising awareness of the inadequate welfare conditions of the macaques involved in coconut picking to instigate a debate on the necessity of this practice.

Acknowledgement

We thank the translators and farmers for their help and participation, and the National Research Council of Thailand for authorising this study.

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