



Habitat use of reintroduced spider monkeys (*Ateles chamek*)

Research report

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Abstract

Black faced spider monkeys (*Ateles chamek*) are known to change their habitat use throughout the year to the habitat type which at that moment and time provides the most fruit and thereby food in the canopy layer of the forest. For reintroduced *Ateles chamek* it's not yet known if they follow this same pattern. That's what has been researched here. A reintroduced *Ateles chamek* group in the Tambopata reserve in South-Eastern Peru has been followed for a total of 10 days during a 6 week period from October 16th to December 7th the monkey group had a home range size of 79 hectares. The monkey group changed their habitat use throughout the follow period but didn't change it's use to areas with higher fruit availability but rather to areas with higher human activity. Since they started out not spending anytime around human settlements but ended up spending 29% of their time around human settlements. It is likely an interest in humans was sparked again by incorrect behaviour by humans towards the monkey group. Reintroduced monkeys can have difficulty adapting to life without their human family and by incorrect behaviour towards them by ways of making excessive contact with them, which is likely what happened before data collection, a degradation of wild behaviour and an increase of interest in humans was seen in the Black faced spider monkey group.

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Introduction

There is a high diversity of frugivorous bird and mammal species in the Amazon. A lot of trees are dependent on the seed dispersal these animals provide. These trees often are not able to disperse efficiently by themselves. Co-evolution made a lot of these plants dependent on these animals for their dispersal (Theodore et al. 1987). Due to these animals bringing the seeds often away from the parental trees, the tree species benefit from these species since seeds dispersed with a scatter distribution have a greater chance of survival than seeds fallen underneath the parental trees in a clumped distribution (Russo & Augspurger 2004).

Spider monkeys (*Ateles*) play an important role in the dispersion of seeds of tree species. They mostly keep the seeds they consume intact and disperse them, since they have a home range of 32-900 hectares with daily path lengths between 500 and 5600 meters, often far away from the parental tree (Symington 1988; Campbell, 2000; Wallace, 2006, 2008; Spehar et al. 2010; González-Zamora et al., 2012, 2015; Velázquez-Vázquez et al. 2015). What makes spider monkeys especially important is that they are able to swallow large sized seeds which make some of the large-seeded plants rely on *Ateles* as their primary seed disperser (Cramer et al. 2007). They primarily go for ripe fruits but if available also unripe figs take up a big part of their diet (Di Fiore et al. 2008) (Felton et al. 2009). Energy is often stated as the primary driver of the food choice of *Atelinae* (subfamily which *Ateles* is part of) (Fiore and Rodman 2001; Rosenberger and Strier 1989; Strier 1992). However, research by Felton et al. (2009) states that *Ateles chamek* eat with the goal to reach a certain amount of protein intake with the total amount of energy intake being of secondary interest.

Ateles chamek are a canopy dwelling species, because of their limb morphology and tail which by itself can hold their whole bodyweight, they are able to move through the canopy in a suspended way rather than in a quadrupled way, which is essential for living in the canopy level. Making them able to have more stability on thin branches, which are more common high in the tree. And makes them able to get to fruit hanging down the branch better (Rosenberger et al. 2008). Since *Ateles chamek* are mainly frugivorous (Campbell et al. 2005; Wallace 2008) and most of the ripe fruit is found in the canopy level of the tree it makes sense that they are found to spend more than 70% of their time in the higher canopy levels over 25m (van Roosmalen 1985; Wallace 2008).

Home ranges of *Ateles chamek* are known to be bigger compared to other primates living in the same habitat. This due to the high energy need and thus large food intake, especially when in big groups in combination with the often scattered distribution of fruit patches which can be especially scattered in dry season since there are less fruiting trees then (Takahashi 2008; Defler 2010). Time spent showing traveling and resting behaviour is likely influenced by the fruit distribution and abundance. The area of the habitat used for traveling would thus be bigger in the case of a highly scattered food distribution and/or low food abundance. *Ateles chamek* researched by Wallace (2006) showed that the habitat type used most changed throughout the year to the habitat type providing most of the fruit in that moment and time.

Due to increased anthropogenic activities in the Tambopata region in Southern Peru *the Ateles chamek* went locally extinct (Rosin and Swamy 2013). Knowing that *Ateles chamek* and in general large primates influence the structure and diversity over time this meant local unique ecological processes were at risk of disappearing (Bagchi et al. 2018). In the year 2000 the Peruvian government created the Tambopata National Reserve, making the area suitable for reintroduction programs. From 2013 on *Ateles chamek* have been introduced back into this part of their original range. These reintroduced monkeys often have a history of living in captivity. But due to effort of rehabilitating them by the Taricaya rescue center and intensive monitoring effort by Kawsay biological Station in the

first 3 months of reintroduction a significant portion of 42% of the monkeys were able to adapt to the forest and establish a home range (Pottie et al. 2020).

Commissioned by the Kawsay ecological station research on the habitat use preference of reintroduced *Ateles chamek* was carried out. In previous studies on habitat use preference of spider monkeys the habitat use preference was found to be primarily driven by habitat based distribution of ripe fleshy fruit resources (Wallace 2006). In this case a group of reintroduced *Ateles chamek* has been studied on their habitat use preference. A goal of this study is to determine the home range the spider monkey (*Ateles chamek*) group had between half October until beginning December, a second goal is to find out what the preferred areas within the home range of the spider monkeys are. The hypothesis is that the established reintroduced monkeys adapt to the food dispersal by changing the areas they mainly have a higher food availability. In the beginning of rain season this would mean the habitat use would be spread more even over their home range due to the high food availability then, with lots of tree species fruiting (Medina 2009). A third goal is to find out if and why the preferred areas were influenced by humans.

Methods

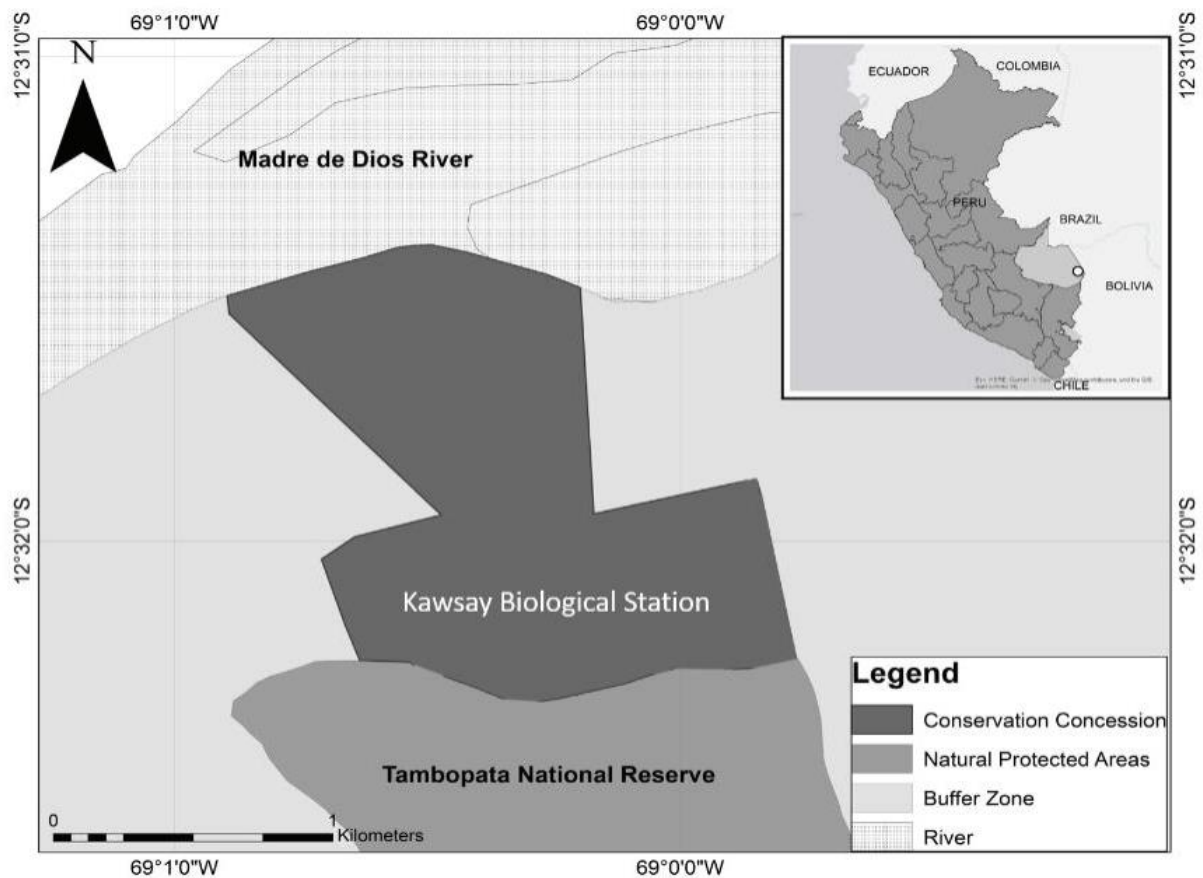


Figure 1: Research area

Location

The home range of the Black faced spider monkey (*Ateles chamek*) group that got studied for this research is located on the border of the Kawsay concession area and the Tambopata national reserve. The group also has a part of its home range in the buffer zone. The area consists of seasonally flooded primary subtropical wet forest according to the Holdridge life zones system (Holdridge 1967). The annual average temperature is 26°C with a participation of 2165 millimetres per year. It's located along de Madre de Dios river about 20 km west of Puerto Maldonado.

Study group

The group consists of 4 individuals, all female and adult ranging from 4 to 7 years old. These monkeys were previously kept in captivity. The organisation Taricaya made them ready to live in the wild again before they got reintroduced. The group was released in April 2022 in the Tambopata reserve just outside of the Kawsay concession area and have established a living area in the Kawsay concession area/Tambopata reserve.

Time period

The gps data was collected in an 8 week period from October 16th to December 7th. The data collection of the monkeys took place for 10 effective days from dawn until they find their sleeping tree at dusk, which means that with all the data collection hours combined the monkeys were followed a total of 10 days and for every daypart followed the same amount of time. Data collection took place for at least 4 hours at a time. Daylight length will roughly be 12 hours, so 10*12 is 120 hours is the minimum amount of hours that the monkeys will be followed during the data collection

period. The data collection time will be equally distributed over the months relative to the length of the month that the data is collected.

Data collection

GPS-points

The group was followed as a whole. Every 30 minutes while following the monkeys a gps point was collected in the middle between the group members, with a minimal gps accuracy 5 meters. these gps points were on positions that were on the route which the monkeys were taking but weren't always on the position where the monkeys were right at this moment, since the monkeys were sometimes in front when traveling. When more than half of the spider monkey group had fed on a tree for more than 5 minutes, the gps point of the tree was collected.

Data analysis

After the gps data collection period the home range was estimated by using the minimum convex polygon method with follow data as the data the home range estimation is based on. Also a heat map is made by making a grid map, with 1 hectare square grids, and placing it on top of a map of the home range area. Classes of < 1, 1-5, 5-10, 10-20 and > 20 were used to show for each grid how much time was spend there and thereby how preferred it was by the group. These values are produced by quantifying the time spent in each grid and made visible on the gid map by using a coloured scale. For clusters made out of 9 grid large squares where disproportionately much time was spent the percentage of time spent there was calculated. Also a map displaying the feeding trees and the feeding tree density was produced.

Results

Using the minimum convex polygon the home range of the reintroduced spider monkeys used was estimated to be 79 hectares (Figure 2). Considering that everything south of cluster 2 (a cluster being a 9 square area where disproportional much time was spent by the monkeys)(figure 3) was only used in the first few days of the follow period indicates the area mainly used was actually much smaller.

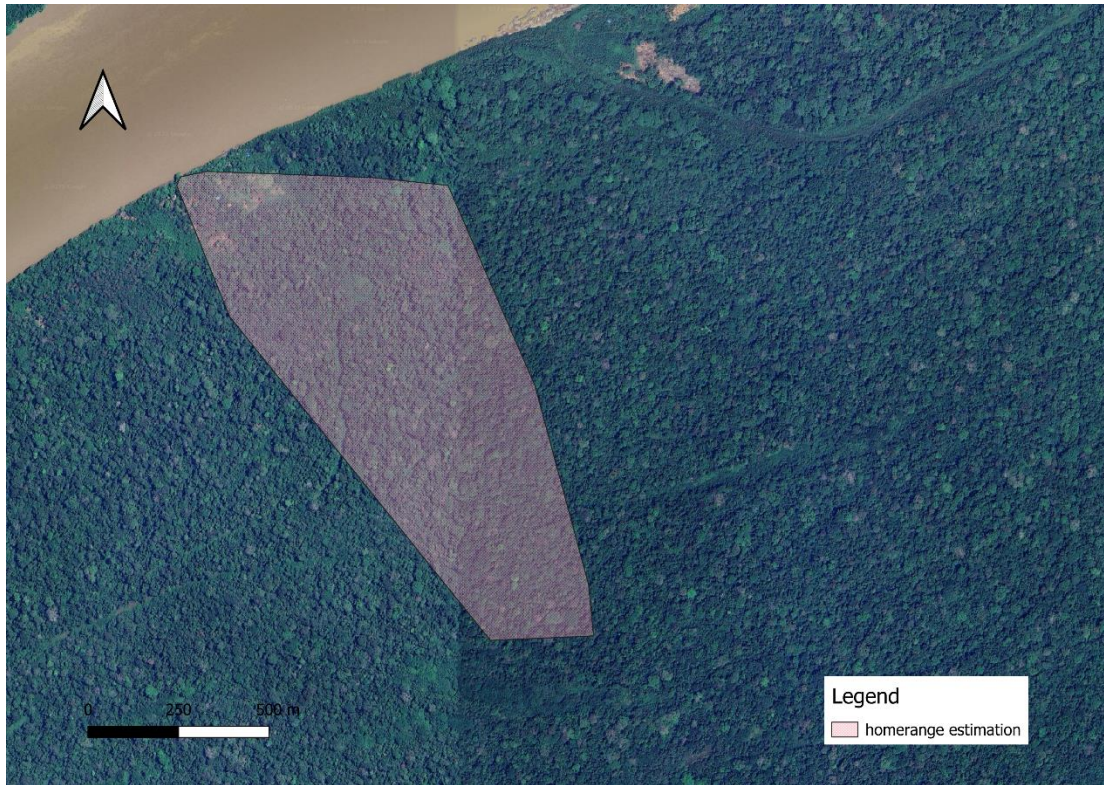


Figure 2: The estimated home range of the Ateles chamek group followed during data collection, the home range is estimated using the minimum convex polygon, and is based on the follow data of Ateles chamek group.

The time distribution over 10 days of follow data was divided mainly over three clusters. These were areas where the monkeys were found to have spent disproportional much time compared to the other areas the monkeys visited during the follow period. Spending 29% time of follow period in cluster 1, 50% time in cluster 2 and 8% in cluster 3 (Figure 3).

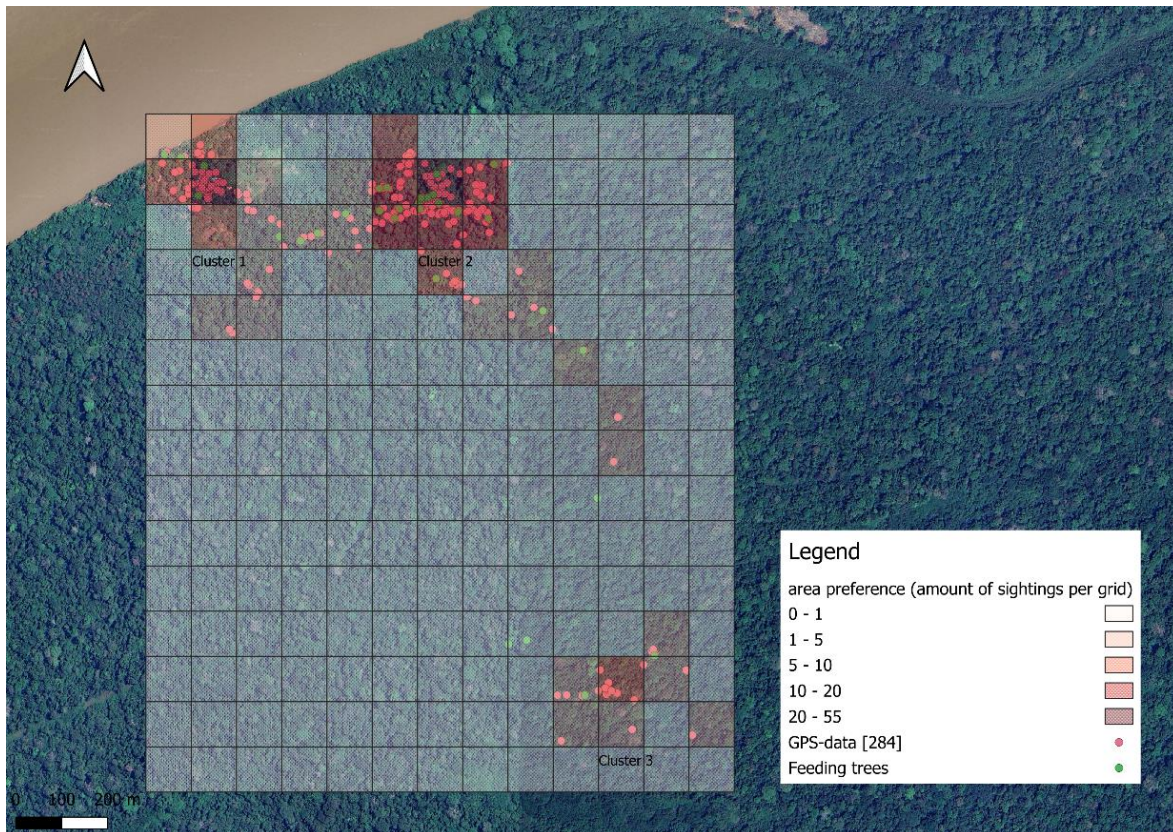


Figure 3: Density map of *Ateles chamek* group followed during data collection, shows how preferred each grid was by the *Ateles chamek*, each grid represents an area of 1 hectare. The most visited 9 grid clusters are highlighted in the map by their cluster name.

Cluster 3 being part of their original home range which is what they were still using as their home range in the beginning of the follow period. Soon after they would move to the north to uncharted territories, before the data collection they had never been spotted here. Here they would use cluster 2 as their main feeding ground, this area consisted of primary forest in which most of the feeding trees eaten from during the follow period were found (Figure 4). From here they would regularly visit the Cluster 1 area using a specific route along the edge of the primary forest, which is showcased in the map by the data points in between the two clusters, which from cluster 2 goes along the edge of the primary forest before making a turn to cluster 1 where the monkeys crossed secondary forest to make it to cluster 1 where they also would find secondary and degraded forests. Which is not vegetation that usually is part of their home range.

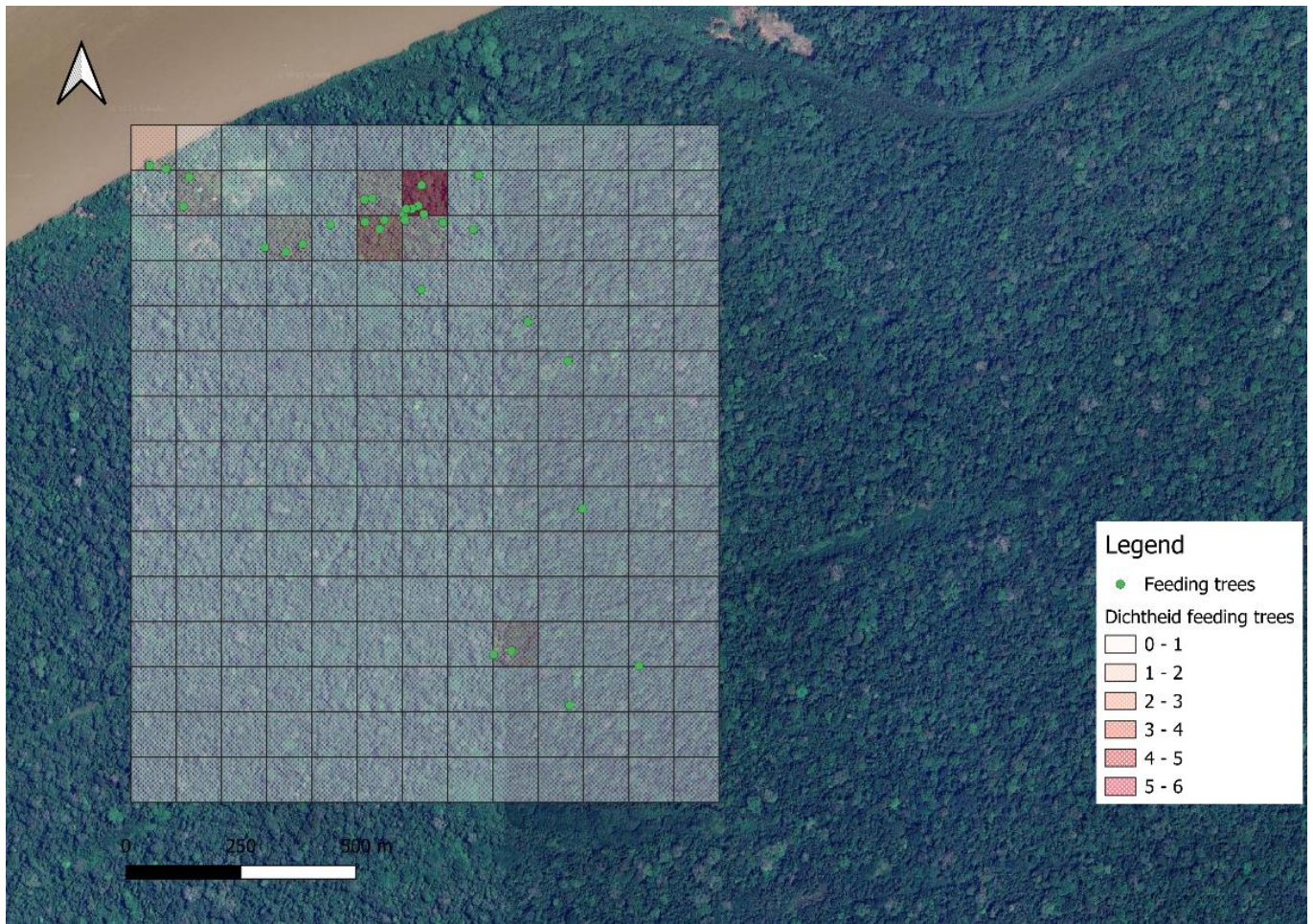


Figure 4: Feeding trees and density of feeding trees per hectare are showcased in this map.

Discussion

The home range size of 79 hectares used by the *Ateles chamek* group falls in the range size which has been recorded before, but is on the smaller side. But knowing that everything south-east of cluster 2 was only used in the first few days of the follow period indicates the area mainly used was even smaller, which makes the home range size particularly small but still within the size range that has been recorded for the *Ateles* since a home range of 32 ha has been recorded before for the *Ateles* genus (González-Zamora et al. 2012). The small home range can be explained by the small group size thus needing less space to find sufficient food for the whole group, as well as by the data collection period falling in the beginning of rain season which usually means a higher availability of fruits and thus needing less area to find enough food. (Pereira et al. 2010).

In the home range of the *Ateles chamek* group followed in this research there were some clear heat points where most of their time was spent, all of them having distinct functions. Cluster 3 (figure 3) being part of their original home range, this area would be used for all uses necessary for the group to live a normal sustainable life. The only thing missing was a male to make it really sustainable, but other than that sufficient food and a habitat that suits them, this being primary forest, is what they had here.

During the first few follows mostly regular behaviour was shown by the monkeys. With them moving through their usual area in their original home range which they had been moving through before the data collection as well. On 23/10 they started moving to the outer edge of where they had been seen before, which was in the direction of where a generator sound came from, in the northern direction. And the next day they moved even further in this direction. Until they hit the edge of the primary forest. Here they sometimes moved just a bit over the edge into the secondary forest to eat from the *Cecropia*. But most of the feeding would still be done in the primary forest side of this edge, where more fruit diversity and more fruits in general could be found. With *Brosimum* as their favourite to feed from. This area would turn out to be their new main feeding area and no sighting would be seen in their original home range (cluster 3 in figure 3) after.

What might have made them come this way was the generator sound that was heard in the direction they travelled. This because they already had experience with generators in the past when some construction happened in their home range, often with the use of a generator. That happened right before the data collection started. And this then often did draw the attention which would make them stop by this area almost every construction day for sometimes multiple hours a day. It could be that during this period more social contact between humans and the monkeys had occurred which could mean that their slight interest in humans turned into a bigger interest in humans. And the generator sound they heard after the construction could have sparked that interest again since there's good chance they associated it with humans.

The monkeys followed in this research have a history of being held in captivity. Meaning they had some level of dependence and bond with humans. During the rehabilitation process monkeys are getting used to living in a group setting and are often placed with the ones they are going to end up being released with again, this period is important for the formation of a social structure. But it's unlikely that just socialisation will turn a former pet into wild animals when it's still in a captive setting (Pottie et al. 2021). Once the monkey are released in the wild negative reinforcement by ways of ignoring when the monkeys try to make contact with humans is a way to discourage this behaviour because this behaviour limits their ability to develop wild behaviours which are more favourable to have in the wild. After release during the establishment process the monkeys are normally being actively monitored in the beginning phase, the human presence gives the monkeys a sense of

protection even though social contact is avoided by the people monitoring them (Dickens et al. 2010). The human presence limits the stress reaction of being released in the wild. No human presence after release can cause them to disperse (Bello 2018).

Once the monkeys show behaviour that is suitable for living in a wild environment and less interest in humans is shown by the monkeys, monitoring can be lessened. Because they should be able to stand up for themselves now. Even though social behaviour towards humans by the monkeys can be lessened significantly in the monitoring period, getting rid of it completely is for most individuals undoable since for a lot of them being close to humans has been a big part of their life history which makes it that social contact with humans is just too ingrained in them, in the case of monkeys that were relatively well treated in captivity also a form of affection toward humans can be reignited by an increase of human contact (Cheyne 2006). If this weakness is exploited by humans not discouraging or even looking for this social contact a quick increase in this behaviour can develop which can lead to a unhealthy interest in humans, unhealthy because it can cause an ongoing increase in the part it takes in of the activity budget. Before the data collection period we believe this weakness was exploited, especially the interests in humans of one individual called Koruba was noticeable. When a person was by itself she would even try to get close to humans and if not stopped go as close to humans as she can get. Lluvia the leader of the group, also showed interest in humans and would often stare individuals of the monitoring team down. But in the beginning of the data collection period she would keep at least her distance. So the monkeys already in the start of data collection showed behaviour towards humans that possibly could affect how the habitat was going to be used. With them using parts of the habitat not just because the characteristics of the area but also because of human presence.

The seeming interest in humans did not end with the generator which they didn't reach because of forestless land in between. But after a couple days they started showing up at the main research station of Kawsay (cluster 1, figure 3) on November 4th, where they would sit on the roof and be very interested in the humans and all the human stuff laying around. The way they potentially found our living area is probably because they heard people going in that direction. Since a part of the main trail that is walked a lot on and ends at the station is situated only around 200 meters away from the new area they started inhabiting.

The monkeys would from then on visit the station regularly, also they would cross the station where they would find a degraded forest with little fruiting tree's that they could eat from so they would mainly eat leaves in this area and since *Ateles chamek* are mainly fruit eaters and leaves aren't as energy rich, their diet here was not sufficient enough here. So their main motivation to be here was not the food but rather a seeming exploratory urge of the area or the humans being there. The more the monkeys came to this area, seemingly without getting tired of it. The more it started to look like their main interest here were the humans and/or the settlements because a big source of food wasn't to be found here.

In this area they were cut off from any kind of primary forest by the research station and a secondary forest so to get back there they had to cross it back to get back to richer feeding grounds. And they would. At some point after visiting they would leave again to the primary forest. This way they were able exert their human interest as well as have the energy and nutrient intake they need since no significant weight loss has been spotted on one of the individuals, the strategy seemed to be working quite well for them.

At the research station, the people there tried to discourage the monkeys to show social behaviour toward humans with negative reinforcement by means of ignoring the monkeys and when the

monkeys would come down to the ground by throwing water on them, after sometime this seemed to work. The monkeys would still come to the research station but would stick around less long, but they would keep coming and spent a good amount of time around the research station, in the degraded forest.

The monkeys would always return to the primary forest area in cluster 2. And actually would spent most their time there. So there priorities were not completely out of order. For their feeding necessities they would still mainly use their natural habitat, this being primary forest.

Normally *Ateles chamek* shift in area they mostly use based on high fruit availability (Wallace 2006). In our case high fruit availability in cluster 2 might have played a role in them coming here originally but since there didn't seem to be a food shortage in their original home range and the area they moved to is so well located to be used as a feeding hub to get the energy intake they need to make trips possible to the human settlements and humans, which they would do. The human interest seems to be the more likely reason they inhabited this area.

Even though degradation of wild behaviour could be caused by humans tapping into weaknesses of reintroduced *Ateles chamek* monkeys by making contact with them, their urge to feed and thereby visiting their natural habitat still outweighs their urge to show interest in humans. Also, active effort by humans having encounters with the *Ateles chamek* to discourage this - interested in humans - behaviour seems to work with at least partly turning around the degraded wild behaviour. If both humans and monkeys adept to the situation of living together then living alongside each other in peace appears to be possible.

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