



Mini Review

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Bridging the Gap: A Critical Review of a Primate Survey in the Mountain Forests of the Peruvian Amazon

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Introduction: Riding the Amazon: Surveying Peruvian Primates on Muleback

As terrestrial primates, our ground-bound nature limits our ability to study arboreal species. Indeed, navigating dense primary forests without established overland routes renders primate inventories exceptionally challenging and perilous. This was the daunting task that the team led by Rolando Aquino, Luis Lopez, and Etersit Pezo had to overcome to write the book *Primates in the Mountain Forests of the Peruvian Amazon: Diversity, abundance, distribution, current status, and threats*. Published in 2021 in Spanish by Editorial Académica and afterwards made available in English and various other languages, including French and Italian, this book provides a synthesis of knowledge on the primates of the mountain forests of northeastern and central Peruvian Amazonia.

In this 88-page book, the authors examine species diversity (the variety of species present in a given habitat), their geographic distribution (a species' presence within a given area), their abundance (the number of individuals of a species observed in a given habitat), and the main threats to their conservation (intrinsic or extrinsic factors are likely to affect the survival of populations). The main objective was to conduct the most detailed inventory possible for an extremely remote region: the mountainous forests of the Peruvian Amazon. Beyond simply cataloguing species, the authors also sought to identify the main causes – particularly anthropogenic ones – that could threaten the current and future populations of these primates.

To achieve this objective over a period of nearly four years, from June 2014 to October 2018 [1–4], the research team conducted linear transects (a method used in ecology that involves following a

predefined line within the study area and recording all individuals seen or heard, along with their GPS coordinates) and ad libitum direct observations (a method involving the recording of behaviors as they occur without a predefined sampling protocol, as described by Altmann [5]). The surveys were conducted at altitudes ranging from 1,018 to 2,632 m, sometimes requiring the team to reach certain study sites by mule. Their perseverance paid off, they catalogued, eleven primate species inhabiting these mountain forests. The book also highlights three major causes of their decline: deforestation (linked to subsistence farming as well as floriculture), hunting (both for subsistence and commercial purposes), and human-caused forest fires used to clear land for agriculture.

To address these threats, the fourth and final chapter calls for the implementation of immediate conservation actions. Among these, the large-scale restoration of forest habitats appears essential to limit the risks of inbreeding within populations that are already highly vulnerable. The authors also point out that forest fragmentation limits the natural movement of primates between forest massifs, thereby encouraging their presence in human-occupied areas and increasing conflicts between humans and primates [6]. For humans as well as for non-human primates, trees remain vital biological pillars: by purifying the air through carbon sequestration and providing critical habitats, they directly sustain our mutual survival, and we must preserve them [7].

An Example of Primatological Methodology Condensed into Four Parts

In addition to filling a long-standing gap in regional species inventories (specific area within a country), this book offers a

comprehensive synthesis of the primates inhabiting the Peruvian Amazon's mountain forests. The accompanying literature review provides a rigorous scientific framework, bridging historical baselines – starting with Grimwood's landmark 1968 survey [8] – with modern field data. In particular, the book builds upon the foundational 2014 preliminary studies conducted by its author Rolando Aquino, a foremost expert in primatology, whose four decades of research validate the book's scientific authority.

His influence in primatology is such that in 2023, a new species of titi was named in his honor: Aquino's titi (*Cheracebus aquinoi*) [9]. As a result, this book is an excellent reference for any literature review on Peruvian primate species, such as the common woolly monkey (*Lagothrix lagotricha*) or the white-fronted capuchin (*Cebus yuracus*), which are extensively described in the book. Another major strength lies in the detailed description of the methodology used as well as the challenges encountered in the field. The inventory protocol, based on linear transects and direct observations in areas with minimal human impact, is replicable, both in this same field setting as part of a long-term monitoring program and at other sites with similar ecological characteristics. This methodological transparency attests to the rigor of the study and enables future research to develop comparable and sustainable protocols.

Finally, another noteworthy aspect concerns the habitat classification, which takes into account both forest structure and anthropogenic factors. For example, the 'moderate disturbance' category is defined as 'fragments of largely residual primary forests where logging has profoundly altered the forest structure'. This approach provides a better understanding of how human activities transform habitats and directly influence the distribution of primate communities, thereby highlighting the importance of scientific research in raising awareness about their conservation.

Future Directions for Improved Primate Surveys

While the book is exceptionally comprehensive and highly insightful, a few limitations remain that could be addressed in future research. The first limitation, which the authors themselves acknowledge, is that certain areas could not be surveyed due to terrain inaccessibility. To address these spatial gaps, future studies could implement a multi-method approach that combines traditional ground-based techniques with advanced remote monitoring software [10]. These include camera traps, passive acoustic monitoring, and drones equipped with thermal cameras. Rather than replacing fieldwork, these technologies are designed to complement it; for instance, a study by Gazagne et al. (2024) [11] emphasized the necessity of pairing aerial thermal infrared (TIR) drone surveys with traditional ground-truthing methods to ensure accurate species identification and comprehensive primate monitoring. Importantly, these modern technological frameworks inherently rely on foundational ground-truth data – such as the historical baselines established by Aquino and his peers – to train algorithms, calibrate sensors, and validate aerial census accuracy.

Given that the study site plays a central role in this book, higher-

quality mapping would also have been a valuable asset. The various survey locations are occasionally difficult to distinguish, and several maps appear relatively dark or challenging to read on the printed version. Furthermore, the software used to generate these maps is not mentioned and reduces reproducibility. To overcome this problem in my own work, I use the open-source user-friendly software QGIS that can easily generate publication ready and printer friendly scientific maps.

Conclusion: The Need for Inventories for Conservation

In conclusion, the work by Aquino et al. (2021) represents a major contribution to our understanding of primates in the mountain forests of the Peruvian Amazon and has likely informed the IUCN's updates to the conservation status of certain species [12]. Thanks to a rigorous synthesis of available knowledge and a clearly described methodology, it serves as a valuable reference for researchers, protected area managers, and all conservation stakeholders. Despite minor limitations, notably the overreliance on linear transects common to these ecological studies and mapping that could be improved, these factors in no way detract from the scientific value of the work. On the contrary, they open up numerous research avenues by highlighting the need to incorporate complementary methods that could improve inventories and population monitoring.

Against a backdrop of increasing deforestation and the accelerated extinction of many animal species, this work underscores the critical importance of continuing research and conservation efforts to identify priority actions for preserving the diversity of Amazonian primates, as well as that of other tropical regions. Indeed, field inventories continue to reveal species previously unknown to science, as illustrated by the recent discovery in 2026 of a new colobus species, *Colobus congoensis* [13], reminding us that primate biodiversity is still far from having revealed all its secrets.

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