

Chapter 2

Study Species and Site

2.1 Study Species

The eastern pygmy marmoset, *Cebuella niveiventris* (Lönnerberg, 1940; Figure 2.1), is a Platyrrhine species found in the Amazon rainforests of Bolivia, Brazil (in the following states: Acre, Amazonas, Rondônia), Colombia, and Peru (de la Torre *et al.*, 2021a). They are formally classified as conspecific with the western pygmy marmoset. A molecular genetic study was conducted by Boubli *et al.* (2018) to test if pygmy marmosets should be split into two subspecies *Cebuella pygmaea pygmaea* (von Spix, 1823) and *Cebuella pygmaea niveiventris* (Lönnerberg, 1940). In their study they found that the two clades diverged around 2.25 million years ago, leading to the evolution of two species of *Cebuella*. One clade found to the north (on the left bank) of the Solimões-Amazonas river and the other to the south (right bank) (Boubli *et al.*, 2018; Porter *et al.*, 2021). This has led to the reclassification of the *Cebuella* genus to be comprised of two species, *C. niveiventris* which are found south of the Napo and Solimões-Amazonas rivers and *C. pygmaea* those found north of those rivers (Boubli *et al.*, 2021).



Figure 2.1 A photograph of an eastern pygmy marmoset taken by Larissa Barker at the study site in Peru.

Pygmy marmosets are habitat specialists and are found in the forests along river-edges. They have small home ranges, ranging from 0.1-0.5 ha, which feature 1-6 central feeding trees/vines (Soini, 1988). Adult males weigh 110g and females 122g on average, making them the smallest monkey species and one of the world's smallest primate species (Soini, 1982; de la Torre and Rylands, 2008). Group size ranges from 2-9 individuals (de la Torre *et al.*, 2000) and are composed of a dominant breeding pair and their successive litters of offspring (de la Torre and Rylands, 2008). The gestation period is 137-138 days, with a maximum of two births a year, once in the dry season and again in the rainy season, with twins occurring frequently (Soini, 1988).

They have adapted sharp teeth and tegulae so that they can chew and create holes in tree bark to stimulate gum production (de la Torre and Rylands, 2008; Jackson, 2011). Their feeding trees are mainly made up of emergent species of *Vochysia lomatophylla*, *Spondias mombin*, *Parkia oppositifolia* and *Qualea amoena* (Soini, 1982). They are an arboreal species and are gum-feeding specialists, however they do also eat insects and fruits (Soini, 1982; de la Torre and Rylands, 2008). Ramirez *et al.*, (1977) found that troops spent 67% of their total feeding time and 32% of their daily activity time ingesting and gouging for exudate. The main predator of the pygmy marmoset are raptors, when in their presence of these large birds they exhibit a higher alarm call rate and freezing behaviours (Snowdon and Hodun, 1981). Their predators are not limited to just raptors, they also risk being predated upon by snakes and tayras (*Eira barbara*) (Snowdon and de la Torre, 2002). However, there is very little published in actual attempted and successful predation attempts on either species of pygmy marmoset, meaning little is known on the mortality rate of this species.

Troops follow a modal daily diurnal activity period of 11.5-12.4 hours, starting when the troop members leave the sleeping tree and ending when the group returns to the roost at the end of the day (Soini, 1982). The troop's day starts shortly after sunrise between 05:40-6:00 and ceases shortly before sunset between 17:35-18:05 (Ramirez *et al.*, 1977; Soini, 1982). Ramirez *et al.*, (1977) described their daily activity as follows, morning activities start with feeding on fresh exudate secreted the night before, this will go on for 0.5-1.5 hours. After which there is a shift to social behaviours such as grooming, playing, basking and huddling. At around 9:00 exudate

feeding and insect foraging become the principal activity. From noon to the early afternoon the second period of resting and social behaviours takes place. Then late afternoon the troop resumes feeding activities before gathering at the roosting tree.

Both the eastern and western pygmy marmosets are listed as vulnerable by the IUCN, and their populations are decreasing (de la Torre *et al.*, 2021a; de la Torre *et al.*, 2021b). One of their main threats besides habitat destruction is being taken for the pet trade, which is why they are listed under CITES Appendix II (de la Torre and Rylands, 2008). In Ecuador they are being taken at such a rate that the capture of these marmosets has negatively impacted populations, and the individuals taken are likely to die in the first two months of capture (de la Torre *et al.*, 2009). de la Torre *et al.* (2000) has provided evidence that this primate is sensitive to capture, human traffic, ambient noise and this causes them to change their behaviour and has been found to cause a decrease in group size and their reproductive rate.

Pygmy marmosets are an ideal species for examining the impacts of human visitation as they are highly specialised. This means that they are incredibly vulnerable to changes in habitat and human activity (de la Torre *et al.*, 2000). de la Torre *et al.* (2009) found a reduction in population density for pygmy marmosets in forest areas that are more disturbed by human activities, their findings suggest that anthropogenic factors are related to this decline and that this species is vulnerable to human impacts. de la Torre *et al.* (2000) found that play behaviours and use of the lower level of the forest decreased where there were higher levels of tourism. Their study also found that the effect of humans, and more specifically tourists, can be tested and measured. Which was furthered by Sheehan and Papworth (2019) who found that after being played human speech audios, pygmy marmosets would move out of sight and spend more time being vigilant. They are ideal for behavioural studies as they have small home ranges and can be found reliably on their feeding trees, this leads the groups to being easily distinguished. These factors make them a model study species, as they are clearly impacted by human presence including tourists and easy to locate. Learning more about this disturbance will help mitigate the impacts they are currently facing.

2.2 Study Site

This research was conducted in the Área de Conservación Regional Comunal Tamshiyacu Tahuayo a communal reserve located in north-eastern Peru, 4°17'37"S 73°14'10"W (Figure 2.2). It was established in 1991 by the local community, researchers and conservationists to protect the endangered red uakari monkey (*Cacojao calvus ucayalii*) and to try to stop/limit activities by hunters and loggers from outside of the region (Newing and Bodmer, 2003). The reserve has three zones: a permanent settlement zone, where people live; a subsistence use zone, designated for the sustainable use of natural resources; and a fully protected zone, where hunting and logging are prohibited (Hurtado-Gonzales and Bodmer, 2004). Hunting inside the reserve is strictly regulated, with the capture of primates being prohibited. It is listed as a category V1 (Protected area with sustainable use of natural resources) by the IUCN management category (IUCN, 2012).

The reserve is one of the largest protected areas in the Amazon covering 420,080 ha (Penn, 2009), it is comprised of upland and flooded forest. Annual precipitation ranges from 2.4 to 3.0 meters with a yearly average temperature of 26°C (Myser, 2015). The area is located on a floodplain which undergoes annual monomodal flooding (Kvist and Nebel, 2001). The reserve encompasses vast number of habitats including rivers, canals, lakes, oxbow lakes, several types of lowland and upland forests including terra firme, igapo and varzea (Bodmer, 1989). It has high levels of biodiversity, having hundreds of species of mammals, birds, fish and reptiles. It is known for the high levels of primate species found there as well as being an important flyway for migratory birds (Puertas and Bodmer, 1993). A biological inventory conducted by the Chicago Field Museum in 2003 found 110 species of terrestrial mammals, 13 species of primates, 600 species of birds, 240 species of fish, 77 species of amphibians, and 45 species of reptiles.

The only manmade structure inside the reserve is the Tahuayo River Amazon Research Centre, which is a research station situated on the Tahuayo River. It is run by the tour operator Amazonia Expeditions. The tour operator's main hub is the Tahuayo lodge (main lodge) which opened in 1995, which lies outside of the reserve limits and close to the local community, El Chino. Most of the tourists stay at the Tahuayo lodge but the tourists can choose to stay at combination of the two sites, with the peak tourist season being July-August. There are several other tourism

facilities operating in areas close to the reserve which offer excursions into the reserve. Curassow lodge, Aqua expeditions lodge and Muyuna lodge are all built within the border areas of the reserve, there is no new construction allowed in the reserve's formal boundaries. Visitors at these tourist facilities partake in boating on rivers, lagoons, and lakes. During the dry season and in areas of high ground tourists partake in more terrestrial activities including hiking and camping activities. The focus of these tour operations is wildlife observation as well as river adventures, including fishing and swimming with the river dolphins.

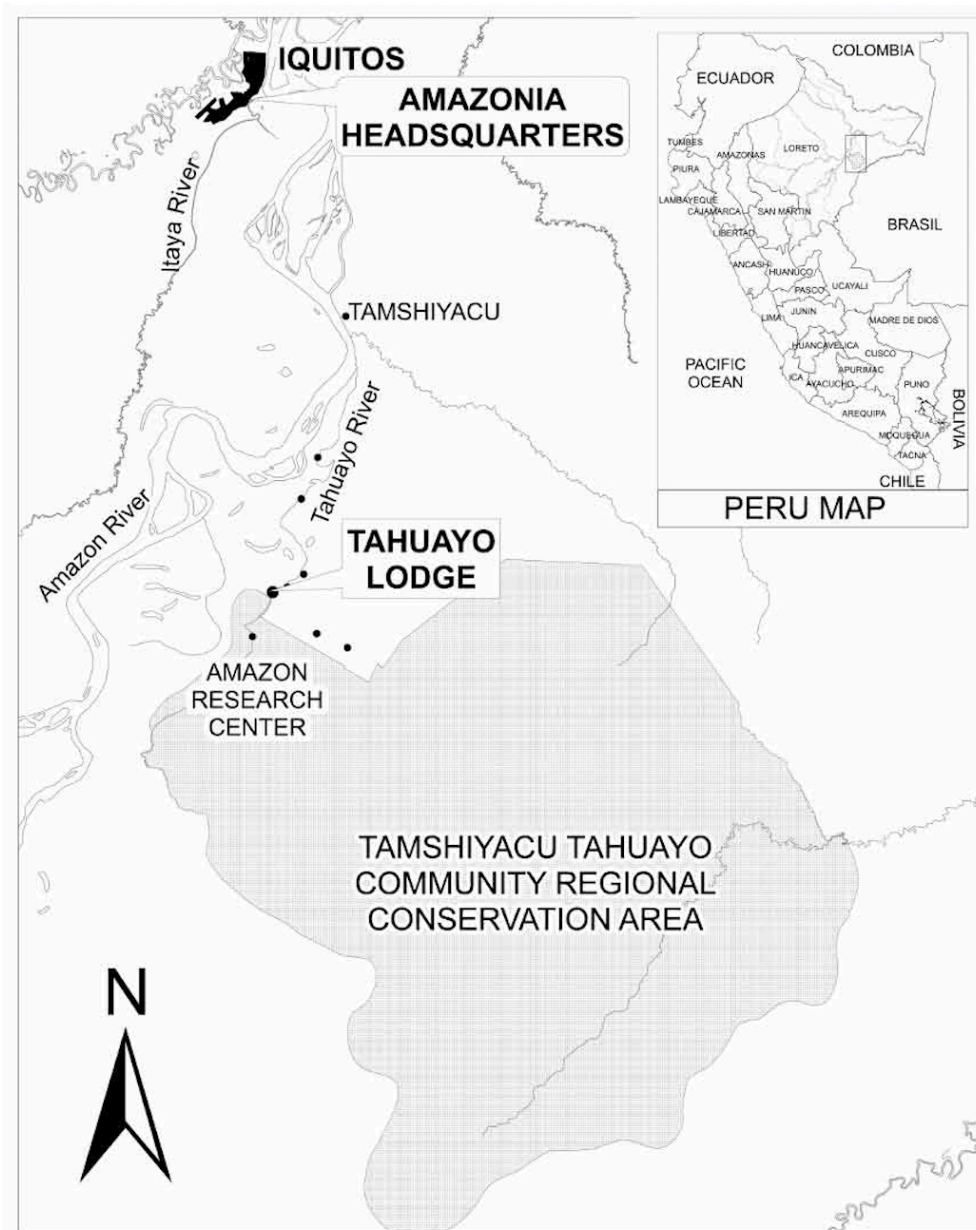


Figure 2.2 A map of the reserve and the tourist operator lodges where this research was conducted, map created by the tour operator Amazonia Expeditions (Perujungle.com., n.d.).

2.3 References

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