

# International Primatological Society

# IPS Bulletin

## President's Corner [jonahrzy@gmail.com](mailto:jonahrzy@gmail.com)

Dear IPS colleague members,

For a period of 4 years, you have elected me as the President of IPS. It is such an honour! I am totally grateful for your trust. There are not enough words to express how big is the trust you put in me. But I shall live up to your expectations for we are the voice of the voiceless. Especially our primate cousins. But first let me give my special thanks to Karen Strier whose advice is as precious as the light that shines upon us every day. I am aware that the work awaiting me won't be easy, but together we can achieve astonishing results. Your concerns are mine, my ears will be listening, my arms will be working, and together with my officers we won't let any primates disappear from the face of earth! We at the IPS will write history! I give you my word that we will attain new heights!

I look forward to seeing everyone at the upcoming IPS Congress in Malaysia in August. We will have a wonderful meeting in that beautiful country of the generous Malaysian people.

Best wishes, Jonah Ratsimbazafy, IPS President

It was a tremendous pleasure to see so many of you in person or via zoom at the IPS-SLAPrim meetings in Quito in January 2022. Those were especially meaningful meetings, not only because travel restrictions and safety concerns necessitated that we postpone them, but also because it was at the conclusion of the General Assembly meeting in Quito that my extended 5½ year term as IPS President came to an end.

My activities leading up to the Quito meetings are described in my final [President's Report](#)<sup>1</sup> and those at the Quito meetings are described in the [Compiled Meeting Minutes](#)<sup>2</sup>. Among the many ongoing and new IPS initiatives was the launching of the Heritage Fund, which raised \$37,000USD in donations and commitments in less than a year. The Founders of the IPS Heritage Fund, and how to become one yourself, is on our website.

I would like to reiterate my gratitude to the IPS membership that elected me, and to the past and current fellow officers, council members, and other friends and members, for helping me to navigate the challenges of leading an international society. This was daunting enough during my first cycle of responsibilities (between the Chicago 2016 and Nairobi 2018 meetings), but even more so since the onset of the pandemic and throughout the persistently shifting landscape we now inhabit. Reflecting back on my term in office, I am very proud of everything that IPS, our affiliate societies, and our members have accomplished in pursuit of our mission "to encourage all areas of nonhuman primatological scientific research, to facilitate cooperation among scientists of all nationalities engaged in primate research, and to promote the conservation of all primate species." It was an honor to serve as your President.

The last and most important thing any president can do is to hand over their responsibilities to a worthy successor. So, please join me in formally welcoming Jonah Ratsimbazafy as our current IPS President. With Jonah and the other outstanding officers, the leadership of IPS could not be in better hands.

With best wishes, Karen B. Strier, IPS Past President

<sup>1</sup> <https://internationalprimatologicalsociety.org/wp-content/uploads/2022/01/IPS-Officers-Reports-to-the-Council-Quito-2022.pdf>  
<sup>2</sup> [https://internationalprimatologicalsociety.org/wp-content/uploads/2022/08/IPS-Compiled-minutes-Quito-Congress-2022\\_Pre-CCM\\_General-Assembly\\_Post-CCM.pdf](https://internationalprimatologicalsociety.org/wp-content/uploads/2022/08/IPS-Compiled-minutes-Quito-Congress-2022_Pre-CCM_General-Assembly_Post-CCM.pdf)



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# VP for Communication

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Greetings Primate folk!

It's been a little while! The Bulletin took a backseat while we got our lovely new website up and running, and to be honest it took a backseat while the rollercoaster of our lives as primatologists in a pandemic continued to throw up new challenges as well as new adventures. In the last issue we collated our Covid Chronicles, some of these still ring familiar today, others seem a part of a distant past, even where that was only a few months ago!

So welcome to the bumper sized catch up Bulletin! There are lots of wonderful reports about all of our and your activities over the past year. We reflect on the profound loss of our own Steve Ross in April this year, who served as VP for Captive Care, and read about the incredible life of Duane Quiatt who passed away in 2021. Vernon Reynolds returns to visit the Mountain gorillas of Bwindi, 60-years after his first trip. Our Past President Karen Strier

describes our new Heritage fund, which has raised almost \$40k in its first year, and Treasurer Trudy Turner highlights some new member benefits of our updated contract with the International Journal of Primatology publisher Springer.

For those of you who follow our social media you'll realise that a couple of months ago our Facebook page was hacked (we're not really a blond woman selling high-end sneakers). We're in the process of setting up a new page – stay tuned! But in the meantime, you can still follow us on Twitter and Insta on the same handle @IPS\_PrimateNews as well as on our website, where we'll be sharing all the primate news, info, and fun, as well as getting ready for the big build up to IPS Malaysia!

Hoots and best wishes for a wonderful 2023!

Cat Hobaiter  
IPS VP for Communication

## VP for Captive Care

The IPS Officers deeply mourn the loss of our Vice President for Captive Care, Steve Ross, who died unexpectedly in April 2022. At the time of his death, Steve was the Director of the Lester E. Fisher Center for the Study and Conservation of Apes at Lincoln Park Zoo in Chicago, Illinois USA, and board chair of Chimp Haven, a sanctuary for captive chimpanzees retired from research in the United States. He became an officer at IPS in 2016, leading the Committee for Captive Care and Breeding in choosing grantees each year, and guiding IPS action and thinking on issues surrounding primates held in captivity. Just one of his many goals was to update the name of this Committee to Welfare and Captive Care, something we were able to at last enact earlier this month.

Steve was both personally and professionally devoted to the care, welfare and study of primates around the world. Most recently, he led

the development of IPS position statements on animal abuse associated with “fake” videos (LINK) and on harvesting wild primates for biomedical research (LINK). For details on Steve's life, we recommend this article/obituary in the Chicago Tribune (<https://www.chicagotribune.com/entertainment/ct-ent-steve-ross-obituary-kogan-0423-20220422-4l3n4jpen5djb56xtvkw3elvm-story.html>).

As his colleagues who worked in the IPS trenches with Steve, we take this opportunity to express our profound gratitude for his service to IPS. We could not have asked for a better colleague. His devotion to improving the relations of human and non-human primates, his good-natured and contributory spirit, and his upbeat way of finding a way forward in all situations will continue to inspire us.

Dear IPS members,

I have some extremely exciting news to share. IPS has recently concluded negotiations with Springer, the publisher of the *International Journal of Primatology*, the official journal of the society. We are formalizing our relationship and as such, members of IPS will be able to access a wonderful new benefit. If you are a member in good standing of IPS, you will be able to access the online version of IJP for free!!! All you need to do is make sure you are a member in good standing in the next month. Go to our website and pay your dues or claim range status membership. And, then--- happy reading.

In another exciting development, Springer will also help support a symposium at our congresses.

We are all truly excited at this wonderful development and this exceptional opportunity for our members.

Also, if you are planning to attend the IPS meetings in Malaysia, this is a good time to make sure your membership status is up-to-date. Registration will be opening soon. Time to get ready.

Please feel free to get in touch with me if you have any questions or if you have any issues accessing your membership in our online system.

Very exciting news for our members!!!

Trudy Turner  
VP for Membership and Treasurer

## Secretary General

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Since my last report in October 2020, COVID-19 vaccines started to be produced in large scale and applied to the population. However, the continuous discovery of new SARS-CoV-2 variants throughout 2021 forced us to move the IPS meeting again. Despite all difficulties and uncertainties, we were able to held our joint meeting with the Latin American Society of Primatology (SLAPrim) between January 9th to 15th, 2022 in Quito, Ecuador. IPS and SLAPrim Officers met many times via Zoom and worked hard to make the congress happen safely during a pandemic. Thanks to the competence and hard-work of the local Organizing Chair Stella de la Torre and the Chair of the Scientific Program Committee Steven Schapiro, our first hybrid congress was a success.

During this time, I assisted the President and the other Officers in reviewing the IPS Constitution and By-laws. The proposed changes will be submitted soon for the voting of IPS membership.

I also organized Zoom meetings between the Brazilian Society of Primatology (SBPr) and the officers of several affiliate societies to present and seek support for the SBPr campaign @EuNãoSouPet (@PrimatesAreNotPets). Similarly, I communicated with the Advisor of the Asociación Colombiana de Primatología (ACP) Angela Maldonado and other members of the IUCN Human-Primate Interactions about their request for IPS support on a policy statement on the capture of wild primates for biomedical research. Both SBPr and ACP proposals were presented at the Pre-Congress Council Meeting in Quito and approved. Before the Congress in Quito, President Karen Strier sent a letter to the President of Kyoto University in support of the Primate Research Institute (PRI). After the Congress, our new President Jonah Ratsimbazafy sent a letter to the Minister of Environment of the Republic of Panama in support of the plea of Panamanian environmental protection organizations for the government to halt the expansion of mining activities in a highly biodiverse region.

During 2020 and 2021 I invited several affiliate societies, mostly from Europe, to submit a bid for hosting the 2025 IPS Congress. I also responded messages from Bureaus of Tourism from many African, European, Asian, and Oceanian cities interested in hosting our congress. Finally, IPS Treasurer Trudy Turner and I corresponded with three African parties during their bid preparation. Durban, South Africa and Antananarivo, Madagascar submitted bids, both outstanding. Antananarivo was chosen by the IPS Council in the poll run during the Pre-Congress Council meeting in Quito.

Again, I invite the affiliate societies and members in good standing with IPS to submit bids for hosting the 2027 congress. The IPS Council will vote on the bids during the Pre-Congress Council Meeting in August 2023 in Kuching, Malaysia.

Alike all officers, I am deeply sad for the premature death of our amazing colleague and friend VP for Captive Care and Breeding Steven Ross.

I thank the help and support of all IPS Officers and affiliate societies with whom I look forward to continue working to promote primatology and the conservation of primates worldwide.

My very best wishes to all!

Júlio César Bicca-Marques

## VP for Research

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In 2021, IPS suspended the usual funding streams because of financial constraints imposed by the delay of the IPS Congress in Quito. In this second year of the pandemic, we had a single special competition for a SARS-Cov2-related project, which could relate to basic research, conservation, education and/or captive care. The four VPs developed a scoring rubric that worked for all types of projects and emphasized the special nature of this competition. We received 8 applications, 5 from applicants in range-countries. Applications were reviewed by multiple committees if relevant. We could award only one grant (\$1500), which went to a student applicant, Clara Mariencheck, for their project “Characterizing COVID 19 genetic risk factors in non-human primates: ACE2 variation in captive chimpanzees (*Pan troglodytes verus*).” This project was reviewed both by the Research and Captive Care committees.

It's very welcome news that IPS research (and other) grants could resume as usual in 2022. The Research Committee received 53 proposals from researchers affiliated with institutions in 13 countries (Argentina, Brazil, Canada, Ecuador, El Salvador, Germany, Japan, Mexico, Peru, Portugal, Spain, UK, and USA).

We awarded a total of \$14,490 in 9 grants, and successful applicants included one MA and eight PhD students. Their projects are listed below, along with the country of their affiliation, with an asterisk (\*) indicating range country nationals.

- Gabrielle Bueno (USA): “Micronutrient supplementation by reproductive female Verreaux’s sifaka (*Propithecus verreauxi*)”
- Isabelle Clark (USA): “Ecological and social benefits of juvenile dependence in chimpanzees”
- John Dalton (USA): “Cognitive ecology of a nocturnal strepsirrhine primate (*Otolemur crassicaudatus*) and its implications on primate cognitive evolution”
- \*Saul de los Santos (Mexico): “Sexual selection in black howler monkeys (*Alouatta pigra*): An evolutionary trade-off between testicular volume and loud calling)”
- Jordan Lucore (USA): “S Integrative physiology in white-faced capuchins (*Cebus capucinus*)”
- Evelina Rodrigues (Portugal): “Chimpanzee ‘babytalk’: Gestural motherese in wild chimpanzees (*Pan troglodytes*)”



- Emma Thureau (USA): “Balancing nutrients and toxins in wild monkey diets: a plant metabolomics approach”
- Tabor Whitney (USA): “Associations between ecological attributes and the gut microbiome of mantled howlers in Los Tuxtlas, Mexico”
- Melissa Zarate (USA): “Population genetic assessment of the yellow-tailed woolly monkey (*Lagothrix flavicauda*) in Peru, including a newly discovered and potentially isolated population”

I would like to remind IPS members that the Research Committee offers pre-submission feedback on draft proposals from nationals of range countries. We received 14 such requests this year, a substantial increase relative to 2020, and one of these final proposals was funded. If you know applicants who could benefit from this service, please help us get the word out: we hope to diversify the awards

more, and realize that access to mentorship can vary considerably.

If you have a Ph.D. and might be interested in joining the Research Committee to help with proposal evaluation, or if you would like to recommend another IPS member for committee membership, please do contact me. I’m happy to answer any questions! Our committee will need new members, and we would like the committee membership to reflect the international scope of our society. I welcome all enquiries and suggestions!

Finally, keep in mind that the next round of proposals will be due on March 1<sup>st</sup> 2023, with pre-proposals for pre-submission reads due February 1<sup>st</sup>, 2023.

Marina Cords, VP Research

## VP for Conservation

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I would like to share my deepest thanks to the IPS Conservation Committee members for their time and help with these past granting cycles and previous grantees for their wonderful reports. This past year, we received some excellent applications for our **IPS Conservation grants**.

We are delighted to have been able to grant seven conservation grants; the following were the successful grantees:

- **Abid Ali:** Population Density and estimate of Endangered Kashmir Langur (*Semnopithecus ajax*) from the Khyber Pakhtunkhwa Province of Pakistan.
- **Fábio dos Santos:** Searching for new populations of the recently discovered and critically endangered Groves’ Titi, Brazil.

- **Mohamed Kibaja:** Urgent conservation surveys of the Endangered Rondo galago (*Galago rondoensis*) in unsurveyed forest patches of coastal forests of Tanzania.
- **Eliette Noromalala:** Ethnoprimatology in Marontandrano Special Reserve, Madagascar
- **Elise Paietta:** Identifying Drivers and Mitigation Strategies for Viral Anthroponoses in the Lemurs of Southeastern Madagascar.
- **Toussaint Rabary:** Leveraging *Varecia variegata* feeding behavior to restore forest and wetland ecosystems in Ihofa, Madagascar.
- **Daniela Solano:** Primate Watching as a tool for primate habitat conservation in Costa Rica

We also received applications for the **Galante Family Winery Conservation Scholarship**. The conservation committee is pleased to have identified a winner in this granting cycle in Tanvir Ahmed.

**Tanvir Ahmed** is a wildlife conservationist and primatologist in his home country of Bangladesh. The scholarship of \$2,500 will help him pursue a training program on primate population genetics at the Primate Genetics Laboratory, German Primate Center (DPZ) under the direct supervision of Dr. Christian Roos further strengthening primate conservation efforts in Bangladesh.

*Major congratulations to this year's grantees, we look forward to receiving your reports which we will showcase in the IPS newsletter.*

*We also look forward to another excellent group of submissions for the IPS conservation grant and the Galante Family Winery Conservation Scholarship in 2023 (Deadline March 1<sup>st</sup>, 2023)!*

**REMINDER:** We offer feedback on proposals on a case by case basis from nationals of primate range-state countries. For this purpose, applications must be submitted by the 1st February for feedback; revised submissions must be resubmitted by the March 1st deadline.

**PLEASE NOTE:** Since we were unable to run our usual **Pre-Congress Training Programme (PCTP)** prior to the IPS congress held in Quito, Ecuador for COVID reasons, the participants who were initially selected to attend will be joining the PTCP at our next IPS congress in Kuching, Malaysia, alongside a selection of four Malaysian candidates. We will therefore not be making our usual call for PCTP applications for this next IPS congress.

Thank you.  
Please stay well and healthy,  
All the best,  
Tatyana Humle

VP for  
**Education**  
[patrizar@usp.br](mailto:patrizar@usp.br)

After the difficult years of 2020 and 2021, the IPS Education Committee had a busy start to the year. We were very grateful to the organizing committee of the joint IPS-SLAPrim 2022 meeting. The Education committee congratulates and thanks all the students that presented their work in the meeting. And of course, congratulations to all of the student competition award winners!

I want to acknowledge the amazing work of our colleagues who helped to evaluate the abstracts and papers. I am very grateful to Adrian Barnett, Alejandra Duarte, Baoguo Li, Bernardo Urbani, Briseida Resende, Bruna Bezerra, Dorothy Fragaszy, Francine Dolins, Gabriel Ramos-Fernandez, Gladys Zikusoka, Goro Hanya, Inza Kone, Jessica Lynch, Joanna Setchell, João Pedro Souza-Alves, Kathelijne Koops, Kimberley Hockings, Laura Marsh, Leandro Jerusalinsky, Marilyn Norconk, Martin Kowalewski, Mewa Singh, Ramesh Boonratana, Renata Ferreira, Simplicious Gessa, Valentina Truppa, and Zarin

Machanda for their invaluable collaboration in this task. They were very generous in their time and efforts to help ensure the success of this prize. We considered both geographic and gender diversity when building the panel of reviewers.

The Education Committee, with the aid of invited reviewers from the membership, evaluated the 113 abstracts submitted to the IPS 2022 student's competition and selected 17 oral presentations and 8 posters to enter the competition.

IPS usually awarded the best oral presentation and two honorable mentions and the best poster. In this edition of the IPS meeting we created new awards for best oral presentation and two honorable mentions and best poster by a student from a Low/Middle income country. The reviewers judged the oral presentations and posters out of 20 points (10 for scientific quality and 10 for presentation quality). I z-scored all grades (independently for orals and posters) and ranked the students based on average z-score, one rank for each type of competition.

The winners were:

**Natalia Camargo:** Scent marking behavior in a wild population of woolly monkeys (*Lagothrix lagotricha poeppigii*) in the Ecuadorian amazon. Best poster and Best Poster from Low/Middle income country

**Cristian Alvarado:** Permanent fission in a spider monkey group (*Ateles belzebuth*) in Yasuni National Park, Ecuador. Best oral presentation and Best oral presentation from Low/Middle income country

**Brogan Stewart:** Climate change impacts on potential future ranges of nonhuman primate species based on cumulative co2 emissions. Honorable mention to oral presentation

**Leveda Cheng:** Variation in aggression rates and urinary cortisol levels indicates intergroup competition in wild bonobos. Honorable mention to oral presentation

**Thiago Cavalcante:** Identifying high-priority areas for conservation of the Endangered black-faced black spider monkey (*Ateles chamek*): the neglected role of broadscale interspecific competition. Honorable mention to oral presentation from Low/Middle income countries

**Lucero Hernani Lineros:** Behavioral and physiological response of Bolivian gray titi monkeys (*Plecturocebus donacophilus*) to an anthropogenic noise gradient. Honorable mention to oral presentation from Low/Middle income countries

Every year the Education Committee of IPS awards the Lawrence Jacobsen Education grant of up to \$1,500 to support the development of primate conservation education programs. In addition, we award the Charles Southwick Conservation Education Commitment Award, in the amount of \$2,000: \$1,000 to the recipient and \$1,000 given in the recipient's name to a project of their choosing in their community.

#### Lawrence Jacobsen Education grant

I am very grateful to the Education Committee members who helped review and judge the applications in 2021 and 2022: Adrian Barnett, Alejandra Duarte, Carla Castro, Carlos Ruiz-Miranda, Francine Dolins, Inza Kone, Joana

Ferreira da Silva, Laura Marsh, Lynne Miller, Luciana Oklander, Martin Kowalewsky, Mewa Singh, Misato Haiashi, Rachel Ikemeh, Renata G. Ferreira, Simplicious Gessa, Suchinda Malaivijitnond, Valentina Truppa, and Zarin Machanda. In 2021, four reviewers reviewed and scored each grant out of 35. In 2022, seven reviewers reviewed and scored each grant out of 35. I standardized the scores and ranked applications based on their mean standardized score. Reviewers provided comments to help applicants in improving their future applications. Only a few applicants used the opportunity of pre-application to get feedback on their proposal before the deadline (one pre-application per year), but numbers are increasing. We are particularly happy that the pre-application process appears to be very successful, with most revised proposals being shortlisted for funding.

In 2021 we received 8 applications from 6 countries across Africa, North America, and Asia (Uganda, Sierra Leone, Cameroon [2 applications], USA (2 applications), and Vietnam). We awarded US\$ 4,000 in two grants (both included Community Conservation Initiatives in their applications).

#### 2021 Awardees:

**Trang Le Thi.** Project: *Implementing a Children's Education Program to Strengthen Primate Conservation in Central Vietnam*. Country: Vietnam

**Bruce Ainebyona.** Project: *Using Radio Programming to promote conservation of Kibale National Park, Uganda*. Country: Uganda

In 2022 we received 10 applications from 9 countries across Africa, Asia, and Latin America (Kenya, Cameroon, Zambia, Bhutan, Brazil, Colombia, Ecuador [2 applications], Mexico, and Peru) . We awarded US\$ 9,499.33 in five grants (four included Community Conservation Initiatives in their applications).

**Sara Álvarez Solas.** Project: *Misahualli's Capuchin Monkey Educational Plan*. Country: Ecuador

**Tamia Torres-Capelo.** Project: *#ForEverWild, conserving primates as a way of protecting their ecosystems and the species that surround them*. Country: Ecuador

**Belinda Kwamboka.** Project: *Evidence-based conservation education in Kenyan communities: Connecting arts and science to conserve Red colobus Monkey in Tana River Delta.* Country: Kenya

**Kuenzang Dorji.** Project: *Developing conservation conscience among local people and commuters for survival of endangered Gee's golden langur (*Trachypithecus geei*) in the human dominated landscapes, Bhutan.* Country: Bhutan

#### Charles Southwick Conservation Education Commitment Award

After the difficult period of the covid-19 pandemics, when many colleagues had to stop their primate conservation activities, in 2022 we received ten nominations for the Charles Southwick Conservation Education Commitment Award! The Education Committee reviewed all ten nominations and ranked them based on the number of people reached by the Conservation Education actions, how long the action was going on, and the primate

species benefited by the action. We awarded five nominees: **Hantanirina Rasamimanana**, from Madagascar, **Martin Kowalewsky** from Argentina, **Jingyu Chen** from China, **Alfred Bongadu** from Cameroon, and **Jesus Martinez** from Bolivia. I am grateful for the Education Committee members that helped with evaluating the nominations in 2022: Carlos Ruiz Miranda, Laura Marsh, Zarin Machanda, and Valentina Truppa.

If any IPS members are interested in serving on the Education Committee, or have specific issues they would like addressed, please contact me at [patrizar@usp.br](mailto:patrizar@usp.br).

Patrícia Izar  
VP for Education

## New Open Access Digital Repository Primate Vocalizations

Thomas Struhsaker

I have recently compiled and archived digitized tape recordings of African monkeys that I made between 1969 and 1992. These recordings are of 10 taxa of red colobus (*Piliocolobus*) and 29 taxa of other African monkeys that I collected from 13 different localities in 8 countries from Senegal to Zanzibar.

The majority of these tape recordings in this repository were analyzed spectrographically years ago (Struhsaker 1970, 1975, 1980, 1981, 2010). While the published measurements and spectrograms allow for quantitative analyzes and visual comparisons, they do not convey how these vocalizations actually sound. There is no substitute for the acoustic experience these digitized recordings provide.

In addition to the value of the acoustic experience, these recordings are important because some of the species recorded are endangered. This is particularly true for the red colobus taxa, most of whom are endangered or critically endangered. Furthermore, some of the areas where I made these recordings are now considered unsafe due to insurgencies, such as Casamance Province in Senegal, the Korup National Park in Cameroon, and the Ituri area and the western slopes of the Ruwenzori Mountains of the Democratic Republic of Congo. What this means for some taxa, such as *Piliocolobus preussi* in the Korup National Park, is that the recordings provided in this repository may be the only ones ever available for this taxon.

At the end of each recording session, I narrate the species, size class (where known), time, date, context, and location. These recordings and an appendix that includes the species recorded and locality in each file are now freely available through the Duke University Libraries Digital Research Data Repository <https://research.repository.duke.edu/concern/datasets/8049g6156?locale=en>

Prof. Tom Struhsaker



# New Grant Opportunity

## National Geographic Society

The National Geographic Society is launching a rigorous global effort to find three of the best scientists doing field research on animal behavior and cognition. Ideal candidates must have at least three (3) years of relevant work experience after the award of their Ph.D. We welcome applications from all career stages beyond that, but preference will be given to early-career scientists. If selected, each individual will receive direct funding of \$800,000 (\$200,000/year), as well as substantial additional resources and services over four (4) years (with the possibility to extend an additional six (6) years, totaling a project length of 10 years).

More information: [www.nationalgeographic.org/society/grants-and-investments/animal-behavior-and-cognition-funding-opportunity/](http://www.nationalgeographic.org/society/grants-and-investments/animal-behavior-and-cognition-funding-opportunity/)

## In memoriam: Masao Kawai

Michael Huffman

### Masao Kawai- The last of the grand-pioneers of Japanese primatology

I was deeply saddened to learn of Kawai sensei's passing on May 14, 2021. He was the last of the three grand-pioneers of Japanese primatology, along with Junichiro Itani (1926–2001) and Shunzo Kawamura (1924–2003), who began their careers under Kinji Imanishi (1902–1992), the founder of primatology in Japan. These were the giants in our field in the early days, whose shoulders we stand upon today. I had not been able to see him for some time and was hoping to pay a visit as soon as the COVID pandemic was over and it was safe to meet. I wanted to reminisce about the past and thank him for the many ways he helped shape my career path in primatology and my staying here in Japan all these years.

I first met Kawai sensei on July 20, 1979 in his office on the 5th floor of Kyoto University's Primate Research Institute (PRI) in Inuyama. At the time, I was a 20-year old undergraduate exchange student from Colorado studying at Kansai Gaidai in Osaka, taking courses in Japanese language, anthropology and other aspects of Japanese culture. At first Japan was a serendipitous detour for this freshman in college, because for as long as I can remember, I had wanted to go to Africa and study chimpanzees. But as my interests in Japan grew stronger, I was motivated to learn to read and write Japanese as well as speak it, so I combined this desire with my love of primates and started reading a copy of 'The Ecology of Japanese Macaques' (1969), written in Japanese by Kawai sensei. On that fateful day in July, with his book in hand and an introduction from the professor at Gaidai who gave it to me, I went to meet the man who unknowingly was my first introduction to Japanese macaques and the world of Japanese primatology. We talked about the book and his pioneering fieldwork on sweet potato washing culture in Japanese macaques on Koshima and his early fieldwork in Africa. He was just beginning a new project on mandrills in Cameroon. After a cup of tea, he kindly signed the book, and then called Itani sensei in Kyoto on the phone to introduce me, while I waited.

A week later I was sitting in Itani sensei's office in the laboratory of Physical Anthropology on the main Kyoto campus, learning about his research on chimpanzees in Tanzania. At that moment, thanks to these two men, the path to Africa and my destiny in Japan became clear. Itani sensei introduced me to the monkeys of Arashiyama, and later arranged for me to begin studying chimpanzees in Mahale. As a graduate student studying under him in Kyoto from 1983, these two sites became key to beginning my career in primatology. Throughout the years both of these kind men provided many opportunities as I integrated into the Japanese primatological community. Kawai sensei took an interest in the work I was doing on the stone handling behavioral tradition of Japanese macaques and once invited me to co-appear on national TV to talk with him about culture in primates. With his trademark goatee and French beret, Kawai sensei always had a kind word when we met. His open and easygoing manner made him very approachable. Years later when colleagues and I were putting together an edited volume on 60 years of research at Arashiyama, he generously wrote the forward for it. Forty-two years from that fateful meeting in 1979, now just a few years from my own retirement from Kyoto University, my office here on the 5th floor of PRI, is just a few doors down from where we first met. Every day I come to work, I am reminded of that fateful meeting, and am grateful.

These are the words I had wanted to share with Kawai sensei had we been able to meet again. For all these things I thank him from the bottom of my heart. He lived a long and productive life, remaining sharp of mind until the end, outliving his two classmates Itani and Kawamura by over 20 years. Kawai sensei leaves behind an indelible legacy in the field of primatology, and for that our entire discipline is grateful.

# Gorillas and Chimpanzees

Vernon Reynolds

The year 2022 marked my second visit to see wild gorillas. The first occasion was in 1962 when, together with my wife Frankie, I visited the mountain gorillas of Mt. Muhavura, setting off from Walter Baumgartel's "Travellers Rest" with two Ugandan guards, Peter and Simon. On day 2 of searching all four of us had a terrifying encounter with an outraged silverback male who roared as he charged us, then stood up and beat his chest as all four of us including the guards ran away down the mountain as fast as we could.

Now, 60 years later, accompanied by my daughter Janie, I decided to try again. This time the problem was different, I was now 86 so did not relish a second encounter like the first one. We went to the Uganda Wildlife Authority's gorilla tracking base where we were provided with hiking sticks and given our instructions. We were with around 50 tourists, the normal number for August. Groups of 6 were formed, each with a UWA ranger as guide and porters if wanted. I was helped up the slopes of Bwindi Impenetrable Forest by various hands and someone pushing from behind. We were accompanied by Gladys Kalema-Zikusoka, who heads the mountain gorilla conservation project Conservation Through Public Health, and with whom we were staying. After a steep uphill trek we encountered the Mubare group whose silverback was fully habituated and tolerated us with disdain while his group sat around him and moved slowly to obtain food. We stayed observing the group for the one permitted hour, masks on. Very different from 1962, but nonetheless a richly rewarding experience and an opportunity for me to compare these gorillas with the chimpanzees we had been watching at Budongo for the previous 10 days.

Later we met Nelson Guma, Chief Warden of Bwindi National Park, who expressed an interest in the similarities and differences between mountain gorillas and chimpanzees. I was reminded of a paper I wrote on just this subject 57 years ago (Reynolds 1965). We had a most interesting conversation. We also discussed the danger to conservation of the new roads being built all along the western side of Uganda by the Chinese oil company CNOOC (Vyawahare 2022). These same roads threaten the chimpanzees of Budongo Forest and indeed all the forests of western Uganda.

Prof. Vernon Reynolds



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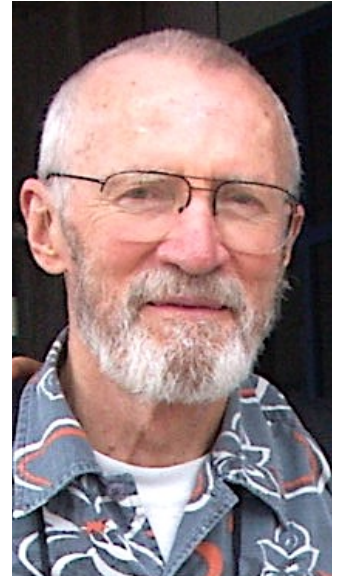
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# Celebration of a Life Well Lived

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## Duane D. Quiatt (1929-2021)

Duane passed away at his home in Boulder Colorado on June 13th at the age of 92. He was Professor Emeritus in the Department of Anthropology, University of Colorado-Denver (UCD) where had been faculty since 1969. Duane led a rich life, always surrounded by students and colleagues of many diverse academic interests and backgrounds. He easily made friends wherever he went around the world. Duane served in the army between 1951 and 1953 based in Japan, before going to the University of Michigan, where he obtained a Bachelor of Arts (1956) and Master of Arts (1959) in English. He moved to Colorado to teach English at UC-Boulder between 1959 and 1961 but switched early on in his academic career to anthropology, first starting out in archaeology, but when he returned from his first field season to find that the crates with his excavated pottery “had all been destroyed beyond recognition”, Duane, true to character, wasted no time and dove into something equally challenging. Switching to primatology, he conducted his PhD research on the social organization of rhesus macaques on Cayo Santiago (Puerto Rico), where he later returned to conduct studies on social learning and food resource access strategies, many years later.



Strongly influenced by his mentor Gordon Hewes (1917-1997), Duane had many interests and approached them all with intellectual rigor and his unique and independent style. These interests ranged from the origin of language, cognition, cultural behavior, social learning and tool use. Duane never forgot his archeological interests however and creatively blended field archaeological method and primate field studies on various occasions. This ranged from experimental work in the famous Anasazi cliff dwellings at Mesa Verde to the study of Japanese macaque stone handling behavior and interpretation of their residual artifacts in the wild in Japan and on a captive population in Colorado. Duane observed gibbons in Khao Yai (Thailand) and chimpanzees in the Budongo Forest (Uganda). With a strong interest in cultural behavior and information transfer he collaborated on two books, one an edited volume with the Japanese primatologists Junichiro Itani of Kyoto University entitled ‘Hominid Culture in Primate Perspective’ and another co-authored with Oxford primatologist Vernon Reynolds entitled ‘Primate behaviour: Information, social knowledge, and the evolution of culture’. These are but a few of his many and diverse activities, but with every endeavor he undertook, he mentored and had a great impact on a number of young anthropologists, many with whom he remained lifelong friends. Duane will be greatly missed, but his legacy lives on in the work of the many he befriended and made an impact on along his journey. (Prepared by MA Huffman)

## Tributes from friends and colleagues

“Duane was one of the finest of my colleagues in primatology, whom I counted as a dear friend. He was what he seemed - an unassuming straightforward caring guy who rode the ups and downs of life without complaint, always seeing a humorous side. I first met Duane in 1982 at the IPS conference in Atlanta, where we learned we had a lot in common, in particular that we had both started our primatological careers with a PhD on the social behaviour of rhesus monkeys. Duane was a first rate primatologist whose interests ranged widely and keenly; a poet; a co-operator without competitive or egotistical traits; empathetic and dependable as a friend. They don't make many like him and we were lucky to have known him.

**Vernon Reynolds, Professor Emeritus, Oxford University (UK)**

“I remember Duane as extremely pleasant, imaginative, and having an engaging curiosity. I recall his suggestion that “household” is a term that can be applied to nonhuman primates. I was skeptical at first, but now, after many years of observations, I think that there are good reasons to justify its application to gibbon social units. They do not always consist of nuclear families, but may be highly variable, depending on how pair bonds are formed, and whether or not any relatives happen to join. Gibbon territories don't look like houses, but they are long-lasting and out-survive any of their individual occupants. And like households,



territories require maintenance and individual commitments. I am grateful to Duane for his insights, his friendship and also his warm hospitality.” **Warren Brockelman, Professor Emeritus Mahidol University (Thailand)**

" He was truly the most gentle gentleman I have ever known. He was a thoughtful thinker and exceptionally generous to others; generous with his time, his brilliance, his encouragement. He nurtured little sparks in all of us and cheered us on. I will never forget the first time I met him; it was 1990. I was so filled with excitement about my dream of studying wild bonobos. A dream that absolutely everyone else had poo-pooed and dismissed. Yet he nourished, uplifted, and encouraged me from the very first. He supervised my Master's degree, and mentored me from that point forward. I was blessed to know him as a friend. Whenever I saw him, as I'm sure he did with others, his eyes would light up and sparkle, a big smile would break out across his face. He always made me feel 'seen' and valued. His guidance was always unassuming and solid.” **Jo Thompson, President / Executive Director Lukuru Wildlife Research Foundation (DR Congo)**

“Duane was my very first mentor in physical anthropology and evolution. I especially remember a seminar class where all the graduate and senior level undergraduate students in the Department got together to participate in a human and primate evolution seminar. Duane let us go and guided our discussions at the fringes of what was known and I know we all came out of it with a huge number of questions that had not yet been asked by the anthropology profession as a whole. Duane was one of the most insightful professor's I had and we continued to keep in contact for many years. I later turned what I had learned in Duane's seminar into a paper on the evolution of land mammal diversity. I loved listening to Duane's lectures which always resulted in a ton of new questions for me.” **Richard Stucky, Curator Emeritus, Denver Museum of Nature & Science, Denver, CO (USA)**

“I met Duane in 1982 when I was an undergraduate at Ft Lewis College (Durango CO), just back from Japan where I first started my training in primatology. We collaborated in Japan in 1984 on stone handling behavior, a newly innovated cultural behavior in Japanese macaques when I was a Masters student at Kyoto University (KU). We wrote two papers from that experience, and he taught me much about the process of critical thinking, writing papers and mentoring. A few years later, after finishing my PhD he arranged for me to become an adjunct research professor at UCD so I could obtain US research funding for a pilot project at Budongo while based at KU on a contract research position. Duane was always there as a trusted friend and solid colleague with good advice, a cup of tea, a plate of pie or a good hike, wherever our paths crossed around the world. **Michael A. Huffman, Associate Professor, Primate Research Institute, Kyoto University (Japan)**

“I had the good fortune to take a course in primate behavior from Duane at UC Denver and also spend time with him in the field. He not only taught me about non-human primates but also about integrity and being true to oneself. He conducted research because it was interesting to him, not because it was a hot topic or fundable. If he didn't have a grant for research he wanted to explore – he self-funded. In 1998, I obtained a Fulbright to study self-meditative behavior at Budongo. Duane helped prepare me for many years in the field. He encouraged me to be my best, trust my observations, and acknowledge that spending time with non-human primates was a privilege. I am grateful for the time I spent with this amazing, creative, and kind soul.” **Paula A. Pebsworth, Scientific Coordinator, Cloudbridge Nature Reserve (Costa Rica)**

“I first met Duane when I was a very green post-grad student heading out to Budongo Forest to study chimpanzees in the late 1990s. We worked together on one of my first ever peer-reviewed publication looking at the prevalence of disabilities from snare injuries in chimpanzees throughout East Africa. Whilst the subject matter might seem a bit dark, Duane always focused on the positive aspect of how chimpanzees had been able to overcome and manage such debilitating injuries well into old-age. He gave me a lot of time in preparing that paper in my formative primatology years, and for that I'm very grateful.” **Emma J. Stokes, Regional Director, Central Africa, Wildlife Conservation Society (Rwanda)**



# IPS Research Grant Report

Louise Loyant

## **Inhibitory control in macaque species: validation of a task battery, individual differences in performance and effect of social tolerance**

Louise Loyant, Department of Psychology, University of Portsmouth (UK)

### 1. INTRODUCTION

To live in a complex social environment, animals need to manage their impulsive behaviours to maintain group cohesion and survival. For example, when a higher ranked social partner is present, an individual might benefit from withholding inappropriate behaviours, such as behaving aggressively, when competing over food or a mating partner. Such cognitive processes are defined as inhibitory control [1], the ability to override an impulsive, automatic or pre-learned response. To cover the main domains of inhibitory control, we focus particularly on three of the most commonly described inhibitory processes in the literature: *distraction inhibition* (i.e., control of an emotional response to an internal or external distractor), *action inhibition* (i.e., inhibition of a prepotent, unwanted, reflexive motoric action) and *cognitive set inhibition* (i.e., inhibition of a pre-learned cognitive set to flexibly adjust behaviours). These crucial cognitive abilities have been studied in a wide range of fields (psychology, neurosciences, animal cognition) and have been tested in several animal classes such as insects, fishes, reptiles and mammals. Unfortunately, the common paradigms designed to measure inhibitory control often suffer from a lack of validity and reliability and have yielded mixed results [2]. Furthermore, the evolutionary processes shaping the variation in inhibitory control are still poorly understood. It has been suggested that one route by which social cognition can evolve is through selection on social tolerance. Tolerant social styles feature higher reconciliation rates, fewer conflicts, and more relaxed social relationships than despotic ones [3]. It is possible that individuals living in a more tolerant social context might experience more diverse and complex social interactions [4] and consequently would have better inhibitory control skills (as in [5]).

### 2. AIMS

Hence, the aim of this project was to first develop a battery of inhibitory control tasks in one species of macaque. Then, using this task battery to contrast the inhibitory control skills in three closely related macaque species which differ in their social tolerance style (*Macaca mulatta*: less tolerant species, *M. fascicularis*: intermediate level of tolerance; *M. tonkeana*: highly tolerant).

### 3. METHODS

#### *Subjects*

We tested 28 rhesus macaques, 20 long-tailed macaques and 18 Tonkean macaques from two institutions: the Medical Research Council Centre for Macaques (MRC-CFM) in Porton Down, (UK) and the Centre of Primatology of the University of Strasbourg (abbreviated as CPUS) (FR). This study was approved by the Animal Welfare and Ethical Review Body of each institutions. All animals were housed in enriched environment and provisioned with commercial monkey pellets seven days a week, in addition to a supply of fresh fruit and vegetables once a week. To ensure low stress levels only subjects voluntarily interacting with the experimental setup participated in the study and were free to leave the testing area. Rewards (dry raisin) were given by hand.

*Apparatus/Design*

Figure 1. Apparatus used in the experiments.

began (acquisition rule). If the subject touched the incorrect stimulus nothing happened. Once a criterion of success was achieved (75% of correct trials out of 20 trials, i.e. the subjects touched the correct stimulus from the first attempt), the rule was reversed: the correct stimulus became the incorrect and the incorrect the correct. The reversed session was continued until the success criterion was reached again.

**Validation of a battery of task:** We looked at the content validity of our three inhibitory control tasks, i.e. a prepotent response (dominant and automatic response to a stimulus) was generated by the test conditions. We also analysed the temporal repeatability of the tasks by showing that subject's performances would be repeatable over two time points (2 weeks apart). We conduct this study on rhesus macaques [6]

**Study on the influence of social tolerance:** Using our task battery, we compared the performances of the 3 species of macaques with different level of social tolerance. We controlled for influencing factors such as age, sex and rank thanks to this study [7].

For the experimental task, we used a touchscreen transported from one cage to another to record subject's performances (see Fig.1).

**Inhibition of a distraction (Distraction task):** the subjects had to touch a red rectangular target presented at the same time as a central pictorial distractor (either objects, neutral or threatening conspecific's faces).

**Inhibition of an action (Go/No-go task):** the subjects were rewarded for touching a red rectangular "Go" stimulus (presented in 75% of the trials) and for withholding touching a green circular "No-go" stimulus. If the "No-go" stimulus was touched, the subjects received no reward and a time out.

**Inhibition of a cognitive set (Reversal learning task):** Two stimuli, a red rectangular "Go" rewarded stimulus and a green circular "No-go" unrewarded stimulus, were displayed simultaneously on the screen. When the subject touched the "Go" stimulus, the subject received a reward, and a new trial

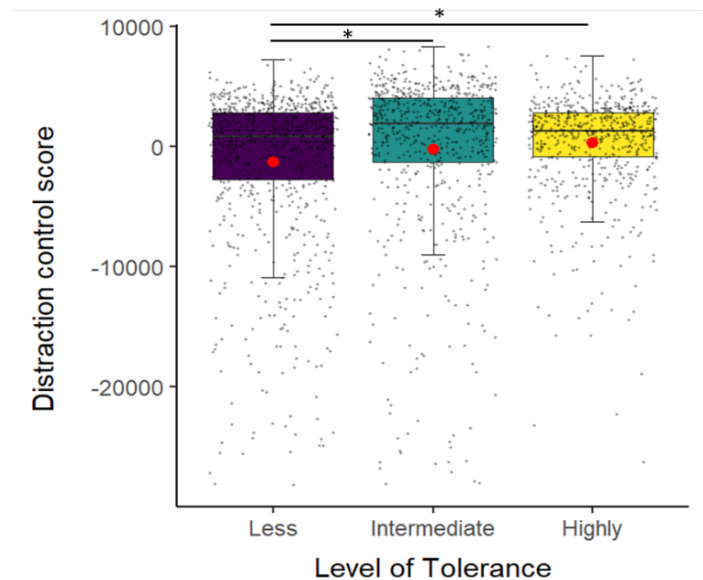


Figure 2. Distraction control score (response latency (RL) in control trial minus RL in trials with pictures) in species of different level of social tolerance (less, intermediate and highly tolerant species) \*  $p < 0.05$  (form models comparison). Horizontal lines represent the 25th, 50th and 75th percentile and error bars are represented. The red dots represent the mean.

#### 4. RESULTS

**Validation of a battery of task:** we found a response pattern characteristic of inhibitory control in each of the 3 tasks. A prepotent response (an interference from a pictorial distractor, a dominant motoric response, and a pre-learned rule) was inhibited by the subjects to successfully achieve the goal of the task. We then confirmed that the performances of the subjects were repeatable across 2 time points, thus validating the test-retest reliability of our tasks (for more details see [6]).

**Study on the influence of social tolerance:**

**Inhibition of a distraction:** we found a significant main effect of the tolerance degree on the response latency of the subjects when pictures were presented ( $\chi^2_2 = 9.857$ ,  $N = 66$ ,  $P < 0.01$ ). The less tolerant species were more distracted by the pictures and were less able to control their emotional response (see Fig.2).

**Inhibition of an action:** We demonstrated an effect of tolerance on the proportion of success on a “No-go” trial ( $\chi^2_1 = 9.683$ ,  $N = 64$ ,  $P < 0.01$ ). The species with intermediate level of social tolerance were more successful than the less tolerant species. We also found that the less tolerant species was the only species which did not have performances above chance level for the last session (Wilcoxon test,  $V = 80.5$ ,  $P = 0.532$ ).

**Inhibition of a cognitive set:** the less tolerant species needed more trial to learn the first rule ( $\chi^2_2 = 12.856$ ,  $N = 63$ ,  $P < 0.01$ ).

#### 5. DISCUSSION

To summarise, we first demonstrated content validity and repeatability of our battery of inhibitory control task. Then, thanks to this battery of tasks, we demonstrated that lower level of social tolerance was associated with the worst inhibitory control performances characterized by enhanced impulsivity and emotivity. As expected, we found the best control of a distraction in the highly tolerant species. The picture was in-between in the intermediate tolerant species. Developing in a more tolerant social group, considered socially more complex [4], may be associated with better inhibitory control skills, corroborating the social intelligence hypothesis [8]. These results confirm our previous findings from a basic task of inhibitory control (the middle cup task) whereby the more tolerant macaques outperformed less tolerant ones [5]. These findings support the hypothesis that social complexity could be associated with the evolution of one of the most crucial cognitive skill, inhibitory control.

This relationship between social tolerance and cognitive skills was also demonstrated in social and physical cognitive tasks. In the social domain, several studies demonstrate that social tolerance is associated with better socio-cognitive performances. For instance in the pointing cup task, which involved cooperating with a human experimenter, more tolerant macaque species outperformed the less tolerant ones [5]. In another cooperative task (simultaneously lifting a heavy stone), highly tolerant species (Tonkean macaques) performed better than less tolerant species (rhesus macaques; [9]). A study also demonstrated that bonnet macaques (*Macaca radiata*, a tolerant macaque species [3]), outperformed rhesus macaques on spatial short memory task and on an object-reward association task [10].

We could also have wanted to interpret our results through the lens of the ‘ecological intelligence hypothesis’[11], better cognitive skills would have evolved to allow species to adjust their behaviour adaptively in response to foraging challenges. The species chosen for this study face different predation risk. For instance, rhesus macaques favour open habitats where they are likely to encounter numerous smaller predators, and thus may benefit from being highly reactive and defending themselves by aggressive confrontation (thus being more impulsive and reactive as in our results).

Our study suffers from a small sample size which could have decrease the power of our analysis. In further research it would be interesting to use collaborative projects such as ManyPrimates to increase the number of subjects [12].

Altogether, we demonstrated that low tolerant species have lower inhibitory control than other more tolerant species. More comparative research is needed to have a better understanding of the selective pressures driving the evolution of inhibitory control.

## ACKNOWLEDGEMENTS

We are grateful to all the research assistants for their help in collecting the data. Many thanks to Dr. Claire Witham, Hélène Meunier, Sébastien Ballesta and all the caretakers from the MRC, UK and CPUS, FR for their help in coordinating in situ the collection of the data. Thank you to the IPS, the PSGB and the University of Portsmouth for funding this project.

The findings of the project were disseminated via two peer-reviewed published papers [6,7] and presented at [13,14].

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# IPS Research Grant Report

Tainara Sobroza

## Sounds, Cities and “Sauins”: the effect of acoustic environment in the pied tamarin (*Saguinus bicolor*) (Primates: Callitrichidae) communication behavior

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**Summary:** Sounds of anthropogenic origin can affect species communication, as their volume can mask animal sounds. While following pied tamarins or "sauins," an endangered primate species from the Amazon, I found that these tiny primates do not increase the number of calls in noisier areas. Though the occurrence of calls is related to noise increase, and their calls became slower in such sites. Possibly in the face of intense noise, tamarins emit a single call with appropriate features and move to quieter areas. Indeed, when I analyzed how the animals use the space, I found that they use more the quieter areas of their territories, as long as there is enough food there. In addition to that, I discovered that in noisier places, they scent mark more often, i.e., they complement the information of the acoustic channel with the olfactory channel to warranty communication effectiveness. Thus, tamarins seem to have strategies to communicate and survive in urban areas.

**Keywords:** sound pollution, soundscape, animal communication, Amazon.

I believe I achieved the primary goal of my project that was to understand how the acoustic environment affect the communication behavior of *S. bicolor*. As proposed, I tested whether pied tamarins 1) produced calls with different acoustic properties in noisy areas. Indeed, I found that the syllable repetition rate of their calls diminished with the increase of noise. I also wanted to test if the pied tamarins 2) changed their daily pattern of vocal communication in noisy areas, and I found that they do not shift their daily pattern of vocal activity through the day in response to noise. I also wanted to know if 3) they avoid noisy areas inside their home ranges, this was confirmed: As long as there are plenty of fruits, pied tamarins use more the quieter areas of their territories. Finally, I wanted to test if pied tamarins 4) use other communication channels, such as olfaction, in noisy places; and I found that they do more scent marking in noisier areas, probably to complement information from the acoustic channel. A priori I also wanted to test if scent markings and calls had redundant information, but due to the reduced number of observations of scent markings, it was not possible to statistically analyze that. Overall, I found that the species seems to have strategies to deal with city noise. The ongoing conservation efforts to establish an urban ecological corridor for the species are justifiable also from a behavioral perspective.

Many species depend on sounds to communicate with con-specifics about essential behaviors such as foraging, defense, territorial activities, and mate attraction (Bradbury and Vehrencamp 2011). However, sounds caused by human activities, such as noise from cars, trains, airplanes, alarms, are loud and mask such natural sounds. Fortunately, many animals may use a variety of strategies to optimize sound propagation to circumvent this (Brumm et al. 2004), like moving to quieter areas (Duarte et al. 2011) or changing the acoustic parameters of their calls, such as frequency and timing (Brumm et al. 2004). Other animals increase and shift the peaks of vocal activity through the day to avoid overlapping with noise (Fuller et al. 2007). A further option for animals in noisy environments could be to complement acoustic communication with another modality, such as chemical (olfaction), or shift to a different communication modality. The pied tamarin (*Saguinus bicolor*), or “sauin” as it is locally known, is a primate with a narrow geographic range in central Brazilian Amazonia. Ongoing habitat loss is restricting individual groups to isolated forest fragments within the city of Manaus, with consequent effects on gene flow, inbreeding depression, and loss of individuals by road-kill (Gordo et al. 2013). Among the suggestions for securing viable populations of *sauins* is creating ecological corridors to connect different urban forest fragments and reserves. We know, for instance, that the pied tamarin is capable of surviving in such urban areas, but how the noise of a city of 2-million people affects its communication? The main goal of this study was to understand how the acoustic environment affects the communication behavior of the pied tamarin (*Saguinus bicolor*).

After following nine groups of pied tamarins and recording their behaviours (calls and scent markings) and information on habitat noise, I found that long call occurrence was positively related to noise levels, while the abundance of long calls did not differ in response to noise. When analysing specific acoustic features, I found that frequency features of pied tamarin calls (dominant frequency and lower frequency) did not change in response to noise, neither did call duration. However, syllable repetition rate (number of syllable/call duration) decreased with increasing noise levels. Also, the pied tamarins did use more intensely the quieter areas of their home ranges, although this only occurred in places where the number of fruits was high. Additionally, pied tamarin scent-marked more often noise amplitude was higher.

In this survey, we found that when noise levels were higher, the probability that pied tamarins emitted a single long call also increased. Long calls are used for group cohesion and may also help in navigation (Sobroza 2017). It could well be that when sound levels surpass a discomfort threshold, pied tamarins move to quieter areas. Indeed, I found that tamarins use more the quieter sites of their ranges when there is enough food in such places. Many studies have shown that loud noises can induce escape responses that influence patterns of both short- and long-range movements such as the use of space, dispersion, and migration (Duarte et al. 2011, Ware et al. 2015,).

Contrary to predictions, I found neither a negative nor positive association between the pied tamarin's abundance of calls and noise levels. Possibly pied tamarins do not have to increase or suppress their calling activities because sound levels did not achieve a threshold that would induce a behavioural response. We also did not corroborate the hypothesis that pied tamarins shift their vocal activity through the day in response to noise, possibly because in most of the places studied, sound levels showed low temporal variation and were non-intermittent across the day. Such regularity may lead to habituation by the pied tamarins and be less impacting.

In noisier places, pied tamarins reduced the syllable repetition rate, meaning that they emitted slower long calls, with either time between syllables being longer or the syllables themselves being more prolonged. A longer inter-syllable duration could allow pied tamarins to call in short periods of silence, a feature also observed with captive cotton-top tamarins (Egnor et al. 2007). Suppose in pied tamarins, the syllables function as a unity of information, as in cotton-top tamarins (Miller et al. 2003), and the lower syllable repetition rate implies that the syllable is longer. In that case, this could also be advantageous as longer signals

As proposed, I made a number of talks to local universities and NGOs. Also, I intended to present my results in at least two scientific articles. I wrote both manuscripts that are part of my thesis defended in November 2021. I submitted one of these papers to two journals. Unfortunately, it was rejected, but I am refining it, and I will submit it to another journal. I also intended to present my results at the International Primatology Congress in Quito. I was selected for the Pre-Congress Training in Conservation. Due to covid, the event was postponed, and PCTP was canceled. I was selected to present my results in a poster at the Student Conference for Conservation Science at Cambridge in March 2022. Happily, I also participated in the Sciencetelling Training Latin America, and my video was exposed in the Nat Geo virtual platforms during the Explorers Week.

In addition to these personal achievements, my project added to strengthen the capacity of Pied Tamarin Project (Projeto Sauim-de-Coleira) to collect data cooperatively. Capture procedures of primates are not trivial because it often takes several months to habituate individuals to feeding platforms where the capturing occurs. The groups I followed took from one to five months of habituation before the capture. Thus, my study only happened because of these collaborations. During these procedures, my personal and monetary help also contributed to other ongoing projects, such as a master's degree evaluating the health of these wild tamarins.

During this period, I also taught undergraduates about using sounds for ecological studies. I participated in other conservation-based educational events such as the "Pied Tamarin Day." I tutored two young undergraduate girls and shared my knowledge about bioacoustics; one is now doing her master's in the area. Jointly with two other colleagues, I am engaged with the "Urban Amazonia", a project where we are elaborating an interactive book that will be freely available for children from public schools in Manaus. The book aims to educate children on the importance of forests in urban areas and how the city impact wild animals.

## ACKNOWLEDGEMENTS

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# IPS Captive Care Grant Report

Jenny Botting

## Building a sanctuary's capacity to increase positive welfare in rescued gorillas through PASA's Primate Care Training Program

IPS Captive Care Grant report – Dr Jenny Botting, Pan African Sanctuary Alliance

### Summary

PASA's 23 member wildlife centers across Africa rescue great apes and monkeys from the bushmeat trade and illegal wildlife trade. This generous grant from IPS allowed PASA to send an expert in gorilla behavior and welfare to the Fernan-Vaz Gorilla Project in Gabon to train and assist the sanctuary staff with improving welfare for the rescued gorillas residing at the sanctuary. Thanks to IPS, the wellbeing of the gorillas has been increased through detailed welfare assessments, training of staff in enrichment and behavioral monitoring, and developing management plans for the specific welfare needs of individual gorillas.

### PASA's Primate Care Training program

Providing a safe home to rescued primates is an integral component of PASA member sanctuaries' roles in primate protection. PASA member organizations currently provide care for more than 3,000 confiscated primates, most of whom need extensive high-quality care and specialized treatment to recover from the physical and psychological trauma they endured. The wildlife centers are dedicated to giving the animals the highest quality of care that they possibly can. However, many sanctuaries are in isolated locations and lack the funding and connections necessary to provide their staff with advanced training by skilled instructors. The Primate Care Training (PCT) program allows them to remain current with the highest international standards.

To ensure that sanctuaries can provide highly specialized care to thousands of primates, PASA's Primate Care Training program (PCT) sends expert instructors to member sanctuaries to provide customized training for all animal care staff. The PCT program trains staff at each sanctuary in current best practices of primate care, allowing their rescued and rehabilitated apes and monkeys to receive specially designed treatment that will aid their recovery from trauma and improve the outcomes of their rehabilitation.

### Fernan-Vaz Gorilla Project (FVGP)

Fernan-Vaz Gorilla Project (FVGP) was informally established in 2001 to relocate four western lowland gorillas to the Fernan-Vaz lagoon after living for decades in a medical research facility in Franceville, Gabon. The Loango coastal forest region of southwestern Gabon is recognised as one of the most important and spectacular tropical ecosystems remaining in the world. In 2006, FVGP began to rescue orphaned gorillas from the bushmeat trade for rehabilitation and eventual release back into the wild.

In 2022, FVGP requested that Caroline Griffis, a French-speaking expert in ape captive care and welfare and long-time PASA volunteer, conduct a PCT session at the sanctuary. Caroline has conducted numerous PCT sessions at PASA member sanctuaries across Africa and conducted four PCT sessions at FVGP in previous years. PASA and the management at FVGP strongly believe that return visits by Caroline are extremely beneficial to raising the capacity and skillset of local staff in the long term. Repeat visits allow Caroline to review the progress and outcomes of previous visits, to ensure that long-term enrichment programs and welfare plans for individuals are consistently upheld, and to suggest adjustments for maximum impact. Additionally, Caroline's mentorship and training are more effective by her excellent collaborative relationship with sanctuary staff.



This year, FVGP requested that PASA send Caroline to conduct a PCT to focus on the following specific welfare needs at the sanctuary:

- ❖ To conduct welfare assessments on all the sanctuary gorillas, and, in particular, on two gorillas held in a quarantine enclosure.
- ❖ To help build an ongoing social management plan for a male and female gorilla.
- ❖ To monitor and continue to train staff in the enrichment program for all animals.
- ❖ To further train staff in behavioral observations to help monitor individual welfare.

### **Ensuring the welfare of gorillas in quarantine**

Niout and Maya are two female gorillas who were rescued and brought to FVGP in early 2021. They were initially placed in quarantine enclosures before they could be moved to the gorilla group living on an island at the sanctuary. However, tragically, the integration enclosure on the island, essential for the careful introduction of these gorillas to the rest of the group, was damaged and its repair is still in progress. Niout and Maya must now wait in the quarantine enclosure until the integration enclosure is complete. During her last PCT session at FVGP in 2021, Caroline initiated an extensive enrichment program for these two gorillas' quarantine period. She initiated activities to try and develop a stronger relationship between the two gorillas, who at that stage, were not closely bonded to one another. Key objectives for this PCT session were to conduct a welfare assessment of Niout and Maya, assess the relationship between the gorilla pair, and monitor the success of the enrichment program.

We are pleased to report that all assessments were successfully conducted, and that the behavioral aspect of the welfare assessment was very positive. After arrival, Niout and Maya did not bond well, and Niout, in particular, did not show many affiliative behaviours towards Maya. However, thanks to the improved enrichment program and activities put in place to encourage bonding, the two are now displaying a lot of affiliative interaction. This is a fantastic outcome as they, for now, have only each other for company, and maintaining positive social relationships is incredibly important for each individual's wellbeing.



**Thanks to IPS, Maya (pictured) and Niout are enjoying varied enrichment to help ensure their positive welfare while they await integration to a larger group of gorillas.**

The welfare assessment also showed, however, that the two gorillas' environment is not optimal for their welfare. It is hoped that Maya and Niout can be moved to the island as soon as the integration enclosure is built, but in the meantime, it is important to provide as much environmental enrichment as possible and to ensure that the gorillas remain healthy and strong in their current enclosure. As a young gorilla, Maya can visit the forest several times a week with her caregivers, allowing her to exercise and learn how to climb trees and forage for food. Unfortunately, Niout is too large to be safely allowed out of the enclosure.

Therefore, in order to improve the welfare of Maya and, in particular, Niout, while they are still in the quarantine enclosures, Caroline designed a management plan to encourage them to move around the enclosure as much as possible. This included continuing their ongoing enrichment program and making changes to how they are fed and given enrichment. They now must climb to the top of the enclosure to retrieve their food and the leaves they use for enrichment. They now must climb to the top of the enclosure to retrieve their food and the leaves they use for enrichment. Caroline also trained staff to use plastic jugs as puzzle feeders, meaning that the gorillas take longer to access the food, which keeps them busy and entertained. These jugs are also hung from the roof of the enclosure to encourage climbing and brachiating, helping to build up Niout's muscles.

Thanks to Caroline's training, Niout and Maya will now be able to stay as active, strong, and healthy as possible while they wait to be integrated into a larger group of gorillas.



**Caroline trained the staff to change the way the gorillas were fed to encourage them to move around the enclosure more and build up muscle.**



**Caroline's enrichment program will keep Niout and Maya healthy and active until they can join a larger group of gorillas on an island at the sanctuary.**

**Building capacity by training staff in enrichment and behavioral observations**



In addition to helping staff directly with specific needs of individual gorillas at the sanctuary, Caroline continued to train caregivers at FVGP on essential skills to ensure the long-term welfare of the gorillas under their care. This included training on recording behavioral observations, which are necessary to better understand why certain situations arise and how different interventions may improve animal welfare. Caroline trained quarantine staff in collecting data on Maya and Niout to monitor these gorillas more closely during their time in quarantine, ensuring that any medical or behavioral problems arising can be quickly addressed. This hands-on, one-to-one training in these techniques to advance welfare greatly builds sanctuary staff's capacity to provide high-quality care to the rescued gorillas.



**With funding from IPS, Caroline was able to train gorilla caregivers on behavioural monitoring and advanced enrichment techniques.**

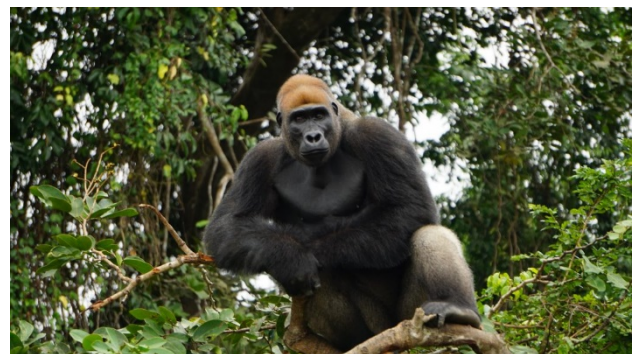
Furthermore, Caroline also continued to work with staff to develop enrichment items for the sanctuary's gorillas. Caroline was happy to find that the enrichment program that she had developed on previous visits was still going strong, and she could monitor and suggest improvements for this program – showing the benefits of repeat PCT sessions. This strengthened enrichment program will help ensure the positive welfare of the rescued gorillas at the sanctuary and builds the capacity of staff with limited resources available to them to provide this high standard of care to all future residents.

#### **Ongoing management of gorillas with traumatic backgrounds**

This grant also allowed Caroline to provide expert consulting on the management of a pair of gorillas who have previously shown behaviors that may negatively impact their welfare.

Essogoué is a male gorilla who came to FVGP in 2004 as an infant. As he grew up, it became clear that he was showing atypical behavior and is sometimes hyper-aggressive. These behavioral issues are not uncommon for primates that have experienced high levels of trauma in their backgrounds, and Essogoué likely watched his family killed by poachers before being taken from the forest.

As a result of his behaviors, Essogoué struggled to live with other gorillas and often tried to escape. In 2018, Caroline helped FVGP manage his integration with a new female companion, Tani, whose personality they hoped would make her a good match for Essogoué. At first, Essogoué was aggressive with Tani and she avoided him as a result, but after a short while, Essogoué became less aggressive, and the pair seemed to live together peacefully. On her last visit in 2021, Caroline noted that Tani was stressed during feeding times and trained staff to feed them separately. On this visit, Caroline conducted a further behavioral assessment to judge the welfare and social relationship of these two gorillas.



**Essogoué has a traumatic background and thus needs special care and management to ensure his positive welfare.**

Unfortunately, it seems that Essogoué and Tani do not have a good social relationship. While Essogoué is not aggressive to Tani any longer, perhaps as a result of their earliest interactions, Tani avoids being near Essogoué. Interestingly, Caroline noted that he often tried to engage Tani in affiliative interactions, like playing and grooming, but she ignored him. This is an important observation for the welfare management of these two gorillas and allows for informed interventions to improve their social relationship.

At Caroline's suggestion, the staff are currently trialing protected contact (where the gorillas can see each other, but Tani knows that Essogoué cannot hurt her), which has successfully reduced Tani's stress levels. For the longer term, Caroline is consulting with the sanctuary management to plan alternative living arrangements for both gorillas to help increase their daily welfare. Integrations and judging the welfare conditions caused by different social living arrangements are among the toughest tasks faced by sanctuaries that rescue apes from various low welfare situations. Thanks to IPS, the gorillas at FVGP are now benefitting from Caroline's decades of experience in this field, and staff are being expertly trained in managing these complex welfare situations.

### **Evaluations of training sessions**

In order to evaluate and improve PASA's PCT program, sanctuary staff who receive the training are asked to complete evaluation forms with a mix of rating-style questions and free form answers after each PCT session. Evaluations of Caroline's visit were overwhelmingly positive, with all staff strongly agreeing that the training session improved how they care for the gorillas, that it was easy to implement what they had learned, and that the training focused on the aspects they needed most help with. One of the staff requested that the training format be more varied, which we are incorporating into future training sessions.

### **Thank you, IPS!**

The welfare needs of these intelligent and social animals are highly complex, especially with the traumatic events that the majority of these rescued gorillas have endured. This PCT session, focusing on these complex welfare needs, has greatly helped the sanctuary to manage and develop plans to improve the wellbeing of their resident gorillas and build their capacity to provide high-quality care to residents of the sanctuary far into the future.

Thank you again to IPS for this generous grant, which has directly improved the welfare of these rescued gorillas through specialist training and capacity building.





# IPS Conservation Grant Report

Karen Ahlem Esper-Reyes & Nicolás Ramos-Lara

## BEHAVIORAL RESPONSES, HOWLING BOUT AND PHYSIOLOGICAL STRESS OF THE MANTLED HOWLER MONKEY (*ALOUATTA PALLIATA MEXICANA*) IN AGROECOSYSTEMS AND ECOTOURISM SITES

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### BACKGROUND

Ecotourism and agroecosystems are two conservation-friendly activities that have been growing rapidly over the past decades (Das y Chatterjee, 2015). However, there is growing evidence that tourism can have negative effects on wildlife populations as well as conflict between farmers and these populations in agroecosystems (Banerjee, 2010). The Mantled howler monkey (*Alouatta palliata mexicana*) is distributed in southeastern Mexico and Guatemala, and is listed as critically endangered by the IUCN (Cuarón et al., 2008). Although research has shown that howler monkeys in fragmented forests modify their diet and present higher levels of glucocorticoid metabolites (Arroyo-Rodríguez y Mandujano, 2006), little is known about how tourists and agroecosystems can affect the physiology and behaviour of Mantled howler monkeys (Behie et al., 2010; Aguilar-Melo et al., 2013). Thus, the aim of this study was to examine the effects of ecotourism and cacao agroecosystems on the behaviour and physiological stress of Mantled howler monkeys.

### PROJECT OBJECTIVES

- a)** To evaluate if anthropic noise affects the vocal communication of howler monkeys, and if there is a change in the amplitude and frequency of their howling bouts due to the presence of anthropic noise.
- b)** To evaluate if the presence of people, during high and low tourism seasons, affect the behaviour and stress of howler monkeys, in ecotourism sites.
- c)** To evaluate if the presence of people, during the cocoa harvest and non-harvest seasons, alter the behaviour and glucocorticoid levels of howler monkeys in cocoa agroecosystems.

### BRIEF OVERVIEW OF STUDY LOCATION AND METHODS IF/AS RELEVANT

The study was conducted in the Mexican state of Tabasco, where mantled howler monkeys occur. Two of the study sites have presence of ecotourism: Yumká, an ecological reserve where tours are carried out in the jungle area and “La Venta” Park-Museum, a site where guided tours are carried out showing the collection of archaeological monuments and species of fauna. On the other hand, we selected two cocoa (*Theobroma cacao*) agroecosystem sites, where mantled howler monkeys are also found. We selected one group of monkeys per site. For data collection, four trips were planned from the city of Querétaro to the state of Tabasco. Each site was visited for four days, giving a total of 16 days per visit. Two of these trips were planned during high tourism seasons and non-harvest seasons in cocoa agroecosystems (April and December 2019) and the other two during low tourism seasons and harvest seasons in cocoa agroecosystems (May and August 2019). For each field trip, three days were assigned to work in the laboratory of the Universidad Juárez Autónoma de Tabasco. We collected behavioural and physiological samples, including recordings of howling data. In total there were 76 days in the field and a total of 768 hours of observation. The data collected were the following:

**Behavior quantification:** Daily activity patterns of each individual (female and male adults) were recorded. A total of 8 individuals per group were observed at each of the sites (Treves and Brandon, 2005). Behavior that indicates stress, height of the animal in the canopy, diet, temperature and humidity were also identified. The “scan sampling” technique was used to collect the data (Li et al., 2015), from 0700 to 1900h. **Fecal cortisol quantification:** Around 270 feces were collected in total, from adult males and females (Martínez-

Mota et al., 2007). After collection, faecal glucocorticoids were extracted using the method of Wasser et al. (2000). Fecal samples were blotted dry and immunoassay performed using 5 cortisol kits (CORTISOL immunoassay kit). **Howling behavior quantification:** The sampling time was conducted from 07:00 to 18:00 hrs, during all time spent with a Mexican mantled howler monkey group, we used all-occurrences sampling (Altmann, 1974) male howling behavior (Hopkins, 2013). When howling from a male of a focal group was heard, we recorded the beginning and ending times of the howling bout, and also recorded any anthropogenic sound that triggered the monkey's howling e.g., plane, truck, people (or tourists), tools and motorcycles (Bolt et al., 2019; Bolt, Russell et al., 2020).

## KEY RESULTS/MAIN FINDINGS OR OUTCOMES

We found that there are differences between the daily activity pattern of aggression, eating and resting. The monkeys spent more time feeding and resting during the low tourist seasons and showed a greater number of aggressions between each other during the high tourist season compared to the low season ( $H=11.80$ ,  $d.f.=3$ ,  $n=18$ ,  $P=0.008$ ). Likewise, we performed a regression between the number of people and the time that the monkeys spend performing aggression and we found that the greater the number of people, the greater the percentage of time in aggressions performed by the monkeys ( $R=0.12$ ,  $p<0.05$ ;  $\text{Time}(\%)=0.006*\text{people}+0.165026$ ). In turn, we observed that the greater the number of people present, the lower the percentage of time that the monkeys spend resting ( $R=0.1503$ ;  $p<0.05$ ;  $\text{Time}(\%)=0.009*\text{people}+59.55$ ). In agroecosystems, we found differences in the daily activity pattern of feeding, resting, moving and interacting with other groups of monkeys. The monkeys spend more time feeding, moving and interacting with other groups during the cocoa harvest season and spend less time resting during this season.

Regarding the concentration of cortisol, we found a higher concentration of cortisol during the high season of tourism, in males compared to females and specifically we found a higher concentration of cortisol in an agroecosystem site compared to the rest of the sites ( $H=11.41$ ,  $d.f.=3$ ,  $n=18$ ,  $P=0.009$ ).

We also found that there are differences in the number of howling bout sequences performed by howler monkeys due to the presence of anthropic noise and in a natural way. In ecotourism sites, howler monkeys responded with howling bouts to a greater number of anthropogenic noises than the vocalizations they made naturally (Wilcoxon ( $z=-7.178$ ,  $p<0.05$ )). On the other hand, in agroecosystems, the greatest number of howling bout sequences performed by howler monkeys is naturally. However, in both ecotourism sites and in agroecosystems, we found that the duration of these howling bout sequences are longer when perform naturally compared to the ones performed in response to anthropogenic noise (Wilcoxon ( $z=-2.002$ ,  $p<0.05$ )).

## DISCUSSION OF RESULTS

Howler monkeys spent less time moving and more time feeding and resting during the high tourist season. The monkeys appeared more alert and showed a higher percentage of inter-group aggression. We can also conclude that both the percentage of aggression and the time spent resting may be influenced by the number of people. According to the daily activity pattern recorded by Mittermeier (1973), howler monkeys spend 70% of their time resting and their rest schedule covers noon (Shedden-González, A., and Rodríguez-Luna, E. (2010)). The greater the number of people, the greater the percentage of aggression and rest. In contrast, in the agroecosystems Howler monkeys spend more time moving and feeding and less time resting, when it is harvest season. It could be because the interaction in the harvest is more invasive, which makes the monkeys have to move from place to place and therefore rest less. We also found a difference in the percentage of time males rest compared to females. Being the males the ones that rest less, this may be due to the fact that they vocalize more during the harvest season.

The highest concentration of cortisol in the high seasons when people are present may be indicating that the monkeys remain in a state of greater stress due to the presence of people and 26

the noise that this entails. We also noticed that males are the ones who present an even higher level than females, being the ones who are more alert and vocalize in response to the presence of anthropic stimuli, as we can see in the results of howling bout behavior. Likewise, we found that in the agroecosystem sites the concentration is higher than in the ecotourism sites, complementing the behavior information, this may be showing us that the interaction in the agroecosystems is more invasive and keeps the monkeys in a state of alert (Aguilar-Cucurachi et al., 2014). The duration of the howling bouts performed in response to noise are as long as the duration of the noise to which they are responding, which indicates that monkeys howl in response to auditory stimuli. Bolt et al. (2019) found that the howling bouts of a group of Mexican mantled howler monkeys were significantly longer in interior forest compared to anthropic edge, in their case they assume that they may be howling more in interior forest, potentially to advertise to other groups that their high-quality habitat is already occupied. However, we can assume that calls in response to anthropic noise are shorter in duration because they respond to the duration of the noise, as noises are short in duration such as the passage of an airplane, a truck, etc., the response it is just as short.

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# IPS Conservation Grant Report

Anne Sophie Cunchant

## Chimpanzee localisation with passive acoustics

Anne-Sophie Cunchant - Liverpool John Moores University

### BACKGROUND/INTRODUCTION

Surveying and monitoring ape populations are critical steps in evaluating conservation efforts aimed at impeding their global decline. Localising animals can help answer questions related to species conservation. The application of this method ranges from informing on social behaviour, habitat use, population dynamics, and estimation of abundance and density<sup>1,2</sup>. Direct visual observations of animals are often difficult if they are cryptic, elusive, nocturnal, live in dense vegetation, or range widely. For those species that make loud calls, researchers can use acoustic localisation to monitor animals, by exploiting sounds that can travel long distances.

Acoustic localisation uses the time difference of arrival (TDOA) of sounds to multiple (time synchronised) sensors to estimate the sound origin location, following triangulation<sup>1</sup>. Despite its ubiquity in marine mammalogy, deployment of acoustic localisation systems (ALS) is not as common with bird or terrestrial mammal systems. Location error varies as a function of inter-caller and inter-sensor distances; localisation can be limited in terms of applicability for widely spaced callers, as it would require a larger number of sensors. Sound transmission and thus localisation can also be impacted by environmental variables such as high temperature, high wind speed and vegetation – all that can distort acoustic signals and affect the signal-to-noise ratio, where in noisy environments target signals can overlap with other sounds. Lastly, sensor time synchronisation error and recording sample rate can bias the estimation of TDOA and lead to inaccurate localisations<sup>2</sup>.

### PROJECT OBJECTIVES/AIMS

The aim of this study was to evaluate a custom-made ALS composed of four GPS time-synchronised acoustic sensors to localise wild chimpanzees (*Pan troglodytes schweinfurthii*) in western Tanzania. Chimpanzees are wide-ranging and rely on loud calls that can travel hundreds of meters to coordinate movement. Our goal was to assess the precision and error of the estimated locations by conducting playback sound experiments, but also by comparing the estimated locations of actual wild chimpanzees with the true (ground) locations obtained in parallel with focal follows. We explored the factors influencing the localisation error, such as wind speed and temperature that fluctuate during the day. We demonstrate the potential of ALS for localising any terrestrial, loud calling species and discuss the behavioural and conservation applications for this emerging census technique with wild chimpanzees.

### BRIEF OVERVIEW OF STUDY LOCATION AND METHODS IF/AS RELEVANT

We conducted the 3-month study between August and October 2019, in Issa Valley, western Tanzania. The study site of about 70km<sup>2</sup> is comprised of a series of riverine valleys separated by steep mountains and flat plateaus. Vegetation is dominated by miombo woodland and also includes grassland, swamp and riparian forest. We deployed a passive acoustic monitoring (PAM) system that enables localisation of chimpanzee loud calls. The acoustic array consisting of four sensors was deployed on the ground, around the perimeter of a



single valley known to be important for the Issa community during the late dry season, when we collected the data. Each audio recorder was comprised of a microphone (USB Lavalier omnidirectional) unit integrated with a nano-computer Raspberry Pi (Raspberry Pi 3 Model B Motherboard); a GPS unit, three 10W solar panels and two 44V batteries and was protected in a Pelicase (Pelican 1170 Case) (Fig.1). The recording script regularly averaged sensor locations that were determined by the GPS. Sounds were recorded continuously, saved as 30min audio files at 48kHz sampling rate in .flac format, and stored in a 32GB SD card. Each sensor was placed ~ 500m from each other, to maximise the likelihood of triangulation via detection on multiple sensors, while simultaneously minimizing the likelihood of missing calls.



*Figure 1. Audio recorder as described in the text*

To quantify the error and precision of the system, we conducted a playback study. Playback sounds consisted of a tonal sequence (range 500-1800Hz). This sound sequence was used in place of a pant hoot (the chimpanzee long call) to minimize disturbance to otherwise xenophobic chimpanzees. We broadcast sounds from 1m above the ground with a FoxPro Fusion portable loudspeaker (FoxPro Inc., Lewiston, PA, USA) at mean peak sound pressure level of 102.4dB (A-weighting), measured at 1m from the speaker with a Sound Pressure Level meter (DL7103 Di-LOG, Manchester, UK). We recorded environmental variables (temperature, wind speed) with a HOBO weather station (model RX3000). We broadcasted repeatedly the tonal sequence at different times of day (6:30, 9:30, 12:30, 15:30, 18:30), fifty consecutive times at a single location, in the geographic centre of the array, as well as two times each at 30 different locations, sequentially separated by 50m.

To validate the system with calls from wild chimpanzees, we conducted focal follows. We selected a focal chimpanzee (adult, subadult or juvenile) each morning and tried to follow him/her for the entire day. We conducted instantaneous focal sampling with a scan defined as the behaviour of the animal recorded every five minutes, when we also collected among other data the location of the individual (GPS). We further noted all vocal behaviour ad libitum of the focal individual. We then compared the estimated location (see below) of chimpanzee calls recorded by the sensors with the associated locations of the calling chimpanzees determined during focal follows. The minimal distance between the observer and the chimpanzee was 10 meters to avoid human-chimpanzee disease transmission, and the GPS location was recorded every five minutes with a handheld GPS.

The time of arrival (TOA) of the sounds was determined at the sub-second by visualising the spectrogram with the software Raven <sup>3</sup>. We then estimated the sound localisations with the software SoundFinder <sup>4</sup>. To model the error of the localisation (E) as a function of the covariates, we used a linear model. Fixed covariates were (1) temperature (T, continuous), wind (W, continuous), number of sensors that detected the sound (S, two levels: 3 or 4 sensors), vegetation type at the sound source (V, two levels: open or closed).

## KEY RESULTS/MAIN FINDINGS OR OUTCOMES

In this study, we sought to demonstrate, as a proof of concept, that a custom-made acoustic array composed of four sensors could localise chimpanzees. The array enables sound localisation in a difficult mountainous environment with heterogeneous vegetation that makes sound propagation unpredictable. With a playback study, we found that the mean localisation error was  $27 \pm 21.8\text{m}$ . To empirically validate the system, we also<sup>29</sup>

successfully localised wild chimpanzee calls within 52m of the location of a researcher closely following the calling individuals, applying this system under natural conditions.

Environmental variables such as temperature and wind speed influence sound behaviour e.g. sound attenuation and consequently, localisation error. Sounds were more precisely localised at 6h30, when temperature is the lowest. This is the same period when chimpanzees are the most vocally active. Inversely, localisation was the most prone to error at 12h30, when temperature is the highest. Wind speed is the highest early morning and might thus not be the main factor influencing localisation error, but the result of the influence of a combination of temperature and wind speed.

## IMPLICATIONS OF PROJECT/DISCUSSION OF RESULTS

Density is a critical parameter for species monitoring. New methods combining PAM and spatially explicit capture-recapture (SECR) models have been developed to estimate animal density<sup>5,6</sup>. The addition of auxiliary data, such as TDOA or signal strength provide more accurate information on the distance between the caller and the acoustic sensor, in turn allowing more precise detection functions and density estimation<sup>6</sup>, and will thus benefit monitoring efforts.

The ALS also enables key resources localisation, such as the presence of chimpanzees at fruiting trees. Chimpanzees produce calls with a different acoustic structure (e.g. peak frequency and call duration) as a function of the food patch size or tree species. Being able to locate such feeding trees via the calls produced by chimpanzees will first help providing a broader picture of their feeding ecology and second further aid habituation efforts. Similarly, the ALS will also enable researchers to identify chimpanzee nesting sites. Locating chimpanzees at their nesting sites and thus indirectly locating fresh nests with the ALS will benefit conservation by allowing researchers to collect e.g. fresh faecal samples that can reveal population dynamics but also for health monitoring, or allowing for nest decay studies.

Finally, poaching and deforestation are the two main threats to great apes. Besides detecting animals, ALSs can also indirectly help species conservation by locating poachers via gunshot sounds or locating illegal logging via chainsaw sounds. ALSs can be used as a law enforcement tool to assist conservationists and prevent animal poaching or deforestation.

## ACKNOWLEDGEMENTS

Many thanks to the International Primatological Society through the Conservation grant and Liverpool John Moores University for supporting data collection. We thank the Tanzanian Wildlife Research Institute (TAWIRI), Commission for Science and Technology (COSTECH), and the Tanganyika District for permission to carry out research at Issa. We are extremely grateful to all GMERC field assistants for their help in the field.

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# IPS Research Grant Report

Abdullah Langgeng

## INVESTIGATING THE EFFECTS OF JAPANESE MACAQUE HOT SPRING BATHING BEHAVIOR ON PARASITISM AND GUT MICROBIOME

ABDULLAH LANGGENG, GRADUATE SCHOOL OF SCIENCE, KYOTO UNIVERSITY

### INTRODUCTION

Hot spring bathing behavior is a form of balneotherapy, generally beneficial for health and ameliorating stress<sup>1,2</sup>. The behavior is mainly performed by humans, and has not been reported in other animals, except in a population of Japanese macaques at the Jigokudani Snow Monkey Park in Nagano, Japan, particularly during cold seasons<sup>3</sup>.

While we generally think of hot spring bathing as beneficial, there have been several cases showing that hot springs may be detrimental, for example, in facilitating transmission of heat-resistant, waterborne parasites. For instance, hot springs in Taiwan have been contaminated with *Acanthamoeba* spp., responsible for keratitis and encephalitis<sup>4</sup>. At the same time, hot spring bathing behaviour may also expose individuals to different types of bacteria. It was recently reported that sharing bathtub water among humans contributes to the exchange of gut microbial taxa<sup>5</sup>. The study demonstrated that the similarity of fecal microbiomes among family members that shared bathtub water was significantly closer than those that did not engage in such practice. Such examples highlight the importance of shared hot water resources as a medium for microorganism transmission, and raise the possibility that other host-associated organisms might be influenced by such behavior. Another possibility is that the hot spring itself creates a microclimate that affects microorganisms in and around it. For example, environmental stages of nematode parasites are influenced by temperature and humidity<sup>6</sup>, which may favor their persistence around the hot spring. Alternatively, the hot water of the hot spring itself may be unfavorable for certain organisms, such as lice<sup>7</sup>, providing further benefits to the macaques that bathe in them. The current study thus arose out of a desire to better understand more of the costs and consequences of this unique and world-famous behavior performed by Japanese macaques at JMP.

### PROJECT AIMS

My research aimed to investigate the effects of hot spring bathing behavior on parasitism and gut microbiota in Japanese macaques at Jigokudani Snow Monkey Park, Shiga Heights, Nagano, Japan.

### METHODS

The research presented here complied with the Guidelines for the Care and Use of Non-human Primate and Guideline for Field Research of Non-human Primates established by the Kyoto University Primate Research Institute (KUPRI). I acquired permissions from the Field Research Committee of KUPRI and the Jigokudani Snow Monkey Park.

Sixteen adult female monkeys of varying ages, social ranks, and reproductive status were selected as study subjects and categorized into bathers (n=9) and non-bathers (n=7). Observation and sample collection was conducted over two winter seasons at the Jigokudani Snow Monkey Park. Continuous time focal sampling over 45-minute blocks per session was conducted to assess grooming bout durations, grooming areas, nit-picking rates (see below), reproductive status, and social rank. Grooming areas were distinguished into submerged and non-submerged areas. The nit-picking rate, a proxy to estimate lice load, was then determined using the following formula:  $\text{rate} = n \text{ nitpicking} / \text{time grooming}^8$ .

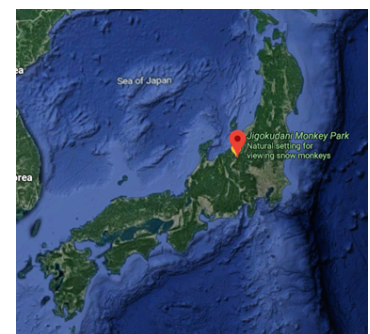


Figure 1. Study site

Samples stored in SAF were later processed using a modified formalin-ethyl acetate sedimentation protocol<sup>9</sup>. I measured the number of eggs observed per gram of fecal sediment (EPG) determined by microscopy using a McMaster chamber. Fecal samples in lysis buffer were processed using the QIAamp DNA Stool Mini kit (QIAGEN GmbH, Hilden, Germany) following the manufacturer's protocol with slight modification. The V3-V4 region of the 16S rRNA gene was amplified<sup>10</sup>. PCR products were sequenced using Illumina MiSeq platform. After raw sequence data processed using QIIME2, alpha and beta diversity were determined.

All statistical analyses were computed using R v4.0.4. To test the impacts of HSBB on ectoparasite burden, nit-picking rate was set as the response variable in the generalized linear mixed-effect models (GLMM). To test the predictions about variation in the prevalence and abundance of parasites, I built GLMM with parasite presence and EPG as the response variables respectively.

## KEY RESULTS

The model testing the effect of hot spring bathing behavior on nit-picking rates showed a significant interaction between bathing status and grooming area (Figure 2), in a way that supports the hypothesis that hot spring bathing behavior may impact louse egg distribution and/or detection by groomers.

The model testing the effect of hot spring bathing behavior on gastrointestinal helminth abundance (Figure 3) showed no noticeable difference in the abundance of *Trichuris trichiura* and *Streptopharagus pigmentatus* between bathers and non-bathers. In addition, the prevalence of *S. pigmentatus* did not differ significantly by bathing status. However, *T. trichiura* was marginally more prevalent in bathers than non-bathers.

The GLMM for gut microbiome on the observed species richness and Shannon diversity indices showed no statistical difference in the gut microbial richness, abundance, and evenness between individuals with different bathing status. In addition, gut microbial composition, as measured with PERMANOVA on Bray-Curtis and Jaccard distance, was not affected by bathing status.

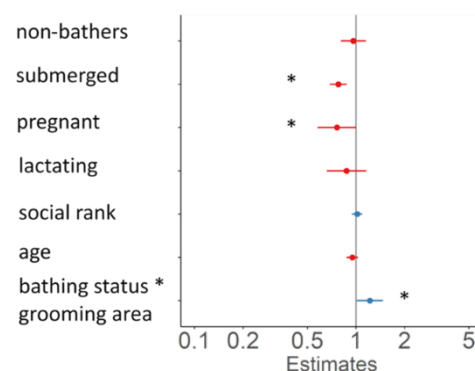
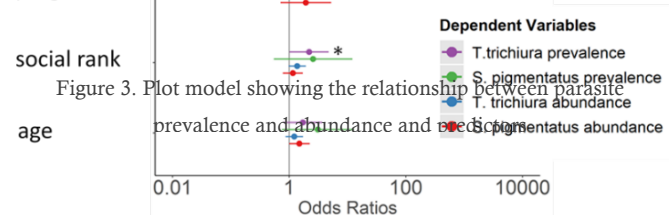


Figure 2. Plot model showing the relationship between nit-picking rates and predictors

## IMPLICATIONS OF PROJECT/DISCUSSION OF RESULTS

The results of this study relate to three different classes of host-associated biota: ectoparasitic lice, gastrointestinal parasites, and gut microbes. The following paragraphs approach each in sequence.

**Ectoparasitic Lice:** The difference in ectoparasite-directed nit-picking rates between bathers and non-bathers depending on the target area of grooming might be explained by factors that influence louse distribution and/or detection by groomers. Our data showed that nit-picking rates in non-submerged areas of both bathers and non-bathers were relatively higher than those in areas that are submerged during bathing (in bathers only). This could mean that lice may concentrate their activities and/or oviposition in those areas in general. But it is important to consider how bathing itself might influence louse distribution or behavior as it changes the physical characteristics of a host's pelage. We propose two non-mutually exclusive hypotheses to explain these results. First, wet pelage may influence a groomer's ability to detect or remove louse eggs. Further investigation of wet versus dry pelage on nit detection and or elimination is needed to corroborate this possibility. Second,<sup>32</sup>



since hot spring bathing behavior involves the application of hot water to the body, a host's hair and thus the ectoparasite's habitat will rapidly and significantly change in temperature. Temperature reportedly influences louse and egg development and survival<sup>11</sup>. In addition, temperature is known to drive lice on the body of a host to cluster in areas of optimal temperature<sup>7</sup>. The hot spring at the Jigokudani Snow Monkey Park is always set to 40°C. Although the monkeys rarely bathe for more than an hour, lice may still avoid submerged areas if there is risk of mortality or morbidity, and they may prefer to oviposition in areas with less physical disruption.

Gastrointestinal nematode parasites: Of the two nematodes for which a statistical test could be performed, only *T. trichiura* showed a marginal relationship with hot spring bathing behavior. Bathers tended to have higher prevalence of *T. trichiura* than non-bathers, though not higher intensity of infection, as measured by fecal egg counts. The whipworm *T. trichiura* generally sheds high numbers of eggs during the colder seasons in Japan<sup>9</sup>. The eggs are able to resist cold temperature<sup>12</sup> and presumably show no sign of development until the following spring and summer<sup>6</sup>, implying that warm temperatures are needed for their maturation. The warm environment around the hot spring might enhance the development of *T. trichiura* eggs, albeit water temperatures resembling peak temperature of summer might also deteriorate the eggs<sup>6</sup>. Nevertheless, bathers could have picked up the infective eggs while visiting the hot spring area and/or bathing in it. This needs further investigation, i.e., whether the environment around the hot spring contains higher numbers of infective eggs compared to more distant and relatively colder spots.

Gut microbiota: In general, the alpha and beta diversity of the gut microbiome was not found to be influenced by bathing behavior. The richness, evenness, and composition of the gut microbiome remained constant despite the animals engaging in bathing, and the potential effects of the marginal differences in *T. trichiura* infection, which has been linked to microbiome structure in other systems<sup>13</sup>. There are other variables which were not observed in this study that might also relate to hot spring bathing behavior, i.e. differences in hormonal profiles between bathers and non-bathers<sup>2</sup>, which could lead to variation in immune function and thus gut microbiome, or parasitism for that matter. But in general, the gut microbiome is chiefly influenced by host diet, phylogeny, and habitat<sup>14</sup>. Therefore, since the monkeys in my study reside in the same habitat, despite key behavioral differences, and are provisioned with the same type of foods, these factors likely outweighed any effects of bathing activity on the gut microbiome of *Macaca fuscata*.

## ACKNOWLEDGEMENTS

I'd like to thank Dr. Andrew MacIntosh, Prof. Munehiro Okamoto, Dr. Goro Hanya, Dr. Wanyi Lee, Kyoto University Primate Research Institute, Center for International Collaboration and Advanced Studies in Primatology, Jigokudani Snow Monkey Park director and staff, and Yuki Kinoshita. I am also thankful for the Japan Ministry of Education, Culture, Sports, Science, and Technology (MEXT) and the Japan Society for the Promotion of Science (JSPS), as well as the International Primatological Society (IPS) for supporting this work.

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# IPS Research Grant Report

Sofya Dolotovskaya

**Does social monogamy translate into genetic monogamy in red titi monkey (*Plecturocebus cupreus*)?**

**Sofya Dolotovskaya,**

**Behavioral Ecology & Sociobiology Unit, German Primate Center (DPZ)**

## BACKGROUND/INTRODUCTION

The occurrence of monogamy in mammals represents an evolutionary puzzle. Because of reduced parental investment, males are expected to increase their reproductive success by mating with multiple females rather than being committed to one mate. Still, some mammals are socially monogamous, or pair living, and several species are even genetically monogamous. In some pair-living species, “monogamy package” further includes biparental care and pair bonding.

To understand why monogamy occurs, it is necessary to examine the relationships between different elements of this package and the factors that influence them. Neotropical titi monkeys of genera *Callicebus*, *Plecturocebus*, and *Cheracebus* are not only socially monogamous, but also have a remarkably high level of male care, where infants are carried almost exclusively by males, and form strong pair bonds, a rare combination among mammals. The aim of this study was to investigate whether this combination is translated into genetic monogamy and which mechanisms help to maintain this social system.

## PROJECT OBJECTIVES/AIMS

The main goal of this project was to examine whether pair-living is translated into genetic monogamy in coppery titi monkey (*Plecturocebus cupreus*), a textbook example of a monogamous primate. Our further aims were to examine main hypotheses for the evolution and maintenance of monogamy. In particular, we first aimed to analyze pair-bonding and territorial behaviors in titi monkeys to address hypotheses for the evolution and maintenance of pair bonds. Second, we aimed to study the effects of infant care on caring adults in titi monkey to evaluate the hypotheses of male care evolution.

## BRIEF OVERVIEW OF STUDY LOCATION AND METHODS IF/AS RELEVANT

The study was conducted at the Estación Biológica Quebrada Blanco in the north-eastern Peruvian Amazonia (4°21'S, 73°09'W; Fig. 1) in June 2017–September 2019. The study area consists mainly of undisturbed primary tropical rainforest of the “terra firme” type (not inundated during the rainy season) interspersed with small swampy areas.

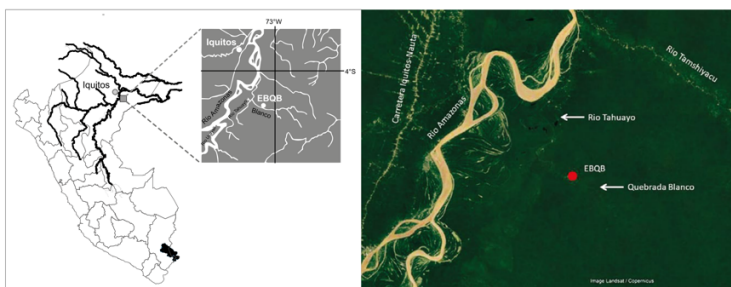


Fig. 1. Geographical location and geo-ecological context of the Estación Biológica Quebrada Blanco. From Heymann and Tirado Herrera, 2021

I non-invasively collected fecal samples for genetic analyses from 41 individuals of 14 family groups, including 18 offspring of nine family groups (up to five offspring generations per group). Seven of these groups were also subject to behavioral observations, during which I collected data on social interactions, activity budgets and

territorial behaviors of adult males and females (total sampling time 2749 h, focal observation time 384 h, 14 months in total).

The study was conducted under all necessary permits (Research Permit No. 249-2017-SER- FOR/DGGSPFFS from the Servicio Nacional Forestal y de Fauna Silvestre of the Peruvian Ministry of Agriculture) and ethical guidelines from the relevant authorities of Peru and the German Primate Center. The study was non-invasive.

## KEY RESULTS/MAIN FINDINGS OR OUTCOMES

- Parentage analyses of 18 young of nine family groups (41 animals of 14 groups in total) revealed no cases of extra-pair paternity, indicating genetic monogamy (Fig. 2) (Dolotovskaya et al., 2020a)

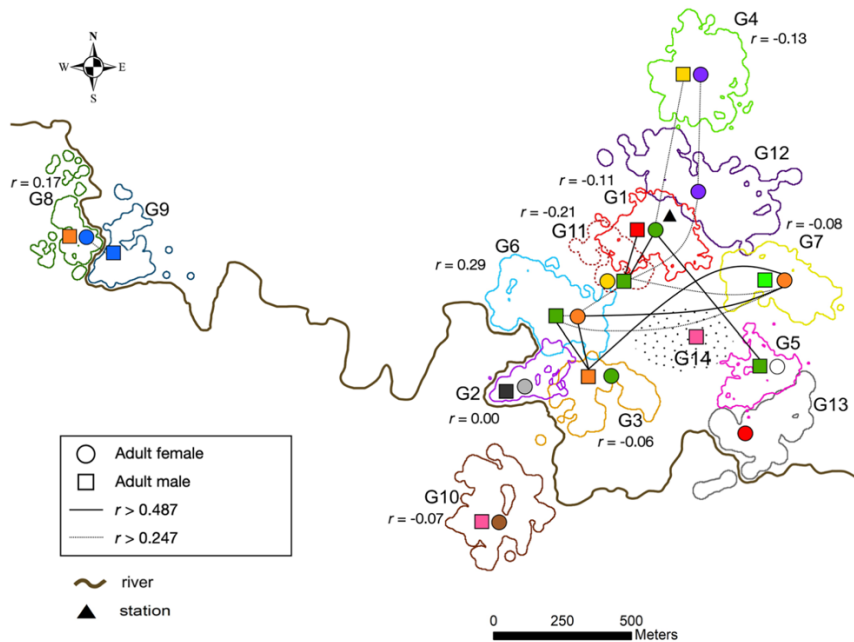


Fig. 2. Home ranges, relatedness, and mtDNA haplotypes of adult females (circles) and males (squares) sampled in this study. From Dolotovskaya et al., 2020a

- The examination of pair-bonding and territorial behaviors in seven titi monkey groups supported the “male services” hypothesis. Females maintained proximity and affiliation within pairs while males provided “services”, such as infant care, territorial defence, and protection from predators (Fig. 3) (Dolotovskaya et al., 2020b)



Fig. 3. An adult male from Group 1 with its (social and genetic) son

- Our analysis of the effects of infant care on caring adults in seven titi monkey indicated contrasting changes in activity budgets and diet composition of female and male caretakers. Our findings suggest that male care relieves mothers from some of the energetic costs of infant care, supporting the “maternal relief” hypothesis of male care evolution (Dolotovskaya and Heymann, 2020)

## IMPLICATIONS OF PROJECT/DISCUSSION OF RESULTS

This study indicates that three factors are important for maintaining social and genetic monogamy in coppery titis: pair bond, male care and possibilities for unconstrained dispersal. Strong pair bond, supported by contributions of both pair mates, likely limits the opportunities for extra-pair copulations and thus maintains genetic monogamy. High level of male care helps to reinforce social and genetic monogamy by freeing the female from the costs of infant carrying. This allows the females to forage more to compensate for the energetic costs of lactation, presumably contributing to their increased fecundity, and also makes the males more attractive to the females.

## ACKNOWLEDGEMENTS

We thank Camilo Flores Amasifuén, Migdonio Huanuiri Arirama, Ney Shahuano Tello, Mathieu Maréchal, Sarah Walker, and all other field assistants without whom the field work would not have been possible. The research was funded by International Primatological Society, Leakey Foundation, German Research Foundation (DFG; Project nr. 407493972), Primate Action Fund, and German Primate Center.

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# IPS Research Grant Report

## Katherine Kling

### Movement in the matrix: Lemur space use and activity across anthropogenic landscapes in southeastern Madagascar

IPS Research Award Granted to Katherine Kling

Interdepartmental Doctoral Program in Anthropological Sciences

Stony Brook University, USA

#### Proposed Project Summary

Primate movement is determined by the spatial and temporal distribution of risks and resources across an exploited landscape. This project aimed to evaluate how human influence and fragmentation impact both space use and temporal activity in a wild primate. As landscape change is rampant across primate range countries, examination of anthropogenic influences on primate behavior constitutes an important avenue of research. The project was proposed to test whether the degree to which habitat areas are repetitively and extensively exploited varies between individuals in continuous forest or within a fragmented landscape, whether individuals avoid areas subject to more intense human influence, such as patch edges or the landscape matrix, and whether individuals living in fragmented forest display a greater proportion of nighttime activity to avoid human contact. Predictions would have been tested using a combination of automated GPS and accelerometer activity tracking alongside behavioral observation of ten red-bellied lemur (*Eulemur rubriventer*) living in southeastern Madagascar. The study landscape proposed was ideal for testing the variable impacts of habitat composition and human influence. This proposal thus aimed to use innovative technical approaches to research in anthropogenic environments, quantifying species' response to human influence, and explicitly examining its resultant impact on primate movement, space use, and behavior.

#### Project Report

**Background.** As primates are particularly vulnerable to habitat degradation, yet commonly-occur within regions threatened most by deforestation, research examining primate response to anthropogenic landscapes is important for the field of primatology. Landscape perspectives in primatological research allow for an exploration of primate response to environmental or spatial variables within a broader context than is typically undertaken. Research has successfully examined primate movement using GPS collars and within human-dominated environments. However, more is needed to combine these approaches further, particularly within agroforest landscapes for arboreal primates, and to examine factors driving matrix use in greater detail. Understanding primate response to landscape change would ultimately provide insights into how primates were able to adapt to changing environments across our evolutionary history. Together with relating to our evolutionary past, this study was designed to help determine whether primate species will be able to persist in the face of future change as driven by anthropogenic influence.

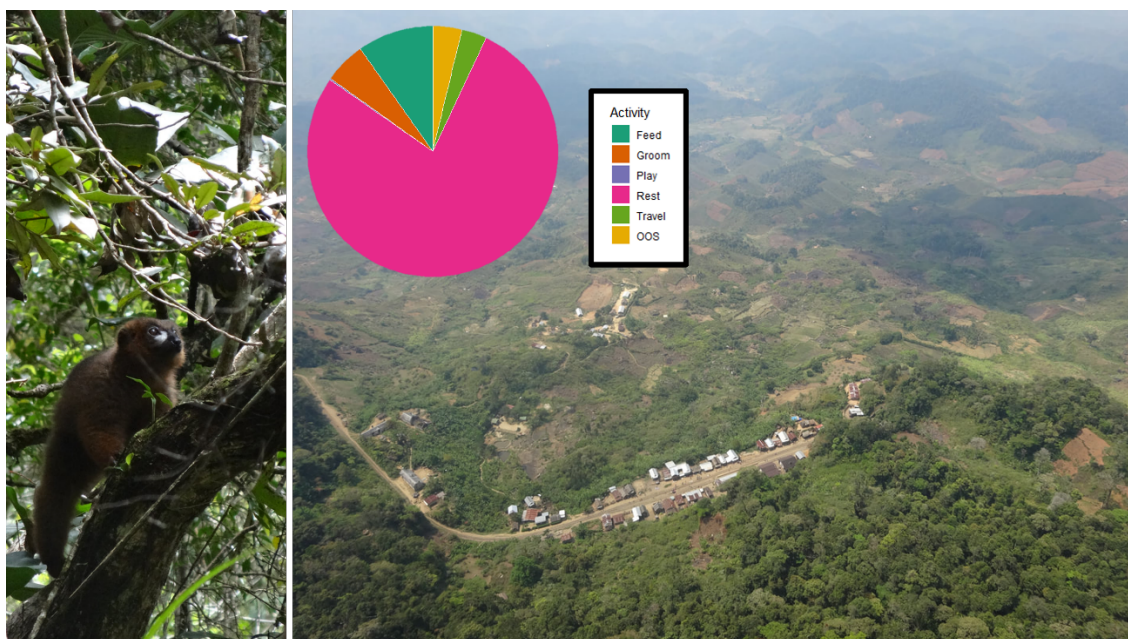
**Project Objectives.** The ultimate goal of the project was to evaluate empirically the effects of landscape fragmentation and human influence on space use and temporal activity in a wild primate. We had the following broad objectives:

- To examine the movement and behavior of red-bellied lemur (*Eulemur rubriventer*; VU) populations living in an anthropogenic environment
- To deploy 5 GPS collars, equipped with accelerometers to quantify lemur matrix use and activity patterns

**Study Location and Methods.** The study was conducted in southeastern Madagascar, across forest fragments in four communities (approx. 16 km<sup>2</sup>) located next to the COFAV Corridor, a protected remnant forest corridor that connects two critical protected areas in eastern Madagascar, Ranomafana and Andringitra National Parks. As Madagascar is well-known for its high rates of deforestation and threatened, endemic primates, Madagascar is a good place to situate research on primate adaptations to human environments. I had conducted several pilot studies (in 2016, 2017, and 2018) in the study communities prior to conducting this research, when my team and I were able to establish important working relationships with community members and verify that our study species (*E. rubriventer*) were present at the site. The strength of this project also rested upon its chosen methodology: deploying GPS collars with accelerometers would allow my team and I to monitor the activity and movement of study subjects across a 24-hr cycle, in a much less-invasive manner than traditional behavioral observation. To validate collar readings and to provide necessary context, however, we still needed to monitor the study population and take data by hand.

**Key Results and Outcomes.** Over three months (August – September, 2019), my team and I documented 5 groups or pairs of *E. rubriventer* (estimated  $N = 14$  individuals: 5 adult males, 6 adult females, 3 sub-adults, and 2 infants) in 9 forest fragments at the site. Although we anticipated some difficulty in following study individuals, habituation at the site proved challenging and ultimately spoke to the extent of human threats in the area. For the first 4 weeks on-site, we did not have any observations, though anecdotal information from community members confirmed the continued presence of lemurs. Over 94 tracking days, we were able to encounter *E. rubriventer* individuals on 46 days, and they were typically very skittish. Ultimately, we were able to document 34 hours of behavioral observation (consisting of 5 min. focal scans; full-day follows, when possible). During sampling days with  $\geq 3$  hours of consistent, continuous observation, the activity budget of observed individuals was as follows (average % of bouts  $\pm$  SD): Resting for  $77.7 \pm 10.8\%$  of bouts, Feeding  $9.8 \pm 8.4\%$ , Grooming  $5.4 \pm 5.5\%$ , Traveling  $3.2 \pm 2.1\%$ , Playing  $0.2 \pm 0.7\%$ , and Out of Sight  $3.8 \pm 4.8\%$  of bouts. While observations of *E. rubriventer* consistently result in high proportions of resting behavior (e.g.,  $> 50\%$  of scans, [1]), we highly caution interpretation of our results given the low sample size. Resting proportions may be inflated due either to the habituation process or because feeding and other activities occur more frequently at night, as we proposed. We observed matrix crossing events on several occasions, once observing a group crossing the ground on railroad tracks to enter the protected corridor from a small forest stand. Of the two groups that we were able to follow most consistently, one was frequently encountered in two fragments separated by agricultural fields.

Due to the difficulty of habituation (presumably due to lemurs actively avoiding human threats) and encountering brown-lemur-specific snares in some of the smaller fragments, my team and I made the difficult decision to stop our habituation process early and to not deploy the GPS collars, as intended. We additionally observed and attempted to track a black-and-white ruffed lemur (*Varecia variegata*) being chased by dogs out of the forest (heretofore only encountered in the protected forest corridor), possible evidence of active hunting in the region. I felt the project imposed an undue, and greater-than-anticipated risk, on the study population, and we have since discontinued working at the site. In hindsight, the arrival of COVID-19 would have made any additional work at the site difficult to carry out regardless. To monitor the safety of the animals, we employed our local team members to census the region weekly and to report back on risks to the population (through 2020). We additionally sent our lead team members from the Centre ValBio Research Station on two expeditions in 2020 to connect with our on-site team.



**Figure 1** (Left to Right): Photo of study subject, male *Eulemur rubriventer*; Activity budget of observed *E. rubriventer*; Overview of study site, southeastern Madagascar

**Implications of Project.** The implications of this project are, broadly, two-fold. First, results from the field season spoke to my project's objectives – that wild lemur populations shift their behavior to avoid human contact – albeit, with largely anecdotal information. The project's study subjects avoided humans and were implicitly shown to use the matrix outside of forest fragments, even crossing between the large, protected corridor and smaller, remnant tree stands. Observations of two infants born within the study population during the field season also provide information that the species may be able to persist in this region, though it is unclear how long they will be able to do so as human pressures increase.

The second, and arguably more critical, set of implications of this study are the cautionary lessons it holds. While I believe it is immensely important to shift the focus of primatological research to anthropogenic environments, I am wary of studying potentially vulnerable populations directly. I have now shifted my own research focus to understanding human-non-human-primate interactions from the “human perspective.” My dissertation research now examines the drivers and consequences of natural resource use by local communities in northeastern Madagascar to understand how both people and wildlife use remaining forest. This work has implications for primate conservation by examining in detail how human and non-human primate (specifically, the red-ruffed lemur, *Varecia rubra*) resource needs overlap – and, importantly, how they may be jointly managed.

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