

Project title:

Urgent conservation surveys for the endangered Ashy red colobus monkey (*Piliocolobus tephrosceles*) in unprotected areas of Tanzania

Mohamed J. Kibaja

Centre for Ecological and Evolutionary Synthesis (CEES), Department of Biosciences,
University of Oslo, P. O. Box 1066 Blindern, N-0316 Oslo, Norway &
Department of Zoology and Wildlife Conservation, University of Dar es Salaam, Box 35064,
Dar es Salaam, Tanzania

Introduction

The declining Ashy red colobus monkeys (*Piliocolobus tephrosceles*) occur in the western parts of Uganda and Tanzania (Struhsaker, 1975, 2005, 2016). This report briefly presents preliminary results of recently concluded population surveys on Ashy monkeys and their conservation threats in unprotected parts of western Tanzania. The purpose of this project was to contribute to the conservation of the Endangered Ashy monkey in Tanzania by: 1) determining its distribution, population status and threats in the Masito-Ugalla Ecosystem and Mbuluzi Forest areas and 2) conducting community conservation awareness campaigns in both areas.

Successful conservation of a primate species requires detailed knowledge on its distribution, numbers and threats. These are important to determine conservation priorities, identify areas of high conservation value and design successful management plans for the species (Groves *et al.*, 2002) as well as to guide the creation of protected areas, corridors, buffer zones, demarcation of boundaries and tourism planning (Kühl *et al.*, 2008). Findings of surveys of Ashy monkeys and their conservation threats in unprotected areas of western Tanzania, the outcomes or outputs and recommendations are incorporated within the report.

Study sites

The study area comprised the following study sites in western Tanzania: Mbuluzi Forest area

and Masito-Ugalla Ecosystem (Figure 1). The Mbuluzi Forest area ($7^{\circ}29' S$, $31^{\circ} 32' E$, approximately 1026 km^2) occurs on the Ufipa plateau and encompasses the Mbuluzi Forest and its neighbouring areas: Chala, Ufipa escarpment and Rondokazi. The Ufipa plateau where the Mbuluzi Forest occurs receives 800-1200 mm of annual rainfall (United Republic of Tanzania or URTa, 1998). The Masito-Ugalla Ecosystem ($5^{\circ}52'S$, $30^{\circ}25'E$, approximately $10,872 \text{ km}^2$) is predominantly miombo woodland interspersed with evergreen forest strips and has relatively low human impact, receiving 955 mm of average annual rainfall (Hernandez-Aguilar, 2009). Elevation ranges from 900 to 2000 m above sea level (URTb, 1998). It possesses at least 50 mammal species including wild dogs, elephants, lions, chimpanzees and other seven primate species (Iida *et al.*, 2012, Piel *et al.*, 2019).

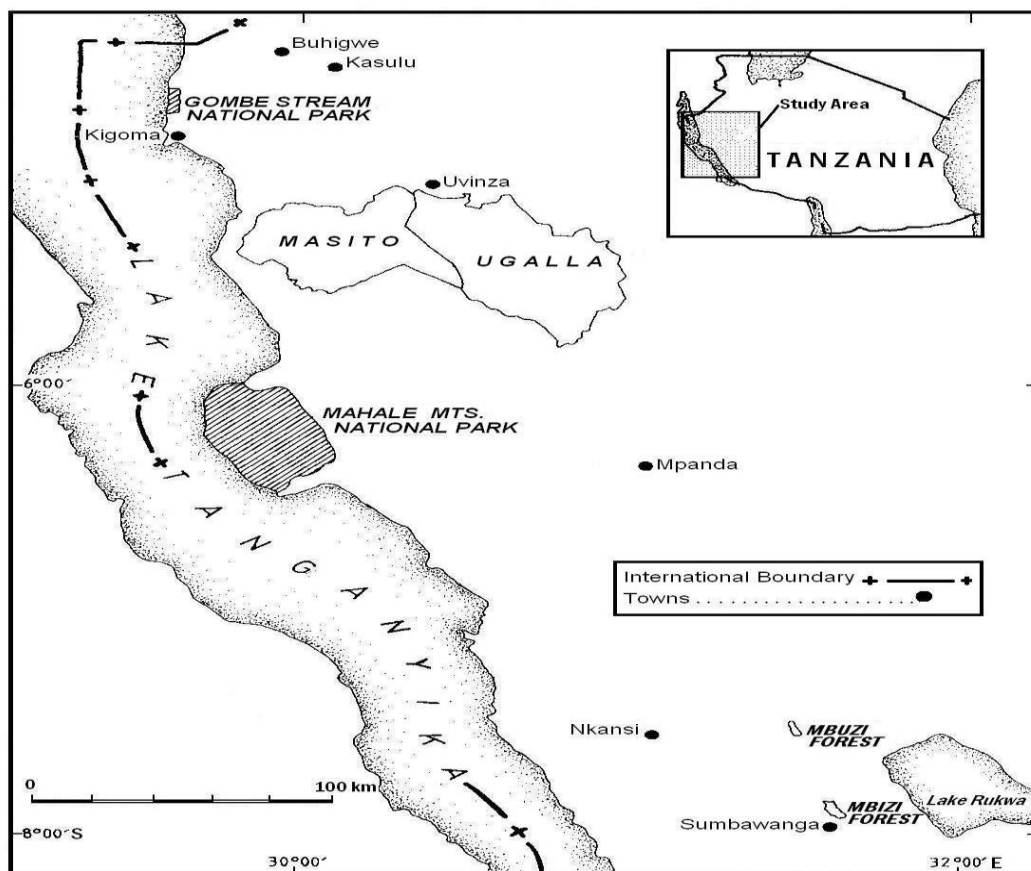


Figure 1: Study area showing the study sites in western Tanzania.

Data collection and analysis

Surveys were conducted from July 2018 to September 2019 after reconnaissance surveys (Figures 2-5). Two teams comprising three people each simultaneously searched for Ashy monkeys using trails (following Peres, 1999). When a group was encountered, the number of individuals, sex and age composition, sighting distances to the group, GPS position and bearing from the observer to the group were recorded. When we encountered a group we followed it from 10 to 30 minutes to ensure that all individuals were counted. Complete counts were done in the small forest fragments of Chala and Mbuzi forests.

Mean group size was obtained by dividing the total number of individuals from all groups by the number of groups. Population size estimates will be obtained by extrapolation from group and individual densities (these results will be published soon). Faecal samples for intestinal parasitological analysis and DNA analyses were collected (Figure 6). Some samples were already analyzed for intestinal parasites (Gonzalez-Moreno, Kibaja, et al. in press) while others are kept in fridges at the University of Dar es Salaam, Tanzania, for future analysis.



Figure 2: Teams going to the interior of the Masito-Ugalla Ecosystem.



Figure 3: Survey team in the Masito-Ugalla Ecosystem (Principal investigator: M. J. Kibaja in the front).



Figure 4: One of the survey teams in the Masito-Ugalla Ecosystem (Left: Principal investigator M. J. Kibaja).



Figure 5: Survey teams on the Ufipa plateau (Mbuzi Forest, Chala Forest and Ufipa Escarpment).



Figure 6: Collection of fecal samples from Ashy monkeys for intestinal parasitological analysis.

Ashy monkey population estimates

A total of 1408.1 km were walked in the study area (1330 in the Masito-Ugalla Ecosystem and 78.1 km in the Mbuzi Forest Area). A total of 162 groups were found: 152 were recorded in the Masito region while 10 groups were found in the Ugalla region of the ecosystem. The

mean group size in the Masito-Ugalla Ecosystem was $34.2 \pm SE1.35$ with group size ranging from 2 to 101 individuals (Figure 7).

The mean group sizes of Ashy monkeys in the Mbuzi Forest was $8.0 \pm SE 2.9$ with group size ranging from 3 to 13 individuals ($n = 3$) and for the Chala Forest was $45.4 \pm SE 26.2$ with group size ranging from 6-96 individuals ($n = 3$). The mean group size of Ashy monkeys in the Ufipa Escarpment was $60.6 \pm SE5.9$; group size ranging from 30 to 98 individuals ($n = 16$) (Figure 7). Ashy monkey groups were found in forest (Figure 8) and savanna-woodland habitats. In woodland vegetation type within the savanna-woodland, Ashy monkeys were seldom found foraging on the ground vegetation (i.e. feeding on shrubs and forbs) (Figures 9-10). In the Ufipa Escarpment 57% of the groups were found in narrow gallery forest and 44% in dense woodland vegetation types. In the Masito-Ugalla Ecosystem 97% of the groups were found in gallery forests whereas only 3% were found in dense woodlands. Intersite variations in group size may be due to differences in land protection status, the extent of human activities (cultivation) leading to population compression, fission-fission behaviours of the monkeys and inter-site habitat heterogeneity. The density of Ashy monkeys in the Masito-Ugalla Ecosystem in the Ufipa Escarpment and the total population sizes in Chala and Mbuzi forests will be published in the near future (manuscript currently being drafted).

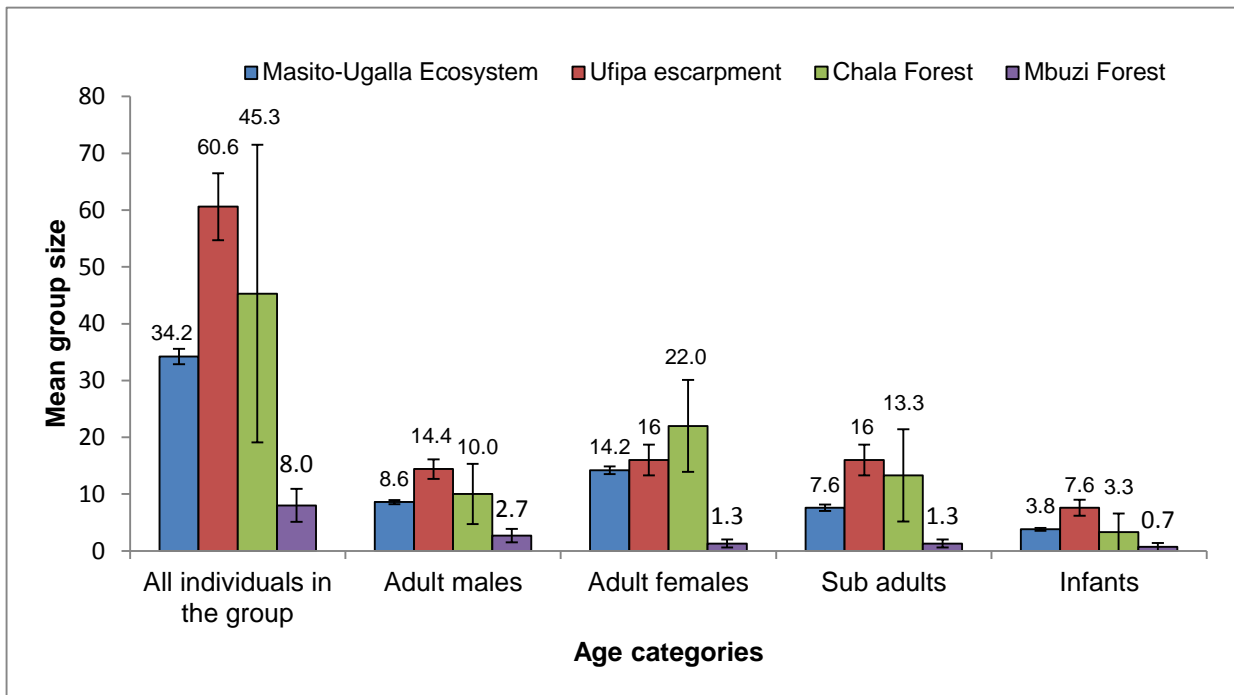


Figure 7: Mean group sizes of Ashy monkeys (divided by different age classes) in surveyed parts of the Masito-Ugalla Ecosystem and Mbuzi Forest area (Mbuzi and Chala forests and Ufipa escarpment).



Figure 8: Ashy monkeys in a forest fragment in Chala Forest on the Ufipa plateau.



Figure 9: Ashy monkey in a savanna-woodland habitat in the Ufipa escarpment on the Ufipa plateau, feeding very close to the ground.



Figure 10: Ashy monkeys in a savanna-woodland habitat in the Ufipa escarpment on the Ufipa plateau, sitting on the ground, uncommon for an arboreal species.

Important outputs of this project: Manuscripts and poster presentation

Two manuscripts are currently being written. These contain the detailed findings of this project. The proposed titles for the manuscripts are “First extensive survey of Ashy red colobus monkeys (*Piliocolobus tephrosceles*) in the Masito-Ugalla Ecosystem” and “Population status and conservation threats of Ashy red colobus monkeys (*Piliocolobus tephrosceles*) in the Mbuzi Forest and newly discovered areas, Rukwa Region, Tanzania”. These manuscripts are expected to be published early 2020. I am the first author of both manuscripts.

Results from the parasitological analysis of Ashy monkey faeces have already been presented at the Iberian Primatological Conference, which took place in Lisbon, Portugal, in October 2019 (Gonzalez-Moreno, Kibaja et al. in press, please see Appendix 1) and are currently being prepared for publication following further DNA analysis of the parasites found to find out if these could have a human origin (transmission from local humans and their livestock to the monkeys).

Conservation threats

Influx of livestock keepers and bushfires are a common problem in all the study sites. In the Mbuzi Forest Area, a variety of human signs were observed, with the leading one being tree cutting (Table 1) followed by forest conversion into farms (Figures 11-12).

In the Masito-Ugalla Ecosystem the major human signs were tree sawing (Figure 13), farming, and poaching (Table 2). This ecosystem has recently been invaded by cattle herders from other regions of Tanzania (Figure 14). Rice farming is very common and takes place along the thin gallery forests that are present in the ecosystem (Figure 15), while cotton farming and other crops occur in woodland vegetation type (Figure 16). Poaching is common in the entire ecosystem, though it is more severe in the proximity to villages. Poaching is intensified by the presence of past refugee villages (mainly from Burundi), situated at the centre of this ecosystem. Uncontrolled bushfires are also common. Beekeeping is the only environmentally friendly activity in the ecosystem (Figure 17, Table 2).



Figure 11: Harvested maize farm on the Mbuji Forest on the Ufipa plateau.



Figure 12: A completely cleared forest waiting for planting rains in the Mbuji Forest Area.



Figure 13: Evidence of illegal logging activities in the Masito-Ugalla Ecosystem found in our surveys (Left: Principal investigator, MJ Kibaja; Right: government district game ranger).



Figure 14: Livestock grazing in Ngo'ndo area in the Masito-Ugalla Ecosystem.



Figure 15: Rice farming along the Luegele river, adjacent to Ntakata forest in the Masito-Ugalla Ecosystem.



Figure 16: Cotton farming along the the Kagobole Wildlife Corridor in the Masito-Ugalla Ecosystem.

Table 1: Encounter rates of human signs in the Mbuzi Forest Area.

| Human activity | Frequency | Encounters/km |
|----------------------------|------------------|----------------------|
| 1 Tree cutting | 48 | 0.62 |
| Sawing pits | 10 | 0.13 |
| Charcoal kilns | 22 | 0.28 |
| Trees stumps | 14 | 0.18 |
| Pole cutting | 1 | 0.01 |
| Medicinal tree cuts | 1 | 0.01 |
| 2 Livestock keeping | 31 | 0.40 |
| Cowsheds | 19 | 0.24 |
| Livestock keepers' huts | 8 | 0.10 |
| Cattle herds | 4 | 0.05 |
| 3 Farming | 26 | 0.33 |
| Farms | 25 | 0.32 |
| Local irrigation furrow | 1 | 0.01 |
| 4 Poaching | 18 | 0.23 |
| Traps | 15 | 0.19 |
| Poachers camps | 3 | 0.04 |
| 5 Bee keeping | 2 | 0.03 |
| Beehives | 2 | 0.03 |



Figure 17: Bee keeping in the Masito-Ugalla Ecosystem.

Table 2: Encounter rates of human signs in the Masito-Ugalla Ecosystem.

| SN | Human activities signs | Masito area | Ugalla area | Masito-Ugalla Ecosystem |
|----------|----------------------------------|--------------|--------------|-------------------------|
| 1 | Beek keeping | 0.120 | 0.215 | 0.159 |
| | Beehives | 0.120 | 0.215 | 0.159 |
| 2 | Uncontrolled bushfires | 0.076 | 0.270 | 0.155 |
| | *Human mediated fires | 0.076 | 0.270 | 0.155 |
| 3 | Sawing/Lumbering | 0.038 | 0.313 | 0.150 |
| | Sawing pits | 0.033 | 0.291 | 0.138 |
| | Truck roads | 0.001 | 0.013 | 0.006 |
| | Sawing camps | 0.001 | 0.007 | 0.004 |
| | Timber plunk sites | 0.003 | 0.000 | 0.002 |
| | Trucks | 0.000 | 0.002 | 0.001 |
| 4 | Farming | 0.214 | 0.039 | 0.143 |
| | Farms | 0.182 | 0.017 | 0.115 |
| | Forest clearing | 0.028 | 0.013 | 0.022 |
| | Tree stumps | 0.004 | 0.009 | 0.006 |
| 5 | Poaching | 0.067 | 0.050 | 0.060 |
| | Human trails | 0.029 | 0.031 | 0.030 |
| | Traps | 0.034 | 0.004 | 0.022 |
| | Bushmeat drying sites | 0.000 | 0.011 | 0.005 |
| | Domestic dogs | 0.004 | 0.000 | 0.002 |
| | Gun powder making site | 0.000 | 0.004 | 0.002 |
| 6 | Livestok keeping | 0.049 | 0.037 | 0.044 |
| | *Cattle tramlings | 0.129 | 0.322 | 0.208 |
| | Cowsheds | 0.011 | 0.024 | 0.017 |
| | Cattle | 0.023 | 0.007 | 0.017 |
| | Pastoral huts | 0.015 | 0.006 | 0.011 |
| 7 | Other resource extraction | 0.015 | 0.009 | 0.013 |
| | Charcoal kilns | 0.010 | 0.000 | 0.006 |
| | Local honey collection | 0.000 | 0.007 | 0.003 |
| | Firewood collection | 0.001 | 0.000 | 0.001 |
| | Orchid harvesting sites | 0.000 | 0.002 | 0.001 |
| | Small holder dam | 0.001 | 0.000 | 0.001 |
| | Local alcohol brewing sites | 0.001 | 0.000 | 0.001 |
| | Mushroom harvesting | 0.001 | 0.000 | 0.001 |

NOTE: Gunpowder making sites- Sites where local people made gunpowder (blackpowder) from rocks rich in sulfur using traditional methods. * = needs an appropriate method for quantification.

Conservation campaigns

Part of my funding from Fundacio Barcelona Zoo was spent in campaigns for the conservation of the Ashy monkeys in the Masito-Ugalla Ecosystem and Mbuluzi Forest Area. In both study areas conservation campaigns were conducted for different targeted groups: villagers, elders, village and religious leaders, students and District Forestry officers regarding the importance of conserving the Ashy monkeys and their habitats. In addition, talks were given to Forestry, Fisheries, Wildlife and Natural Resources officers in the Sumbawanga, Nkasi and Mpanda Districts (Figure 18). Progress reports were given to Forest and TFS officers in Nkasi and Mpanda Districts. They contained information about the status and threats that Ashy monkeys face in their areas, and it was suggested that the Districts involved took actions for the conservation of the monkeys. Lectures, excursions and poster displays were held to sensitize audiences (primary and secondary school students, villagers and village committees) in the following villages: Lugonezi, Lwega and Mwese in the Masito-Ugalla Ecosystem; and Chala A, Chala B, Swaila and Mfinga villages on the Ufipa plateau (Figures 19-23). Face to face interviews were held for farmers growing crops in the Mbuluzi Forests and firewood collectors at the Ufipa escarpment. However, further conservation campaigns are needed in the study areas to follow up these conservation actions.



Figure 18: Adhoc talks with villagers (agro-pastoralists) who have re-invaded the Kagobole Wildlife Corridor in the Masito-Ugalla Ecosystem.



Figure 19: Talks and poster displays in school, with teachers and village scouts, in Mwese ward, Masito-Ugalla Ecosystem.



Figure 20: Excursions of school children to the Sitwe Forest fragment occupied by Ashy monkey in Mwese ward in the Masito-Ugalla Ecosystem.



Figure 21: Arrival in the Sitwe forest. Students, teachers and village committees watching Ashy monkeys in Mwese ward, Masito-Ugalla Ecosystem.



Figure 22: Delivering conservation education to primary school students in Mwese ward, Masito-Ugalla Ecosystem.



Figure 23: Delivering conservation education to secondary school students in Chala village, Ufipa plateau

Further steps

There is still a need for more systematic population surveys in the Masito-Ugalla Ecosystem. This is a very large landscape (more than 10,872 km²) and most of its remote sites are very difficult to access, especially during the rainy season. Despite of outstanding findings (160 groups of Ashy monkeys, which is a much higher number than suspected previous to this survey), monthly line transect surveys for at least 6 or 12 consecutive months are recommended in the main vegetation types (gallery forest and dense woodland) in the ecosystem. This will compel me to re-apply for an extension grant in order to comprehensively and systematically survey this endangered primate in this unique savanna woodland habitat. Two manuscripts are currently being written for publication reporting these findings.

Conclusion and recommendations

Conservation of the endangered Ashy red colobus in Tanzania, aside from the two National Parks of Gombe and Mahale, remains imperative. Anti-poaching activities should be intensified in the Ufipa escarpment and Chala Forest as well. The Masito-Ugalla ecosystem has remote large pristine forest patches which are promising for the survival of this primate. One of such forests is the Ntakata. I strongly recommend that this forest is upgraded into any form of strictly protected area in order to save its wildlife before it is too late. The government should increase the number of wildlife rangers (forest guards) and village scouts in all Districts Councils in western Tanzania. Also, community conservation should be increased for endangered primates and other wildlife occupying village lands in the ecosystem. Intensification of anti-poaching activities in the Tongwe East Reserve in the Masito-Ugalla Ecosystem will be critical to save Ashy monkeys and other primates that share their habitat (baboon: *Papio cynocephalus* and *P. anubis*, vervet monkeys: *Chlorocebus pygerythrus* and chimpanzees: *Pan troglodytes*).

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Appendix 1: Poster presented at the Iberian Primatological Conference in Lisbon, Portugal, October 2019 (Gonzalez-Moreno, Kibaja et al. in press)

Abstract VII IBERIAN PRIMATOLOGICAL CONFERENCE

Content: The abstract should state the main objectives, hypotheses tested, location of study, species, sample sizes, results, and conclusions in a single paragraph. Abstracts mentioning «results will be discussed» will not be accepted

| | |
|--|--|
| Please mark with a cross (x) the preferred type of presentation: () Oral (X) Poster () No preference | |
| Title | Prevalence of intestinal parasites in Endangered Ashy red colobus monkeys (<i>Ptilocolobus tephrosceles</i>) in Tanzania |
| Authors | O González-Moreno ^{1,2} , MJ Kibaja ^{3,4} , P Chueca ⁵ , P Goñi ⁵ , C Nahonyo ⁴ , J Torres ² , J Huguet ¹ , RA Hernandez-Aguilar ^{3,6} |
| Affiliation | ¹ Synlab Diagnostics, Esplugues de Llobregat, Barcelona, Spain ² Laboratory of Parasitology, Faculty of Pharmacy, University of Barcelona, Barcelona, Spain ³ Centre for Ecological and Evolutionary Synthesis, Department of Biosciences, University of Oslo, Oslo, Norway ⁴ Department of Zoology and Wildlife Conservation, University of Dar es Salaam, Tanzania ⁵ Department of Microbiology, Preventive Medicine and Public Health, Faculty of Medicine, University of Zaragoza, Zaragoza, Spain ⁶ Department of Social Psychology and Quantitative Psychology, Faculty of Psychology, University of Barcelona, Barcelona, Spain |
| e-mail of the first author | olga.gonzalez@synlab.es |
| Keywords | <i>Giardia</i> assemblage B, <i>Strongyloides stercoralis</i> , colobines, disease risk, conservation |
| Abstract The abstract should not exceed 250 words in english | Intestinal parasites constitute one of the most frequent causes of gastrointestinal diseases in primates, directly affecting their health. We sampled three populations of the Endangered Ashy red colobus monkey (<i>Ptilocolobus tephrosceles</i>) with different levels of anthropogenic disturbance in Tanzania. We collected fecal samples (N=157) soon after defecation and fixed them <i>in situ</i> in 70% ethanol. We then re-fixed half of each sample in MIF (merthiolate iodine formaline) for the microscopic study and saved the rest for molecular analysis. We examined helminth eggs, larvae and protozoan cyst using a light microscope after fecal sedimentation. We analyzed samples positive to <i>Giardia</i> using Polymerase Chain Reaction (PCR) to determine genotypes. The overall prevalence of protozoan and helminth infection was 94.3% (148/157), with 64.9% (96/148) being infected by one species, 25.7% (38) by two species, and 9.5% (14) by three or more species. We detected eight species of intestinal parasites: <i>Ancylostoma</i> sp. (13.4%), <i>Trichuris trichiura</i> (3.8%), <i>Strongyloides stercoralis</i> Rhabditoid Larvae (2.5%), <i>Entamoeba chatonni</i> (82.8%), <i>Iodamoeba butschlii</i> (14%), <i>Endolimax nana</i> (4.5%), <i>Blastocystis hominis</i> (2.5%), and <i>Giardia duodenalis</i> (14%). These species were detected in different combinations in the three areas, while <i>Giardia</i> was detected in only one area. The molecular analysis of positive <i>Giardia</i> samples showed that all of them belonged to assemblage B, which could also infect humans. However, we could not identify an exclusively anthropogenic origin of the parasitic species found. Our study contributes to our knowledge of parasitic infections in Ashy monkeys in Tanzania, allowing us to assess their health status and disease risk, which in turn will help us design more successful conservation strategies for this endangered primate in Tanzania. |
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