ASP AMERICAN SOCIETY OF PRIMATOLOGISTS BULLETIN
Banner artwork by Joel Ito

Carolyn L. Ehardt - Executive Secretary
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# A Message from the President...

***Dear ASP members,***

Welcome to 2014. It was a great pleasure to see so many of you at the ASP 2013 annual meeting in San Juan, Puerto Rico. Our local hosts, led by Dr. Janis Gonzalez, provided an amazing experience, especially for those of us who had never visited Cayo Santiago before. The Program Committee provided an exceptionally strong lineup of symposia, posters, and talks, and it was all around a good time. Our next meeting, to be held in Decatur on September 12-15, 2014. Once again, we are looking forward to a vibrant and exciting meeting.

One new innovation at last year's conference was the inaugural meeting of the (ad hoc) Student Committee. This committee has come up with a number of initiatives, including social activities to help integrate new student members into the Society, and discussions of material that students would like to see added to the website. Students who are interested in joining the Student Committee should contact the Chair, Josh Smith (hominoid@yorku.ca).

2013 has seen a lot of major events in primate research, including the announcement of the closing of the New England Primate Research Center; the new NIH guidelines on chimpanzee research; and the recent Congressional funding for the retirement of many chimpanzees to sanctuary. Our diverse membership has a variety of opinions on these subjects. However, the unifying characteristic of ASP has been our ability to come together through our mutual enthusiasm for the study of primates -- which continues unabated throughout these changes.

One hopeful sign for the Society is the excellent slate of candidates provided for us by the Nominations committee. Please consider carefully, and please vote! We also are moving to establish two committees, the Primate Care Committee and the Media and Public Engagement Committee, as standing rather than ad hoc committees. This also requires a vote of the membership, which will be electronic -- and the time that you take to do this is greatly appreciated.

See you in September,

Karen Bales

ASP President
Professor and Vice-Chair of Psychology, UC-Davis
Unit Leader, Brain, Mind, and Behavior, California National Primate Research Center

# Candidates for 2014 ASP Elections

**It's time to elect officers for the American Society of Primatologists! Please go to the members portal on the ASP website to cast your vote beginning 15 February. Here is the link:**

https://www.asp.org/portal/index.cfm

***Remember:*** According to our Constitution, ***you must be an Active or Retired member of ASP to be eligible to vote (Student members are not eligible to vote)***. If you have not yet renewed your membership in ASP, now is a great time to do so...

***Voting begins on 15 February - and will conclude on 15 March 2014... Please vote!!!***

The Biosketches and statements for the candidates provided here (as well as on the ASP website):

## President Elect

### Kimberley A. Phillips

**Biosketch**: Current Positions: Professor of Psychology, Trinity University and Adjunct Scientist, Southwest National Primate Research Center. Education: B.S., Wofford College; M.S., The University of Georgia; Ph.D., The University of Georgia.

**ASP Activities:** I have been active in ASP since 1990. I have served on the Conservation Committee, first as a committee member, and then as Co-Chair (2006-2008), and Chair (2008-2010). I was elected Treasurer of the Society in 2009 and re-elected in 2011. I am an *ad hoc* reviewer for the American Journal of Primatology.

**Vision for ASP**: I have studied numerous primate species – including New World Monkeys, Old World Monkeys, and Apes [unfortunately, no tarsiers or prosimians … yet] – both in the field and in the laboratory. These experiences have provided me an opportunity to understand and appreciate key concerns shared by the diverse membership of ASP – whether these concerns are those of funding, animal welfare, or increased regulatory oversight. Initiatives by recent ASP Presidents have included expanding our members in habitat countries, increasing and enhancing support of student members, and strengthening and enhancing educational outreach. These are important aspects of our Society, and I would work to continue the strong foundation laid by past Presidents. Additionally, the past few years have seen key decisions made at the national level that affect our ability to conduct research with primates. ASP is represented at several national and international organizations – including the IUCN, AAALAC, and AIBS. I feel ASP can play a larger role in both science policy and public awareness of nonhuman primate research. I would work toward strengthening our role in these arenas.

### Lynne Miller

**Biosketch:** Current Position: I am the Head of the Program in Anthropology at MiraCosta College in Oceanside, CA. This position carries enormous teaching responsibilities but also allows me to work closely with students, instilling in them an interest in anthropology and an appreciation for learning. As head of the program, I also oversee hiring and training of new young faculty in anthropology, who are in turn inspiring the next generation of students. Unfortunately, my teaching responsibilities prevent me from doing research on a regular basis, but I have a long history of field research with capuchins in Venezuela, including experimental investigations of the impact of (model) predators on foraging decisions. Education: I earned my B.A. from Pitzer College (Claremont, CA) with a double major in anthropology and human biology, and a Ph.D. from U.C. Davis in anthropology.

**ASP Activities:** I have been attending ASP conferences and participating in Society activities for about 25 years. I was a proud recipient of the student award for best presentation in 1991. I went on to chair the Education Committee for four years, which was a very rewarding experience, given my focus on student success. Since then, I have served on the Program Committee and was the local arrangements coordinator for the 2009 meeting in San Diego.

**Vision for ASP:** Primates represent a fascinating way to understand many facets of the development, ecology, and evolution of behavior. The Society plays a critical role in fostering research and education in these arenas, and thus research and education would be the central foci of my vision. In terms of research, the Society needs to continue to provide support, both financial and informational, to investigators. The AJP must continue to be a premier journal for disseminating research results, and the annual meeting must find creative ways to engage young scientists with our important endeavors. Furthermore, the Society must continue to balance its emphasis on research with natural vs. captive populations, encouraging both and increasing opportunities for synergistic interactions among colleagues from diverse fields. In terms of education, the Society must continue its efforts on behalf of outreach, not only to our emerging colleagues but also to younger enthusiasts who might discover a love of primates in the pages of our website. I would achieve these goals by establishing dialogue among the Society's members to attract the brightest ideas for improving the things we already do well and establishing new policies to help the Society find additional ways to grow.

## Executive Secretary

### Michelle Bezanson

**Biosketch:** Current Position: Associate Professor and Chair of Anthropology at Santa Clara University. My research has focused on ontogenetic effects on posture, locomotion, limb use, and the behavioral, arboreal, and resource-based contexts of these patterns in wild mantled howling monkeys (*Alouatta palliata*) and white-faced capuchins (*Cebus capucinus*) inhabiting tropical forests in Costa Rica and Nicaragua. In addition, I have recently initiated efforts to communicate natural history on Santa Clara's campus to students and the broader community via a citizen science program called 'SCU gone Wild'. Education: BA, 1996: University of Arizona; Ph.D., 2006: University of Arizona.

**ASP Activities:** I first joined the ASP in 2004 as a graduate student and have just recently served on the Conservation Committee (2013-present) and on the Fund Raising subcommittee.

### Justin A. McNulty

**Biosketch:** My current position is that of the Sr. Institutional Animal Care and Use Committee (IACUC) & Institutional Biosafety Committee (IBC) manager at The University of Texas at Austin. In addition, I am the Founder and President of LabDog Consulting, LLC. Education: B.S. Biology, University of Washington, 2004; B.S. Psychology, University of Washington, 2004; M.L.A.S. (Master in Laboratory Animal Science), Drexel University, expected May 2014.

**ASP Activities:** I have been a member of ASP since 2001; this includes three years as a student member and over 10 years as a full member. My service with ASP has encompassed over 10 years now. This has included multiple years on the Education Committee (2004-2005), Membership & Finance Committee (2006-current), and the Media & Information Committee (2012-current). I was organizer for the 2011 annual meeting in Austin, Texas, in 2011.

## Treasurer

### Cory Ross

**Biosketch**: I am currently an Assistant Professor of Biology at Texas A & M University San Antonio. I also am an adjunct scientist at Southwest National Primate Research Center and the Department of Cellular and Structural Biology at the University of Texas Health Science Center San Antonio. My research focuses on marmoset reproductive physiology and the development of obesity. Education: B.S. Cornell University1997, M.A. University of Nebraska at Omaha 1999, PhD. University of Nebraska Lincoln 2005.

**ASP activities**: I have been a member of ASP since 1999 and have attended every annual meeting since I joined (with the exception of the Boulder meeting in 2000, since I was due to deliver my son that weekend). I have been a member of the

Education Committee since 2002 and served as the chair of that committee from 2006-2010. I also have served on the Media and Public Relations Committee since 2010 and am currently the co-chair. I had the pleasure to serve on an *ad hoc* committee to review the updates to the ASP website. I often serve as an *ad hoc* reviewer for the *American Journal of Primatology,* as well as for the ASP Program Committee.

**Larry Williams**

**Biosketch**: Current Position: Associate Professor, Department of Veterinary Sciences, UT MD Anderson Cancer Center. Education: B.S. Rhodes College, 1977, M.S., University of Georgia, 1980, Ph.D., University of Georgia, 1982. Research interests revolve around captive behavioral management and studies of the basic biology of squirrel and owl monkeys.

**ASP Activities:** Joined 1979; Local Arrangements Chair 1989; Co-Chair Program Committee 2004-2006; Education Committee 1992-94; Finance & Membership Committee 1992-98, 2002-04; Research and Development Committee 2010-present. ASP has been fortunate to have had very fine Treasurers in the past and I would strive to continue their work.

# 37th MEETING OF THE AMERICAN SOCIETY OF PRIMATOLOGISTS 12-15 September 2014 Decatur, Georgia

## The 37th meeting of the American Society of Primatologists will be held at the Courtyard Marriott in Decatur, GA, September 12-15, 2014

As always, this meeting promises to be of the highest scientific quality. The meeting will feature contributed paper and poster presentations, as well as symposia that address our wide-ranging interests in primatology.

Room rates at the Courtyard Marriott will be $139.00 per night, single or double. You should make your reservation through this website: http://cwp.marriott.com/atldc/emoryyerkes. To receive the special rate, please do so ***by 18 August 2014***.

On-line conference registration and abstract submission are now available in the Members section of the ASP website All final ***abstracts are due*** for symposia, oral, and poster presenters by ***15 April 2014***.

***The Program Committee welcomes hearing from members who would wish to join the committee and participate in the review of submitted abstracts. If you would like to serve, please contact Julie Worlein (worleinj@wanprc.org) and Brian Kelly (bkelly8980@gmail.com).***

# Beautiful San Juan, Puerto Rico - Site of the 2013 ASP Meeting...

# Memories from the 2013 ASP Meeting...

## Recipient of the
## 2013 Distinguished Primatologist Award:

# *Dr. Linda Fedigan*

**University of Calgary, Alberta, Canada**

The Society presented the Distinguished Primatologist Award to Dr. Linda Fedigan at the thirty-sixth Annual Meeting of the Society held in San Juan, Puerto Rico, 19-22 June, 2013.

Dr. Fedigan received her Ph.D. in Biological Anthropology from the University of Texas, Austin, in 1974. She currently is a Professor in the Department of Anthropology at the University of Calgary, Alberta, Canada. Among her academic honors, she has been named Fellow of the Royal Society of Canada, Canada's most prestigious recognition of research excellence. Dr. Fedigan is a dedicated teacher and mentor. She has taught 14 different courses throughout her career and has supervised over 23 Masters theses and nine Ph.D. dissertations. At least eight of her former graduate students and postdocs have established successful careers in primatology. Over the past 40 years, Dr. Fedigan has become internationally renowned for her contributions to primatology, increasing our understanding of non-human primate life histories, behavior, ecology and conservation. She has written or co-authored several books and has published over 140 peer-reviewed articles in top scientific journals, including one recently in *Science* (2011).

Among her notable lifetime accomplishments in primatology was the Arashiyama East-West Primate Project (1972-1996) in which she intensively focused on the life history and reproductive strategies of Japanese macaques (*Macaca fuscata)* in Arashiyama, Japan, and later in an offshoot population translocated to North America. Dr. Fedigan also has worked at the Santa Rosa National Park Project in Costa Rica for 30 years, studying the behavioral ecology of three sympatric neotropical primates (capuchins, spider monkeys and howler monkeys). A main focus of her research has been the long-term life history patterns and female reproductive strategies of white-faced capuchins. Dr. Fedigan's work also has made important contributions to our understanding of the impact of forest protection and regeneration on the conservation of primate populations. On a broader level, Dr. Fedigan has studied the role of gender in the research programs of scientists in disciplines such as anthropology, primatology and biology. She has written widely on the topic of gender and science, with a focus on the influence of gender on the history of primatology.

The Society is exceptionally pleased to recognize Linda as Distinguished Primatologist.

-- Peter Judge and Nominators
ASP Awards & Recognition Committee

## *A Very Important Message from the Chair of the ASP Awards & Recognition Committee, Peter Judge:*

**Dear ASP Members,**

I am writing to most strongly encourage you to **nominate deserving candidates for one or more of the Society's awards** (Distinguished Primatologist, Senior Research Award, Distinguished Service Award, and the Special Recognition Award)).

Let us recognize individuals who have made outstanding contributions to primatology and/or the Society. Further information concerning the awards and the nomination process can be found at the ASP website under "Grants > Other Awards."

**Nomination documents are due by May 1st, 2014**

***We will be looking forward to hearing from you!***

## *Recipient of the 2013 ASP Conservation Award:*

## *Francis Rwabuhinga*

Francis Rwabuhinga is a dedicated conservationist from Uganda who has played a significant role in the conservation of the primates and the forest of Kibale National Park through his outstanding work in conservation education.

# *Recipient of ASP's First Legacy Award:*

## *Dr. Julienne Rutherford*

The recipient of ASP's first Legacy Award, presented at the 2013 ASP meeting in San Juan, Puerto Rico, is **Dr. Julienne Rutherford**, a biological anthropologist at the University of Illinois at Chicago. She teaches in the Department of Women, Children, and Family Health Science at the UIC College of Nursing, and also is an assistant professor in the Graduate College and an adjunct assistant professor in the UIC Department of Anthropology.

Dr. Rutherford's project on which the Legacy Award was based explores the critical links between placental function and fetal brain development. She will explore the relationships between measures of placental nutrient transport at various time points during gestation and brain developmental processes. Her focus is directed toward aspects of brain ontogeny implicated in executive functioning, such as white matter structural maturation and the growth of the corpus callosum as visualized by magnetic resonance imaging (MRI) and histological immunostaining. This novel approach is central to understanding not only the temporal relationship between brain and placental development in normal pregnancies, but also how intrauterine nutrient restriction and stress exposures could lead to suboptimal brain development and postnatal cognitive disorders.

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*The ASP Legacy Award is made possible through a fund established to facilitate interdisciplinary training for an 'early-career' professional in primatology. The intent of the award is to provide for a period of short-term training in a discipline, or development of a skill-set, that is outside the recipient's area of expertise, but will add to the ability of the recipient to make unique contributions to primate research or to the agencies and organizations that affect primate research.*

*- Jeff French, Chair, Legacy Award Search Committee*

The ASP Conservation Committee would like to remind you of the ***upcoming deadlines for the ASP Conservation Small Grants (due 31 Jan 2014) and the ASP Young Conservationist Award (due 1 March 2014).***

***CONSERVATION SMALL GRANTS*** (up to $1,500): Grant proposals are solicited for conservation research or related projects, including conservation education. ASP members working in habitat countries are especially urged to apply or to help someone from a habitat country submit a meaningful project that can be a portion of a larger effort. Recipients of grants must agree to submit a brief report (maximum 1-2 pages, single spaced), in a form suitable for publication in the ASP Bulletin, to the chair of the ASP Conservation Committee within 6 months of completion of the project.

**Who is eligible:** students, researchers, and educators of primate conservation from any country. Please note that non-ASP members and student applicants MUST submit a letter of recommendation with their application.

**How to apply**: please first visit the list of FAQ about the grant. Application forms will soon be available for download and can then be submitted online using the grant application system (available after January 1st, 2014). Applications will ONLY be accepted through the ASP online grant submission system. Please note that this system requires applicants to log-in to the ASP portal. You do not need to be an ASP member to apply, but you will need to register online in order to submit your application. All non-members and students are required to submit one (1) letter of recommendation (preferably from a current ASP member if a non-member; from an academic advisor if a student). Students and non-members will be asked to enter the email address of their letter writer. An email message will then automatically be sent to the letter writer with information on how to submit the letter.

***Due date: 31 January, 2014***

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***YOUNG CONSERVATIONIST AWARD*** ($750): This award provides recognition and financial support for students and young investigators from habitat countries who demonstrate potential for making significant and continuing contributions to primate conservation. Past awards have been presented by U.S. Ambassadors or other senior officials, thereby obtaining favorable publicity for the award, its recipient, and primate conservation in the recipient's country.

**Who is eligible:** students, researchers, and educators from primate habitat countries for whom no more than five years have elapsed since receipt of their terminal degree.

**How to nominate someone:** send the following via email to the chair of ASP Conservation Committee, Erin Riley (epriley@mail.sdsu.edu): 1) The name, title and full mailing address of their nominee, along with a statement about the nominee's qualifications for the award, focusing on past and potential contributions to primate conservation. 2) A copy of the nominee's vita. 3) Supporting letters from other individuals acquainted with the nominee's work may be submitted.

***Due date: 1 March, 2014***

***- Erin Riley - Chair, ASP Conservation Committee***

# ASP CONSERVATION SMALL GRANT AWARDS FOR 2013

- **Dilip Chetry & Randall Kyes -** "Field Course in Conservation Biology & Global Health at the Gibbon Conservation Centre, Assam, India"
- **Mariana Landis** – "Effects of Hunting and Population Density of Southern Muriqui in the State Park "Carlos Botelho," Brazilian Atlantic Forest, São Miguel Arcanjo, São Paulo, Brazil"
- **Deborah Moore** - "Investigation of Habituated Bonobo (*Pan paniscus*) Communities at Kokolopori Bonobo Reserve, DRC"
- **Nicolien Schoneveld** – "Effecting Primate Conservation through an Education Program in Rural and Urban Nigeria: Using an Evidence-Based Approach"

Congratulations to all...
Erin Riley, Chair, and Members of the ASP Conservation Committee

# ASP SMALL RESEARCH GRANT AWARDS FOR 2013

- **Margaret Corley, University of Pennsylvania -** "Leaving home: genetic correlates of owl monkey dispersal in a naturally fragmented habitat"
- **Brendan Barrett, UC Davis** – "Cultural Inheritance: Identifying social learning heuristics in wild capuchin monkeys"
- **Katharine Thompson, Pennsylvania State University** - "Did you hear that? Properties of deadwood that influence extractive foraging in aye-aye"
- **Cynthia Thompson, Northeast Ohio Medical University** – "Non-invasive methods to evaluate thermoregulatory and metabolic hormones in free-ranging New World primates"
- **Tim Bransford, Rutgers University -** "An interdisciplinary approach to understanding the cost of motherhood in wild Bornean orangutans"
- **Andrea Spence-Aizenberg, University of Pennsylvania** – "Olfactory signals and partner choice in monogamous owl monkeys"
- **Allison Howard, University of Georgia** - "Navigation and route choice in bearded capuchin monkeys"

Congratulations to all...
Kai McCormack & Erin Kinnally, Chairs, and Members of the ASP Research and Development Committee

# ASP STUDENT PRESENTATION AWARDS FOR 2013

***At the 2013 meeting in San Juan, Puerto Rico, the ASP Education Committee selected the following awardees:***

### *Oral Paper Award*

***Francisca Vidal-Garcia, "KNOWING THE CURRENT DISTRIBUTION OF PRIMATES IN SOUTHEASTERN MEXICO BY USING MODELS OF POTENTIAL DISTRIBUTION AS TOOLS OF QUEST"***

### *Honorable Mention -- Oral Paper Award*

***Nicoletta Righini, "DOES ENERGY INTAKE CORRELATE WITH FECAL GLUCOCORTICOIDS IN FREE-RANGING ALOUATTA PIGRA?"***

### *Poster Paper Award*

***Katie Chun, "BEHAVIORAL INHIBITION CHARACTERIZED IN INFANCY PREDICTS SOCIAL BEHAVIOR AND IMMUNE FUNCTION IN YOUNG ADULT RHESUS MONKEYS (MACACA MULATTA)"***

*Congratulations!*

--- ASP Education Committee
Amanda Dettmer, Chair

# ASP Student Conference Travel Award Recipients for the 2013 Meeting

***Erica Dunayer, "SHORT TERM STEEPNESS CHANGES IN TIBETAN MACAQUES (MACACA THIBETANA), AT MT. HUANGSHAN, CHINA" - University at Buffalo, SUNY***

***John Aristizabal Borja, "INTAKE MEASURES AND SELECTIVITY OF PLANT PARTS CONSUMED BY FREE-RANGING ALOUATTA PIGRA IN A FRAGMENTED ENVIROMENT IN SOUTHEASTERN OF MEXICO" - Instituto de Ecología A.C. Veracruz, México***

***Brittany Thomas, "THE INFLUENCE OF INTERTROOP ENCOUNTERS ON THE SPATIO-TEMPORAL DYNAMICS OF TWO TROOPS OF FREE-RANGING VERVET MONKEYS (CHLOROCEBUS AETHIOPS)" - University of Lethbridge***

***Katie Chun, "BEHAVIORAL INHIBITION CHARACTERIZED IN INFANCY PREDICTS SOCIAL BEHAVIOR AND IMMUNE FUNCTION IN ADULT RHESUS MONKEYS (MACACA MULATTA)" – UC Davis***

-- Matthew Novak

## Highlights of ASP's Education Committee Activities


### ASP to again particpate in the USA Science and Engineering Festival

### Washington, DC

ASP is proud to be an Official Partner of the 3rd USA Science & Engineering Festival, to be held April 24-27, 2014 in Washington, D.C. ASP has participated in the Festival since its inception in 2010, and is delighted to once again be hosting a booth in 2014 highlighting the intellectual and behavioral differences between human and non-human primates, as well as our society's conservation and research efforts. ***Interested in representing ASP at the USA Science & Engineering Festival?*** Contact the ASP Education Committee Chair, Dr. Amanda Dettmer at dettmera@mail.nih.gov to help with the exhibit booth. This is a perfect outreach opportunity for students, faculty, and researchers of ASP!

-- Amanda Dettmer, Chair


Committee co-chair Corrinna Ross participated in the Voelker Biosciences Teachers Academy Annual Conference in Spring 2013. She presented the American Society of Primatologists education activities to 40 local teachers. Each of the teachers and representatives from the local schools took an ASP Education CD with them. The resources include a guide which matches the activities to each grade level's science standards for the state of Texas. The teachers were very excited to have some tools and activities to teach about primates in their classes.

-- Cory Ross, Member

## *In Memorium:* Roger A. Brumback, 1948 – 2013

The American Society of Primatologists joins Creighton University School of Medicine, friends, and family in mourning the passing of Dr. Roger A. Brumback and his wife of many years, Mary. Both were found dead in their home in Omaha, Nebraska on May 14, 2013.

Roger had a distinguished career in pathology after receiving his MD degree from Penn State University Medical College in Hershey, PA. He had professional appointments at Washington University, the NIH, University of Pittsburgh, University of North Dakota, University of Oklahoma, and finally at Creighton University School of Medicine, where he was Chair of the Pathology Department from 2001 to 2010. He remained a Professor in Pathology at Creighton, and was planning to retire in June 2013. His professional medical interests included diagnosis and treatment of neurodegenerative diseases, particularly Alzheimer's disease, neuromuscular diseases, and metabolic disorders. He has over 190 publications in pathology and neuropathology listed in PubMed, so he was a prolific scholar in his own right.

There was a chance event early in his medical training that linked Roger forever with primatology. Looking for a research project while an M1 student in medical school in the late 1960's, he was steered by mentors toward a project using the then-revolutionary technique of chromosome analysis (karyotyping) to answer questions regarding the evolutionary status of a rather obscure and unknown species of neotropical primate, the owl monkey (genus *Aotus*; now known commonly as "night monkeys"). After several years of working on this project alongside his medical training, Roger collected sufficient data to make a claim that there were two forms (species) of night monkeys, and published several papers to support this claim. When Roger's career in pathology began in earnest in 1975, he deposited his original data and publications with Philip Hershkovitz at the Field Museum of Natural History in Chicago, the recognized world expert in neotropical primate systematics and biology, and commenced his distinguished career as an academic and clinical pathologist.

Thirty years after he thought he was through with primatology, Roger saw a group of night monkeys on display at the San Diego Zoo. This chance viewing piqued his interest in his long-forgotten subjects, and he searched the internet for recent knowledge about this species. To his surprise and delight, he discovered that his original data on multiple species of night monkeys had withstood the rigors of peer review, and that one of the forms of night monkeys now had his name attached to it: Brumback's Night Monkey (*Aotus brumbacki*). He also discovered that Brumback's Night Monkey was on the IUCN's 'Red List', classified as vulnerable to extinction due to habitat destruction.

Brumback immediately felt a desire to contribute to conservation efforts for 'his' monkey, and other organisms that shared the South American forests with it. He contacted the ASP, and primarily though the good efforts of Janette Wallis, a long-time member of the ASP, he made a substantial contribution to the ASP to support fieldwork and conservation efforts with monkeys in the genus *Aotus*. His contribution to the ASP funded the work of three scientists who continue their work in neotropical primate conservation, including **Cecilia Juarez**, Fundacio ECO, Argentina, **Angela Maldenado**, Fundacio Entropika, Colombia, and **Sam Shanee**, Neotropical Primate Conservation, Peru.

Roger will be missed by many in his primary professional field of pathology, but a legacy will live on in his scientific contributions, his impact on colleagues' careers, and in the students he has trained. His legacy in primatology likewise will persist even in his absence. Significant conservation scientists and organizations dedicated to preserving the forests of South America, and the primates that live there, have been inspired by Roger's financial gifts to the ASP. If these people and institutions, along with the efforts of many others with similar goals, are successful, the night monkey that bears the Brumback name will have a bright future.

Jeffrey A. French, Omaha, Nebraska
15 May 2013

Acknowledgements to Janette Wallis' original essay on Roger's story from the ASP Bulletin (June 2000, Vol. 24(2).

# MINUTES OF THE 2013 ASP EXECUTIVE COMMITTEE MEETING, San Juan, Puerto Rico

President President Karen Bales called the meeting of the Executive Committee to order at 5:10 pm, 20 June 2013. In attendance: Karen Bales, Marilyn Norconk, Kim Phillips, Carolyn Ehardt, Kai McCormack, Peter Judge, Erin Riley, Julie Worlein, Brian Kelly, Mollie Bloomsmith, Cory Ross, Dee Higley, Amanda Dettmer Erard, Julienne Rutherford, and Joshua Smith.

President Bales invited reports by the attending chairs of ASP committees, with discussion by the Executive Committee.

**Membership and Finance Committee; Kim Phillips, ASP Treasurer and Chair:**

The final membership count for 2012 indicated a decline, with a total of 501 members. For 2013, the membership as of 31 May is close to that count, with 489 members to that point in the year. The committee has sought to address the apparent decline in membership which has been evident in recent years through an email solicitation effort, although it is difficult to gage its effectiveness as the membership count at present is incomplete but does appear to reflect some degree of stability relative to last year. The committee also is discussing the importance/structure of benefits of membership, how best to convey those benefits as a means to promote membership, and the effectiveness and reach of membership aspects such as the Facebook page (less than half of the ASP membership is on Facebook) and the ASP Bulletin (which some see as outdated in light of continued growth in other forms of media).

The Treasurer also reviewed the ASP Financial Statements for the period of 1 June 2012 through 31 May 2013 with the Executive Committee. The period began with $115,409 in the General Fund; post the cited expenditures, the 31 May 2013 balance was $145,676 (which will be impacted by the expenses for the 2013 meeting). The 2012 ASP meeting in Sacramento generated $65,633 in base expenditures, and brought in revenue of $90,582 - a profit of $24,949. Additional donations to the Legacy Fund ($2,240) increased the 31 May 2013 balance to $36,926. The period ending balance in the Ruppenthal Fund was $3,655 (the Watts Fellowship balance was 'folded into' this Fund after the 2012 awards, with the stipulation that one of the Ruppenthal awards is to go to a student from Latin America). Expenditures reflect the $2,500 in Ruppenthal travel awards made and funding for the 2012 Galloping Gibbon event ($140); revenue generated by the Galloping Gibbon event totaled $396 and that from donations was $1,130. The 31 May 2012 previous balance in the Conservation Fund was $79,755; current balance as of 31 May 2013 was $73,234, reflecting only a slight change (~ 8% decline). Expenditures for the Conservation Fund totaled $11,188 and included support of the 2012 and 2013 Conservation Small Grants ($4,616 and $5,771, respectively), the Conservation Award ($750), and the 2012 and 2013 IUCN dues ($939). Revenue generated through the Amazon website ($1,029), donations ($1,419), last year's Silent Auction ($1,823), and the Galloping Gibbon event ($396) totaled $4,667.

Additional discussion focused on Wiley's movement to only electronic publication of the journal and ramifications for acquisition of print copies, and ASP subscription awards. President Bales indicated that these would be topics of discussion during a scheduled meeting with Wiley representatives, as would the potential for a 5-year membership category with a special fee.

**Research and Development Committee; Kai McCormack, Co-Chair:**

The Committee evaluated 53 proposals submitted to the General Small Research Grants competition (up from 28 in 2012); nine of these were projects to be conducted under captive/laboratory conditions, with the remainder as field projects. The 11 reviewers chose to recommend seven of these for approval, at a total of $10,500 in funding. Recommended awardees include one undergraduate student and a beginning assistant professor, with the remainder being graduate students and post-doctoral scholars. Two recommended projects are laboratory studies and five are field-based; five of the recommended projects focus on New World primates (the taxonomic focus of the majority of proposals received in this year's competition).

*ASP Executive Committee Minutes (cont'd)...*

**Awards and Recognition Committee; Peter Judge, Chair:**

The Chair reported receipt of 17 applications for the Maderas Rainforest Conservancy Scholarship for Education and Training in Field Primatology; the previous year, 19 applications were received. The Committee's consensus was that two of these should be recommended for funding. Also reported was that the Committee would only be able to announce one additional award at the 2013 meeting, as this was the only nomination received for any of the various major ASP awards administered by the Committee. The Chair indicated intention to make a plea at the closing banquet for nominations for Distinguished Primatologist, Senior Research Award, Distinguished Service Award, and the Special Recognition Award.

**Conservation Committee; Erin Riley, Chair:**

The Chair reported that membership on the Committee had been increased to 14 members with the addition of five new members, including two students. The Committee received 17 applications for the Conservation Small Grants and recommended funding four of those applications; the number of applications was down from the more usual number of ~40. For the Subscription Awards, the Committee voted to recommend both of the nominated recipients; of the two nominations received for the Conservation Award, one is being recommended.

The Committee is discussing several issues related to their activities. One is a potential change in the format of the required reports from recipients of the Conservation Small Grants; there is interest in knowing not only the results of the research, but also the impact on conservation. Related to this is a current effort by the Committee which involves a questionnaire survey of previous grant recipients to assess the impact of their projects on primate conservation; results are being generated and will be communicated to the leadership and ASP membership. Several mechanisms for fundraising also have been under discussion, including efforts to generate donations tied to public information videos about primate conservation, video interviews of previous grant recipients, or 'citizen science pages' related to primates and their conservation.

**Program Committee; Julie Worlein and Brian Kelly, Co-Chairs:**

The program committee received 219 abstracts for the 2013 meeting; two were rejected and two submitters subsequently withdrew, leaving a total of 215 (127 oral presentations, across the 8 symposia and the volunteered sessions; 88 posters). The Committee indicated that the number of symposia accepted complicated the logistics of scheduling for the meeting and wanted to recommend that the number be limited in the future (to ~ 3?), that symposia be limited to two hours in duration, and that symposia proposals include abstracts of intended presentations, rather than just titles. Discussion also included the possibility of the Board of Director's taking responsibility for inviting the Interdisciplinary Symposium, which might increase the prestige/visibility of this designated symposium. The Chairs also agreed to include in future discussions the option of an 'interactive' poster symposium, patterned similarly to these at the meeting of the American Association of Physical Anthropologists.

The Committee also wished to recommend to the Board that two 'check-boxes' be added to the form for submission of meeting abstracts: one which indicates receipt of IACUC and/or IRB approval of the research generating the abstracts; another indicating agreement with ASP By-Laws.

**Education Committee; Amanda Dettmer, Chair:**

The new format for the Student Competition resulted in a much more competitive pool of 18 1000-word 'applications;' 10 oral presentations and 8 posters. The Committee narrowed these to 14 to be judged at the 2013 meeting (8 oral; 6 posters) (pre-judging identifies the top 4-8 entries in each of the Poster/Oral categories to be judged in-person at the meeting). From these, three winners were identified ("Best" and "Honorable Mention" for the oral presentation category; "Best" for the poster presentation category). New in 2013, winners of both the Best Oral and Best Poster presentations are to each receive a $150 prize and a 1-year membership to ASP; Honorable Mention winners receive $100 cash prizes. Joshua Smith reported to the Chair that some students experienced confusion about the new format; e.g., citation style,

references. The Chair indicated that the committee would revisit the guidelines/instructions and work to further clarify these, where required, for the next competition.

The Committee did not conduct outreach activities in association with the 2013 meeting, but Cory Ross participated in the Voelker Biosciences Teachers Academy Annual Conference in April that trained 40 local teachers from south Texas. In addition, ASP again will have a booth at the 3rd Annual US Science and Engineering Festival in Washington, DC, in April 2014. ASP's participation in the past was highly successful, and the Committee will be soliciting participation from the membership.

**Student Committee (Ad Hoc); Joshua Smith, Chair:**

The Chair reported the Committee should expand to approximately 5-8 members, based on attendance at the recently-held first meeting and expressed interest on the part of other students. At least 20 students had expressed interest in the 'mixer' to be held after the poster session, and which is being supported through $200 contributed by the Board of Directors.

Several potential 'goals' of the Committee were discussed, including creation of a student page on the website that could include student-relevant information (e.g., locating appropriate graduate school programs or research field sites) and links to already-existing information on the site that would be important for students to readily access (e.g., writing a good abstract). The Committee also expressed that greater input to the Education Committee on the topic of the Student Workshop would be appreciated, as would the facilitation of contacting committee chairs for students who might wish to volunteer to join ASP committees.

**Primate Care Committee (Ad Hoc); Mollie Bloomsmith, Chair:**

The Chair indicated that the Committee has three new members and is active on several issues/goals related to primate care. The Committee has organized 'working groups' on social housing, animal training, and environmental enrichment. They are recommending to the Board of Directors that ASP endorse and post on its website the recommendations of the Association of Primate Veterinarians on social housing. The Committee also is working to develop a set of information regarding various aspects of primate welfare that could be considered for posting on the ASP website, following proscribed procedures for review and approval. Also recommended for consideration by the Board was creation of a Primate Welfare Award which would be supported through donations and include a presentation at the annual meeting. In addition, the Committee indicated intention to propose a special issue of the *American Journal of Primatology* focused on animal welfare.

**Media and Information Committee (Ad Hoc); Julienne Rutherford and Cory Ross, Co-Chairs:**

The Co-Chairs reiterated their preference that the Board of Directors proceed with the required vote to amend the ASP By-Laws and convert the committee to a standing committee of the Society. They also raised the possibility that the 'position' of Historian could be 'folded into' the committee, if it is to be maintained.

The Committee has expressed several concerns about the dissemination of official information to the membership. They expressed that the website could be made more dynamic through allowing committee chairs to directly update information on the site relevant to their committee's charge, although consideration would need to be given to maintaining the quality of that information (perhaps through preliminary review by the Media and Information Committee?). Recognizing that there could be improvement in the process of sending official emails to the membership, the Committee also wished to propose that emails be consolidated into a monthly 'email blast' to the membership, useful for distribution of general information such as job openings, etc. For email notifications that require immediate dissemination, these could still be sent as needed. Discussion of this possibility included consideration of a potential problem, that of 'opting out' of receiving emails such that important information would not be received; this might require a policy of not allowing opting out of receipt of monthly formal email 'blasts.'

*ASP Executive Committee Minutes (cont'd)...*

The Committee has concluded that moving to a 'public' Facebook page is not in the best interest of the Society and that Facebook should be a recognized 'perk' of membership in ASP (as well as receipt of the month email blasts). They also recommend that ASP have a formal Twitter 'handle' which the Committee could use to tweet during annual meetings. General discussion ensued regarding tweeting from the meeting and the potential concerns regarding unpublished data and other issues. Possible mechanisms for addressing these concerns could include distribution of guidelines on 'responsible tweeting' or workshops at the beginning of the annual meeting that would structure how Twitter is used during the meeting. The more general issue of inappropriate use of social media also generated discussion, including the potential to increase monitoring and respond quickly to hostile or other inappropriate media traffic.

**Publications Committee; Dee Higley, Chair:**

The Chair reported that editor Paul Garber will announce in his report at the business meeting that the impact factor for the *American Journal of Primatology* is now at 2.459, the highest in the journal's history. All agreed with the Chair that ASP should express its gratitude and admiration for the outstanding accomplishments achieved by Paul as editor of AJP. The Chair also indicated that submissions are increasing, the average days from submission to first decision letter is now at 34 days, which is excellent, and the journal continues to attract and publish innovative special issues of broad interest.

The Committee has been giving consideration to the issue faced by the journal's Board of editors regarding editing of papers by non-English speaking authors. They are recommending to the Board of Directors that one solution might be provision by ASP of funds to hire a "translator/editor" to work on these manuscripts.

**Other Discussion:**

At the adjournment of the meeting, Peter Judge raised the issue of attendees at the meeting not being aware of the expectation that members attend the Society's business meeting, or even not knowing that they 'can' attend the business meeting. He requested that such information about the business meeting, including when/where it is scheduled to be held, be announced with the other daily morning announcement preceding the symposia - to which President Bales agreed.

**The meeting was officially adjourned at 7:10 pm.**

Submitted by:
Carolyn L. Ehardt, Executive Secretary

**Addendum to the 2013 Reports - Submitted by Jeff French, Chair of the ASP Legacy Award Search Committee:**

The ASP Legacy Award was announced to the primatological community via a notice on the ASP webpage, emails to the Society membership, and postings on PrimateScience. The committee (Jeff French, Chair; Randy Kyes, Nancy Caine) received 13 applications for the award; one was excluded because the candidate did not yet possess the terminal degree in their career track, and thus, the committee evaluated 12 full applications.

The committee used the "Call for Proposals" as a guideline to evaluate applications. The relevant text from this document was:

*. . . a fund has been established to facilitate interdisciplinary training for an 'early-career' professional in primatology. The intent of the award is to provide for a period of short-term training in a discipline, or development of a skill-set, that is outside the recipient's area of expertise, but will add to the ability of the recipient to make unique contributions to primate research or to the agencies and organizations that affect primate research.*

*The Legacy Project Committee will evaluate the Candidate's full application, and assess the degree to which the training will lead to a career-enhancing outcome with regard to the ability of the candidate to make important contributions to the field of primatology.*

Based on these criteria, the committee reviewed and ranked applicants independently, and then conducted two phone/skype conferences to discuss the candidates and make a final selection. The committee was unanimous in identifying Dr. Julienne Rutherford as the recipient of the first ASP Legacy7 Award.

**********

Adult female rhesus macaque Macaca mulatta with infant and juvenile along the edge of the Silver River in Silver Springs State Park, Florida. These macaques are part of a feral population of rhesus macaques that has been living along the Silver River since the founding individuals were first introduced in the 1930s. Photograph by Tiffany Wade.

A yearling rhesus macaque Macaca mulatta makes a daring leap between cedar trees at the Laboratory for Comparative Ethology Field Station at NIH. Photograph by Amanda Dettmer.

## MINUTES OF THE 2013 ASP BOARD OF DIRECTORS MEETING, San Juan, Puerto Rico

President Karen Bales called the meeting of the Board of Directors to order at 6:00 pm, 21 June 2013. In attendance: Marilyn Norconk (President-Elect), Kim Phillips (Treasurer), and Carolyn Ehardt (Executive Secretary).

The following recommendations were considered by the Board:

**Recommendation:** That a total of $2000 be allocated to support Ruppenthal Student Travel Awards for four students, one of which is a student from Latin America. **Action:** Approved.

**Recommendation:** That a total of $700 from the General Fund be allocated in support of the activities and role of the Student (ad hoc) Committee ($500 for use by the Chair and/or Co-Chair; $200 for a student 'mixer' at the 2014 ASP meeting). **Action:** Approved.

**Recommendation:** The Student Committee (ad hoc) recommended that a link be established on the website which will access a 'student affairs' page with student-relevant information. **Action:** Approved, with the stipulation that the Media and Information Committee take responsibility for vetting the intended content and submission of the reviewed content to the Board of Director for final approval.

**Recommendation:** The Primate Care (ad hoc) Committee recommended that the statement on social housing by the Association of Primate Veterinarians be endorsed by the Society and posted on the website. **Action:** Tabled until the Board can fully review the statement.

**Recommendation:** The Primate Care (ad hoc) Committee recommended that a Primate Welfare Award be established and supported through donations. **Action:** Tabled pending further discussion with the originator of the funding initiative identified by the Committee as supporting the new award. The Board requires further information regarding the original intention of the identified donations and affirmation that the originator of the fund has seen and approved the proposal for the award.

**Recommendation:** The Program Committee recommended that the form for submission of meeting abstracts contain checkboxes which would indicate that 1) IACUC and/or IRB approval had been acquired for the research generating the abstracts, and 2) that the submitter agrees to the By-Laws of the Society. **Action:** Approved.

**Recommendation:** The Publication Committee recommended that ASP funds be designated to support hiring of a translator to work on manuscripts authored by non-English speakers to be published in the *American Journal of Primatology*. **Action:** Declined. The Board expressed that this activity should be the responsibility of the editors/publisher of the journal.

**Recommendation:** The Conservation Committee recommended allocation of $750 and purchase of an award plaque in support of the 2013 Conservation Award to Francis Rwabuhinga. **Action:** Approved.

**Recommendation:** That the Subscription Awards made by the Conservation Committee be suspended until discussions with the publisher (Wiley) of the *American Journal of Primatology* concerning the new policies regarding subscriptions are finalized. **Action:** Approved.

*ASP Board of Directors Minutes (cont'd)...*

**Recommendation:** The Media and Information (ad hoc) Committee recommended establishment of a system of monthly 'email blasts' which would aggregate non-time sensitive official Society email communications to the membership. **Action:** Approved.

**Recommendation:** The Media and Information (ad hoc) Committee recommended establishment and use of an ASP Twitter 'handle' by the Chair of the Committee as a mechanism for use of this medium as an information distribution tool during annual meetings of the Society. **Action:** Approved.

**Recommendation:** The Media and Information (ad hoc) Committee recommended that consideration be given to the need for the position of ASP Historian, and that if it is to be continued, the position should be 'folded into' that Committee. **Action:** Tabled pending submission of more specific recommendations from the Media and Information Committee.

**Other Business:**

In recognition of a downward trend in the activity and funding generated by the annual silent auction, the Board agreed that the Conservation Committee should work to establish plans to reverse the decline and convey those plans to the Board.

**The meeting officially adjourned at 8:00 pm.**

Submitted by:
Carolyn L. Ehardt, Executive Secretary

"Jaya," an adult male moor macaque (Macaca maura) in Bantimurung Bulusaraung National Park, South Sulawesi, Indonesia. The ecology and behavior of this group are currently being studied by US researchers and their Indonesian colleagues at Hasanuddin University in Makassar, Sulawesi. Photograph by Iskandar Kamaruddin.

# Conservation Small Grants Award Report:

## Conservation value of landscape supplementation for spider monkeys (*Ateles geoffroyi*) inhabiting rainforest patches in the Lacandona region, Mexico

**Gloria K. Pérez-Elissetche and Víctor Arroyo-Rodríguez**

Centro de Investigaciones en Ecosistemas, Universidad Nacional Autónoma de México, Morelia, Michoacán, Mexico

### Introduction

Deforestation and forest fragmentation often force primate populations to inhabit isolated and very small forest patches surrounded by an anthropogenic matrix of agricultural fields and pastures (Estrada et al. 2006; Arroyo-Rodríguez & Dias 2009). This situation represents an important risk to the survival of threatened populations (Cowlishaw & Dunbar 2000). The availability of food resources may be limited in forest patches (Arroyo-Rodríguez & Mandujano 2006; Chaves et al. 2012); yet, some patch-dwelling primates are able to supplement their food intake by using resources from the surrounding matrix, including neighboring patches, vegetation corridors, isolated trees and even agricultural fields (Asensio et al. 2009; Pozo-Montuy et al. 2013), a process named 'landscape supplementation' (sensu Dunning et al. 1992). Although landscape supplementation may be a key process for population survival in highly fragmented landscapes, little is known about the ability of most primate species to move through the matrix and feed from different landscape elements.

Here, we assessed the process of landscape supplementation in three independent groups of spider monkeys (*Ateles geoffroyi*) inhabiting three different forest patches in Lacandona, southeastern Mexico; a region that has been highly fragmented during the last 40 years. In particular, to evaluate the ability of this species to move through the matrix, we first identified the landscape elements used by this primate for feeding outside of their home forest patches. Second, we recorded the food species and food items eaten. Because of their strict arboreal habits and habitat requirements (e.g., large home range size) (Di Fiore et al. 2008; González-Zamora et al. 2009), spider monkeys are valuable models for understanding how other forest mammals might perceive the fragmented landscape in terms of food availability and isolation. The information gathered from studies with spider monkeys will therefore allow us to develop conservation programs for this and other mammal species at the landscape level.

### Methods

The study is part of a larger project in which we are reviewing the ability of spider monkeys to move through the matrix and feed from different landscape elements throughout their geographic range. Here we present only the methods and results of the study conducted between May and June 2012 in the Marqués de Comillas region, a fragmented and bordering zone of the Montes Azules Biosphere Reserve, Lacandona rainforest, southern Chiapas, Mexico. We studied three spider monkey communities located in three different forest patches (35, 75, and 325 ha). The size of the smaller patch (35 ha) is lower than the average home range size of spider monkeys in continuous forest in the region (ca. 50 ha; Chaves et al. 2012).

We sampled subgroups of monkeys from 7 am to 4 pm during five consecutive days, once every 15 days totaling 180 sampling hours per community. We used 5-min focal animal sampling, and focal animals were randomly changed at 10-min intervals or when animals moved out of sight. We recorded the plant species used and food item eaten. Only adult individuals were recorded.

**Results**

We only observed landscape supplementation events in the smallest patch, which was bordered by a cocoa plantation and other kinds of agricultural lands. In this patch, monkeys were seen feeding from a cocoa plantation (38 supplementation observations), a live fence (5 observations) and an isolated tree (1 observation). In the cocoa plantation they used 9 plant species (*Attalea butyracea*, *A. cohune*, *Cupania glabra*, *Mangifera indica*, *Pithecellobium hymenaeifolium*, *Smilax* sp., *Swietenia macrophylla*, *Theobroma cacao* and *Pouteria sapota*). These species were mainly used as a source of fruits (76.2% of the time feeding in this landscape element), bark (13.3%) and leaves (10.5%). In the live fence they used *Mangifera indica* and *Pouteria zapota*. From these tree species they spent 100% of time feeding on fruits (Fig. 1). Finally, a subgroup of three adult males also fed on fruits from an isolated tree of *P. hymenaefolium*. To reach this isolated tree (located 10 m apart from the border of the home patch) the monkeys walked through a wired fence (Fig. 2), and then came back to the home patch walking on the ground.

a. b.

**Figure 1**. Spider monkeys feeding on the fruits of *Mangifera indica* (a) and *Pouteria zapota* (b) in a live fence connecting their home forest patch and a cocoa plantation in the fragmented Lacandona rainforest, Mexico.

**Figure 2**. Movement of an adult male of spider monkey (*Ateles geoffroyi*) across the barbed wire of a wired fence to feed on fruits of an isolated tree of *Pithecellobium hymenaeifolium* in the fragmented Lacandona rainforest, Mexico

## Discussion

Despite the short time period of our study, we observed a large number of supplementation events (n = 44) compared with previous studies. For example, Asensio et al. (2009) only observed 10 events in two groups of howler monkeys (*Alouatta palliata*) during a 2-year period in Los Tuxtlas, Mexico. Yet, these events support the idea that agroecosystems (e.g., cocoa plantations) represent key landscape elements for primate conservation (Estrada et al. 2006), as most supplementation events (86%) occurred within a cocoa plantation. This can be related to the fact that this landscape element offers more protection against predators and hunters, and more food sources than live fences or isolated trees. Interestingly, in most cases monkeys fed from fruits of native (e.g. *T. cacao; P. zapota*) and introduced tree species (*M. indica*) that are propagated by local people, highlighting the importance of such species for primates. In fact, it was noteworthy that spider monkeys left their home patches to feed principally from fruits. This supports the idea that these feeding events contributed to supplement their diets, as these items are of higher nutritional value than other plant items (see Asensio et al. 2009). Thus, consistent with an increasing number of studies on the topic (Asensio et al. 2009; Chaves et al. 2012; Pozo-Montuy et al. 2013), our preliminary results underline the importance of these landscape elements for the survival of spider monkeys in highly fragmented landscapes, as they can provide important food resources and landscape connectivity.

## Acknowledgments

This research was funded by the American Society of Primatologist (ASP Conservation Grant 2012) and the Programa de Apoyo a Proyectos de Investigación e Innovación Tecnológica (PAPIIT), DGAPA-UNAM (Projects IA-203111 and IB-200812). GKPE obtained a scholarship from the CONACyT, Mexico. The Centro de Investigaciones en Ecosistemas (UNAM) provided logical support. We are indebted to the local people of the Marqués de Comillas región.

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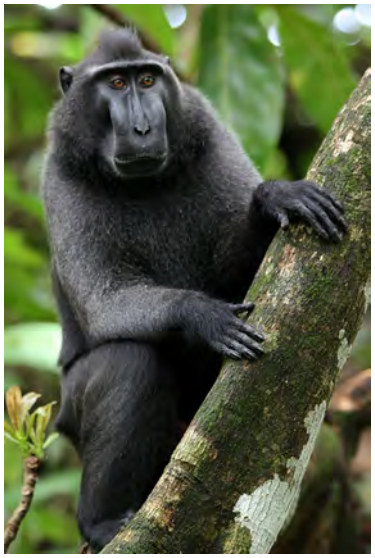

Sulawesi crested black macaque (*Macaca nigra*) Conservation status: Critically Endangered

# Conservation Small Grants Award Report:

## "Tangkoko Conservation Education"
## Environmental and conservation education for the local community surrounding the Tangkoko-Duasudara nature reserve, North Sulawesi, Indonesia

**VICTOR WODI and MATHILDE CHANVIN**

Synergy Pacific Institute for Sustainable Development, Manado, Sulawesi, Indonesia

**INTRODUCTION**

Sulawesi is the fourth biggest island of Indonesia and part of the Wallacea region, one of the 25 biodiversity hotspots of the world for conservation priorities (1). Due to his geographical situation, Sulawesi is of particular interest with respect to primate endemism, as it hosts seven macaques species found nowhere else in the world (2). The Tangkoko-Duasudara Nature Reserve, situated in North Sulawesi, Indonesia, is a unique protected area of around 88000 hectares, home of many endemic primate species, noteworthy the spectral tarsier (*Tarsius tarsier*) and the crested macaque (*Macaca nigra*). However, despite being a protected area, wildlife is often the target of poachers. Furthermore, illegal logging, agri-business, and non-sustainable farming practises occur around the area and increase habitat loss (3). Due to these threats, crested macaques are listed as critically endangered by the IUCN red list since 2008. Population surveys conducted over the last four decades have documented an 80% decline in this taxon's population size (4). It is estimated that there are perhaps as few as 5,000 individuals left in North Sulawesi (ditto). This is why an urgent and sustainable action is needed locally to avoid the extinction of this species.

Tangkoko Conservation Education, a conservation education programme, taking place around the Tangkoko-Duasudara nature reserve, aims at giving the survival of this species in this reserve a long-term perspective. To achieve this goal, we develop education and conservation activities for local population (especially school interventions for young people), in order to increase their knowledge and awareness towards the crested macaques and the local biodiversity.

**METHODS:**

Our methods consist in bimonthly educational interventions such as theoretical presentations, field trips in the reserve and a wildlife rescue centre, and various workshops about the Tangkoko reserve and its wildlife (especially the crested macaques). These interventions are implemented at school, with the help of local stakeholders such as local guides,


Map of the Tangkoko-Duasudara reserve and the villages involved in our programme (Macaca nigra Project)

researchers from the Macaca Nigra Project, Tasikoki wildlife rescue and education centre, Selamatkan Yaki conservation programme, and the local government authorities for nature conservation (BKSDA).

These organisations take part in our interventions, field trips and/or provide us with valuable material to engage with the pupils.

This project has started in 2011 in one village surrounding the reserve (Batu Putih), following by another project in 2011-2012 including two more villages (Pinangunian and Winenet). The Conservation Small Grant Award provided by ASP has helped us to conclude our 2011-2012 activities, and complete a third school year in two other surrounding villages, Sagerat and Kasawari, starting August 2012 until June 2013. This project has involved 7 primary schools and 4 junior schools, for a total of around 330 pupils between 8 and 15 years old.

For this 2012-2013 school year, we gave evaluation questionnaires to the pupils before and after the programme, in order to measure the effectiveness of our action on their knowledge, attitudes and behaviours regarding the reserve ant its wildlife.

**RESULTS:**

This evaluation is based on 331 pupils' questionnaires before the school year programme (September 2012) and 292 after the school year programme (April-May 2013).

**First results of the evaluation and comments (work in progress)**:

We do not perceive an improvement about the pupils' **habits** regarding the forest: activities such as taking wood from the forest displayed a small increase: 73% of the pupils declared that their families took wood before the programme and 86% after. This result might be explained by the difficult socio-economic situation in Indonesia at that time. Indeed, during this 2012-2013 year, the price of cooking fuel has drastically increased in North Sulawesi, and during some weeks the towns were running out of gas, both essential for the villagers to cook. Therefore, local communities relied on wood. However, we can see an improvement regarding pupils' habits towards wildlife, as they seemed to realise that wildlife should remain in the wild: Before the programme, 24% wished to have wildlife as pets, whereas 10% still wish after the programme.

Regarding their **knowledge** about Sulawesi and Tangkoko fauna, we can mention a significant improvement: For example, pupils are more familiar with recognising all the animals of Sulawesi based on pictures. The best improvement concerns the Babirusa (*Babyrousa babyrussa*), as 34% of the pupils wrote the correct name of this animal before the programme (it was more considered as a wild pig), and 75% after. They also have a better understanding of the protected and endangered status of the crested macaque: 77% of the pupils acknowledged the fact that crested macaques were a protected species and 90% after the programme. Before the programme, 51% acknowledged its endangered status and 69% after the programme; The number of appropriate answers given by pupils increased when asked to write the names of animals present in Tangkoko, though they seem to focus more on crested macaques rather than other animals (33% wrote "crested macaque" before the programme, and 70% after).

The results also demonstrate that there is an improvement regarding how children declare to react when encountering crested macaques in their local environment (the forest) or in their gardens/crops. They perform less disturbing activities such as approaching or feeding the macaques: 19% of the pupils approach the macaques in the garden before, 9% after; 29% of the pupils approach the macaques in the forest before, 18% after. 15% of the pupils feed the macaques in the garden before, 7% after; 27% of the pupils feed the macaques in the forest before, 7% after. This good result can be explained by our trips to Tangkoko forest where the pupils observe the macaques in their natural environment, and where the local guides and researchers explain them the appropriate behaviour to adopt next to the animals. Finally, they overall are interested to be part of our education programme: 72% wrote that they were interested before, and 82% after.

Through these first results are encouraging, we consider that we still need to pay attention to help the pupils and their family improve their habits (especially regarding eating wildlife and taking wood from the forest). We consider that our project has a positive impact on the pupils' knowledge and attitudes, and they seem to show interest about the topics we teach them. Therefore, we consider that we need to carry on our actions on a regular and long term basis in order to confirm that this project can have a positive effect on the protection of crested macaque and Tangkoko forest through education. More detailed data will be added at a later stage, and published in an assessment article about the education programme in Tangkoko.

**ADDITIONAL INFORMATION:**

Part of the funds of the ASP grant are those related to the May 2012's program's restitution final event to the local community that we held each year with the participation of the pupils involved in our programme. Therefore, these funds have helped us to edit promotion material and install 11 information posters in each school involved in our programme. These posters helped the schools pupils involved to have a summary of the information learned during this year with our Tangkoko Conservation Education programme.

Parts of the fund have also helped us to cover the edition of an education booklet based on our lessons, as well as the fees for a scientific illustrator, Elodie Philippe, who works with us on this booklet. It will be used as a pilot education tool during this 2012-2014 school year.

**ACKNOWLEDGMENTS:**

This 2011-2013 school years' programme was funded by the Rufford Small Grants for Nature Conservation, the American Society of Primatologists and the Primate Society of Great Britain.

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Mathide Chanvin and Victor Wodi in one of the schools


School pupils of Winenet with the information panels that we have provided to the schools which are part of our education programme.

In the classroom in Batu Putih village: experimenting the illustrated booklet with the pupils (Lesson 1: Environmental Changes)

# Conservation Small Grants Award Report:

## *Problems in protecting both food security and biodiversity: a case study of the relationship between primate pests and the livelihoods of subsistence farmers in rural South Africa*

**RORISANG MOKOENA**

University of the Witwatersrand, Johannesburg, South Africa

**Introduction**

The conflict that arises between rural subsistence farmers and non-human primates (here-after: primates) as a result of crop-raiding events raises two key concerns: the impact of the often violent retaliations from the farmers on the primate populations (Hill, 2000; Lee, 2010) and the socio-economic impact on the farmers (Campbell-Smith *et al.*, 2010; Hill, 2000; Strum, 1994). In this study, these two factors were specifically viewed in terms of the food security of the farmers and the conservation of the primates they interact with.

Few studies have investigated the human-primate interface in South Africa, with the bulk focusing on the impact on semi-urban chacma baboon populations in the Western Cape Province (see Kaplan *et al.*, 2011; van Doorn *et al.*, 2010). One study examined human-primate interactions by canvassing the attitudes of commercial farmers towards baboons that raid their farms situated near the Suikerbosrand Nature Reserve in Gauteng (Pahad, 2010), making this study the first to explore these interactions in a rural subsistence context. The broad aim of the study was to assess human and non-human primate interactions in a rural subsistence community in KwaZulu Natal, South Africa. The study addressed three research questions: (1) Is there perceived primate-related conflict as a result of crop-raiding? (2) Do the farmers respond to raiding? (3) What are the farmers' attitudes towards crop raiding primates?

**Methods and materials**

The study took place in the Jobe ward (KwaJobe) in the Jozini Municipality district (27º36'S, 32º20'E) on the Maputuland coastal plain of KwaZulu Natal, South Africa. The Mkuze Game Reserve is to the west and south of the ward, naturally separated by the Mkuze River which flows into a floodplain and several pans in the village. Data collection took place between 26 May and 2 June 2012 and with permission to conduct the study in KwaJobe from the local tribal authority. Interviews were conducted with 35 farmers through the aid of a local interpreter. In all cases, either the household head or family member in charge of farming activities was interviewed. GPS (global positioning system) points were also taken for the farmers' cultivated fields where possible. Feedback on the research outcomes was presented to members of the KwaJobe community in June of 2013.

**Results and discussion**

The primate species of concern in KwaJobe were identified to be chacma baboons (*Papio hamadryas ursinus*) and vervet monkeys (*Chlorocebus aethiops*). Most of the farmers were found to be Christian females who were also heads of their households.

Most of the farmers interviewed claimed to experience primate raiding in their cultivated fields. Vervet monkeys were identified as the most common crop raiding primate species; most of the farmers reported raiding by both vervets and chacma baboons, followed by farmers reporting only vervet raiding, while few farmers reporting raiding by chacma baboons alone.

Crop assemblages and the distance of the cultivated field from the reserve fence were found to influence the incidence of crop raiding by primates. These findings were similar to the findings of studies conducted in Uganda (crop assemblages: Hill, 2000; Naughton-Treves, 1998; distance from fence: Saj *et al.*, 2001).

A large proportion of the farmers who experienced crop raiding by primates responded to the raiding using either active or passive deterrence methods. Similar to other studies, most of the farmers who experienced raiding responded using active

deterrents, with the most popular method being chasing away the primates (Marchal & Hill, 2009; Saj *et al.*, 2001; Strum, 2010). The most popular passive response in this study was to hang up old blankets as a scarecrow. Only one male farmer reported that he trapped or killed primates found in his field; the remaining farmers provided a variety of reasons for not trapping or killing primates found in their fields. The most common reason given was that the farmers did not know how to trap or kill the primates. This was closely followed by fear, physical inability, and that trapping and killing were not tasks suitable for women to carry out.

Most of the farmers in the study believed that the primates were entitled to be in the community, regardless of whether they experienced or did not experience crop raiding by non-human primates. The reason most commly given for this opinion was that primtes were created by God and so had a right to be in the community. This was an important factor in this context as there is no legislation that specifically protects primates in South Africa. It thus becomes pertinent to identify additional ways of increasing tolerance in human-wildlife conflict systems (Riley, 2007). The views expressed by the farmers in KwaJobe raise the question of whether the primates in KwaJobe enjoy some level of protection because most of the farmers are female and Christian.

## Conclusion

The findings of this study confrim that conflict between the subsistence farmers and primates, mainly vervet monkeys, exists in KwaJobe. The crops planted and the distance of the farm from the reserve fenceline were found to be likely predictors of raiding taking place in a field and the raidng was most likely met with an active form of deterrence. However, most of the methods used did not lead to the capture or killing of primates, which is most likely because most of the farmers are female or that many of the farmers were tolerant of primates in their community for religious reasons. It is recommended that the tolerance found in the system be explored by local conservationists and that further studies should be undertaken to provide quantitative measures of livelihood impacts and the impacts on the primate populations in South Africa as a result of the human-primate interactions.

## Acknowledgements

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A trap found on one of the respondent's cultivated field.

One of the KwaJobe farmers in their cultivated field.

Walking along the Mkuze River which separates the Mkuze Game Reserve and KwaJobe.

# Conservation Small Grants Award Report:

## *Exploring the Role of Conservation Education and Environmental Communication in Human Wildlife Conflict Resolution*

**JULIE SHERMAN**

Executive Director, Pan African Sanctuaries Alliance

### BACKGROUND

Africa's great apes and monkeys are among the most iconic species on earth, yet many of them are in peril due to human-wildlife conflict, habitat destruction, the bushmeat and pet trades, and emerging infectious diseases. Human-wildlife conflict is a well-known phenomenon across Africa. According to the IUCN Primate Specialist Group, conflicts between humans and great apes have been intensifying, often due to competition over resources such as food and water or attacks on humans by the apes (Hockings and Humle, 2009). As human populations continue to grow, encroaching on the primates' remaining forest habitat, these types of conflicts are inevitable. It is therefore essential to have a plan for mitigating these conflicts to minimize the impacts on both humans and nonhuman primates.

The Pan African Sanctuary Alliance (PASA) was established in 2000. It is the only network of wildlife sanctuaries, global experts and local communities working across Africa to protect endangered primates and their habitats. We work to keep primates in their forest homes by engaging local communities, law enforcement, and governments to support primate protection laws, conserve vast tracts of natural habitat and halt the hunting and habitat destruction threatening Africa's primates with extinction. There are currently 22 PASA member sanctuaries in 12 countries stretching from Gambia in the west to Kenya in the east.

A key component of our work is providing professional development opportunities for African nationals working in wildlife conservation, education, and the primate healthcare field. PASA has provided professional training to sanctuary educators for ten years, enabling them to empower a new generation of African conservationists. PASA's 2013 Education Workshop was held in Yaoundé, Cameroon and was hosted by Ape Action Africa. The workshop was the first step in a three-year project on Human-Wildlife Conflict Resolution.

PASA 2013 Conservation Education Workshop


Educators Severin Bipan, Patricia Poaty, and Irene Erdem test educational teaching tools

### METHODS

The PASA 2013 Human-Wildlife Conflict Resolution (HWC) workshop was attended by 25 conservation educators from PASA member sanctuaries across Africa. Facilitators and trainers came from Africa, Canada and the United States. Attendees identified and explored the sources of conflict about primates and natural resources in their communities, and challenged each other to develop methods to address these issues. Communication methods were highlighted and attendees were able to practice their new skills through group exercises and participation. They also worked on programs

that teach local communities about the value of protecting native forests and wildlife and about halting the bushmeat and pet trades.

Goals of the workshop were:

1. To build the capacity of local sanctuary staff members to increase education and communication program efficiency that promotes awareness and protection of primates and their habitats.
2. To improve the ability of PASA education staff to assess and address human wildlife conflict in conservation projects.
3. To incorporate concepts of mitigating human wildlife conflict resolution including communication, facilitation and education into sanctuary programs.

Objectives included that workshop participants will:

- Understand the mission and vision of PASA including the history, minimum standards and best practices;
- Communicate their sanctuary's goals, objectives and successes with regards to conservation education and environmental communication;
- Define the concepts of conflict, resolution and human/wildlife conflict resolution and its role in conservation projects;
- State the difference between conservation and development projects;
- Define the common conflict situations faced by sanctuaries;
- State the common dynamics of conservation conflict and analysis models including the levels of conflict, conflict mapping and conflict transformation;
- Practice common skills that sanctuaries can use when addressing HWC situations including communication, facilitation and leadership;
- Strategize different types of process and resources to address conflict.

## RESULTS

The effectiveness of the workshop was evaluated by pre-post surveys. Some highlights of the results include:

- After the workshop, 40% of workshop attendees felt that they gained knowledge in communication techniques, 27% learned about conflict resolution, and 20% learned about education techniques.
- When asked what they would take back to their respective locations, 50% of workshop attendees mentioned types of education techniques, 14% mentioned communication skills, 7% mentioned conflict resolution skills, and 29% mentioned other skills they had learned.
- When asked to share conservation stories, 36% of workshop attendees shared a story about how their programs had led the community to inform them of injured wildlife that they then assisted, 36% of attendees shared a story about how their education programs had changed views or shaped the way of life of a local community (cleaning up the environment, etc.), and 27% of attendees shared a story about how hunting rates have been reduced in an area because of their programs.

Africa Education Coordinator Jeta James and Executive Director Julie Sherman present at the workshop

Single Mothers Craft Group started by Ape Action Africa

PASA sanctuary community conservation programs have resulted in measurable success in 28 communities (see Birungi, 2012; Bettinger et al., 2012; Fawoh, 2012; Lehnhardt et al., 2010). A survey of PASA sanctuaries showed that staff engages more than 500,000 people each year, and almost half the sanctuaries felt that community development and relations activities have the most significant impact on conservation. Workshop participants shared stories about the impact of their community conservation education programs:

- Lola ya Bonobo (DRC) recently had a former bushmeat hunter arrive at their center to turn in his gun, because he said he now realizes it is a mistake to kill bonobos and other endangered animals.
- A Vervet Monkey Foundation (South Africa) educator was told by a mother in the grocery store about how much she appreciated the Foundation's work to teach her children to care for local wildlife.
- Ape Action Africa (Cameroon) works with a group of local single mothers who collect and clean plastic trash, turning it into purses and other useful items to sell. They also train villagers to build energy efficient cook stoves out of local materials.

Village elders and Ape Action Africa educators teach participants about making energy efficient cookstoves from local renewable materials

**SIGNIFICANCE**

Conflicts between humans and nonhuman primates are increasing as human populations expand into Africa's remaining forests. *In situ* conservation organizations must be able to minimize the impacts of this conflict to both humans and nonhuman primates. This PASA workshop on Human-Wildlife Conflict Resolution prepared conservation educators from 22 sanctuaries to work directly with their local community members to address this conflict and protect wild primates and their habitat. Six sanctuaries applied for funding to conduct community meetings to identify local HWC issues and discuss potential solutions. Meetings are taking place in several communities across Cameroon, Democratic Republic of Congo, Republic of Congo, Nigeria, Uganda and South Africa. This first workshop of a three year program will be followed by a needs assessment and collection of data on HWC; development of HWC intervention plans; training for implementation of the intervention plans; and finally implementation and evaluation of the intervention plans.

**ACKNOWLEDGEMENTS**

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# Research Small Grants Award Report:

## *Habitat degradation and lemur-fruit tree mutualisms in Madagascar*

**KIM REUTER[1], ANDREA GUDIEL[1], SHANE NIEVES[2], BRENT SEWALL[1]**

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Crowned Lemur

**Abstract:** Over 90% of Madagascar's forests have been logged, fragmenting habitat critical to the *Eulemur coronatus* and *E. sanfordi* lemurs and disrupting their fruit-tree mutualisms. It is unknown how these lemurs, whose population densities have declined, are reacting to these decreased habitat and food resources. One way to accurately assess the impact of habitat degradation on lemur food sources, and learn which food sources are preferred is to quantify effectiveness and utilize mutualistic network analyses. Measured effectiveness has not been used in a mutualistic network analysis, and has before not been used to help identify key food sources primates. This study highlights specific tree species that are most important to lemur populations, across a gradient of degradation.

**Introduction:** Frugivorous primates and other vertebrate frugivores provide an important seed dispersal service to fruit-bearing trees in tropical forests. The critical importance of this interaction is illustrated by the reproductive failure observed to occur in fruit-bearing trees after the complete loss of frugivores from forest communities.[1] However, human-modified forests are expanding rapidly worldwide,[2] and the influence of gradual anthropogenic modification on mutualistic interactions remains unclear, especially among frugivorous primates. Mutualistic networks – which model mutualistic interactions among suites of interacting partners, including those between fruiting plants and frugivores – can clarify how habitat modification is affecting species interactions,[3-5] while systematically identifying species important to prioritize for conservation purposes. Nevertheless, the application of quantitative studies of mutualistic networks to understanding community interactions of primates has been limited.[6-8]

Past research utilizing mutualistic networks noted solely the presence-absence of an interaction or its frequency, or considered only one of the partners; these approaches convey only limited ecological information.[6, 7] This study will be the first to use effectiveness – the quantitative effect of one interactor on its partner[9] - to describe mutualisms in networks. In other words, while researchers have considered mutualistic networks in the past, they have never measured these interactions in a way that shows the benefits obtained by *all* participants in diffuse mutualisms;[10] we expand the use of mutualistic networks by describing the mutualisms of *Eulemur coronatus* and *E. sanfordi*, two diurnal lemurs that can only be found in northern Madagascar,[11, 12] a biodiversity hotspot.[13] Population estimates indicate that only 1,000 – 10,000 *E. coronatus* remain,[14-16]

with even more reduced *E. sanfordi* populations.[14] These species are listed as Vulnerable and Endangered, respectively,[11, 12] and persist in highly fragmented habitats, where their primarily frugivorous diets tie them strongly to fruit-bearing trees in forested areas, including our study site (Ankarana National Park).[17] Measuring interactions of all participants in the mutualistic network will enable new insights into costs and benefits of interactions and the asymmetrical nature of many mutualisms. It is also the first study to study how these mutualisms vary over a gradient of habitat modification, to highlight how *E. coronatus* and *E. sanfordi* are changing their feeding behaviors and interactions with mutualistic partners over increasingly disturbed and fragmented habitat. The increased understanding of these interactions will help conservation managers better plan restoration programs and predict where ecosystems will experience secondary extinctions after the loss of an important mutualist partner.[4] In this study, we aim to increase understanding of lemur interactions with fruit-bearing trees by examining community organization and structure across increasingly disturbed habitat.

**Methods:** This research was based in the semi-evergreen forest within and surrounding the northern Malagasy Ankarana National Park. Three distinct forest types were included in this study: primary forest, secondary forest, and degraded forest.[18] This study examined frugivore visits (including *Eulemur coronatus* and *Eulemur sanfordi* and five birds species) to 13 fruiting tree species in three forest types, over the course of 684 hours of observation, across 0.0067 $km^2$. Species richness and density of the fruiting tree and frugivore communities were quantified.

Mutualisms were quantified between fruit-bearing trees, the two lemurs, and five birds using an effectiveness measure of mutualistic interactions that quantified the benefits gained by the fruit-eating animals and the seed dispersal benefits received by trees. For the purposes of this study, the *effectiveness of mutualist interactions for frugivores was be defined as the consumption rate of fruit biomass (*a product of visitation rate, per-visit fruit consumption, and fruit mass), and the *effectiveness of the interaction for fruit trees was the number of seeds dispersed beyond the tree canopy* (product of visitation rate, per-visit fruit consumption and fruit removal from the canopy, and seed quantity per fruit). Mutualist networks (one network per forest type) were analyzed for their connectance and other network characteristics.[6]

**Results:**

*Frugivores in degraded forests:* We found that frugivores varied in how they compensated for changing mutualistic partners in degraded forests. For example, the bird *H. madagascariensis* increased its generality – the proportion of potential partners with which it interacted – by maintaining and establishing new pairwise mutualistic interactions (relative to the primary forest) the more degraded the habitat became. In contrast, *E. coronatus* decreased its generality (the proportion of species with which it interacted) markedly from the primary to the degraded forest. Of the two lemur species, only *E. sanfordi* was an important seed disperser and mutualistic network partner for its importance in dispersing seeds in the primary forest when birds were functionally excluded (due to gape size restrictions) from being seed dispersers in round two of data collection.

The two lemur species varied in their species degree across the different forest types and differed in their response to habitat degradation. *E. sanfordi* had a higher species degree (interacted with more species) than *E. coronatus* in the secondary forest, though the opposite was true in the primary forest. Only *E. coronatus* was observed consuming fruit at trees in the degraded forest. *E. coronatus* contributed 14.5% of all seed dispersal services (per capita) in the primary forest. *E. sanfordi* contributed 60% of all seed dispersal services recorded in the primary forest. In the secondary forest, *E. coronatus* contributed only 5.3% of seed dispersal services, while *E. sanfordi* contributed 18.6% of seed dispersal services.

*Important fruiting tree sources for frugivores: Ficus grevei* seems to be the most important fruit source for most frugivores in the primary and secondary forest. *F. grevei* not only provides fruit to almost all the frugivorous species, but also provides the most fruit biomass, on average, to an individual forager (average per-capita benefit provided) for many of the frugivores studied. On a per-capita basis, *F. grevei* provided 76.3% of all fruit biomass consumed by secondary forest. When this species was fruiting in the primary forest, it provided 78% of all fruit biomass benefits consumed by frugivores on a per-capita basis.

*Mutualistic network changes in degraded forests:* In accordance with our hypothesis, the primary forest had the most complex mutualistic network with 14 interacting species (7 trees and 7 frugivores). Modified forests had less complex mutualistic

networks with fewer interacting species; the secondary forest had 12 interacting species (6 trees and 6 frugivores) and the degraded forest had 7 interacting species (4 trees and 3 frugivores). In addition, like in many other mutualistic networks, our networks had many specialists, some generalist, and few super-generalists. However, the degraded forest had less generalists than the secondary or primary forest.

The mutualistic network structure was less connected in degraded habitats. The connectance of the mutualistic networks decreased from 0.286 in the primary forest, to 0.244 in the secondary forest, and 0.143 in the degraded forest. The average number of mutualistic network partners that both frugivores and fruiting tree species interacted with, decreased as the habitat became more modified: frugivores had an average of 1.79±2.28 partners in the primary forest, 1.38±1.71 in the secondary forest, and 0.86±1.46 partners in the degraded forest. Likewise, fruiting tree species had an average of 2.13±2.10 frugivore partners in the primary forest, 2.00±1.83 partners in the secondary forest, and 1.20±1.10 partners in the degraded forest. Finally, the likelihood that a visiting frugivore would consume fruit at a tree decreased as the habitat became more degraded. In the primary forest 69.62% (165 of 237) visits by frugivores to fruiting trees resulted in fruit consumption. This decreased to 51.41% (164 of 319 visits) and 34.29% (24 of 70) of visits in the secondary and degraded forests, respectively.

**Discussion:** We found that habitat degradation caused the characteristics of forest types to change significantly, and that this affected the strength of mutualisms that fruit-eating animals maintained with fruiting trees. This was especially true for our two focal lemur species, who differed in their response to deforestation. Though both lemur species were found in all three forest types, only *E. coronatus* was recorded consuming any fruit in the degraded forest. This indicates that *E. sanfordi* has a different response to habitat degradation than *E. coronatus*, despite their similar habitat and diet requirements. We also found that *Ficus grevei* seemed to be the most important fruit biomass provider to our focal lemur species, despite their relatively low densities, compared to other fruiting tree species. Finally, we found that the mutualistic network as a whole became less stable as the forest became more degraded, presumably due to the change/loss of preferred fruiting tree species in degraded forests.

Ongoing work will aim to further quantify benefits exchanged in these frugivore-fruit tree mutualisms. In addition, portions of this research are currently being prepared for publication in two manuscripts; one focusing exclusively on the lemur species, with a second manuscript discussing larger changes to the mutualistic network as a result of habitat degradation.

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Crowned lemur eating fruit

Destruction in Madagascar

# Research Small Grants Award Report:

## *Behavioral inhibition and stress regulation of the immune system*

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**Background:** Behavioral inhibition reflects a disposition to react warily in novel situations, and has been long associated with inflammation-mediated diseases like asthma.[1,2,3] Although a wide variety of studies have confirmed this relationship, few have investigated possible mechanisms underlying the relationship between behavioral inhibition and inflammation. I aimed to understand how behavioral inhibition during infancy predicts altered immune function during young adulthood in rhesus macaques (*Macaca mulatta*).

Continuity of behavioral inhibition from yearling age to adulthood (Aim 1). Our first goal was to examine the stability of behavioral inhibition through early adulthood. Coll et al. (1984) found that human infants at the extreme end of the spectrum of behavioral inhibition continue to be behaviorally inhibited throughout childhood, while infants characterized as only moderately inhibited do not maintain this temperament style as they mature. Coll et al. (1984) therefore concluded that there is a degree of discontinuity in behavioral inhibition. On the other hand, Caspi et al. (1989) found that behavioral inhibition shows moderate continuity from childhood to adulthood: children that had previously been identified as shy and reserved develop into adults who describe themselves as nonassertive and overcontrolled. In rhesus monkeys, inhibited infants retained this temperament style as adolescents by showing less activity, exploratory behavior, play, and other social behavior.[6] We previously characterized rhesus monkeys as behaviorally inhibited in infancy, then later quantified behaviors in both naturalistic and stressful environments at one year of age.[7] We found that behaviorally inhibited infants show less social behavior as yearlings in the naturalistic environment, and also display more anxious behavior in stressful environments.[7] Although much of the data suggests considerable continuity of behavioral inhibition, the substantial individual variation in developmental consistency necessitates repeated assessments of behavior in order to ascertain the extent to which behavioral inhibition changes over time. In our proposal we assessed social behavior in a naturalistic setting at four years of age.

Continuity and specificity of HPA axis regulation of immune function (Aim 2). One mechanism of the aforementioned link between behavioral inhibition and health may be through stress response systems; particularly the hypothalamic-pituitary-adrenal (HPA) axis.[8] The HPA axis uses glucocorticoids (GCs, i.e. cortisol) as its main effector molecule. GCs regulate the immune system by countering inflammation, principally through suppressing the production of inflammatory proteins, like cytokines, which are used by immune cells to promote inflammation: GCs are anti-inflammatory. Behavioral inhibition has been associated with altered activation of the HPA axis and HPA regulation of immune cells may present a mechanistic link between behavioral inhibition and health outcomes. For example, prolonged stress may lead to decreased responsiveness of immune cells to GCs, thereby blunting their anti-inflammatory properties. This decreased responsiveness of immune cells is known as glucocorticoid resistance (GCR): even in the presence of GCs, immune cells do not suppress the production of inflammatory proteins. Therefore GCR may manifest as inflammatory disease. In previous work[9], I quantified GCR *in vitro* by looking at gene expression of interleukin-12 (IL-12; an inflammatory cytokine) in response to an antigen (staphylococcal enterotoxin B (SEB)) and varying molar concentrations of dexamethasone (a synthetic GC). With increasing concentrations of dexamethasone, non-inhibited animals showed the expected dose-response decrease in IL-12 gene expression, while inhibited animals showed no effect, suggesting that IL-12 expression was GC-resistant ($F(5,53)=3.554$; $p=.023$).[9] To look at the continuity of GCR, we used the same assay to look at stability of the immune response in older animals.

**Methods:**

Behavioral Measures (Aim 1).

*Behavioral observations:* Animals were observed at the half-acre, outdoor, field corrals at CNPRC for 10-minute focal observations four times a week for two weeks, using a standard ethogram of behaviors for this species. We quantified age/sex classes of subjects' interactants as well as behaviors including: proximity, contact, grooming, and emotional behaviors (vocalization, scratch, lipsmack, threat).

*Dominance rank:* CNPRC behavioral management staff collected data for 30 minutes on a weekly basis, at least 3 times a month. Scan sampling was employed, using the HanDbase program to record dyadic displacement interactions between individuals. A hierarchy grid was used to analyze the best hierarchical configuration for each given field corral. Using the hierarchical configuration, subjects were arranged in a rank order. For analyses, subject rank was divided by the number of same-sex individuals in the field corral. Normalized ranks that were less than 33% were categorized as high ranking, between 33% and 66% were mid-ranking, and above 66% were low ranking.

Physiological Measures (Aim 2).

*Whole blood stimulation assay:* A total of 5 ml of blood was drawn by femoral venipuncture. Blood was cultured for 24-hr with SEB and dexamethasone (Dex), a synthetic GC. SEB was used to stimulate immune cells and the functionality of the immune system was quantified by measuring IL-12 expression in response to stimulation. The concentration of Dex that was used was the concentration that showed the largest difference between inhibited and non-inhibited animals during yearling age. If, in the presence of Dex, IL-12 expression shows no decrease in response to SEB, the subject is GCR.

**Data Analysis:**

To better understand how behaviorally inhibited and non-inhibited animals differed in adult behavior, we used bivariate tests with behavioral inhibition as the predictor variable and outdoor field corral behaviors as outcome variables. We then used multiple regression to predict adult non-social duration as the outcome measure with dominance rank and sex as covariates and tested predictors including: behavioral inhibition characterized during infancy, non-social duration as yearlings, and finally their respective interactions. Interactions between all variables were tested and interactions that were non-significant were removed from the model.

Repeated measures ANOVA was used to analyze the dose effect of dexamethasone on concentration of cytokines with the between subjects factor of behaviorally inhibited animals and non-inhibited animals. Significant results were followed by a series of T-tests that were corrected for multiple comparisons. All analyses were done in SPSS software version 18.0 (IBM, Armonk, NY).

**Results:**

Continuity of behavioral inhibition from yearling age to young adulthood (Aim 1). Bivariate analyses of outdoor field corral behaviors and the BI classification variable revealed no significant relationships ($p$>.206). However, yearling non-social duration was highly correlated with adult non-social duration ($p$=0.005). We then used multiple regression to see which factors contributed to adult non-social duration (outcome variable). Low ranking animals spent more time non-social ($p$=.023). The duration of time non-social as one-year-olds was positively associated with adult non-social duration ($p$=.060). Main effects of sex and behavioral inhibition were not significantly associated with adult non-social duration. A significant interaction was found, however, between behavioral inhibition and yearling non-social duration: animals identified as non-inhibited as infants showed a positive association between non-social duration as yearlings and adults, while inhibited animals did not show this positive association ($p$<.05; Fig. 1).

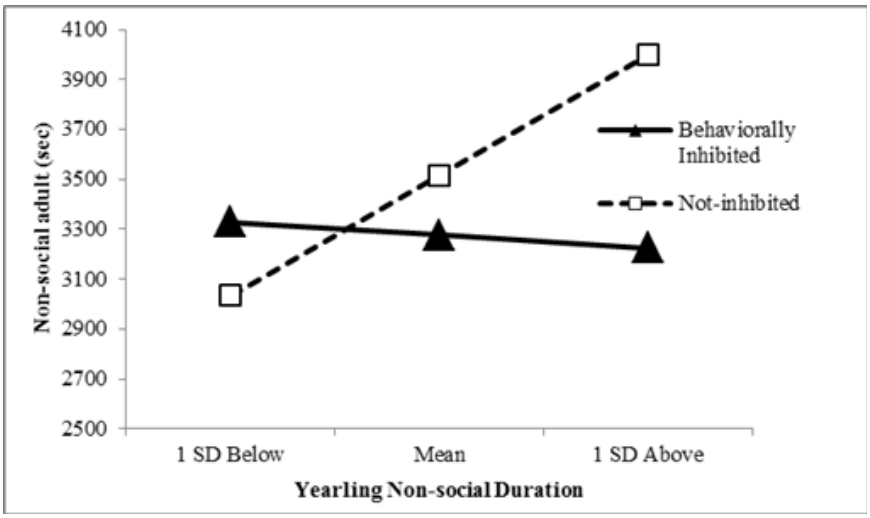


**Figure 1**: Interaction of yearling non-social duration with inhibition to predict adult non-social duration

When only the covariates (dominance rank and sex) were added to the model, 21.9% of the variability (adjusted $R^2$) in adult non-social duration was explained; sequentially adding temperament, yearling non-social duration, and the interaction of temperament and yearling non-social duration increased the explained variance to 19.7, 38.9, and 47.5% respectively.

Continuity and specificity of HPA axis regulation of immune function (Aim 2). In preliminary analyses, we found a significant interaction (N=6; 3-inhibited; $F(3,6)=78.41$; $p=.001$; Fig. 2). *Inhibited* animals showed a significant decrease in IL-12 expression in response to dexamethasone concentration, while *non-inhibited* animals did not show a significant decrease (Fig 2).

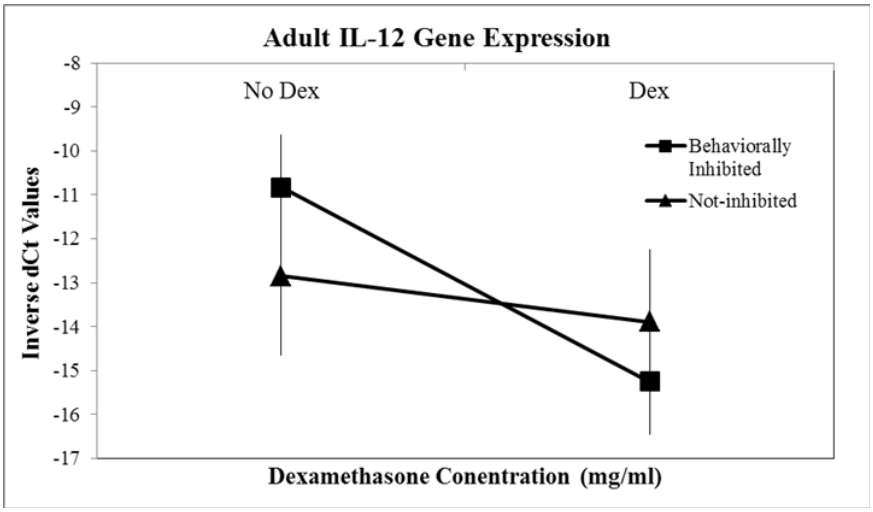


**Figure 2**: Inhibited and non-inhibited IL-12 gene expression

**Significance:**

In our model predicting adult social behavior, we found a significant interaction between temperament, characterized during infancy, and social behavior: monkeys identified as not inhibited in infancy showed consistency between yearling age and young adulthood in the amount of time they spent alone. In contrast, monkeys identified in infancy as behaviorally inhibited showed no relationship between duration of time spent alone at yearling vs. adult ages (Fig 1). Furthermore, as adults, behaviorally inhibited and non-inhibited animals showed differences in cytokine gene expression (Fig 2).

There is some evidence that subsets of behaviorally inhibited individuals become non-inhibited later in life. Evidence suggests that parental sensitivity can reduce behavioral inhibition by enhancing feelings of self-worth[10], where infants became less negative from 3 to 9 months when mothers were more complementary and harmonious. In contrast, there is evidence suggesting that sensitive parenting may increase negative reactivity, where firm parenting may help the child cope and lead to reduced inhibition.[11] Unfortunately, we did not include measures of maternal care in our sample. Furthermore, although we quantified age/sex classes of our subjects' interactants, we did not quantify the identity of each interactant. Perhaps behaviorally inhibited animals interact with a small subset of animals; that is, behaviorally inhibited animals may spend a lot of time nonsocial as yearlings, but become close to a small number of animals (or a single animal) with whom they interact consistently as they age.

Although we found a significant interaction between behaviorally inhibited and non-inhibited animals for IL-12 gene expression, the results were unexpected, and the opposite of what we found when the animals were yearlings. *Inhibited* animals showed a significant decrease in IL-12 expression in response to dexamethasone concentration, while *non-inhibited* animals did not show a significant decrease (Fig 2). We do not know what might explain this difference in our Year 1 vs. Year 4 data, but we plan to continue analyzing the rest of our samples (n=20; 10-inhibited).

The data collected with this award will help contribute to the understanding of the association of the development of temperament and immune function. This award helped cover the cost of part of my doctoral research, which I defended in September 2013, and contributed to in prep publications.[7,9] Furthermore, I presented the results from this award this past June in Puerto Rico and received both the Ruppenthal Travel Award and Poster Paper Award at the conference for this work.

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A great blue herron, Canada geese, and a juvenile female rhesus monkey Macaca mulatta share the pond at the Laboratory for Comparative Ethology Field Station at NIH. Photograph by Amanda Dettmer.

# Research Small Grants Award Report:

## *Do chimpanzees (Pan troglodytes) choose to exert control over their environment to maximize personal gain in comparison to their peers?*

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**Outcomes:** This research was conducted in collaboration with Susan P. Lambeth, Steven J. Schapiro and Sarah F. Brosnan. I would like to take this opportunity to thank ASP for funding this highly successful research project for which data collection and analysis were completed in 2012. We found that the chimpanzees tested participated more (i.e. they refused less) in situations when they had individual control than when they did not. In the context of this experimental test, chimpanzees took advantage of the individual control provided to them in those conditions in which they received less-preferred rewards to enable them to obtain better quality food items. Furthermore, the chimpanzees' responses appeared to be primarily influenced by the quality of the rewards they had received (individually-driven motivation) but also by the actions of their test partner (socially-driven motivation).

An update since submission of the original report: The data from this study were published in 2013: Hopper LM, Lambeth SP, Schapiro SJ & Brosnan SF (2013). When given the opportunity, chimpanzees maximize personal gain rather than "level the playing field". [*PeerJ*. 1, e165; DOI 10.7717.peerj.165]

**Background**

How does individual control influence decision-making? For animals, living in captivity is, in of itself, a potential stressor (Morgan & Tromborg, 2007). A common feature of husbandry measures developed to improve captive welfare is that they incorporate ways to increase the captive animals' environmental control; reduced individual control over the environment is a notable aspect of captive-living (Sambrook & Buchanan-Smith, 1997). A lack of individual control arises from the fact that animals in a captive setting are managed by human caretakers who determine many aspects of the animals' lives, including what, and when, they will be fed, and the social make-up of the group in which they are housed (Hosey, 2005The reduced individual control in a captive environment can result in animals suffering from 'learned helplessness' (Seligman & Maier, 1967). For captive animals, learned helplessness can be a pervasive issue with long-term ramifications (Visalberghi & Anderson, 2008), but reports have shown that providing animals with the ability to exert control over their environment may reduce chronic stress and the associated health risks (Carlstead & Shepherdson, 1994). Less well understood is whether a primate's desire for control, and indeed its implementation, is socially mediated, as it is for humans (Daddis, 2011). There have been many studies which have attempted to provide animals with control over environmental stimuli (e.g., Hanson et al. 1976) but, to our knowledge, no study has attempted to test whether animals perceive their level of control against conspecific partners'. This is especially surprising given that many of these previous studies have tested highly gregarious primate species (e.g., *Callithrix jacchus*, Buchanan-Smith & Badihi, 2012).

**Study Design**

To assess whether nonhuman primates' desire for individual control is socially mediated, we tested captive chimpanzees (*Pan troglodytes*) as our model species. Like humans, chimpanzees are highly gregarious and live in large mulit-male, multi-female, social groups maintained by strong and complex social bonds, affiliations and hierarchies (Smuts et al., 1987; Mitani et al., 2012). Importantly, chimpanzees have also been shown to respond to social contingencies (Brosnan et al., 2010) – assessing the quality of their food rewards to those of social partners. Following this, we incorporated the provision of individual control into a typical test of inequity using an exchange procedure (c.f. Brosnan & de Waal, 2003; Brosnan et al., 2010). This allowed us to test the interplay between a

chimpanzee's control over food acquisition, with the comparisons they made between the foods they received, and the foods a social partner received. Food rewards were used for two key reasons. Firstly, at least in certain circumstances, chimpanzees respond to inequity when they receive less-preferred food rewards than those given to conspecific partners (Brosnan 2011; Price & Brosnan, 2012 provide reviews). Secondly, provision of food represents one of the common daily experiences of captive primates over which they have little control, both with regard to what food is provided and when that food is delivered (Bloomsmith & Lambeth, 1995; Waitt & Buchanan-Smith, 2001). With this paradigm we could ask whether chimpanzees, which are known to be capable of social comparison, incorporate such evaluations into their uptake of control. For example, do chimpanzees act to increase their personal gain absolutely or relative to their partner's rewards when provided with the opportunity to do so? Whether chimpanzees chose to improve their rewards may so depend on their prior experience. Specifically, the chimpanzees we selected to test had all previously participated in multiple tests which had created inequity between them and a social partner (Brosnan et al., 2010; Hopper et al., 2011). Therefore, these chimpanzees all had experience of multiple trials in which they had been given less-preferred rewards than a social partner, but were given no control over improving the quality of those rewards, and we were interested to determine how the provision of control would affect their responses.

Below, I provide a detailed description of our methods, analysis, results and discussion:

**Methods**

*Study Animals and Housing*

We tested sixteen captive chimpanzees (8 males, 8 females), who had an average age of 29.4 years (range: 17 – 50 years), at the Michale E. Keeling Center for Comparative Medicine and Research, UT MD Anderson Cancer Center, USA. All had participated in a minimum of two previous studies of social contrast (Brosnan et al., 2010; Hopper et al., 2011). The chimpanzees were tested in pairs comprised of familiar cagemates (three female-female pairs, three male-male pairs and two male-female pairs) and outside of times of testing, these chimpanzees were socially-housed. UT MD Anderson is fully accredited by the Association for Assessment and Accreditation of Laboratory Animal Care-International and approval for the chimpanzee study was gained from the Institutional Animal Care and Use Committee (IACUC approval number: 07-92-03887) of UT MD Anderson.

*Experimental Design*

The chimpanzees were tested in pairs in a series of four conditions (Table 1). Within each condition, one chimpanzee acted as the 'subject' and one as the 'partner'. Chimpanzees were tested in both roles and were tested in each condition twice. All conditions were administered in a counterbalanced manner. Following Brosnan et al. (2010), in each condition, chimpanzees took turns exchanging a PVC token (a pipe 20cm long, 5cm diameter) with the experimenter and were rewarded with a piece of food for each completed exchange. All chimpanzees were already familiar with exchanging tokens with an experimenter and so no training for this was required. Each condition had two phases (A and B) that were run one immediately after the other (Figure 1).

**Table 1.** The experimental conditions

| Condition | Rewards Received | | | Use of the picture frame allowed… |
|---|---|---|---|---|
| | Partner | Subject: Phase A | Subject: Phase B | |
| Inequity Baseline | GRAPE | Celery | GRAPE | Subject = Partner |
| Frustration Control | Shown GRAPE, offered celery | Shown GRAPE, offered celery | Shown GRAPE, offered GRAPE | Subject > Partner (no frustration) |
| High-value Equity | GRAPE | GRAPE | GRAPE | No change |
| Low-value Equity | Celery | Celery | GRAPE | Subject > Partner (inequity) |

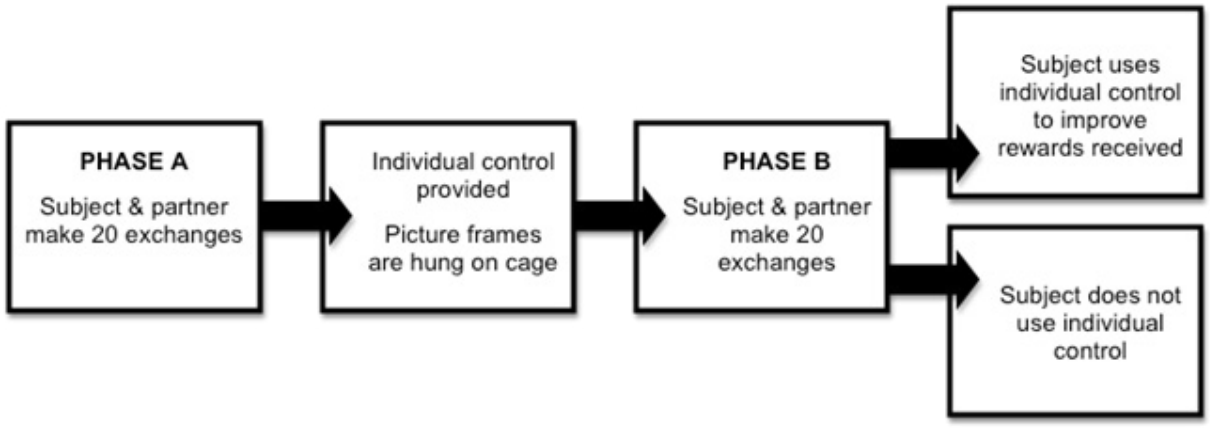


**Figure 1.** A schematic showing the experimental procedure

In Phase A, the two chimpanzees each took turns exchanging over 20 trials (10 exchanges per chimpanzee). Depending on the condition, for every exchange the subject either received the same reward or a different reward compared to their test partner (Table 1). The food rewards were classed as either high-value (a grape) or low-value (a piece of celery). To determine these food preferences (which were equivalent across all chimpanzees tested) we conducted a series of food preference tests (described below). After each chimpanzee had been given the opportunity to make ten exchanges, they were then tested in Phase B.

In Phase B, the subjects were given increased control over the rewards they could receive and they could improve the quality of the rewards given to them. To enable this, after the completion of Phase A, picture frames were hung on the chimpanzees' cage front (Figure 2). If the chimpanzees exchanged their token through a picture frame they would receive the more-preferred food reward for completing the exchange, irrespective of the experimental condition, or whether they were in the role of the subject or partner (Table 1).


**Figure 2.** A series of stills from video footage of Phase B showing the Subject returning the token through his picture frame (**a, b**). To avoid cuing, the experimenter only reached for the token when the chimpanzee has pushed 50% of the token through the picture frame (**c**). Note, although there is a central support bar in the middle of the mesh, the chimpanzees are in the same enclosure and have full visual access to both food rewards outside the cage and also of the actions of their test partner.

*Food Preference Testing*

To determine food items for the high-value and low-value rewards, we ran a series of dichotomous forced-choice tests. For these, chimpanzees were individually offered a choice between two food items. Once the chimpanzee selected one (by reaching for it with either their hand or mouth) they were given it to eat and the other food option was withdrawn. In this way, the chimpanzees could only obtain one of the two offered foods. This same dichotomous choice was presented to the chimpanzees on ten occasions on one day and a further ten on a second day. These tests were run with every chimpanzee until one food was found to be continually selected by all sixteen

chimpanzees in preference over the other. Thus, we did not exclude chimpanzees that did not prefer a particular food, but selected foods as a reflection of the choices that the chimpanzees made. These tests determined that the universal high-value reward was a grape (as has been used with these chimpanzees in previous tests of inequity and social learning, e.g., Brosnan et al. 2010; Hopper et al., 2011) while the low-value reward was a piece of celery.

*Picture Frame Pre-exposure Sessions*

Prior to being tested in any of the experimental conditions, in which chimpanzees would be given an opportunity to exchange tokens through a picture frame in Phase B, each chimpanzee experienced a series of pre-training trials to expose them to the use of the picture frames. These pre-exposure sessions followed the reward structure of the Low-value Equity and High-value Equity conditions outlined in Table 1 (but note that the chimpanzees were tested individually not in a pair). The chimpanzees received five such sessions, each run on separate days, and alternating between Low-value Equity and High-value Equity, commencing with the Low-value Equity. For every pre-exposure session, the chimpanzees had to make ten exchanges without the picture frame (as per Phase A), the picture frame was hung on their cage, and then they made a further 10 exchanges (as per Phase B). In the first two pre-exposure sessions, the chimpanzees were not trained nor encouraged to exchange the token through the picture frame. This was done to determine whether the chimpanzees would spontaneously use the picture frames or not. Although we deemed it acceptable if some chimpanzees used the picture frame during these initial exposure tests, we did not want all to do so as that may have meant that the response was too potent and we not see variation across conditions in the experimental phase. Of the 16 chimpanzees tested, three spontaneously used the frame in their first pre-exposure session in which they received a low-value reward for every exchange (see the Results).

In the third pre-exposure trial (Low-value Equity) the chimpanzees were exposed to the significance of the picture frame. We did not want to train the chimpanzees to use the frame as we did not want exchanging through them to become a 'learnt trick' that the chimpanzees did on cue when they saw the picture frame. Rather, the experimenter 'showed' the chimpanzee how to use the picture frames by holding her hand at the bottom of the aperture created by the picture frame so that, as the chimpanzee returned the token to her hand, they did so by returning the token through the picture frame. The chimpanzee was then rewarded with a grape rather than the piece of celery. Other than this conditioning, no overt training technique or bridge (a clicker) was used. On the following day, the chimpanzees received a comparable session but it followed a High-value Equity reward schedule to demonstrate to the chimpanzees that if they used the picture frame, their reward value stayed constant. The final, fifth, session was another Low-value Equity session but, in this, the experimenter placed her hands on her knees after the chimpanzee took the token so as not to actively cue the chimpanzee to use the picture frame for their exchange.

After both chimpanzees in a test-pair completed all five pre-exposure trials they commenced with the testing schedule for the experimental conditions. As all pre-exposure sessions were conducted on consecutive days through the week starting on Monday, there was always a two-day break between the pre-exposure sessions and the test sessions.

*Experimental Conditions*

In Phase A the chimpanzees were reward according to the values described in Table 1. The Inequity Baseline condition, in which the subject always received a less-preferred reward than their partner, allowed us to test whether a chimpanzee's desire to increase their reward value (in Phase B) was mediated by the comparable quality of the reward received by their test partner. The Low-value Equity condition, in which both chimpanzees received a piece of celery for every exchange in Phase A, allowed us to determine if, rather than social contrast, the quality of reward a chimpanzee received during Phase A drove their desire to improve it in Phase B (irrespective of what their partner received). In this way we could tease apart the social impacts on individual control.

In the Frustration Control in Phase A, before a chimpanzee was offered a token to exchange, the experimenter first showed them a grape, but after the chimpanzee exchange they were offered a piece of celery. Showing the chimpanzees the grape prior to their exchange highlighted the better quality food available in their environment (Brosnan et al., 2010). If the chimpanzees only sought to increase their reward values in the Inequity Baseline, but not the Low-value Equity, we might assume that they were doing so because they had compared the value of the rewards they were receiving to those of their partner. However, by handing a grape to the partner, the experimenter may have drawn the subject's attention to it, and the subject might have been frustrated, irrespective of whether their partner ultimately received the grape or not. Thus, the Frustration Control distinguished between frustration effects and social contrast. Finally we included a High-value Equity condition in which both chimpanzees received grapes for each exchange. In this condition, there is no value for the chimpanzees to use the picture frame as doing so would not increase the quality of the reward they could receive. This control condition allowed us to determine whether the chimpanzees exchanged through the picture frame whenever they saw it, irrespective of the experimental condition, or if they were using it flexibly to maximize their rewards (either in relation to their partner's or to their own).

*Procedure*

For every experimental test session, the chimpanzees were called in to one of their inside dens by the experimenter. Only those chimpanzees that came in readily were tested. If a chimpanzee did not come in, the experimenter simply tried again the next day. Most chimpanzees were willing to test once every day (no pair was ever tested more than once a day) and there was never more than a three day period between test sessions (no testing occurred at weekends). The pair was tested together in the same inside den of their enclosure so that they could easily see whether their partner completed an exchange and what food reward they received for doing so. During tests, these pairs did not have visual access with the rest of their group. Immediately after a test was completed the experimenter reintroduced the pair to their group. Each test lasted no more than 25 minutes.

In all of the four conditions, the chimpanzees were tested first in Phase A and then in Phase B. Phase A represented a typical exchange test of inequity (c.f. Brosnan et al., 2010) in which both animals took turns exchanging tokens with the experimenter (Table 1). After completing Phase A the experimenter hung two small picture frames onto the chimpanzees' caging (Figure 1). The inside aperture of the picture frames was $10cm^2$ so that it perfectly framed one hole of the cage mesh. In this way, the picture frame 'highlighted' a particular hole through which the chimpanzees could exchange a token (Figure 2). In Phase B, if either chimpanzee exchanged their token through one of the picture frames, they would receive the high-value food reward (a grape) irrespective of the condition. In Phase B, like in Phase A, the chimpanzees took it turns to each make ten exchanges with the experimenter.

After calling both chimpanzees into the inside testing den the experimenter placed two food buckets on the floor directly in front of the chimpanzees. One contained grapes and the other, pieces of celery. Both food rewards could easily be seen by the chimpanzees and both food rewards were on display in all conditions. This ensured the chimpanzees' responses were not cued by the presence or absence of one of the foods.

Starting with the partner chimpanzee, the experimenter then alternated between the two offering a token and then giving them a reward if they did not refuse to exchange. Every time the experimenter offered a chimpanzee their food reward she held it up in front of both chimpanzees so that both could see what the reward was. Once each chimpanzee had had the opportunity to make ten exchanges, the experiment moved to Phase B.

Phase B was run directly after Phase A. There was no temporal gap between the two, apart from the time it took for the experimenter to quickly hang the two picture frames on the caging (they attached with double-ended spring clips). Two picture frames were hung on the cage mesh so that one chimpanzee could not monopolize access to

the picture frame (monopolizeable resources have been shown to increase aggression and stereotypic behavior which is something we wished to mitigate, Akre et al., 2011). The distance between the two picture frames when they were hanging on the cage front was roughly 1.5m. Phase B followed the protocol for Phase A. The experimenter squatted down in between the two picture frames and so was central to the cage front. For every exchange, the experimenter offered the chimpanzee the token directly in between the two picture frames so as not to cue the chimpanzee to use a (particular) picture frame. Furthermore, the moment that the chimpanzee took the token from the experimenter, the experimenter laid her hands on her knees. In this way, she was not asking for the token and did not show the chimpanzee where on the cage to exchange the token. As soon as the chimpanzee had pushed more than 50% of the token back through the cage (either through the picture frame or another hole in the mesh) the experimenter then reached up and took the token.

*Coding and Analysis*

For every completed exchange, the chimpanzee was offered a food reward. If the chimpanzees failed to exchange the token or did not accept the reward offered to them, this was classed as a "refusal". A chimpanzee could refuse to accept the token within 10 seconds, they could take it but not return it within 30 seconds or they could take it but push it back through the caging violently and not towards the experimenter's hand. All these actions were coded as token-refusals. Food-reward refusals were similar; they were coded as when an animal did not accept the food item within 10 seconds, took the food item but did not eat it within 30 seconds, or took the food but then pushed it back outside their cage uneaten.

The experimenter recorded every response that the chimpanzees made (exchanges and refusals) in real-time during the experiment. The experimenter also recorded the latency for the chimpanzee to exchange the token back to the experimenter (note that any exchanges in excess of 30 seconds were classed as refusals). All test sessions were video-taped.

Due to the small sample sizes, nonparametric tests were used throughout. To determine whether the chimpanzees' behavior varied between conditions and phases, we conducted nonparametric Wilcoxon signed-ranks tests for related samples and to compare the responses of male and female chimpanzees we used Mann Whitney U test for unrelated samples. All tests were two tailed.

**Results**

*Picture Frame Use in Pre-exposure Phase*

Three of the sixteen chimpanzees spontaneously used the picture frame in their first pre-exposure trial when they were offered celery for every exchange (they were given a grape when they returned the token through the picture frame). One female exchanged the token through the picture frame once, while, of the two males that used the picture frame, one exchanged the token through it for all of the ten possible trials and the other used the picture frame for five trials.

*Exchange Latencies*

Across all conditions, in Phase A, the average latency for a chimpanzee to return a token was 2.55 seconds (range: 0.91-10.93 seconds) while in Phase B the average exchange latency was 2.41 seconds (range: 0.92-8.94). There was no difference in the time it took chimpanzees to exchange a token with the experimenter across the two phases in any of the four conditions: Inequity Baseline (Wilcoxon's signed-ranks test, $T+ = 343.0$, N = 31, $P = 0.063$), Frustration Control ($T+ = 210.0$, N = 28, $P = 0.873$), Low-value Equity ($T+ = 227.5$, N = 30, $P = 0.918$), and the High-value Equity ($T+ = 203.5$, N = 32, $P = 0.383$).

InIn Phase A, when the subjects had no control over which reward they could receive, there was no difference in the time it took them to return the token to the experimenter across the four conditions (Friedman's test:

$X^2(3) = 1.978$, N = 27, $P = 0.577$) but there was in Phase B ($X^2(3) = 10.333$, N = 27, $P = 0.016$, Table 2). In Phase B, chimpanzees returned the token more quickly in the High-value Equity condition (average exchange latency: 2.00 seconds) compared to the Inequity Baseline condition ($T+ = 113.0$, N = 31, $P = 0.008$), Frustration Control condition ($T+ = 80.5$, N = 28, $P = 0.005$), and the Low-value Equity condition ($T+ = 341.0$, N = 30, $P = 0.026$). There was no difference in the time it took chimpanzees to return the tokens across the Inequity Baseline, Frustration Control, and Low-value Equity conditions ($X^2(2) = 3.63$, N = 27, $P = 0.163$).

| | Average Exchange Latency (Range) / seconds | |
|---|---|---|
| | **Phase A** | **Phase B** |
| **Inequity Baseline** | **2.34** (0.91-5.84) | **2.72** (1.15-8.94) |
| **Frustration Control** | **2.68** (0.96-6.03) | **2.43** (1.14-5.41) |
| **Low-value Equity** | **2.69** (1.16-10.65) | **2.51** (1.08-6.08) |
| **High-value Equity** | **2.53** (0.92-4.79) | **2.00** (0.92-4.79) |

**Table 2.** The average time it took chimpanzees to exchange tokens with the experimenter in each of the four conditions across both Phase A and Phase B.

*Refusals: Phase A and B Compared*

In those conditions in which the chimpanzee had received a less-preferred reward in Phase A (irrespective of what their partner received) they refused less than in Phase B when they were afforded the opportunity to obtain the high-value reward (Figure 3). This was true in the Inequity Condition (Wilcoxon's signed-ranks test, $T+ = 7.0$, N = 32, $P < 0.001$), Frustration Control ($T+ = 8.0$, N = 32, $P = 0.001$), and Low-value Equity conditions ($T+ = 12.5$, N = 32, $P < 0.001$).

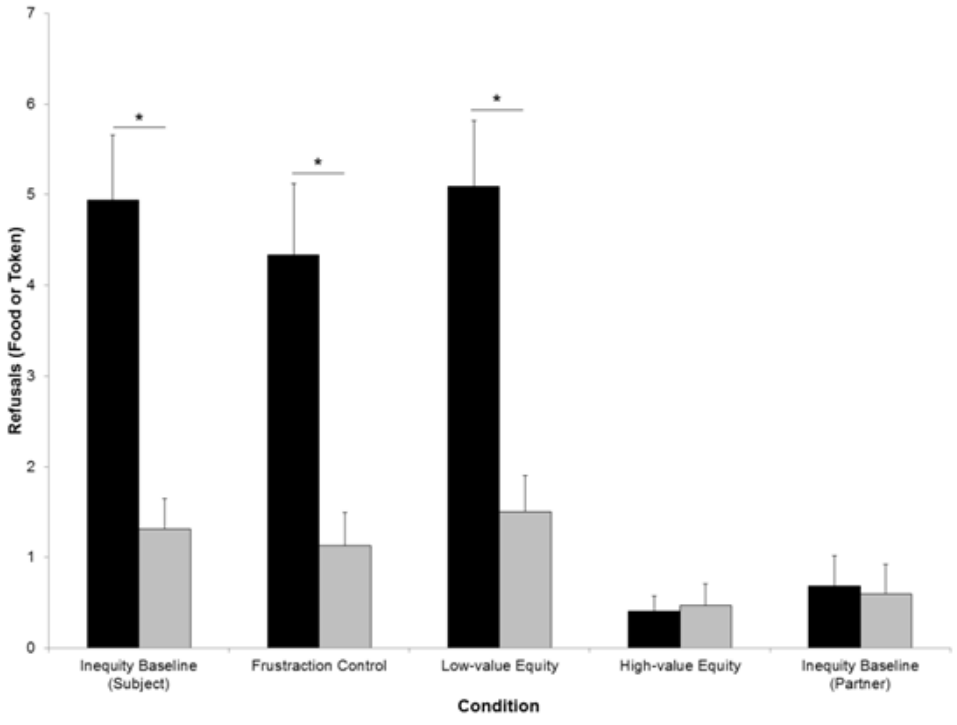


**Figure 3.** The total number of refusals (of a possible 10 exchanges) made by chimpanzees in Phase A (black bars) and Phase B (grey bars). Also shown are the responses by the chimpanzees in the role of the partner in the Inequity Baseline condition.

The chimpanzees showed no difference in the number of refusals they made in the High-value Equity condition in Phase A compared to in Phase B ($T+ = 140.5$, N = 32, $P = 0.939$). Like chimpanzees in the High-value Equity condition, the partners in the Inequity Baseline received the high-value reward for every exchange in Phase A and B irrespective of their use of the picture frame. Therefore, we compared the responses of the partner chimpanzees in the Inequity Baseline condition in Phase A to Phase B and determined that they, like those in the High-value Equity condition, also revealed no differences in their refusals ($T+ = 18.0$, N = 32, $P = 0.584$).

Across all conditions, males showed a trend to refuse more than females, but this was only significant in the Low-value Equity (Mann Whitney U, $U = 191.0$, $N_{males} = 16$, $N_{females} = 16$, P = 0.011) and High-value Equity conditions ($U = 197.0$, $N_{males} = 16$, $N_{females} = 16$, P = 0.007). For the other two conditions P > 0.05.

*Picture Frame use in Phase B*

Reflecting the manner in which chimpanzees refused to participate in Phase A, in conditions in which they received a less-preferred reward (irrespective of what their partner received), chimpanzees also took advantage of the individual control provided to them in Phase B, and used the picture frame, more in these conditions (Figure 4). Compared to when tested in the High-value Equity condition in Phase B, chimpanzees used the frame more in the Inequity Baseline (Wilcoxon's signed-ranks test, $T+ = 9.5$, N = 32, $P < 0.001$), Frustration Control ($T+ = 373.5$, N = 30, $P < 0.001$), and Low-value Equity conditions ($T+ = 485.5$, N = 32, $P < 0.001$).

Considering the Inequity Baseline condition we note that, when in the role of the subject, chimpanzees were more likely to use the picture frame in Phase B than when they were tested in the role of the partner (Wilcoxon's signed-ranks test, $T+ = 319.0$, N = 32, $P < 0.001$). When tested as the partner in the Inequity Baseline condition the chimpanzees received the same high-value rewards as chimpanzees in the High-value Equity condition. Perhaps surprisingly, partner chimpanzees in the Inequity Baseline used the picture frame more than subjects in the High-value Equity condition ($T+ = 55.5$, N = 32, $P = 0.021$).

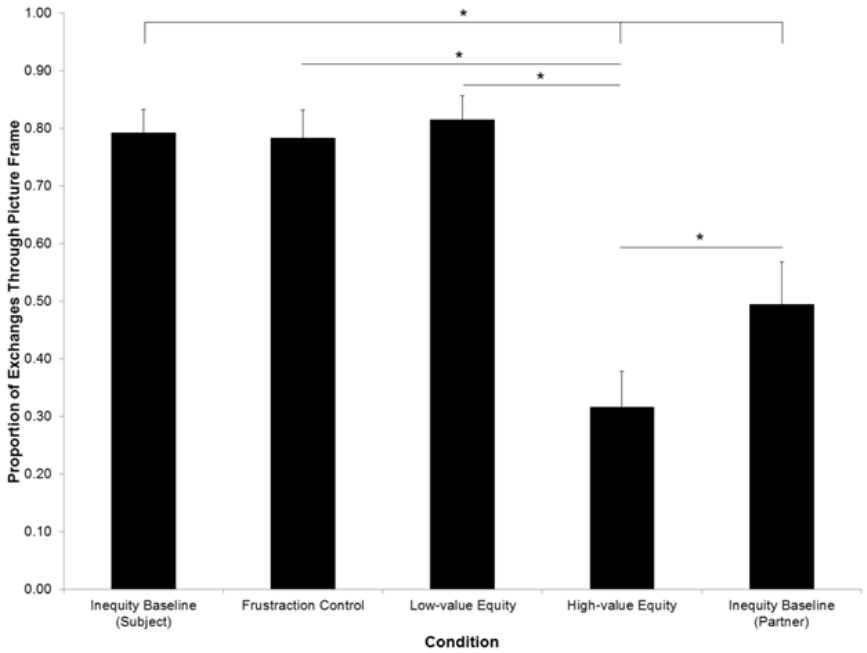


**Figure 4.** For each of the ten exchanges that a chimpanzee made with the experimenter in Phase B they had they could either exchange the token directly through the mesh or return it through the picture frame. This shows the proportion of those completed exchanges in which the chimpanzees returned the token through the picture frame. We were interested to ascertain whether the chimpanzees took advantage of the individual control provided to them in Phase B, and used the picture frame differentially across conditions.

**Discussion**

The chimpanzees participated more (i.e. they refused less) in situations when they had individual control (Phase B) than when they did not (Phase A). This emphasizes the positive impact created by increased individual control and supports previous work highlighting the benefits of increased control for captive primates (e.g., Buchanan-Smith & Badihi, 2012). In the context of this experimental test, chimpanzees took advantage of the individual control provided to them in those conditions in which they received less-preferred rewards to enable them to obtain better quality food items (a comparable behavioral response has also reported for humans, Vohs & Schooler, 2008). The specific aim of this study was to determine whether chimpanzees' use of individual control was socially mediated, as has been suggested for humans (Daddis, 2011). With regard to the current study, the chimpanzees' responses appeared to be primarily influenced by the quality of the rewards they had received in Phase A (individually-driven motivation) but also by the actions of their test partner in Phase B (socially-driven motivation). We discuss the interplay of these individual and social factors in turn.

The chimpanzees were motivated to maximize their gains across all conditions, irrespective of how their rewards compared to those received by their partner (i.e. not in response to inequity, Brosnan et al., 2010) or what rewards were available in the environment (i.e. not in response to frustration, Bräuer et al., 2009). Importantly, however, in those conditions in which the chimpanzees had received the more-preferred high-value reward in Phase A, they were significantly less likely to use the picture frame in Phase B. Thus, they were not conditioned to exchange through the picture frame. Thus, the chimpanzees were not suffering from learned helplessness; their responses were flexible and they were able to take advantage of the individual control offered to them to improve the quality of rewards they could obtain.

The chimpanzees were also influenced by the responses of their test partner. In Phase A of the High-value Equity condition, both chimpanzees received a high-value reward for every exchange. Similarly, chimpanzees in role of the partner in the Inequity Baseline also received a high-value reward for every exchange in Phase A. If the chimpanzees were only assessing the quality of the rewards they received in Phase A to determine whether to use the picture frame in Phase B, then when tested in these conditions/roles, the chimpanzees should have responded similarly in Phase B (i.e. not used the picture frame). For these conditions/roles, using the picture frame would not have changed their reward outcome: they would have received a high-value reward irrespective of whether they used the picture frame. This is not what they did however (see Figure 4).

Intriguingly, when chimpanzees were tested as the partner in the Inequity Baseline, they used the picture frame more often than when tested as the subject in the High-value Equity condition. We propose that the partners in the Inequity Baseline condition were influenced by the actions of their test partner, the subject (i.e. response facilitation; Bates & Byrne, 2010; Huber et al., 2009). Response facilitation describes when an already-known behavior is elicited in individuals after they observe conspecifics performing the same act (Hopper et al., 2013). Indeed, its influence has previously been proposed as a component of primates' responses to inequity (Bräuer et al., 2006; Dubreuil et al., 2006). In the present study, partner chimpanzees in the Inequity Baseline saw the subject chimpanzee they were tested with, use the picture frame in Phase B (the subject could improve the quality of their rewards) and this caused them, the partner, to also use the picture frame in Phase B. In this way, the responses of the chimpanzees were socially-mediated but ultimately it appears that whether they took advantage of the individual control provided to them was driven more by their individual needs to improve the rewards they received, irrespective of social comparisons.

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