ISSN 1813-2286
Volume 15/2 ■ No. 20
December 2006

TAPIR SPECIALIST GROUP

Tapir Conservation

The Newsletter of the IUCN/SSC Tapir Specialist Group

www.tapirs.org

Edited by Leonardo Salas and Stefan Seitz

■ TSG Conservation Fund – Supported Projects in 2006

© Liana John / Terra da Gente

- **Tapirs discover the Media**
- **Reports about Tapirs attacking Humans**
- **Population Dynamics in the Lowland Tapir**
- **Presence of Baird's Tapir in Costa Rica and Colombia**
- **Hunting Sustainability in Nicaragua**
- **Tools to detect Polymorphism in Tapirs**

Printing and distribution of the Tapir Conservation Newsletter is supported by the Houston Zoo Inc., 1513 N. Mac Gregor, Houston, Texas 77030, United States, http://www.houstonzoo.org

CONTENTS

Volume 15/2 ■ No. 20 ■ December 2006

Cover Photo Credits:
Large and background photo of lowland tapir baby and mother. Credit: Liana John / Terra da Gente.
Check-holding at Houston Zoo: pictured, left to right: John Bovyar, Jennifer McLain and Kelly Russo of the Houston Zoo. Credit: John Bovyar.

TAPIR CONSERVATION

Abbreviation **Tapir Cons.**

ISSN **1813-2286**

Production & Distribution This issue is kindly sponsored by Houston Zoo Inc., Cons. Program Asst., Kelly Russo, 1513 North Mac Gregor, Houston, Texas 77030, USA.

Website **www.tapirs.org**

FROM THE CHAIR

Letter from the Chair

By Patrícia Medici

We have done it once again – we have completed six very busy months for the Tapir Specialist Group! The list to report is long, so please bear with me…

First of all, I would like to let you know that Siân Waters has resigned her position as TSG's Co-Deputy-Chair, and on behalf of the entire TSG membership I would like to thank Siân for everything she has done for the Tapir Specialist Group. Siân will continue working with us on the coordination of the Human/Tapir Conflict and Malay Tapir working groups. We have had other changes on our group's structure so I would advice you to take a good look at our TSG Structure directory on this issue.

Several new members have joined the group over the past few months, and currently, the TSG has 104 members, including field researchers, educators, veterinarians, governmental agencies and NGO representatives, zoo personnel, university professors and students, from 27 different countries worldwide (Argentina, Australia, Belize, Bolivia, Brazil, Canada, Colombia, Costa Rica, Denmark, Ecuador, France, French Guiana, Germany, Guatemala, Honduras, Indonesia, Malaysia, Mexico, Myanmar, Republic of Panama, Paraguay, Peru, Thailand, The Netherlands, United Kingdom, United States, and Venezuela). Please see TSG Membership directory included in this issue.

I am very pleased to announce that the Final Report of the "Baird's Tapir Conservation Workshop: Population and Habitat Viability Assessment (PHVA)" held in Belize, Central America, in August 2005, has been finalized and made available online on the TSG website. Unfortunately, this first version of the Baird's Tapir Action Plan is available only in Spanish, but we are looking for volunteers to translate this document, as well as the Mountain Tapir Action Plan developed in 2004, into English. If you have any suggestions of anyone you know that could help us with this huge task, I would appreciate hearing about them!!!

Cover of the "Baird's Tapir Conservation Workshop: Population and Habitat Viability Assessment (PHVA)" held in Belize, Central America, in August 2005.

The new, updated Baird's Tapir Action Plan is available at: http://www.tapirs.org/action-plan/action-index.html and I would like to ask all of you to please help us distribute this action plan to all interested parties and stakeholders in your countries. We are counting on your help to guarantee that all researchers and organizations directly or indirectly involved with Baird's tapir conservation in the range countries and/or with *ex-situ* programs will have access to this plan and, most importantly, will help us to put our actions into practice. We will not print the document, so the distribution process has been done via e-mail and our website. We do have a CD label ready to be used in the case you want to burn CDs and distribute them in your country. If you would like to receive the label, you just have to let me know and I will send it to you right away.

The lowland tapir (*Tapirus terrestris*) will be the focus of the last Tapir PHVA to be held at the Sorocaba Zoo, São Paulo, Brazil, from 15 to 19 April, 2006. PHOTO CREDIT: Patrícia Medici.

Considering that there are four tapir species, and that three of them have been the focus of previous PHVA workshops – Malay Tapir PHVA Workshop held in Malaysia in 2003, Mountain Tapir PHVA Workshop held in Colombia in 2004, and Baird's Tapir PHVA Workshop held in Belize in 2005 – we can now say that we have finalized 75% of the second version of the Tapir Action Plan, listing and prioritizing strategies and actions for the conservation of these three species and their remaining habitats.

We are now left with one last species to work with – the Lowland Tapir (*Tapirus terrestris*). This fourth meeting – Lowland Tapir Conservation Workshop: Population and Habitat Viability Assessment (PHVA) – will be held from April 15 to 19, 2007, in the Municipality of Sorocaba, São Paulo State, Brazil. Our major partners for the organization of this workshop are the Houston Zoo Inc. in the United States, and the Sorocaba Zoo and IPÊ – Instituto de Pesquisas Ecológicas in Brazil. The IUCN/SSC Conservation Breeding Specialist Group (CBSG) Headquarters and its Brasil Network will be responsible for the design and facilitation of the workshop.

Currently, a planning committee formed by TSG members, as well as CBSG staff and local partners are working really hard to raise the necessary funds for the meeting, as well as on the invitation process and organization of the local logistics.

In terms of fundraising, the Houston Zoo Inc., as well as the AZA (American Zoo and Aquarium Association) and EAZA (European Association of Zoos and Aquaria) Tapir Taxon Advisory Groups (TAGs), have once again joined forces to conduct a major fundraising campaign targeting zoos in order to help us raise the necessary funding to make this last PHVA workshop happen. All lowland tapir holders in North America and Europe received a letter from us requesting support for the workshop. So far, we have received quite a significant number of positive responses, including eleven (11) zoos in the United States (Alexandria Zoo, Brookfield Zoo, Denver Zoo, Evansville Zoo, Houston Zoo Inc., Mesker Park Zoo, Miami Metro Zoo, San Antonio Zoo, San Diego Zoo, San Francisco, and Wildlife World Zoo), three (3) zoos in Europe (Copenhagen Zoo in Denmark, Zlin-Lesna Zoo in the Czech Republic, and Herberstein Zoo in Austria), and also a generous contribution from WAZA (World Association of Zoos and Aquariums). Needless to say, we all are very grateful for their contributions and, most importantly, for their support on making this last workshop happen!!!

This workshop has been especially difficult to organize given the fact that the geographic distribution of this tapir species covers a huge area, almost all of South America including 11 different range countries (Argentina, Bolivia, Brazil, Colombia, Ecuador, French Guiana, Guyana, Paraguay, Peru, Suriname, and Venezuela), from which we need to make sure to have a good representation. Approximately 200 key conservationists and organizations have been invited to attend the workshop and in the end we are expecting to have 80 participants. This process of inviting key stakeholders and building our list of participants is the most delicate part of the organization of a PHVA given the fact that we must guarantee that all key people and organizations will be present, including researchers, conservationists, representatives from NGOs and governmental agencies, members of the local communities, research institutes, zoos, universities etc.

A smaller TSG meeting was carried out during the "VII International Congress on Wildlife Management in the Amazon and Latin America" held from September 3 to 7, 2006, in Ilhéus, Bahia, Brazil. This international conference is held every two years in Latin America and is an excellent opportunity for TSG members to meet in between Tapir Symposia. The TSG meeting in Bahia was a 6-hour session, which was initiated with a general presentation about the TSG as a whole given by myself. We then followed with a series of very good presentations about lowland tapir research and conservation in Brazil, Colombia, French Guiana, and Peru, and a final working group facilitated by TSG member Kevin Flesher who has been conducting a major project to determine and map the biogeography of lowland tapirs in the Atlantic Forest ecosystem. Kevin's work will be extremely important in terms of generating precious information for the upcoming Lowland Tapir PHVA Workshop and we used this opportunity in Ilhéus to get as much input as we could from as many participants as possible on the current presence/absence of tapirs throughout their historical range.

Still on the subject of TSG participation in conferences and meetings, our group continues to be represented in the annual conferences of both the American Zoo and Aquarium Association (AZA) and European Association of Zoos and Aquaria (EAZA). The main idea behind attending these zoo conferences is to make sure we have the chance to meet our donors so that we can keep them informed about how we have been using their contributions and, most importantly, so that we can thank them in person! This year we had a large group of TSG members attending the AZA Conference

Alberto Mendoza, Manager of Latin America Programs of the Houston Zoo and member of the TSG, is the new Chair of the AZA Tapir Taxon Advisory Group (TAG). PHOTO CREDIT: Patrícia Medici.

in late September, in Tampa, Florida, and I attended the EAZA conference in the second week of October, in Madrid, Spain. During the conference in Madrid I made a presentation during the Tapir TAG meeting, which consisted of a very detailed overview of the current work of the TSG and I also made absolutely sure to acknowledge all the support we have been receiving from European zoos, support that has been growing over the years and have been critical to make some of our conservation initiatives happen.

Speaking of Tapir TAGs… I would like to announce that Alberto Mendoza, Manager of Latin American Programs of the Houston Zoo Inc. in the United States and a very active member of the TSG, is the new chair of the American Zoo and Aquarium Association (AZA) Tapir Taxon Advisory Group (TAG). Alberto is replacing Lewis Greene, Director of the Chaffee Zoo, who served as chair of the AZA Tapir TAG for the past three years. On behalf of the entire TSG membership I would like to thank Lewis for all his efforts to establish a strong, long-lasting partnership between the TAG and the TSG, and congratulate Alberto for his new position. We are looking forward to continuing making this partnership stronger and stronger and, most importantly, beneficial for tapir conservation as a whole.

Our TSG Veterinary Committee, now chaired by Colombian Veterinarian Javier Sarria Perea, is currently putting a lot of effort into finishing our long-awaited Tapir Veterinary Manual, which will include procedures for capture, immobilization and manipulation of tapirs in the wild, as well as details about how to collect samples for epidemiological studies, what samples to collect, how to store them, what analysis to carry out, necropsy protocols etc. Additionally, Javier has worked with ISIS – International Species Information System – in order to make the "Physiological Data Reference Values for Tapir Species" available on our TSG website. The ISIS database is the most complete and extensive wildlife health information source, and for a long time we wanted to make the tapir normal physiological values available to all professionals involved with tapir health investigation.

Our TSG Fundraising Committee had a busy couple of months between June and September organizing and carrying out the 2006 Funding Cycle of our TSG Conservation Fund (TSGCF). We were successful raising a considerable amount of funding during the live and silent auctions conducted during the Third International Tapir Symposium in Buenos Aires, Argentina, in January, and therefore, the original idea for this year's TSGCF funding cycle was to distribute five (5) grants of US$ 1,000 dollars. However, and to our great surprise, we received a generous donation from the Tapir Preservation Fund (TPF) – Heidi Frohring Fund – that allowed us to select a sixth proposal for funding. As you will probably remember, Heidi Frohring was a TSG member who passed away last year. Her family has been raising and donating funds to tapir conservation in memory of Heidi, and we were extremely happy to see part of this funding being used through the TSG Conservation Fund. We have no doubt whatsoever that this would have made Heidi very happy!

We received twelve (12) proposals and our reviewing committee selected six (6) of them. Each one of the six selected projects received a grant of US$ 1,000. Selected proposals were: Conservation of Baird's Tapir in Guatemala – Manolo García, Guatemala; Population Status and Conservation of Baird's Tapir in the Zoque Forest, Mexico – Iván Lira Torres, Mexico; Determining the Presence of Andean Tapir (*Tapirus pinchaque*) in the Massif of Mamapacha (Boyacá, Colombia) – Javier Sarria Perea, Colombia; Lowland Tapir Footprint

Cover of the September Issue of the Brazilian Nature Magazine "Terra da Gente". A 10-page tapir article written by renowned environmental journalist – Liana John – is included.

Identification Technique (FIT) – Cristina Tófoli, Brazil; Foraging Habitat Preferences, Diet Composition, and Seed Dispersal of the Lowland Tapir (*Tapirus terrestris*) in the Interior Atlantic Forest of Paraguay – Miguel Morales, Paraguay; and Tapir Density and Habitat Use in El Rey-Centinela Conservation Unit: First Stage – Silvia Chalukian, Argentina. Congratulations Manolo, Iván, Javier, Miguel, Cristina, and Silvia! We are very happy to be able to help you, even if just a little bit... In fact, we cannot help it but be absolutely ecstatic about the fact that the TSG has been able to support some projects financially. This is, in my opinion, one of the major accomplishments of our group!!!

TSG member Kevin Flesher working with participants of the Tapir Workshop during the Wildlife Conservation and Management Conference held in Ilhéus, Bahia, in September 2006. PHOTO CREDIT: Patrícia Medici.

For further information about the 2006 selected projects and applicants see the article "TSG Conservation Fund 2006 Funding Cycle - Successful Applicants" in this issue. You can also find additional information on our website: http://www.tapirs.org/tsgcf/tsgcf-projects2006.html which also includes information about all projects funded by the TSG Conservation Fund since its establishment in 2003.

Besides conducting this year's funding cycle of the TSG Conservation Fund, our TSG Fundraising Committee has finalized our official list of tapir projects endorsed by the TSG. The main idea behind the creation of the TSG List of Endorsed Projects was to have a menu of tapir projects that funding agencies could review and select the ones that fit their interests. We started working on this list last year when we requested all our TSG members and other tapir researchers to send us abstracts of their tapir projects, as well as general information about the budgets, including the annual and total cost of the project, how much funding has been secured, and how much is still pending.

The final result is a comprehensive list of 55 tapir projects, including 13 projects on Baird's tapirs (Belize – 2, Colombia – 1, Costa Rica – 3, Ecuador – 1, Guatemala – 1, Honduras – 1, Mexico – 3, and Panama – 1); 23 projects on lowland tapirs (Argentina – 9, Bolivia – 2, Brazil – 6, Colombia – 1, Ecuador – 2, French Guiana – 1, Paraguay – 1, and Peru – 1); 12 projects on mountain tapirs (Colombia – 7, Ecuador – 3, and Peru – 2); 3 projects on Malay tapirs (Indonesia – 1, Malaysia – 1, and Myanmar – 1); and 4 general projects including more than one species or international initiatives.

The TSG List of Endorsed Projects is available online on the TSG website (http://www.tapirs.org/projects/index.html) and will be soon distributed to potential funding sources, including zoos in North America, Europe, Latin America and Asia, as well as conservation organizations and other funding institutions. For a researcher, having the project information on this list means that it will get excellent exposure with potential funding opportunities for his/her tapir conservation initiatives. The list has been used by several funding agencies already. Besides the list of endorsed projects, we also have available on our website our TSG Project Endorsement Guidelines in English, Spanish and Portuguese.

Additionally, the TSG Fundraising Committee is currently discussing the development of a list of "Top Ten Tapir Conservation Projects", very much in the same way the Primate Specialist Group developed a list of 25 most endangered primates. This idea is listed as a priority action on our TSG Strategic Planning for 2006-2007 and comes from our need to focus our fundraising efforts to raise funds for priority projects. The list will be a living directory which will be re-evaluated every two years during the Tapir Symposium.

Another major piece of good news is the recent publication of a 10-page article on tapirs on the very well known Brazilian nature magazine called "Terra da Gente". The article was written by one of the most respected environmental journalists in Brazil – Liana John – and explored not only lowland tapirs, the species that occurs in Brazil, but also the other three tapir species, as well as projects being carried out worldwide, conservation initiatives in general and, most importantly, the work of the Tapir Specialist Group. The article has generated a huge feedback to the TSG in Brazil and has provided high exposure to the tapir conservation cause. We would like to thank Liana for an amazing piece of work! The article is available online on the TSG website in PDF format.

If you visit our website regularly you probably noticed that we have finally made ALL previous versions of our *Tapir Conservation* newsletter since 1990 available for download! All the issues of the newsletter

published before 2002 were still in printed format in our personal libraries and had to be scanned and converted into PDF in order to be made available on the website. So… if you are curious to learn what the TSG was up to during the 1990's make sure to check it out at http://www.tapirs.org/Downloads/tsg-newsletter.html

And last but MOST DEFINITELY NOT LEAST… I would like to announce that our TSG Virtual Library is finally ONLINE!!! The creation and establishment of this library was also included as one of the priority actions on our TSG Strategic Planning 2006-2007 and was one of our major tasks for 2006!!!

Once the idea of the virtual library was conceived, it was put into practice through a joint volunteer project of the TSG and the Botanical Research Institute of Texas (BRIT) in the United States. The project was spearheaded by TSG member Harald Beck, who put together a group of students to initiate the development of the library and the compilation of literature, and kept us all on track for launching this database quickly. TSG member Mathias Tobler joined the effort a few months later and introduced us to the BRIT virtual library system, which we decided to adopt. Jason Best and Anton Weber from BRIT, as well as our TSG Webmaster Gilia Angell and our TSG Server Administrator Benjamin Leblond, were other fundamental collaborators of this project… and all I can say to all of them is a big, fat THANK YOU!

The TSG Virtual Library aims to make available all published literature on the four species of tapirs. Right now, the library includes over 500 tapir bibliographical references including scientific articles, book chapters, BS / M.Sc. / Ph.D. Dissertations etc. all in PDF format. All the literature that was already available online from different virtual libraries around the world was downloaded, and all bibliography we had in printed format in our own personal collections was scanned and converted into PDF. After all this very time-consuming work, we do believe it is safe to assume that we have been able to collect just about EVERYTHING ever published about tapirs and that our Virtual Library is THE most amazing collection of tapir information, which is now available for download from the TSG website absolutely for free!!!

All users may browse article references and abstracts by searching by keyword. However for now, only TSG members will have an account and will be able to download full articles. At the moment we are seeking permissions from publishers in order to avoid copyright problems, and once this issue is taken care of, we will be able to make the library available to any visitors of the TSG website.

We aim to make the TSG Virtual Library a constantly updated and robust resource for tapir researchers and those interested in accessing published studies and articles on tapirs which are often difficult to obtain in hard copy. For this reason, we would appreciate your help in keeping our library updated. We would like to ask all of you to please take some time to go through the library at http://atrium.tapirs.org/ and make sure we have all tapir literature available. If you notice we are missing an article, a dissertation or any other type of tapir literature, please make sure to let us know. Please let us know if you have any additional tapir-related articles to add. And if you publish something about tapirs, please let us know as soon as possible and send us a copy of your publication. It is very important that all of us work together to keep this library constantly up to date.

Enjoy the library! We strongly believe that the establishment of this library is A MAJOR accomplishment of the Tapir Specialist Group and we hope this new tool will be very useful for our tapir conservation efforts!

Harald Beck from Germany and Mathias Tobler from Switzerland… the two men behind the creation of the TSG Virtual Library.
PHOTO CREDITS: William Konstant (Mathias Tobler's photo) and Harald Beck (Harald Beck's photo).

Patrícia Medici
M.Sc. Wildlife Ecology, Conservation and Management
Research Coordinator, IPÊ - Instituto de Pesquisas Ecológicas (Institute for Ecological Research), Brazil
Ph.D. Graduate Student, Durrell Institute of Conservation and Ecology (DICE), University of Kent, UK
Chair, IUCN/SSC Tapir Specialist Group (TSG)
Convener, IUCN/SSC Conservation Breeding Specialist Group (CBSG) - Brasil Network
Avenida Perdizes, 285, Vila São Paulo, Teodoro Sampaio
CEP: 19280-000, São Paulo, Brazil
Phone & Fax: +55-18-3282-4690 /
Cell Phone: +55-18-8119-3839
E-mail: epmedici@uol.com.br

TSG COMMITTEE REPORTS

Fundraising Committee
TSG Conservation Fund (TSGCF)

Successful Applicants for the TSGCF in 2006

Conservation of Baird's Tapir in Guatemala

Manolo García, manelgato@gmail.com
COUNTRY: Guatemala
SPECIES: Baird's tapir

ABSTRACT: This project is the beginning of an educational program for the conservation of Baird's tapir and its habitat in Guatemala. A workshop will be held in order to contact organizations (governmental and NGOs) which work in areas of potential distribution of Baird's tapir in the country, to form a support network and to get specific information about the tapir's status in each area. With the data collected in the workshop, educational and divulgation material will be designed, printed and given to the organizations for local and regional dissemination. With the creation of the support network we expect a flow of information and cooperation between organizations. This workshop and the design of the educational material will represent the start of an educational program for Guatemala, and valuable information is going to be generated for the development of a National Action Plan for the conservation of the tapir and its habitats.

Population Status and Conservation of Baird's Tapir in the Zoque Forest, Mexico

Iván Lira Torres, ilira_12@hotmail.com
COUNTRY: Mexico
SPECIES: Baird's tapir

ABSTRACT: Baird's tapir had a continuous distribution from southeastern Mexico to northwestern Colombia, ranging from coastal forests and wetlands at sea level to cloud forests and páramos above 3,000 meters. However, high rates of deforestation, habitat fragmentation and over hunting have restricted current tapir distribution to mostly protected and/or remote areas. Given the fast human population growth in southeastern Mexico, it is essential to maintain large preserves extant for the survival of viable tapir populations. It is also very important to identify large forest fragments where tapirs remain in order to promote habitat management, hunting regulation, and other conservation practices in surrounding human communities. This project aims to: (1) estimate the distribution, abundance, home range, and movement patterns of tapir populations inside Zoque Forest; (2) assess the impact of hunting on the specie considered; and (3) design and propose a conservation strategy that contemplates the sustainable use and monitoring of the species in collaboration with local inhabitants. These objectives are thoroughly included in the Action Plan's list of priorities for Baird's tapir conservation.

Determining the Presence of Andean Tapir (*Tapirus pinchaque*) in the Massif of Mamapacha (Boyacá, Colombia)

Javier Adolfo Sarria Perea, jasarrip@yahoo.com
COUNTRY: Colombia
SPECIES: mountain tapir

ABSTRACT: The Mamapacha massif is an isolated fragment of 27,512 hectares of cloud forest and páramos, located in the department of Boyacá in the north of the Colombian Eastern Cordillera. Recently a few unconfirmed reports of the Andean tapir in this area were reported, which if correct may imply its northernmost distribution. This project aims to collect scientific evidence of the presence of the Andean tapir in the Mamapacha massif.

Lowland Tapir Footprint Identification Technique (FIT)

Cristina Tófoli, cftofoli@yahoo.com.br
COUNTRY: Brazil
SPECIES: lowland tapir

ABSTRACT: The lowland tapir (Tapirus terrestris) is listed as endangered on the Red List of São Paulo State, Brazil, given the fact that it only exists in small populations inhabiting small forest patches. One of these populations occurs in the Pontal do Paranapanema Region, located in the extreme west of São Paulo State, Brazil. This region includes Morro do Diabo State Park (35,000 ha), one of the last remnants of Atlantic Forest of significant size, Black-Lion-Tamarin Ecological Station (~12,000 ha), and surrounding forest fragments. This project aims to develop the Footprint Identification Technique

for lowland tapirs and use this tool to estimate and monitor population density over time. FIT is a non-invasive, inexpensive wildlife monitoring technique. For the development of the algorithm, digital photographs of tapir footprints are taken and downloaded into a computer. Landmarks are placed at anatomical references points on the image. Software derives more points, and measures distances and angles between all the points. These measurements create a geometric profile; statistical tools enable individual tapirs (or clusters of a few animals) to be identified. Results from this project will be extremely important for the long-term lowland tapir monitoring program at the Pontal region.

Foraging Habitat Preferences, Diet Composition, and Seed Dispersal of the Lowland Tapir (*Tapirus terrestris*) in the Interior Atlantic Forest of Paraguay

Miguel A. Morales, mamorales@wisc.edu
COUNTRY: Paraguay
SPECIES: lowland tapir

ABSTRACT: The lowland tapir (Tapirus terrestris) is considered "vulnerable" at the regional level and declining at the country level. High rates of habitat destruction and fragmentation, as well as poaching, are the main threats to this species in Paraguay. Although the species has been the subject of numerous studies throughout its geographic range, no research on its ecology has been conducted in Paraguay. The purpose of this research is to study the foraging habitat preferences, diet composition, and the role of lowland tapir as seed disperser in the Mbaracayú Forest Reserve. The methodology includes three components: (1) information on foraging preferences will be collected through direct observation of browsed vegetation recorded along line-transects; (2) diet composition will be assessed through fecal analysis; and (3) the seed dispersal role will be studied comparing germination rates of seeds found in feces with seeds collected elsewhere in the wild. We expect that the results of this research will guide wildlife managers and policy-makers in implementing effective conservation actions for this species. They will also contribute directly to achieving the goals of the Tapir Specialist Group (TSG) at the regional level.

Tapir Density and Habitat Use in El Rey-Centinela Conservation Unit: First Stage

Silvia Chalukian, schalukian@yahoo.com.ar
COUNTRY: Argentina
SPECIES: lowland tapir

ABSTRACT: The El Rey-Centinela Conservation Unit, located in the mid-Yungas region, includes El Rey National Park and many private lands that still maintain a considerable amount (about 380,000 ha) of continuous montane forests, all of which have been only slightly modified by humans. Basic ecological information for landscape planning for tapir's long-term survival is urgent. This strategic planning must be supported with basic ecological information. Using non-invasive methods such as digital camera traps, track analysis, transects and DNA through feces analysis, in different areas of the Park and nearby lands, we will assess density and habitat use by tapirs. This project is the first stage, which involves the assessment of the species' presence and abundance in some sectors of the Conservation Unit.

Marketing Committee

By Gilia Angell

We on the Web and Marketing Committees wanted to announce the addition of a large amount of new content on our site, and some exciting tapir-related media events. You may have already read about them in the website (http://www.tapirs.org/news).

Here they are:

- Secured ownership of www.tapirs.org and will now point our site to that URL. The domain www.tapirspecialistgroup.org will now redirect to www.tapirs.org.

- Tapirs receive international media coverage:
  - Baird's tapirs featured in both the Corcovado National Park & Pantanal segments of USA's Public Broadcast System (PBS) weekly nature series "Wild Things".
  - Tapirs nominated by National Geographic photographer Joel Sartore to be considered for next year's "Nature as Canon Sees It," the

monthly nature-themed Canon Camera ad featured in *National Geographic* magazine.
- o *Terra da Gente* article by Brazilian journalist Liana John published nationally in Brazil, with supporting poster and web campaign (http://www.tapirs.org/news).
- o October 31st publication of Jeffrey Masson's book *Altruistic Armadillos, Zenlike Zebras,* featuring an entire chapter on tapirs, written with help from TSG members (http://www.tapirs.org/news).
- o Tapirs and a tapir character featured in new Mel Gibson movie *Apocalypto*, slated for U.S. theaters in December, 2006.
- o Two childrens' books featuring tapirs were published in 2006:
  1. Sandrine Silhol's *Le tapir terrestre,* available at www.amazon.fr
  2. David McLiman's *Gone Wild: An Endangered Animal Alphabet* showcases the mountain tapir under the letter "T," and is available at www.amazon.com

- Tapir-related interviews: We are now featuring interviews with Zoo Leon veterinarian Jesus Barroso and curator Richard Sheffield about their tapir Scooter's experiences working with Mel Gibson's film production; and an interview with former Costa Rican Minister for the Environment Juan Carlos Rodriguez Echandi about his tapir "run-in" in Corcovado National Park. Links to both can be found on the homepage: http://tapirs.org

- We have launched an "About Tapirs" page on the website, which showcase Stephen Nash's tapir illustrations and text (some TBD) written by TSG tapir experts. Juliana Rodriguez coordinated bilingual content acquistion. Thanks to Manolo Garcia, Keith Williams, Diego Lizcano and Juliana Rodriguez for their help creating content for these pages.

See the site for all downloads and additional information, now at TAPIRS.ORG!

Gilia Angell
Coordinator, TSG Marketing Committee
E-mail: gilia_angell@earthlink.net
http://www.tapirs.org/committees/marketing-committee.html

FUNDRAISING

"Save the Tapir" Campaign Collects Funds for the TSG

By Brian Bovyer

"Dr. Martin Luther King Jr. believed that it was critical for a person to discover something in life which it was worth dying for."

I agree with Dr. King that everybody should find something worth dying for, and I have found that "something". In a recent visit to Costa Rica with my family, I learned that the rainforest is disappearing at an alarming rate. I never really realized this at home in Ohio, because I wasn't there to witness the loss actually happening. All of our rainforests are being destroyed and not enough is being done to save them. This is one issue I feel is worth "dying for", because if we don't save the rainforest, our chances for survival are slim. We all should get involved because of the resources the rainforest supplies. Some resources include oxygen, medicines, and the most diverse wildlife in the world. I also think that not enough people sense the imminence of this impending threat to our survival. What would it look like if there weren't any forests where the Amazon is right now? It would be barren land; a wasteland. The Amazon Rainforest supplies more that 20% of the world's oxygen by absorbing carbon dioxide. I hope that we can save what is left, and that we can save the rainforest not for us, but for everyone else.

There are many endangered species in our world, and one of them is the Baird's Tapir. My family and I stayed at Rafiki Safari Lodge near Santo Domingo, Costa Rica, where the people there are biologists, veterinarians and environmentalists who are trying to reintroduce this tapir species. The Baird's Tapir scatters seeds and eats the low-lying vegetation that covers up where young trees grow. The tapir is a very important part to the re-growth of the rainforest, and without it the rainforest there has a small chance of re-growth.

When we arrived back home, I thought for a while on what I could do to help. I learned that small steps make big statements, and so I organized a Save the Tapir drive. My mom and I researched the "LIVEstrong" type bracelets, and we also did a lot of research on the tapir. We worked long and hard and we are able to start helping to Save the Tapir by selling these bracelets at school and public places. The proceeds will go to the Tapir Specialist Group to reintroduce the tapirs to the

rainforest. I am excited knowing I can help save the tapir.

Based on knowledge, I believe that we need to take a stand to save the rainforests. Our future generations have a slim chance of surviving if there is no rainforest. We need to get more people involved in this issue. I was fortunate to go to Costa Rica and see it and understand this urgency, but if the rainforest disappears, people are not going to get the same chance. I believe rather than allowing the problem to take control of us, we must take control of the problem. In doing so we will help to preserve the rainforest for future generations and ensure that there will always be clean air to breathe. Like Dr. King I will fight for what is right by staying involved in conservation issues.

Brian's Advisory Group. Back row: Alex Royer, Britanny Ramsey, Mr. Ronald Teunissen Van Manen, Nathan Napolitano, Alexandra Stec. Front row: Blake Gross, Brian Bovyer, Anita Salley. Missing from picture: Lauren Smith.
PHOTO CREDIT: Vicki Henschen

I am proud to know that the Save the Tapir drive was a great success, and that we made US$ 450 for the Tapir Specialist Group. This was a team effort by several people; without the help of my advisory at Old Trail School, this never would have been a success. The help and support of the following friends was very important: Mr. Teunissen, Blake Gross, Alexandra Stec, Lauren Smith, Brittany Ramsey, Alex Royer, Nathan Napolitano, and Anita Salley. Hopefully the success of this project, and others like it, will bring a better future for the tapirs.

Brian Bovyer
High school student, Texas, USA

INTERVIEW

Interview with Carlos Manuel Rodriguez Echandi

By Jeffrey Flocken

Carlos Manuel Rodríguez Echandi, the former Costa Rican Minister of Environment and Energy and highly acclaimed conservationist, recently left his post to work for an international NGO.

This past April, just prior to his departure from his government appointment, the Minister was separated from a ranger patrol in Costa Rica's Corcovado National Park and attacked by a tapir. After a harrowing two days wandering injured through the dense forest, he was able to find his way out and was taken by helicopter to a hospital where he was treated for his injuries. IUCN Tapir Specialist Group member Jeff Flocken had the opportunity to interview him about tapirs and biodiversity conservation in Central America.

JF: Thank you for giving me the opportunity to ask you these questions Mr. Rodríguez. I'll start right off with the one that is most important – have you recovered from your ordeal in the Corcovado?

CR: *Absolutely, I had a lot of minor cuts, an injured hip and rib, and a couple of dozen ticks on my body. But now I am doing great.*

JF: Tapirs, though large wild animals, are generally considered shy and non-threatening to humans. Had you ever heard of any tapir attacks prior to your incident?

CR: *I remember as a child my grandfather telling his experiences as a hunter, and telling us his grandchildren how many dogs he lost because tapirs were extremely aggressive when chased by hunting dogs. I also remember some tales of park rangers about tapirs and about them being aggressive when chased or when they are with their young.*

JF: What was your previous experience with tapirs?

CR: *I've seen quite a lot of wild tapirs in different national parks in Costa Rica, because, even though I*

am a lawyer, I did work a lot in the field as a volunteer and later as the Director of the National Parks System. And yes they are extremely shy. Every time I saw them, it was basically their hind parts as they ran away into the forest. In the last eight years I have seen a lot of tapirs of the Sirena Biological Station in Corcovado National Park, where Charly Foerster has been working with tapirs for many

Mr. Rodríguez pilots a boat during one of the ranger patrols that he created to rid Costa Rica's National Parks of poachers that threaten endangered wildlife, including the Baird's tapir.

years. His radio-collared tapirs are very tame and I've taken people to visit the area and see the animals -- including a couple of Costa Rican Presidents and my four year old son. And everybody gets very excited by watching this incredible animal.

JF: Are there any details or comments you could make on the incident in Corcovado?

CR: *Let me tell you my story. I was visiting this Park with a ranger patrol as my last visit to the area as Minister. In this park we had a serious poaching problem and for the last three years I personally got very involved in solving it. With a grant from the Moore Foundation and support by The Nature Conservancy, we hired 68 new rangers and have been able to rid the park of poachers. We decided to patrol a remote area we call the "bajura" (the lowlands) and planned to be in the forest for four or five days. On our first day we were walking a 14 km-long trail to base camp. While walking, I decided to move ahead of the rest of the group (around 12 park rangers) because I wanted to see some rare Caracara birds, when all of a sudden I saw a tapir right next to the trail. This tapir had a small calf, probably two months old, which was limping. The calf immediately attracted my attention and I got off the trail to follow both of them into the dense rain forest. The mother tapir noticed me following them and never gave me a clear angle of her baby. I was very interested to see why it was limping, but again and again, the mother tapir never allowed me a clear view. So I decided to run ahead of them and hide behind a tree, waiting to see the calf as it passed by, which was a big mistake!!!! Indeed, they passed by me and I was able to see the calf very well. The baby tapir had deep wounds in its back, probably due to a jaguar attack. At that moment, the mother tapir saw me and immediately charged me. I turned around and ran, but in less than 5 meters she caught up with me. She pushed me to the ground and began biting me. The first bite was on my rubber boot and the next four bites were to my backpack (which saved my life!). All along I was playing dead, like an opossum, until I felt the tapir was trying to bite me in the back of my neck. At that moment, I ran on all four limbs and jumped into a dry rocky creek. I hit many rocks and fallen branches and landed hard on one side of my body. I lost consciousness and when I came to, probably an hour later, I was walking in the forest very confused and in a lot of pain. I remembered everything that happened to me and realized that I was very lucky to have survived, because this animal was furious and her strength was incredible. I never saw her again. No doubt my backpack saved my life.*

I tried to return back to the trail but never found it. The rangers never saw anything because they were walking in the trail behind me when I left them, and they continued their journey always thinking that I was ahead of them. After failing to find the trail, I realized that my only option was walking my way through the forest out of the park. So in a nutshell, I walked in extremely dense lowlands tropical forest for three days (around 16 km) until I made it to the coast, where helicopters and many people were looking for me. During those days I didn't have food, except for some crackers, but otherwise I was very well equipped because my plans were to spend five days in the jungle.

JF: Has the attack changed your personal view of tapirs?

CR: *Yes. First, I am very lucky to be alive, because I know that had that animal bitten me, I probably wouldn't have been able to walk out of the park. Second, surviving an experience like this makes me respect nature more and recognize the need to redouble our efforts to conserve and protect it. And finally, I developed a personal and particular interest in tapirs that I never had before.*

JF: What an incredible story. With your considerable field and government experience, what do you think are the greatest challenges to the tapir's survival in Latin America?

CR: *The biggest challenge for tapir survival in the Neotropics is the level of poverty in communities in tropical areas, and the lack of political stability in the tapir range countries. This translates into difficult challenges for long term conservation.*

JF: On behalf of the IUCN Tapir Specialist Group, thank you for your time and for your willingness to discuss tapirs and conservation in Latin America. I wish you great luck in your new position -- both tapirs and people are lucky to have you fighting for biodiversity conservation.

CR: *One final request: now with this personal experience, I want to be included in the Tapir Specialist Group of IUCN!*

JF: That should not be a problem. Thank you again.

NEWS FROM THE FIELD

Humans Attacked by a Baird's Tapir (*Tapirus bairdii*) in the Sierra de Agalta National Park, Olancho, Honduras

By Nereyda Estrada

The tapir (*Tapirus bairdii*) is the largest mammal that inhabits the Neotropical forests. In Honduras this species is found mostly in the eastern portion of the country and in some isolated cloud forests patches elsewhere. One of these areas is the Sierra de Agalta National Park (SANP), which encompasses 51,792 hectares of broadleaf and pine forests. A considerable number of villages can also be found in the buffer zone of this park, where people live mostly from subsistence agriculture and extensive cattle grazing.

From November 2005 to June 2006 I conducted a research about some aspects of the ecology of the tapir in the SANP. During one of the field trips I documented the attack by a tapir of two adult men from a local village. I interviewed people that witnessed the attack and I visited the Orthopedic Department at the National Honduran Hospital (Hospital Escuela) in Tegucigalpa, where one of the injured men was given medical treatment.

The attack occurred the second week of January 2006, in the neighborhood of the village of Vallecito de Río Tinto, Olancho, located in the buffer zone of the SANP. The animal that perpetrated the attack was a juvenile male tapir that weighed approximately 170 pounds (adult Baird's tapirs can weigh >250 pounds).

According to eyewitnesses, a local farmer was working at a grazing field for cows when his dogs surrounded the tapir in a small river nearby and the barking attracted the man. The man approached the scene and attacked the animal with a machete; the wounded tapir in return attacked and bit the man's right arm. He was brought immediately back to the village, from where other men took off in search of the tapir. When they found it bleeding in the small river, a 24 year old man attacked the tapir with a machete but slipped and fell in front of the animal, thus allowing the animal to reach and bite his left arm. Finally, other men shot and killed the tapir with a fire arm caliber 0.70. By the time the animal was shot, he had received several wounds from the machetes.

Figure 1. Farmer's left forearm X-ray photograph after he was bitten by a Baird's tapir (*Tapirus bairdii*), in the Sierra de Agalta National Park, Olancho, Honduras, 2006.

The second man that was bitten came to the National Hospital (Hospital Escuela) in Tegucigalpa for treatment. According to the doctors, Faustino Lainez and Roger Domínguez, at the Orthopedic Department, the man suffered a bite on the middle third of the forearm that cut the tendons and caused an exposed multiple fracture of both ulna and radius bones, bone loss, and a severe tissue infection (Figure 1). In order to reconstruct the arm, it was necessary to perform several disinfections, a bone implant, and to set up a platinum bolt and two platinum plates on both sides

of the forearm. The bone implant was taken from the hip and the patient had to remain hospitalized for five weeks. The Honduran Government paid approximately US$ 40,000 for the medical treatment of this man.

Tapirs are normally shy animals that will avoid humans and will rapidly flee when encountered by people. Throughout Honduras tapirs are extremely difficult to find and see in their natural habitat, unless they are chased with hunting dogs, in which case the dogs will corner and surround the tapir until the hunter comes within shooting distance. Haddad *et al.* (2005) report on a fatal attack caused by a lowland tapir (*Tapirus terrestris*) in southeastern Brazil. In that case, the man who was killed by the tapir provoked the animal by grabbing and stabbing it. The tapir was later found nearby, dead from the wounds inflicted by the local farmers. To my knowledge, there is no other documented or published case of tapirs attacking humans in Honduras, although several hunters have related to me how provoked tapirs have attacked and killed their hunting dogs.

This event may motivate several reactions in the people from the village of Vallecito. Farmers armed only with machete (the great majority) will avoid trying to kill a tapir, while men with firearms will shoot a tapir on sight. A local hunter told me that a businessman from the city of Catacamas, Olancho, had requested a tapir's calf and was willing to pay him up to US$ 500. Usually, in order to get the calf, hunters have to first kill the adult female. This hunter commented that after the attack, he was no longer interested in this kind of deals. On the other hand, there is a possibility that hunters and their dogs will more often organize tapir hunting expeditions that will now be positively seen by the local villagers.

In the SANP as in most of the rest of the country, deforestation and human population growth are severely reducing the tapir's habitat.

Nereyda Estrada M.Sc.
Proyecto Manejo Integrado de Recursos Naturales (USAID/MIRA)
Country Coordinator, Honduras,
IUCN/SSC Tapir Specialist Group (TSG)
E-mail: nerestr@yahoo.com

Literature

Haddad, V., Assuncao, M. C., de Mello, R. C. and Duarte, M. R.. 2005: Wilderness & Environmental Medicine, 2(16): 97-100.

CONTRIBUTED PAPERS

Population Dynamics and DNA Microsatellite Survey in the Lowland Tapir

Benoit de Thoisy[1], Cécile Richard-Hansen[2], François Catzeflis[3], Anne Lavergne[4]

[1] TSG Member, Association Kwata, Cayenne, French Guiana. thoisy@nplus.gf
[2] Office National de la Chasse et de la Faune Sauvage, Kourou, French Guiana
[3] Laboratory of Paleontology, University of Montpellier, France.
[4] Institut Pasteur de la Guyane, Cayenne, French Guiana

Introduction

Located on the Eastern part of the Guianas shield, French Guiana is an administrative unit of France, covered by one of the largest remaining blocks of tropical rainforest, and with a very low rate of deforestation (Whitmore, 1997). Despite a still favorable context, the country suffers from lack of political interest in conservation of natural resources; for instance, only 3% of the territory is classified as nature reserves. The region also faces a dramatic increase of gold mining activities (Hammond *et al.*, 2006). Lastly, no hunting regulations are in effect. Several large species of birds and mammals are currently considered threatened, at least in the northern part of the country where most human populations are concentrated. In previous works, hunting pressure was quantified in 4 sites in the north of

the country, and results showed that the observed harvests were beyond maximal thresholds for several large primates species (de Thoisy *et al.*, 2005) and for the Lowland tapir (de Thoisy & Renoux, 2004).

We present the results of the first survey on microsatellite DNA polymorphism in the Lowland tapir, *Tapirus terrestris*, from French Guiana. Molecular approaches are gaining importance in species conservation, since molecular markers can provide reliable information on population dynamics, trends, and gene flow between areas (for studies in Neotropical mammals see Eizirik *et al.*, 2001; Norton & Ashley, 2004; Ruiz, 2005; for studies in Neotropical reptiles see de Thoisy *et al.*, 2006). Population genetics usefully complement field ecological and classical methods, such as surveys, assessment of habitats, and levels and impacts of threats.

Material and Methods

DNA was extracted with the phenol-chloroform procedure from tissue samples (n=37) collected in hunted animals all over the country (Figure 1). Five oligonucleotide primers developed for *T. bairdii* and *T. terrestris* (Ashley & Norton, 2004) were used: Tte15, Tte5, Tba21, Tba15, Tba23.

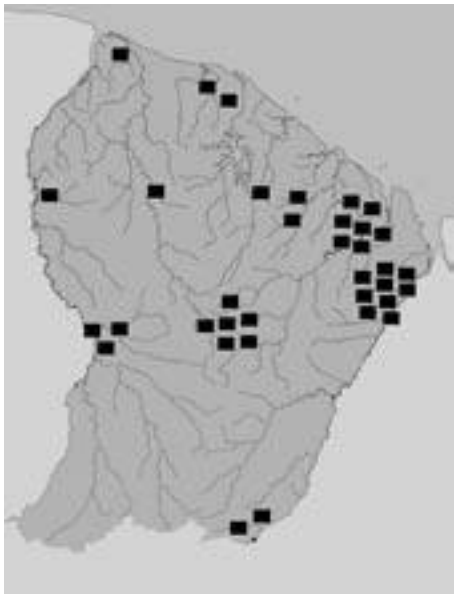

Figure 1. Location of survey sites in French Guiana.

Population structuring was investigated with a Bayesian model-based clustering algorithm with STRUCTURE v.2 (Pritchard *et al.*, 2000). Genetic analyses were performed with GENEPOP v.3.4 (Raymond & Rousset, 1995). Genetic polymorphism was measured as observed number of alleles (A), observed heterozygosity (Ho) and the heterozygosity expected under Hardy-Weinberg proportions (He). Deviation from Hardy-Weinberg equilibrium was tested using Fisher's exact test for fit of genotype proportion (Guo & Thompson, 1992) with the alternative hypothesis H_1 = heterozygote deficiency. The genetic structure of populations was examined by use of Fis and Fst (Weir & Cockerham, 1984). The significance of Fst was determined by a log-likelihood G-based test (Goudet *et al.*, 1996). Presence of bottlenecks was investigated with the probability of heterozygote excess with a Wilcoxon test, and qualitatively by the shape of the distribution of pairwise differences in repeat numbers among all alleles at each locus, averaged across loci (BOTTLENECK 1.2.02, Cornuet & Luikart, 1996). The interlocus g-test and the Pk distribution method were used to evaluate the hypothesis of population expansion.

Results

The Bayesian model demonstrated with a high probability (p = 0.94) that the animals came from one single ancestral cluster. Further, the between-sample variation of alleles indicates no differentiation between northern and southern samples (Fst = -0.0014, p = 0.64 – Table 1), suggesting a single panmictic population. The allelic diversity in our sample ranged from 5 to 12, with high observed and expected heterozygosities (0.76 and 0.78 – respectively); the population is at Hardy-Weinberg equilibrium (Fis = 0.03, p = 0.95). This feature was confirmed by significant heterozygote excess (Wilcoxon test: p=0.03), which revealed a bottleneck estimated to have occurred 15-25 generations ago. In contrast, the second test, the loci pair-wise difference, showing a normal L-shape distribution, was not significant and suggests that this bottleneck was not severe. Lastly, both the interlocus-g test and the pK distribution revealed that the population is not expanding.

Table 1. Average alleles/locus (Â), expected (*He*) and observed (*Ho*) levels of heterozygosity and inbreeding coefficient (*f*).

Population (n)	*(Â)*	*He*	*Ho*	*f (Fis) / P-value*
French Guiana (37)	8.00	0.78	0.76	0.03 / 0.95
Costa Rica* (15)	2.50	0.37	0.39	-0.06 / 0.69
Panama* (15)	3.30	0.43	0.41	0.03 / P>0.05

*** in *Tapirus bairdii*, Norton & Ashley 2004.**

Discussion and Conclusions

Gene diversity and heterozygocity values recorded in the French Guianan population of *T. terrestris* are comparable to those recorded in other healthy populations of large mammals, and higher than those recorded in fragmented populations of *T. bairdii* (Norton & Ashley, 2004) (Table 1). But the limited evidence of a rather recent bottleneck may nevertheless suggest a weakened population. These data represent our preliminary results on assessment of densities, showing reduced abundances in the northern part of the country, where threats to both the tapir and its forest habitats are higher (B. de Thoisy, unpub data). Also, the monitoring of game harvest showed, on the base of analysis of skulls, that almost 75 % of animals killed in this region were not adult (C. Richard-Hansen, unpub. data). Current pressures, including unmanaged hunting, the possibility to commercially market tapir meat, and the cryptic but nevertheless widespread hunting by gold miners, may have dramatic short-term consequences on tapirs in French Guiana.

The identification of a single population in French Guiana has nevertheless important conservation implications. Indeed, absence of structure in the genetic sample allows for a wide range of management options for the species, such as hunting periods and quotas. Large protected areas must also play a major role as hunting refugia for species management; i.e. the possibility that hunted areas may be adjacent to areas free of harvest. The latter could act as efficient sources for re-colonization, and may facilitate population recovery, as along with efficient conservation measures undertaken in hunted areas.

Acknowledgements

The study was funded by the Association Kwata, and made possible with the logistic help of the Institut Pasteur de la Guyane.

Literature Cited

Cornuet, J.M., Luikart, G., 1996. Description and power analysis of two tests for detecting recent population bottlenecks from allele frequency data. *Genetics* 144: 2001-2014.

Eizirik E., Kim J.H., Menotti-Raymond M., Crawshaw P., O'Brien S.J., Johnson W. 2001. Phylogeography, population history and conservation genetics of jaguars (*Panthera onca*, Mammalia, Felidae). *Molecular Ecology* 10: 65-79.

Goudet, J., 1999. FSTAT, a program to estimate and test gene diversities and fixation indices, version 2.8.

Goudet, J., Raymond, M., De Meeüs T., Rousset, F., 1996. Testing differentiation in diploid populations. *Genetics* 144: 933-1940.

Guo, S.W., Thompson, E.A., 1992. Performing the exact test of Hardy-Weinberg proportion for multiple alleles. *Biometrics* 48: 361-372.

Hammond D.S., Gond V., de Thoisy B., Forget P.M., DeDijn B. Causes and consequences of a tropical forest gold rush in the Guiana Shield, South America. *Ambio*, in press.

Norton J.E., Ashley M.V. 2004. Genetic variability and population structure among wild Baird's tapirs. *Animal Conservation* 7: 211–220.

Pritchard, J.K., Stephens, M., Donnelly, P. 2000. Inferrence of population strcuture using multilocus gentype data. *Genetics* 155: 945-959.

Raymond, M., Rousset, F., 1995. GENEPOP version 1.2: population genetics software for exact tests and ecumenicism. *Journal of Heredity* 86: 248-249.

Reich, D.E., Goldstein, D.B., 1998. Genetic evidence for a Paleolithic human population expansion in Africa. *Proceedings of the National Academy of Sciences* 95: 8119-8123.

Ruiz-Garcia M. 2005. The use of several microsatellite loci applied to 13 neotropical primates revealed a strong recent bottleneck in the Woolly Monkey (*Lagothrix lagotricha*) in Colombia. *Primate Report* 71: 27-55

Shriver, M.D., Jin, L., Ferrel, R.E., Deka, R., 1997. Microsatellite data support an early population expansion in Africa. *Genome Research* 7: 586-591.

de Thoisy B, Renoux F, Julliot C. 2005. Hunting in northern French Guiana and its impacts on primates communities. *Oryx* 39: 149-157.

de Thoisy B, Renoux F. 2004. Status of the lowland tapir in French Guiana: hunting pressure and threats on habitats. Second International Tapir Symposium, TSG/SSC, Panama

de Thoisy B, Hrbek T, Farias IP, Vasconcelos WR, Lavergne A. 2006. Genetic structure, population dynamics, and conservation of Black caiman (*Melanosuchus niger*). *Biological Conservation* 133: 474-482

Weir, B.S., Cockerham, C.C., 1984. Estimating F-statistics for the analysis of population structure. *Evolution* 38: 1358-1370.

Whitmore T.C. 1997. Tropical forest disturbance, disappearence, and species loss. Pages 3-12 in W.F. Laurance and R.O. Bierregaard Jr., editors. Tropical forest remnants: ecology, management and conservation of fragmented populations. The University of Chicago Press.

Evaluación del Hábitat para la Danta Centroamericana (*Tapirus bairdii*) en la Zona Norte de Costa Rica

Olivier Chassot, Guisselle Monge Arias & Vladimir Jiménez

Centro Científico Tropical / Corredor Biológico San Juan-La Selva
Apartado 8-3870-1000 San José, Costa Rica, E-mail: lapa@cct.or.cr

Abstract

Baird's Tapir (*Tapirus bairdii*) survives in the San Juan-La Selva Biological Corridor, a mosaic of fragmented forest habitats that maintain the ecological connectivity between the lowland rain forest ecosystem of Southeastern Nicaragua and Northern Costa Rica with Costa Rican montane forests. This corridor totals more than one million hectares of protected areas in different degrees of conservation. Evidence of tapir presence in the corridor has been observed during the last eight years, but the status of this species in the area remains largely unknown, leading us to conduct a habitat viability assessment based on our knowledge of the area and on information about Baird's Tapir in similar ecosystems. We used GIS data, measuring seven ecological parameters that allowed us to characterize the availability of habitat for Baird's Tapir in the San Juan-La Selva Biological Corridor. We estimated the number of tapirs to range from 69 to 208 individuals. Our methods exemplify an inexpensive means to assess Tapir's habitat viability where there is substantial and reliable georeferenced data about the ecosystems present in the study area.

Introducción

El Corredor Biológico San Juan-La Selva (CBSS), en la Zona Norte de Costa Rica, alberga el último hábitat de conexión viable que permite mantener la continuidad del Corredor Biológico Mesoamericano* entre Nicaragua y Costa Rica, garantizando la conectividad ecológica y la viabilidad de una biodiversidad regional única - un bosque biológicamente diverso, dominado por el almendro (*Dipteryx panamensis*). Esta región, entre el Río San Juan y la vertiente norte de la Cordillera Volcánica Central, contiene varias especies en peligro de extinción, incluyendo la danta centroamericana (*Tapirus bairdii*), la lapa verde (*Ara ambigua*), el jaguar (*Panthera onca*), el pez gaspar (*Atractosteus tropicus*) y el manatí (*Trichechus manatus*). En la región actualmente se desarrolla una iniciativa integral para implementar el Corredor Biológico San Juan-La Selva y su área núcleo, el Refugio Nacional de Vida Silvestre Mixto Maquenque, con el fin de conservar un mosaico de habitats boscosos amenazados y establecer un mayor enlace del Corredor Biológico Mesoamericano, a nivel nacional, binacional y regional.

Ubicación Geográfica del Corredor Biológico

El Corredor se ubica al norte de las provincias de Heredia y Alajuela, abarcando parte de los cantones de Sarapiquí y San Carlos. La superficie del Corredor Biológico San Juan-La Selva es de 246.608 hectáreas y pertenece a la Cuenca del Río San Juan.

La razón principal por la cual planteamos la creación del Refugio Nacional de Vida Silvestre Mixto Maquenque es porque éste contiene los únicos

Fotografía 1. Hábitat de alto potencial de uso para la danta (*Tapirus bairdii*) en el Corredor Biológico San Juan – La Selva.

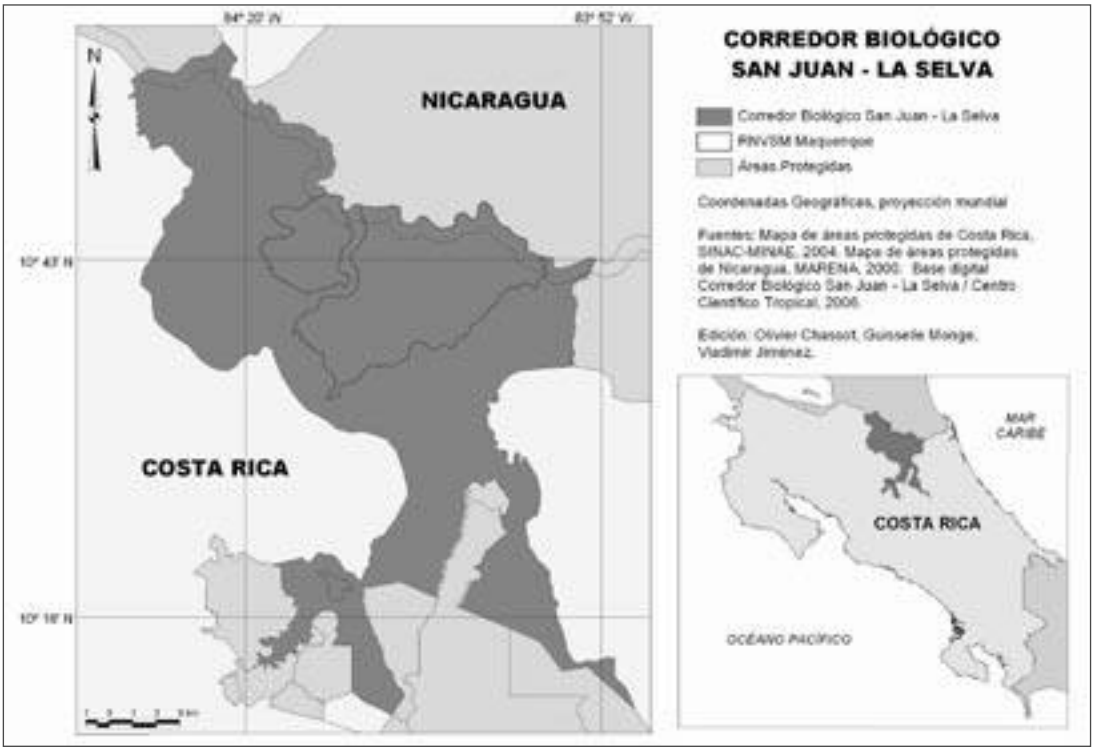

Figura 1. Ubicación del Corredor Biológico San Juan - La Selva.

El Corredor Biológico Mesoamericano es un esfuerzo de conservación conjunto de todos los países en Centroamérica; establecido oficialmente en 1997 por los Jefes de Estado; tiene como objetivo promover la protección de áreas estratégicamente ubicadas, de manera de asegurar la interconexión del Sistema Centroamericano de Areas Protegidas (SICAP) con zonas aledañas de amortiguamiento y uso múltiple, y permitir el movimiento de especies que requieren grandes áreas de acción, tales como la danta.

bosques primarios remanentes de gran extensión en la Zona Norte, dentro de ecosistemas que no tienen representación en ningún otro sitio (Figura 3). Estos bosques pertenecen principalmente a la zona de vida de bosque tropical muy húmedo (Holdridge, 1967); los mismos han ido desapareciendo a un ritmo acelerado en la Zona Norte, y en el presente persisten tan sólo en unos cuantos fragmentos ubicados en El Jardín, La Cureña y Chaparrón.

Los bosques primarios remanentes representativos de la región suelen presentar altos índices de biodiversidad, como se describe más adelante. Es necesario destacar que la región no solamente es importante por el número de especies sino porque se encuentran varias especies amenazadas o en peligro de extinción. Existen poblaciones de árboles de almendro de montaña (*Dipteryx panamensis*), titor (*Sachoglottis trichogyna*), pinillo (*Podocarpus guatemalensis*) y jícaro (*Lecythis ampla*). Por otro lado, es poco común ver humedales de bajura yuxtapuestos con montañas cercanas; gradientes altitudinales en cortas distancias como éste frecuentemente son muy ricos en biodiversidad. Históricamente, este dúo pantanos-bosques de montaña estuvo presente en toda la zona norte; sin embargo, hoy sólo persiste en la extensión del propuesto Refugio Nacional de Vida Silvestre Mixto Maquenque.

El Refugio Nacional de Vida Silvestre Mixto Maquenque contiene un complejo de humedales asociados a la cuenca baja del Río San Juan: Humedal de Tamborcito, Tambor, Maquenque, Remolino Grande y Colpachí, con vegetación muy característica localizada a orillas de cuerpos de agua, humedales lacustrinos con ciénagas y marismas, y yolillales o áreas con dominancia de yolillo (*Raphia taedigera*). El área de los humedales representa un porcentaje alto del área total del refugio.

Diversidad Biológica

La diversidad biológica presente en el Corredor Biológico San Juan-La Selva es excepcionalmente alta, reflejo de la situación biogeográfica general de Centroamérica y a consecuencia de cambios altitudinales abruptos, entre 30 y 3.000 msnm; diferentes regímenes de precipitación y variaciones en los tipos de suelos. Posiblemente, San Juan-La Selva sea el corredor con mayor diversidad florística en Costa Rica, hospedando más de 6,000 especies de plantas vasculares, con un número significativo de endémicos. Hartshorn y Hammel (1996) reportaron que un 45% de las especies en seis familias de plantas (Cyclanthaceae, Marantaceae, Cecropiaceae, Clusiaceae, Lauraceae y Moraceae) eran endémicas de Centroamérica y estimaron que un 10% de la flora caribeña costarricense es endémica del país, una tasa más alta que la encontrada en la mayoría de las regiones templadas (Gentry, 1986).

La fauna del Corredor Biológico San Juan-La Selva también refleja la transición entre las zonas Neotropical

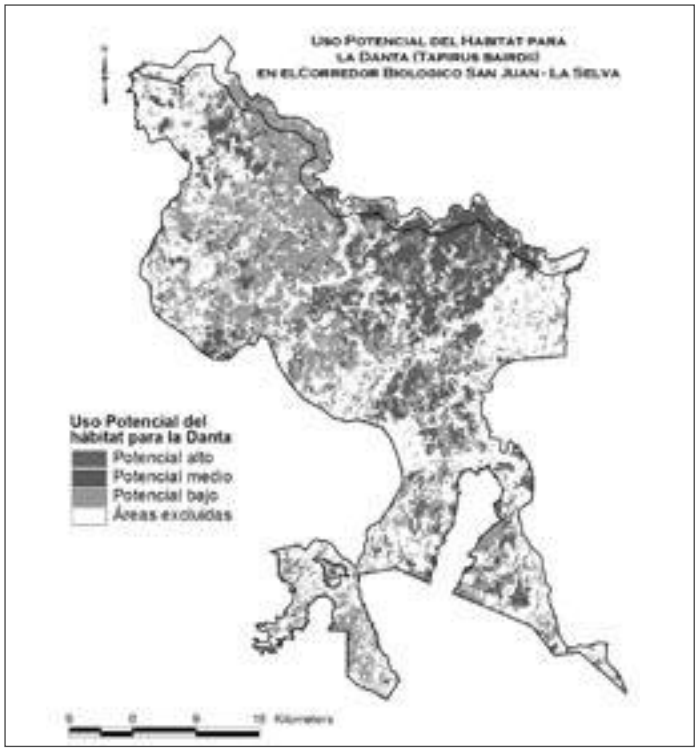

Figura 2. Uso potencial de hábitats para la danta (*Tapirus bairdii*) en el Corredor Biológico San Juan – La Selva.

y Neártica (OEA/PNUMA, 1997); alberga 139 especies de mamíferos, 515 aves, 135 reptiles y 80 anfibios. En comparación, la ecorregión terrestre prioritaria de Mesoamérica definida por Conservación Internacional alberga un total de 1,193 aves (Mittermeier *et al.*, 1999), de las cuales un 43% se encuentra presente en el Corredor Biológico San Juan-La Selva. La flora vascular y la fauna de vertebrados son eclipsadas por la riqueza de especies de invertebrados. La fauna de Lepidoptera reportada en la Estación Biológica La Selva excede 6,000 especies (De Vries, 1994).

Uso de Hábitat de la Danta Centroamericana

La danta centroamericana (*Tapirus bairdii*) vive en bosques húmedos, bosques secos, bosques secundarios viejos, y yolillales. Por lo tanto, ha de estar presente en el Corredor Biológico San Juan-La Selva donde haya cobertura forestal, humedales y una combinación de yolillales y pantanos herbáceos. Se alimenta de follaje y semillas de una gran variedad de plantas, razón por la cual se considera un buen dispersor de semillas que contribuye a la regeneración de bosques (Naranjo, 1995b). Según Matola *et al.*, (1997), esta especie es más abundante en áreas de difícil acceso. La danta muestra preferencia por las frutas de "yolillo", las cuales se traga entera.

Las densidades de danta centroamericana se han estimado entre 0.22 individuo / km^2 (Lacandon, Chiapas, México, Naranjo & Bodmer, 2002), y 1.60 individuo / km^2 (Parque Nacional Corcovado, Costa Rica, Foerster, 2002). Se ha observado una preferencia de la especie por paisajes con fragmentos importantes de bosque de bajura intervenido y bosque secundario, con claros naturales o provocados por el ser humano (Foerster & Vaughan, 2002), combinaciones de humedales, cuerpos de agua permanente (Matola et al., 1997; Naranjo & Bodmer, 2002), quebradas y caños, yolillales y pantanos herbáceos, y bosque ripario (Naranjo, 1995a) o con pendientes suaves (Tobler, 2002). Además, se ha estimado que el rango hogareño de la danta centroamericana puede medir de 125 hectáreas (Foerster & Vaughan, 2002) hasta 136 hectáreas (Parque Nacional Corcovado, Costa Rica, Foerster, 2002), y que la danta centroamericana puede desplazarse grandes distancias en búsqueda de un nuevo rango hogareño (Parque Nacional Corcovado, Costa Rica, Foerster, 1998). Al menos hay un reporte en la literatura de una zona de exclusión de al menos 290 metros alrededor de centros de población humana (Flesher & Ley, 1996).

Análisis Geo-Espacial del Hábitat Potencial de la Danta Centroamericana en el CBSS

Con el propósito de crear un mapa que resalte el hábitat potencial de la danta centroamericana en el Corredor Biológico San Juan-La Selva, realizamos un

Fotografía 2. Hábitat de alto potencial de uso para la danta (*Tapirus bairdii*) en el Corredor Biológico San Juan – La Selva.

análisis geo-espacial mediante el cual se combinaron diferentes parámetros ecológicos preferidos por este mamífero:

1. Fragmentos de cobertura forestal (bosque primario, bosque secundario, charral, tacotal)
2. Lagunas y espejos de agua
3. Humedales
4. Red hidrográfica
5. Pendientes del terreno

Además se consideraron otras coberturas que implican un factor de exclusión por afectar directa y negativamente a poblaciones de danta, incluyendo:

1. Poblados
2. Carreteras y caminos asfaltados o lastrados

Para la cobertura forestal, se empleó el mapa de cobertura de uso del suelo del 2000, del Instituto Meteorológico Nacional – Ministerio del Ambiente y Energía (IMN-MINAE), analizando imágenes de satélite a escala 1:50,000 de las cuales excluimos previamente todos los usos agropecuarios para trabajar con los fragmentos de uso forestal o en proceso de forestación. La cobertura de bosques fue preclasificada de acuerdo a la Tabla 1.

Tabla 1: Categorización de los datos de cobertura forestal en el CBSS.

Área del fragmento de bosque	Calificación para el hábitat	Puntaje
< 125 ha	Deficiente	1
> 125 ha a < 136 ha	Adecuado	2
> 136 ha	Excelente	3

Para las capas de datos geo-espaciales referidas a las lagunas y espejos de agua, utilizamos las hojas cartográficas del Instituto Geográfico Nacional (IGN) de Costa Rica, escala 1:50,000, de las cuales extrajimos las lagunas permanentes e intermitentes, así como las áreas anegadas en todo el CBSS. Debido a que la danta centroamericana prefiere ambientes con fuentes de agua, a estas áreas se les asignaron tres áreas de amortiguamiento con un ancho de 100 metros cada una, las áreas más cercanas a las lagunas presentando mayor probabilidad de que exista una danta y las áreas más alejadas menor probabilidad. La cobertura de lagunas fue preclasificada de acuerdo a la Tabla 2. Por otra parte, tomando en cuenta la afinidad de la danta por los ambientes semiacuáticos, utilizamos la capa de información del mapa de humedales identificados por la UICN dentro del CBSS.

Tabla 2: Categorización de los datos de cobertura de lagunas en el CBSS.

Área del segmento	Calificación del hábitat	Puntaje
Laguna	Excelente	3
Área de 1 a 100 m	Excelente	3
Área de 101 a 200 m	Adecuado	2
Área de 201 a 300 m	Adecuado	1

Al igual que en el caso anterior, tomamos como criterio que la danta prefiere ambientes con alto grado de humedad (tierras anegadas); a estos hábitats se les generaron tres áreas con un ancho de 100 metros, las áreas más cercanas a los humedales consideradas con mayor probabilidad de que exista una danta y las áreas más externas con menor probabilidad.

La cobertura de humedales fue preclasificada de acuerdo a la Tabla 3.

Tabla 3: Categorización de los datos de cobertura de humedales UICN en el CBSS.

Área del segmento	Calificación para el hábitat	Puntaje
Humedal	Excelente	3
Área de 1 a100 m	Excelente	3
Área de 101 a 200 m	Adecuado	2
Área de 201 a 300 m	Adecuado	1

Alrededor de todos los cauces de ríos, quebradas y caños, se generaron tres áreas con un ancho de 40 metros entre cada una, los espacios del cauce y las áreas más cercanas con mayor probabilidad de que existe una danta y las áreas más externas con menor probabilidad, de acuerdo a la Tabla 4.

Tabla 4: Categorización de los datos de red hídrica en el CBSS.

Área del segmento	Calificación para el hábitat	Puntaje
Ríos, quebradas y caños	Excelente	3
Anillo de 1 a 40 m	Excelente	3
Anillo de 41 a 80 m	Adecuado	2
Anillo de 81 a 120 m	Adecuado	1

Debido a que la presencia de la danta se ve limitada por la densidad de la actividad humana, se generó

un área de exclusión de 300 metros alrededor de cada poblado dentro del CBSS. Por lo general, las áreas de asentamientos humanos se encuentran desprovistos de cobertura forestal por lo que la exclusión de zonas con bosque debido a la proximidad de poblados son muy pocos. Para esta cobertura se emplearon las hojas cartográficas del IGN de Costa Rica y el trabajo de campo realizado durante la fase de diagnóstico del Plan de Manejo del Refugio Nacional de Vida Silvestre Mixto (RNVSM) Maquenque.

La red vial es otro factor limitante, especialmente en zonas de alto tránsito; sin embargo, estas zonas son las que se encuentran más alteradas, por lo que difícilmente podemos encontrar núcleos de bosque. En el caso inverso, los caminos de tierra dentro de zonas boscosas son empleados sólo por períodos muy cortos y con poca frecuencia, por lo que la vía en si no constituye una fuerte limitante de peso, y a menudo se observan huellas de danta. Para esta cobertura se emplearon las hojas cartográficas del IGN de Costa Rica y el trabajo de campo realizado por CEDARENA y los autores para el Plan de Manejo del RNVSM Maquenque, en la región norte del CBSS. Para toda la red de caminos se generalizó un área de 10 metros desde el camino hacía ambos lados, considerando que es este ancho de 20 metros es poco probable localizar una danta (este índice se aplica principalmente dentro de las áreas boscosas del corredor).

El grado de pendiente del terreno suele constituir también cierta limitante para el libre desplazamiento o el establecimiento del rango hogareño de la danta, razón por la cual utilizamos el Mapa de Capacidad de Uso de las Tierras Forestales de Costa Rica elaborado por el Centro Científico Tropical y la Fundación Neotropica, escala 1:50,000, en el cual se presentan los rangos de inclinación del terreno según los porcentajes de pendientes. En este caso se clasificaron las pendientes según los rangos de inclinación, como se indica en la Tabla 5.

Tabla 5: Categorización de los datos de grado de pendiente en el CBSS.

Área por grado de pendiente	Calificación para el hábitat	Puntaje
Plano a 15%	Excelente	3
16% a 30%	Adecuado	2
> 31%	Deficiente	1

Al tener los anteriores siete parámetros de valorización para determinar las áreas potenciales para el hábitat de la danta centroamericana, procedimos a realizar una unión de las coberturas en un mismo mapa. En este producto cartográfico se sumaron los diferentes valores que presentaban los criterios establecidos, con el fin de alcanzar los valores totales para toda el área del corredor determinando tres categorías de uso de hábitat por este mamífero.

El valor máximo obtenido de la sumatoria de valores de cada parámetro fue de 16 puntos, evidenciando sitios principalmente cercanos a las zonas con lagunas, rodeados de bosque, con presencia de flujos de agua y dentro de zonas consideradas como humedales.

Aunque la cobertura de pendientes se extiende por toda la parte norte del corredor en valores que corresponden a grados de pendiente de 0 a 15%, aquellas que no contienen fragmentos de bosque de los tamaños requeridos fueron excluidas.

La Tabla 6 presenta la zonificación del hábitat potencial de la danta dentro del CBSS, según los parámetros antes mencionados.

Tabla 6: Clasificación del uso potencial de hábitat para la danta en el CBSS.

Clasificación del las zonas	Área en ha	Porcentaje %
Zonas de potencial alto	2.438,0	1
Zonas de potencial mediano	52.328,3	21
Zonas de potencial bajo	75.255,6	30
Zonas excluidas	117.777,0	48
Total	**247.798,9**	**100**

De los resultados anteriormente presentados, se deduce que el Corredor Biológico San Juan-La Selva ofrece un total de 130.022 hectáreas o 130 km^2 de terreno con potencial para mantener o aumentar la actual población de danta. Utilizando los estudios de telemetría sobre la densidad poblacional de la danta centroamericana en bosque húmedo en Barro del Colorado Panamá, (Glanz, citado por Naranjo, 1995a) y en el Parque Nacional Corcovado, Costa Rica, (Valdez & Foerster, 2004; Foerster, 2002), pensamos que el estimado más conservador de la densidad poblacional de la danta en el Corredor Biológico San Juan-La Selva podría ser de 0.53 individuos / km^2, para un total de 69. El estimado más optimista podría ser de 1.60 individuos / km^2, para un total de 208 dantas.

Observaciones sobre el Análisis Geo-Espacial

El análisis evidencia que existen muchos fragmentos pequeños de bosque que están por debajo de las necesidades mínimas de la danta centroamericana en relación a su rango hogareño. Los fragmentos de gran

tamaño en algunos sectores se encuentran disminuidos por corredores de poco grosor que pueden limitar el paso permanente de estos animales. Se observa que las áreas de mayor importancia para el hábitat de la danta se encuentran en los sitios con fuentes de agua permanentes o intermitentes (lagunas, ríos, quebradas y/o humedales). Será necesario realizar un estudio detallado del área del corredor con el fin de ubicar las áreas con humedales que no aparecen registradas en las hojas cartográficas. El presente análisis está basado en la información extraída de diferentes mapas y coberturas de datos dentro del Corredor Biológico San Juan-La Selva y representa zonas hipotéticas, por lo que se debería de realizar una contraparte de trabajo de campo para contrastar la hipótesis planteada en la Figura 3 acerca de las zonas preferidas por la danta.

Planes de Manejo

El Comité Ejecutivo del Corredor Biológico San Juan-La Selva propone metas de protección basadas en gran parte en los resultados de la investigación biológica sobre el uso del hábitat por la lapa verde, una especie que habita los bosques de almendro de América Central, usa extensos rangos hogareños y conduce migraciones estacionales desde las bajuras hacia bosques mas elevados conectados con su hábitat reproductivo. De afinarse, la definición de zonas de hábitat potencial para la danta centroamericana pueden contribuir a definir zonas prioritarias para la conservación dentro del Refugio Nacional de Vida Silvestre Mixto Maquenque (59,717 hectáreas).

El presente análisis constituye un método fácil, rápido y poco costoso para evaluar el potencial de hábitat para la danta centroamericana en otras áreas geográficas de su rango de distribución que presentan características biofísicas similares.

Referencias

Bolaños, Rafael; Watson, Vicente 1992. Capacidad de uso del suelo de Costa Rica. San José, Costa Rica: Centro Científico Tropical.

Brooks Daniel M., Bodmer Richard E., Matola, Sharon (Ed.) 1997. Tapirs - Status Survey and Conservation Action Plan. Gland, Switzerland and Cambridge, UK: IUCN/SSC Tapir Specialist Group, VIII + 164 p.

Chassot, Olivier; Monge, Guisselle, 2002. Corredor Biológico San Juan-La Selva. Ficha técnica. San José, Costa Rica: Centro Científico Tropical, 80 p.

Comité Ejecutivo del Corredor Biológico San Juan-La Selva, El Corredor Biológico San Juan-La Selva: un proyecto del Corredor Biológico Mesoamericano para la conservación de la lapa verde y su entorno. San José, Costa Rica: Centro Científico Tropical, 2005 (quinta versión), 101 p.

De Vries, Philipp 1994. *Patterns of Butterfly Diversity and Promising Topics in Natural History and Ecology*, in Mc Dade, L., Bawa, K., Hespenheide, H., Hartshorn, G. (Eds.), La Selva: Ecology and Natural History of a Neotropical Rain Forest. Chicago: The University of Chicago Press, 187-194.

Flesher, Kevin M.; Ley, Eduardo 1996. *A Frontier Model for Landscape Ecology: The Tapir in Honduras*, Environmental and Ecological Statistics 3(2), 119-125.

Foerster, Charles R. 1998. Ámbito de hogar, patrón de movimientos y dieta de la danta centroamericana (*Tapirus bairdii*) en el Parque Nacional Corcovado, Costa Rica. Tesis de Maestría, Universidad Nacional, Heredia, Costa Rica.

Foerster, Charles R. 2002. *Baird's Tapir Project, Corcovado National Park, Costa Rica*, Tapir Conservation 11(2), 11-13.

Foerster, Charles R., Vaughan, Christopher 2002. *Home Range, Habitat Use, and Activity of Baird's Tapir in Costa Rica*, Biotropica 34(3), 423-437.

FUNDEVI / PROAMBI / UCR, Evaluación Ecológica Rápida de la región de la Cureña. San José, Costa Rica: FUNDEVI / PROAMBI / UCR, 1996, 255 p.

Gentry, Alwyn, *Endemism in Tropical versus Temperate Plant Communities*, in Soulé, M. (Ed.), Conservation Biology: the Science of Scarcity and Diversity. Sunderland, Massachussets: Sinauer Associates, 153-181.

Hartshorn, Gary; Hammel, B. 1994. *Vegetation Types and Floristic Patterns*, in Mc Dade, L., Bawa, K., Hespenheide, H., Hartshorn, G. (Eds.), La Selva: Ecology and Natural History of a Neotropical Rain Forest. Chicago: The University of Chicago Press, 73-89.

Holdridge, Leslie 1967. Life Zone Ecology. San José, Costa Rica: Tropical Science Center.

Janzen, Daniel 1983. Tapirus bairdii, Costa Rican Natural History. D. Janzen (Ed.), 496-497.

Lira, Iván 2004. *Ecology of Baird's Tapir in a Cloud Forest of Southeastern Mexico*, Second International Tapir Symposium. Conference Report, Panama.

Matola, Sharon; Cuarón, Alfredo D.; Rubio-Torgler, Heidi 1997. *Status and Action Plan of Baird's Tapir (*Tapirus bairdii*)*, Tapirs - Status Survey and Conservation Action Plan. (Brooks D., Bodmer R., Matola S., Ed.), Gland, Switzerland and Cambridge, UK: IUCN/SSC Tapir Specialist Group.

Mittermeier, Russel; Myers, Norman; Robles Gil Patricio; Goettsch-Mittermeier, Cristina 1999. Biodiversidad amenazada. Las ecorregiones prioritarias del mundo. México D.F, México: Cemex / Conservación Internacional, 430 p.

Momge, Guisselle; Chassot, Olivier; López, Rocío; Chaves, Henry 2002. Justificación biológica para la creación del propuesto Parque Nacional Maquenque. San José, Costa Rica: Corredor Biológico San Juan-La Selva / Centro Científico Tropical, 50 p.

Naranjo, Eduardo J. 1995. *Abundancia y uso de hábitat del tapir (*Tapirus bairdii*) en un bosque tropical húmedo de Costa Rica*, Vida Silvestre Neotropical 4(1), 20-31.

Naranjo, Eduardo J. 1995. *Hábitos de alimentación del tapir (*Tapirus bairdii*) en un bosque tropical húmedo de Costa Rica*, Vida Silvestre Neotropical 4(1), 32-37.

Naranjo Eduardo J.; Bodmer, Richard E. 2002. *Population Ecology and Conservation of Baird's Tapir (*Tapirus bairdii*) in the Lacandon Forest, Mexico*, Tapir Conservation 11(2), 25-33.

OEA / PNUMA, Manejo ambiental y desarrollo sostenible de la Cuenca del Río San Juan. Estudio de diagnóstico de la Cuenca del Río San Juan y lineamientos del plan de acción. Washington, MINAE / MARENA: 1997, 268 p.

Tobler, Mathias W. 2002. *Habitat Use and Diet of Baird's Tapirs (*Tapirus bairdii*) in a Montane Cloud Forest of the Cordillera de Talamanca, Costa Rica*, Biotropica 34(3), 468-474.

Townsend, Josiah 2002. *Field Notes from Eastern Honduras: Tapirs (*Tapirus bairdii*) in the Río Patuca Region*, Tapir Conservation 11(1), 17-18.

Valdez, Juan de Dios; Foerster, Charles R. 2002. *A Correlation Factor to Estimate Baird's Tapir Population Density in the Rainforest*, Second International Tapir Symposium. Conference Report, Panama.

Assessing the Sustainability of Baird's Tapir Hunting in the Bosawas Reserve, Nicaragua

Jeremy M. Koster

Department of Anthropology, 409 Carpenter Building, University Park, PA 16802
E-mail: jmk458@psu.edu

Abstract

In many locales throughout its range, the Baird's tapir is a preferred game species for subsistence hunters. I review research on Baird's tapirs and use the methods of Robinson and Redford's (1991) production model to present MSY estimates based on three diverse density estimates. These estimates are used to assess the sustainability of tapir hunting in Nicaragua's Bosawas Reserve. The assessment indicates that tapirs are harvested unsustainably in the core hunting zone around two indigenous communities. The immigration of tapirs from unexploited areas upstream of the communities appears to explain their continued existence in the hunting zone. I discuss efforts to protect this species, and I describe some of the challenges to the conservation of tapirs in the reserve.

Introduction

Tapirs are hunted throughout much of their range in the Neotropics. Despite the infrequency of kills, their large size ensures that they comprise a large percentage of the hunted biomass in many settings. In general, tapirs trail only peccaries in their contribution of hunted biomass to Neotropical diets (Vickers 1984). Among other factors, the increased influx of firearms into once isolated settlements poses a threat to tapir populations, as Yost and Kelley (1983:215) report that Waorani hunters prefer shotguns to traditional weapons when hunting tapirs.

Because of their endangered status and vulnerability to habitat loss and over-hunting, tapirs have received considerable attention from conservationists. Interestingly, whereas the production model of Robinson and Redford (1991) allows Amazonian researchers to assess the sustainability of lowland tapir (*Tapirus terrestris)* harvests, similar figures are lacking for Baird's tapir (*Tapirus bairdii*). Given that Baird's tapirs are hunted in many of the locations where they survive in Central America and Mexico (Fragoso 1991; Naranjo and Cruz 1998; Smith 2005; cf. Jorgenson 2000), an estimate of the maximum sustainable yield (MSY) might prove useful for management decisions related to this species. Using the methods of Robinson and Redford's production model (1991), I surveyed the literature to find estimates of Baird's tapir reproduction and densities, with which I generated MSY estimates. I then compare these estimates to the harvest of tapirs that I observed during a yearlong project in Nicaragua's Bosawas Biosphere Reserve.

The Maximum Sustainable Yield (MSY) Estimate

Researchers have used the production model of Robinson and Redford (1991) to assess the sustainability of hunting in a number of Neotropical settings (Alvard et al. 1997; Leeuwenberg and Robinson 2000;

Townsend 2000). Although it is widely applicable, the model is not without its weaknesses, many of which were noted by the authors themselves (Robinson and Redford 1994). The model has the advantage of generality, but given its limitations, the authors emphasize that the model can be used only to demonstrate that a harvest is unsustainable; the opposite is not true, as the model cannot demonstrate that an observed harvest *is* sustainable (Robinson and Redford 1994:255).

Like Robinson and Redford (1986*a*), I reviewed the literature for reproductive data. There are relatively few publications on Baird's tapir reproduction, however, and Brown et al. (1994) provide some of the only data available on captive Baird's tapirs. Fortunately, these data suggest that the reproductive characteristics of Baird's tapir are comparable to those of the lowland tapir. For the lowland tapir, Robinson and Redford (1986*a*) list 3.7 and 23.5 as the ages of first and last reproduction and 0.38 as the annual birth rate of female offspring. These figures differ little from estimates drawn from observations of captive Baird's tapirs (Janine Brown, personal communication, June 23, 2006). The maximum finite rate of natural increase (λ_{max} in the Robinson and Redford model) would therefore be identical for the two species: 1.22.

Calculation of the maximum sustainable yield also requires a density estimate for the population. Because density estimates from observational studies are often unreliable, Robinson and Redford (1991:418) typically use predicted densities from their review of the allometric relationship between population density, body size, and diet (Robinson and Redford 1986*b*). The body mass that the authors cite for Baird's tapir is 300 kg, more than twice the value cited for the lowland tapir (Robinson and Redford 1986*b*). Assuming a body mass of 300 kg for Baird's tapir, the regression equation used by Robinson and Redford (1986*b*) for frugivore-herbivores yields a predicted density of 0.66 individuals/km^2. However, a body mass of 300 kg typically represents the highest mass in the range of estimates for this species, with some authors giving a range of estimates that includes values below 200 kg (Emmons 1990; Reid 1997). Substituting a body mass estimate of 200 kg in the same regression equation gives a predicted density of 0.94 individuals/km^2.

To some extent, the former estimate of 0.66 individuals/km^2 is comparable to estimates based on observational studies, many of which are cited by Brooks et al. (1997). In particular, this estimate is similar to the density estimate of 0.6 individuals/km^2 cited by Naranjo (1995) for Corcovado National Park in Costa Rica. However, many density estimates for Baird's tapir are much lower. For example, Naranjo and Bodmer (2002) cite estimates of 0.24 individuals/km^2 in slightly hunted areas and only 0.05 individuals/km^2 in persistently hunted areas in Mexico. By contrast, one of the highest estimates in the literature also comes from Corcovado National Park, as Foerster (2002) reports an average density of 1.6 adult individuals/km^2 during his multi-year study. It is important to note that Foerster's methods, which include direct measurements of radio-collared animals, represent the most rigorous attempt to document the density of a Baird's tapir population.

Given this variability in density estimates for Baird's tapir populations, it is difficult to advocate a single value as the basis for the MSY estimate. By using predicted values or an average of density estimates, it is possible to generate an MSY estimate that would not be sustainable in settings where the density is unexpectedly low (Peres 2000). This problem highlights the need for long-term studies to determine population density and dynamics for proper estimation of the MSY for this endangered species in settings throughout Central America. Because such long-term research is not always possible, however, an alternative approach would be to generate a range of MSY estimates, which should be applied conservatively when the actual density of tapirs remains in doubt. Accordingly, I present separate MSY estimates for three of the density estimates cited above.

The Study Area

First created in 1991 as a "natural reserve," the Bosawas Biosphere Reserve is located in north-central Nicaragua. Part of the largest tract of tropical rain forest north of Amazonia (Stocks 1996), the reserve is inhabited by a number of generally endangered species, including jaguars (*Panthera onca*), spider monkeys (*Ateles geoffroyi*), giant anteaters (*Myrmecophaga tridactyla*), and white-lipped peccaries (*Tayassu pecari*). The reserve is also inhabited by the Mayangna and Miskito, the two most populous indigenous groups in Nicaragua. In 2005, after a decade of cooperative work with The Nature Conservancy (TNC), the indigenous communities in the reserve were granted legal land title by the Nicaraguan government. The reserve is divided into six territories, which were delineated and mapped as part of the TNC effort to document the indigenous land claims (Stocks 2003). My research was based in two communities along the Lakus River in the territory of Kipla Sait Tasbaika (Figure 1). Specifically, I worked in Arang Dak and Suma Pipi, two communities with a combined population of about 260-265 individuals. Elevations within five kilometers of the communities range from about 150 to 400 meters. There are no permanent settlements upstream of Arang Dak, and the headwaters of the Lakus River watershed are largely unexploited by residents of the reserve.

Like most Neotropical horticulturalists, the Mayangna and Miskito rely on agricultural products for the bulk of their diet. Staple crops include bananas, manioc, rice, corn, and beans. Along with meat from domestic animals, especially pigs, fish and hunted game provide much of their dietary protein. Rifles and dogs are the principal hunting technologies, and adult men do most of the hunting. Although men sometimes leave on intentional hunting trips into the forest, many of the animals in the harvest are acquired opportunistically in the course of other subsistence activities. In the reserve, tapirs are notorious for raiding bean fields, and a farmer who notices signs of tapirs in his beans might visit the field at night with a rifle in an attempt to encounter and kill the animal. On intentional hunting trips, hunters simultaneously search for a broad suite of prey types, but they sometimes make a point of visiting boggy sites where tapirs are known to rest on occasion during the day.

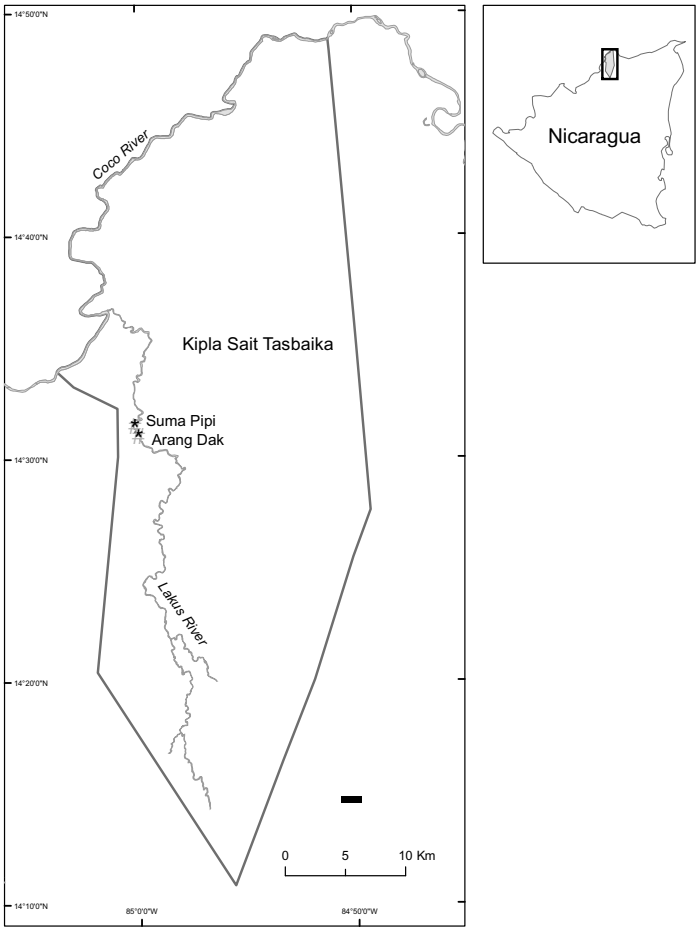

Figure 1. The location of Kipla Sait Tasbaika within Nicaragua and the location of Arang Dak and Suma Pipi within the territory.

Methods

Fieldwork in Bosawas lasted approximately 13 months, from August 2004 to September 2005. As part of a project on subsistence strategies, I employed indigenous research assistants to document the acquisition of game animals. An assistant remained in the community during daylight hours to administer questionnaires to hunters as they returned with game. The assistants also carried scales and weighed the animals whenever possible. The hunting questionnaire included data on time expenditure, participants, the technologies brought by each participant, the names of dogs on the outing, and other factors. Following Smith's (2003) methodology, the assistants also drew sketch maps of the kill sites in relation to known landmarks such as fields, trails, and streams. These kill sites were later entered into a Geographic Information System (GIS), as were landmarks that research assistants and I collected with a Global Positioning System (GPS) receiver. Household food consumption forms, which were completed daily, revealed game animals that were not initially reported to the assistants. Kills of tapirs attract considerable attention upon the hunter's return to the community, however, and I am confident that no tapir kills went undocumented during the yearlong study period.

An important component in sustainability estimates is the size of the hunting zone (Alvard et al. 1997: 979). Although men sometimes hunt while far from the community on multi-day excursions, most of the hunting on daylong expeditions occurs within a few kilometers of Arang Dak and Suma Pipi. I estimated the size of this core hunting zone by creating a polygon that included all kill sites from daylong hunting trips, with a 500 meter buffer on all sides to account for possible inaccuracies in the sketch mapping process. The result is a hunting zone of 77.6 km^2 (Figure 2).

In light of evidence that tapirs often frequent anthropogenic habitats, especially secondary forest (Foerster and Vaughan 2002; Reyna-Hurtado and Tanner 2005), I also include actively cultivated fields in Figure 2. These are fields cleared during the dry season (January-May) for planting in May and June, 2005. The map does not include fields planted at the beginning of the dry season, which are usually bean or corn fields in the alluvial floodplains alongside the river. The map also does not include fallows, although the Mayangna and Miskito preference for starting new fields next to fields from the previous season ensures that the fallows exhibit a distribution similar to the fields depicted in Figure 2. Throughout the hunting zone, the areas within one kilometer of the river are generally characterized by a mosaic of active fields, fallows, secondary forest, and relatively mature forest. All of the tapir kills in the hunting zone were located

within two kilometers of an actively-cultivated field, and most were much closer.

To produce MSY estimates, I hold λ_{max} constant, using the aforementioned value of 1.22. Production is calculated with the following equation (where D is the density estimate):

$$P_{max} = (0.6\ D \times \lambda_{max}) - 0.6\ D$$

Like Robinson and Redford (1991), I note that Baird's tapir is a long-lived species, and I therefore assume that hunters can sustainably harvest only 20% of production. Using these figures, if the density is 0.24 individuals/km^2, then the MSY is 0.006 individuals/km^2. If the density is 0.66 individuals/km^2, then the MSY is 0.017 individuals/km^2. Finally, if the density is 1.6 individuals/km^2, then the MSY is 0.042 individuals/km^2. These MSY estimates can be multiplied by the average body mass of the species to calculate the potential harvest of biomass (kg/km^2).

Results

Fourteen tapirs were killed during the study period. Informants also reported that they injured two other tapirs with rifles, but the animals subsequently managed to escape. Although hunters returned the following day to track these injured tapirs, they could not locate them, and the extent of the injuries is not known. Of the fourteen tapirs that were killed and brought back to the community, ten were males and four were females, and all were adults. We were able to weigh two of the animals in their entirety, both times in December. An adult female weighed 166.5 kg while an adult male weighed 186.5 kg. Dogs played a role in eleven of the kills, usually by pursuing the tapir to a site where the hunter or others could catch up and attack it. Hunters with rifles made two of the remaining three kills. The last tapir was killed when a hunter spotted a tapir in the shallows of the river, and he and his companions were able to maneuver their boat close enough to stab the animal with a lance.

Thirteen of the kills occurred in the core hunting zone. Six of these kills were made in the river itself, usually because the dogs had chased the tapir into the water. Six other kills occurred in stream beds, where the tapirs turned to face the dogs, thus giving the hunter time to catch up and initiate an attack (cf. Smith 1976:456). The final kill site (the westernmost point in Figure 2) was a boggy location visited by a rifle hunter who suspected that he might find a tapir there.

Including only the thirteen tapirs killed in the hunting zone, the annual harvest of tapirs is 0.168 individuals/km^2. This harvest easily exceeds all of the MSY estimates calculated above. The harvest of tapirs in the hunting zone would therefore exceed sustainable limits even if the density of tapirs around the communities were equal to the highest population density ever recorded, that of Corcovado National Park in Costa Rica (Foerster 2002).

Discussion

Native informants in Arang Dak and Suma Pipi report that the annual harvest of tapirs has been fairly consistent since they returned to the area from Honduran refugee camps in 1991. It is probable that the harvest of tapirs in the hunting zone has exceeded sustainable limits for about 15 years, although there are no data to confirm this supposition. Therefore, an interesting question is how the tapir population has avoided localized extirpation in the hunting zone.

There are essentially two possible explanations, which are not necessarily mutually exclusive. The first possibility is that tapirs exist at higher densities than the estimate used to calculate the MSY. Germane to this hypothesis is the observation that tapirs seem to thrive in anthropogenic habitats, where they browse on fast-growing secondary vegetation. Theoretically, the enhanced foraging opportunities in anthropogenic habitats could allow tapirs to breed more prolifically and exist at abnormally high densities. This relationship has not been demonstrated empirically, however.

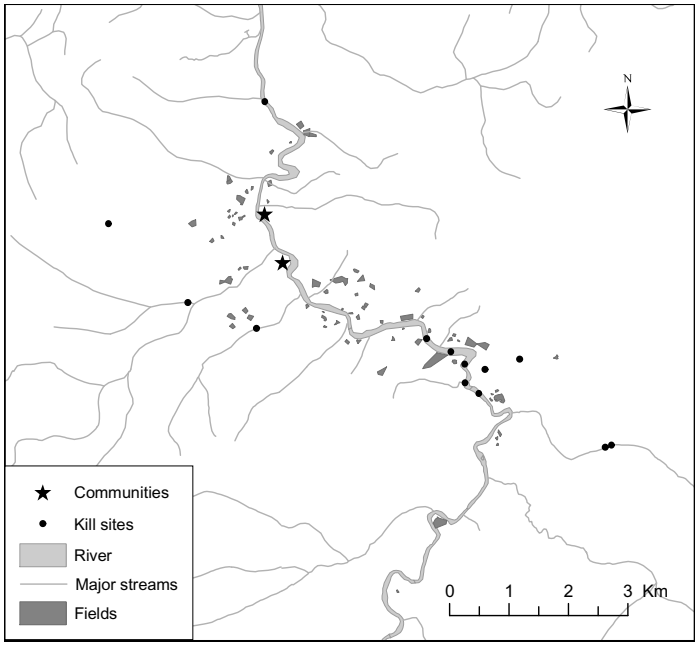

Figure 2. The location of the 13 tapir kills in the hunting zone.

The second explanation is that the unsustainable harvest of tapirs in the hunting zone is balanced by the immigration of tapirs from lightly hunted areas. In a review of source-sink hunting dynamics in the Neotropics, Novaro et al. (2000) note that hunted tapir populations generally survive only where there are large unexploited areas adjacent to the hunting zone. Similarly, the undeveloped areas upstream of Arang Dak probably serve as a source of dispersing tapirs. As part of the TNC project, the indigenous territories were divided into use zones, including areas of infrequent use and conservation (Stocks 2003). In Kipla Sait Tasbaika, the size of these two zones exceeds 500 km^2, and most of this area is located in the headwaters of the Lakus River upstream of Arang Dak. Neighboring territories have similar zones, which combine with the unexploited area in Kipla Sait Tasbaika to form the Waula Conservation Area (Stocks 2003). Given the extent to which tapir populations can be depleted near communities, maintaining the integrity of this conservation area might be the key to the survival of this species in the reserve. Because source-sink dynamics seem vital to the long-term sustainability of tapir populations throughout the Neotropics, conservationists should give more attention to sustainability models that specifically address the spatial characteristics of source areas (Salas and Kim 2002).

Reducing the harvest of tapirs would also help to sustain the population. Employees of the Saint Louis Zoo's *Proyecto Biodiversidad*, which has been working in the Bosawas Reserve since 2000, recently met with territorial leaders in Kipla Sait Tasbaika to present results of the project's research (Williams-Guillen et al. 2006). During that meeting, territorial leaders informally agreed (pending ratification) to implement limits on the harvest of three species: white-lipped peccaries, spider monkeys, and tapirs. This agreement limits the number of tapirs that individual hunters can kill each year, and the hunting of tapirs is forbidden in November and December. Geographically, the hunting of tapirs is restricted to the agricultural and frequent use zones. Additional stipulations include a prohibition on kills of females with accompanying offspring, and hunting should be directed only at those tapirs which damage crops. Employees of the zoo's project are currently cooperating with leaders to explain and present these norms to communities throughout Kipla Sait Tasbaika.

This conservation initiative is not without challenges, however. Tapir meat is highly-valued, and a hunter who sells most of the meat from a full-sized tapir can earn almost US$100. In a setting where the standard pay for a day of agricultural labor is about US$4, a tapir kill can be a relatively lucrative economic opportunity for hunters. As long as this opportunity exists, hunters might be inclined to disregard the newly-established norms. Similarly, foregoing chances to kill tapirs might seem risky to local farmers, who are understandably concerned about the possibility that the animals could soon consume their staple crops. Hunters generally hunt in patches of forest near their fields, and tapirs that they encounter are considered a potential threat even if there has been no recent damage to crops.

Hunting with dogs also complicates the situation somewhat. On hunting trips, the dogs typically fan out into the forest to search for game. When the dogs encounter and pursue animals, the hunters are often uncertain what species is being pursued, and they are effectively powerless to interrupt the pursuit until they catch up to the dogs, at which point the tapir and the dogs might be in active combat. Although tapirs are usually considered less dangerous to dogs than jaguars, giant anteaters, and white-lipped peccaries, hunters say that bites from a tapir can severely wound a dog. Good hunting dogs can be sold for more than US$30, and hunters attempt to protect their dogs as much as possible. When a tapir poses an immediate threat to a valued dog, it is difficult to imagine a hunter refraining from an attack.

Not all dogs are capable of matching the tapir's pace on a high-speed pursuit, and escapes are common. Also, unless the tapir is chased into the river, hunters without rifles are often unable to get close enough to attack the animal. Dogs and rifles are a potent combination, as the use of dogs increases the rate at which hunters encounter tapirs, and rifles allow hunters to attack tapirs once they catch up to the pursuit. Although forbidding the use of rifles when hunting with dogs might reduce the harvest of tapirs, hunters would be reluctant to relinquish their guns, as they are sometimes needed to fend off jaguars that prey on the dogs (perhaps the leading cause of death for adult dogs in the reserve).

It is important for conservationists to understand and appreciate the economic context in which hunting decisions are made. When management plans account for local concerns and perspectives, they stand a better chance of lasting success. By promoting a management plan that does not prohibit the hunting of tapirs which damage crops, the Saint Louis Zoo's project has increased the likelihood that the residents of the territory will abide by the new regulations. Overall, the prospects for the conservation of tapirs in the Kipla Sait Tasbaika are reasonably promising, in large part because the indigenous leadership has repeatedly emphasized its commitment to wildlife management. The Mayangna and Miskito residents of the Bosawas Reserve recognize the value of the forest to their livelihood and subsistence, and their willingness to cooperate with external scientists and organizations bodes well for the immediate future of the tapir population.

Acknowledgements

This research was supported by a Fulbright student grant, the National Science Foundation (Dissertation Improvement Award #0413037), the Hill Foundation, and a Sanders Dissertation Grant. I would like to acknowledge the assistance of everyone associated with the Saint Louis Zoo's *Proyecto Biodiversidad*.

Bibliography

Alvard, M.S., Robinson, J.G., Redford, K.H. & Kaplan, H. 1997. The sustainability of subsistence hunting in the Neotropics. *Conservation Biology* 11:977-982.

Brooks, D.M., Bodmer, R.E. & Matola, S. (compilers). 1997. *Tapirs – Status Survey and Conservation Action Plan*. IUCN/SSC Tapir Specialist Group. IUCN, Gland, Switzerland and Cambridge, UK. viii + 164 pp.

Brown, J.L., Citino, S.B., Shaw, J. & Miller, C. 1994. Endocrine profiles during the estrous cycle and pregnancy in the Baird's tapir (*Tapirus bairdii)*. *Zoo Biology* 13:107-117.

Emmons, L. 1990. *Neotropical Forest Mammals*. University of Chicago Press, Chicago.

Foerster, C. 2002. Baird's tapir project, Corcovado National Park, Costa Rica. *Tapir Conservation* 11:11-13.

Foerster, C.R. & Vaughan, C. 2002. Home range, habitat use, and activity of Baird's tapir in Costa Rica. *Biotropica* 34: 423-437.

Fragoso, J.M.V. 1991. The effect of hunting on tapirs in Belize. In: J.G. Robinson & K.H. Redford (eds.) *Neotropical Wildlife Use and Conservation*, pp. 154-173. University of Chicago Press, Chicago.

Jorgenson, J.P. 2000. Wildlife conservation and game harvest by Maya hunters in Quintana Roo, Mexico. In: J.G. Robinson & E.L. Bennett (eds.) *Hunting for Sustainability in Tropical Forests*, pp. 251-266. Columbia University Press, New York.

Leeuwenberg, F. & Robinson, J. 2000. Traditional management of hunting in a Xavante community in Central Brazil. In: J.G. Robinson & E.L. Bennett (eds.) *Hunting for Sustainability in Tropical Forests*, pp.375-394. Columbia University Press, New York.

Naranjo, E.J. 1995. Abundancia y uso de hábitat del tapir (*Tapirus bairdii*) en un bosque tropical húmedo de Costa Rica. *Vida Silvestre Neotropical* 4:20-31.

Naranjo, E.J. & Bodmer, R.E. 2002. Population ecology and conservation of Baird's tapir (*Tapirus bairdii*) in the Lacandon Forest, Mexico. *Tapir Conservation* 11:25-33.

Naranjo, E.J. & Cruz, E. 1998. Ecología del tapir (*Tapirus bairdii*) en la reserva de la biosfera la Sepultura, Chiapas, Mexico. *Acta Zoologica Mexicana* 73:111-123.

Novaro, A.J., Redford, K.H. & Bodmer, R.E. 2000. Effect of hunting in source-sink systems in the Neotropics. *Conservation Biology* 14:713-721.

Peres, C.A. 2000. Evaluating the impact and sustainability of subsistence hunting at multiple Amazonian forest sites. In: J.G. Robinson and E.L. Bennett (eds.) *Hunting for Sustainability in Tropical Forests*, pp. 31-56. Columbia University Press: New York.

Reid, F.A. 1997. *A Field Guide to the Mammals of Central America and Southeast Mexico.* Oxford University Press, New York.

Reyna-Hurtado, R. & Tanner, G.W. 2005. Habitat preferences of ungulates in hunted and nonhunted areas in the Calakmul Forest, Campeche, Mexico. *Biotropica* 37: 676-685.

Robinson, J.G. & Redford, K.H. 1986*a*. Intrinsic rate of natural increase in Neotropical forest mammals: Relationship to phylogeny and diet. *Oecologia* 68:516-520.

Robinson, J.G. & Redford, K.H. 1986*b*. Body size, diet, and population density of Neotropical forest mammals. *The American Naturalist* 128:665-680.

Robinson, J.G. & Redford, K.H. 1991. Sustainable harvest of Neotropical forest mammals. In: J.G. Robinson & K.H. Redford (eds.) *Neotropical Wildlife Use and Conservation*, pp. 415-429. University of Chicago Press, Chicago.

Robinson, J.G. & Redford, K.H. 1994. Measuring the sustainability of hunting in tropical forests. *Oryx* 28: 249-256.

Salas, L.A. & Kim, J.B. 2002. Spatial factors and stochasticity in the evaluation of sustainable hunting of tapirs. *Conservation Biology* 16:86-96.

Smith, D.A. 2003. Participatory mapping of community lands and hunting yields among the Buglé of Western Panama. *Human Organization* 62:332-343.

Smith, D.A. 2005. Garden game: Shifting cultivation, indigenous hunting, and wildlife ecology in western Panama. *Human Ecology* 33:505-537.

Smith, N.J.H. 1976. Utilization of game along Brazil's transamazon highway. *Acta Amazonia* 6:455-466.

Stocks, A. 1996. The BOSAWAS Natural Reserve and the Mayangna of Nicaragua, In: K.H. Redford & J.A. Mansour (eds.) *Traditional Peoples and Biodiversity Conservation in Large Tropical Landscapes*, pp. 1-32. America Verde Series of The Nature Conservancy, Arlington, VA.

Stocks, A. 2003. Mapping dreams in Nicaragua's Bosawas Reserve. *Human Organization* 62:344-356.

Townsend, W.R. 2000. The sustainability of subsistence hunting by the Sirionó Indians of Bolivia. In: J.G. Robinson & E.L. Bennett (eds.) *Hunting for Sustainability in Tropical Forests*, pp. 267-281. Columbia University Press, New York.

Vickers, W.T. 1984. The faunal components of lowland South American hunting kills. *Interciencia* 9:366-376.

William-Guillen, K., Griffith, D., Polisar, J., Dixon, O., Camilo, G., Asa, C., Bauman, K., McDaniel, P., Bradshaw, L., Shank, S., Zidek-Vanega, A., Koster, J. & Espinoza Mendiola, V. 2006. Poblaciones de animales silvestres y sostenabilidad de la cacería en Kipla Sait Tasbaika Kum, Bosawás, Nicaragua. Unpublished Report, Saint Louis Zoo, Managua, Nicaragua.

Yost, J. & Kelley, P. 1983. Shotguns, blowguns, and spears: An analysis of technological efficiency. In: R. Hames & W. Vickers (eds.) *Adaptive Responses of Native Amazonians*, pp. 189-224. Academic Press, New York.

Confirmación de la Presencia del Tapir Centroamericano (*Tapirus bairdii*) en Colombia, y Estudio Preliminar sobre Algunos Aspectos de su Historia Natural en el Parque Nacional Natural Los Katíos

Héctor F. Restrepo[1] & Octavio Betancourt

[1] Biólogo, M.Sc. Fundación Wii, Colombia
Member, IUCN/SSC Tapir Specialist Group (TSG)
E-mail: restrepof@gmail.com

Resumen

En el presente estudio se estudia a la especie Tapir Centroamericano (*Tapirus bairdii*), presente en el Parque Nacional Natural Los Katíos, mediante 19 observaciones directas de un minuto o más de duración (tres minutos en promedio), respaldadas con registro fílmico. Además se documenta aspectos relacionados con la alimentación, actividad diaria, uso de hábitat y aspectos poblacionales de esta especie. El estudio es el primero en ser realizado in situ para esta especie en Colombia, y además confirma la presencia de la especie en el país. En el área estudiada se logró diferenciar seis individuos por medio de características externas, se determinaron 27 especies vegetales de las cuales se alimentó el tapir, siete de ellas nuevos reportes de consumo para la especie. Se observó que los tapires presentaron actividad diurna y nocturna, ocupando todo el rango altitudinal del parque (50 a 600 metros aproximadamente). Se observó que estos animales fueron selectivos en su dieta, prefiriendo las partes jóvenes de las ramas y consumiendo un alto porcentaje de frutos, y se anota que pueden ser dispersores o depredadores de semillas.

Introducción

Diferentes autores como Hershkovitz (1954), Eisenberg (1989), Mejía (1995) y Peña *et al.* (1996) reportan la presencia de las tres especies de tapires Neotropicales en Colombia: *T. pinchaque* ha sido reportada desde los 1.400 hasta los 4.700 metros sobre nivel del mar, pero son mas comunes entre los 2.000 y los 4.300 metros (Downer 1996), mientras que las otras dos especies (*T. terrestres y T. bairdii*) habitan en tierras bajas y bosques premontanos (Eisenberg 1989). Se supone que la distribución histórica de *T. bairdii* en Colombia cubre la Región del Pacífico, pero se ha documentado su extinción en la mayor parte de su territorio (Ulloa *et al*. 1996, Rubio *et al*. 1998). Ulloa et al. (1996) y Rubio et al. (1998) reportan la especie únicamente para el norte de la Provincia Biogeográfica del Chocó, basándose en la observación de huellas y en comentarios hechos por pobladores locales, como lo anota Matola *et al.* (1997), por lo tanto estos reportes no son suficientemente válidos como para definir cuál especie esta presente en el lugar. Dicha duda se ve reflejada en Alberico *et al.* (2000) quienes ponen en interrogante la presencia de la especie para Colombia. Navarro & Muñoz (2000) también comentan que actualmente no existen reportes de la especie para el Chocó. En general los sitios habitados por *T. bairdii*, son semejantes a los habitados por *T. terrestris.* De hecho, se ha reportado la simpatría de las dos especies al Noroccidente de Colombia (Herskovitz 1954). Herskovitz (1954) especula que la ocurrencia de *T. bairdii* especie al noroccidente de Suramérica hace que sea posible la ocurrencia de *T. terrestris* en Centroamérica. Estas conjeturas hacen pensar que es posible que *T. terrestris* podría ser la especie que habita en el Parque Nacional Natural Los Katíos, debido a que su zona de distribución llega hasta muy cerca de dicho parque. Por estos motivos es crucial la identificación de la especie de tapir presente en el parque.

La presencia de una cresta muscular en el cuello y la parte superior del cráneo, notoria en *T. terrestris* y ausente o poco notoria en *T. bairdii*, hace que sea posible diferenciar ambas especies (Hershkovitz 1954). Un requisito para ello es que la persona que realice la identificación debe mirar detenidamente la parte superior de la cabeza y debe tener conocimientos previos acerca de dicha morfología. El objetivo del presente estudio fue el de identificar la especie de tapir presente en el Parque Nacional los Katíos y determinar algunos aspectos de su historia natural, de forma que dicha información contribuya al esclarecimiento de

la presencia de *T. bairdii* en Colombia, actualizar su rango de distribución y tener conocimientos previos que se puedan usar en la adopción de medidas para su protección y conservación.

Materiales y Métodos

Área de estudio: El Parque Nacional Natural Los Katíos se encuentra en el extremo noroccidental de Colombia entre los 70° 42' y los 7° 56' de Latitud Norte; y entre los 77° 03' y 77° 19' de Longitud Oeste (AZOBIONAL 1988), al nordeste del Departamento de Chocó, jurisdicción de los municipios de Río Sucio (Chocó) y Turbo (Antioquia), en la frontera de Colombia con Panamá. El parque tiene una extensión de 72 mil hectáreas ; la precipitación allí varía entre 2000 y 3000mm, y los meses de abril a noviembre corresponden a los lluviosos con un veranillo en junio, mientras que el período de diciembre a marzo corresponde a los meses secos. La temperatura media es de 27°C y la humedad relativa varía entre 80 y 100% en el día (Garcés & de la Cerda 1994). El parque, según la clasificación de zonas de vida de Holdridge, corresponde a bosque húmedo Tropical (bh - T). El parque abarca alturas entre los 50 y 600 m.s.n.m (Fundación NATURA 2000) y se puede dividir en tres sectores: de colinas y serranías, de superficies inundables y de superficies anegadizas, donde sobresale el "Tapón del Darién" (INDERENA 1988). La zona de colinas altas y serranías ocupa la mayor parte del parque, mientras que la zona de llanura aluvial ocupa un 45% del parque (Molano *et* al. 1996). El parque Nacional Natural Los Katíos esta inscrito desde 1994 en el listado del Patrimonio Mundial de la UNESCO. El presente estudio se realizó durante la estación seca e inicios de la estación lluviosa entre los meses de enero a mayo de 2002, en un área comprendida entre las microcuencas de los ríos Tendal y Tilupo.

Identificación de la especie: con el fin de obtener observaciones directas y registros fílmicos y fotográficos que permitieran identificar la especie, se realizaron búsquedas diurnas y nocturnas en las zonas donde previamente fueron observados rastros de tapir en forma repetida (pisadas, ramoneo y excretas). Los tapires se detectaron por su olor (parecido al olor que despiden las mulas), ruido al caminar o comer, o por encuentros casuales. Una vez ubicados los animales, se efectuaron acercamientos cautelosos que permitieran obtener los registros, procurando tener un buen enfoque en la parte superior de la cabeza del animal.

Alimentación: Con el fin de establecer los hábitos alimenticios de los tapires en el área de estudio, se cuantificaron las proporciones de diferentes partes vegetales presentes en las excretas. Para ello se caminó por los cauces de los ríos y arroyos observando las orillas y el fondo de los mismos (Naranjo 1995a), colectando las heces frescas que presentaran al menos cinco pelotillas. Éstas fueron secadas al sol y etiquetadas, para luego ser analizadas con los métodos de frecuencia de ocurrencia y peso utilizados por Naranjo (1995a) y Naranjo & Cruz (1998). Dichos métodos consisten en estimar las proporciones de tres tipos de alimentos (hojas, partes de frutos incluidas las semillas, y tallos con más de 1mm de diámetro), expresados como porcentajes. En el método de frecuencia de ocurrencia se extrajo de cada muestra de excreta una submuestra de 15g que se analizaron segun la técnica propuesta por Chanrad & Box (1964, citados por Naranjo 1995a): la submuestra se esparció uniformemente sobre un rectángulo de cartón de 14 x 18 centímetros, con diez líneas divisorias equidistantes, con un marco de puntos de diez varillas en 60 puntos ubicados al azar. Para cada submuestra se registró la frecuencia de ocurrencia de cada uno de los tres tipos de alimento. En el método del peso, se separó manualmente de cada una de las excretas los tres tipos de alimento de una submuestra de excreta de 30g. Los tres tipos de alimento presentes en la submuestra (hojas, tallos y frutos) se pesaron en una balanza con precisión de 0.1 gramos. Los resultados obtenidos con ambos métodos (frecuencia de ocurrencia y peso) fueron comparados mediante análisis de correlación de Pearson y los resultados obtenidos de cada ítem fueron contrastados entre los métodos con una prueba de T-Student para muestras independientes.

Para determinar las especies botánicas que el tapir consume en el área de estudio, cada vez que se observó a un individuo de tapir forrajear se colectó y marcó la planta consumida para luego colectar partes fértiles que posteriormente fueron preservadas y llevadas al Herbario de la Universidad de Antioquia para ser determinadas. También se tuvo en cuenta aquellas plantas que presentaron señales de ramoneo característico del tapir (en la zona son los únicos ungulados ramoneadores con incisivos en la parte superior) y que además presentaran huellas de pisadas de estos animales alrededor. Las partes vegetales encontradas en las excretas y que permitieran saber la planta de procedencia también fueron colectadas, para luego determinar la especie a la cual pertenecían.

Horario de actividad: con el objeto de establecer un patrón de horario en el cual los tapires realizan diferentes actividades, en todas las observaciones directas se registró el tipo de actividad observada y la hora.

Frecuencia de presencia: con el fin de determinar la frecuencia de presencia de la especie en la zona, se recorrieron en horas de la mañana (0700-1100 horas) tres segmentos del río Tendal (de dos, uno y dos km de distancia) durante 59 días consecutivos, registrando la presencia de pisadas o excretas en las márgenes y en las orillas, las excretas encontradas se removie-

ron para evitar ser contadas de nuevo al día siguiente (Aranda 1988). También se recorrió todo el rango altitudinal de la zona de estudio (50 - 600 metros de altitud aproximadamente) registrando la ocurrencia de tapires, indicada por la presencia de huellas o por observación directa. Se establecieron dos transectos de 11 Km cada uno, en el sector del Tendal y otro en el sector del Tilupo, en cada uno se realizaron 9 recorridos. Igualmente siguiendo los cauces de las quebradas del mismo nombre se hicieron recorridos de 5 km por 30 días en total, en el tiempo de estudio. Estos sector y los quebradas que allí se encuentran están cubiertas por bosques altos densos perennifolios de la selva húmeda característica del choco biogeográfico.

Aproximación de la estructura poblacional: en cada observación directa se realizaron anotaciones de sexo, edad relativa, acompañamiento de infantes, y presencia de características externas.

Resultados

Este estudio se desarrollo durante los meses de octubre noviembre y diciembre del 2001 y enero del 2002.

Identificación de la especie: se obtuvo un total de 19 observaciones directas, con una duración mínima de 1 minuto, una duración máxima de 26 minutos y tres minutos en promedio por observación, también se obtuvo material fílmico (las películas fotográficas obtenidas sufrieron deterioro a causa de las condiciones de alta humedad y temperatura de la zona). Mediante dichas observaciones se logró establecer que *Tapirus bairdii* es la especie presente en el área de estudio.

Alimentación: se colectaron 33 excretas frescas. Las muestras de estas excretas presentaron en promedio una ocurrencia de 65% de hojas y 27% de frutos, mientras que el peso promedio fue de 41% para las hojas y de 47% para los frutos. Se observó correlación entre los porcentajes obtenidos mediante ambos métodos (frecuencia de ocurrencia y peso) para cada tipo de alimento hallado en las excretas (Tabla 1). Sin embargo no hubo similaridad de los porcentajes promedio de tipo de alimento entre ambos métodos (Tabla 2).

Se observaron 27 especies vegetales consumidas por los tapires (Tabla 3), ocho de ellas se lograron identificar hasta especie, tres de ellas son nuevos reportes de consumo para *T. bairdii*. Dieciséis especies se identificaron hasta género, cuatro son nuevos reportes de consumo; tres especies se identificaron hasta familia. El total de especies pertenecen a 24 familias. Las especies vegetales que se considera son consumidas con mayor frecuencia fueron *Acalipha diversifolia* y *Sanchesia penellii,* seguidas por *Cecropia* sp. (yarumo), *Urera* sp. (pringamoza) y *Philodendron* sp. Las demás especies se observaron ramoneadas esporádicamente. En general los tapires consumieron partes tiernas, tales como brotes y hojas terminales. En las excretas se pudo diferenciar cinco especies de vegetales debido a la presencia de semillas o parte de ellas (*Ficus* sp., *Manilkara sapota, Dipterix panamensis* y una fabacea no determinada), o por la presencia de partes de frutos (*Raphia taedigera, Astrocaryum standleyanum* y *Ficus* sp.).

Horario de actividad: se observó actividad de desplazamiento y consecución de alimentos en el día y en la noche, las actividades de descanso (se consideró como actividad de descanso aquella en la que los tapires permanecieron echados, sin tener en cuenta los momentos en los cuales permanecieron quietos y parados) se observaron solamente durante el día. En una ocasión se encontró un macho y una hembra en estado de sueño profundo (1330 y 1345 horas), a trescientos metros uno del otro; otra observación de descanso ocurrió a las 1245 horas, después de seguir a un macho por 18 minutos. La mayor actividad observada fue la de caminar y comer.

Frecuencia de presencia: solo en una ocasión no se presentaron indicios de presencia de tapir en el recor-

Tabla 1. Prueba de correlación de Pearson entre los valores de porcentaje de los *ítems* alimenticios de *Tapirus bairdii* hallados con los métodos de frecuencia y peso.

	Peso de hojas	Peso de frutos	Peso de tallos
Frecuencia de hojas	0.851 P < 0.001		
Frecuencia de frutos		0.8494 P < 0.001	
Frecuencia de tallos			0.867 P < 0.001

Tabla 2. Prueba T-Student de similaridad entre los valores medios de *ítems* alimenticios de *Tapirus bairdii*, obtenidos con los métodos de frecuencia y peso.

	Frecuencia (%)		Peso (%)		
	media	Desviación estándar	media	Desviación estándar	Valor P
Hojas	65.2	20.10	41.1	17.3	< 0.001
Frutos	27.2	20.94	47	21.27	< 0.001
Tallos	7.6	5.42	11.9	9.62	0.03

Tabla 3. Especies vegetales consumidas por *Tapirus bairdii* en el Parque Nacional Natural Los Katíos.

Familia	Especie	Nombre vernáculo	Parte consumida	Dispersión de semillas
Acanthaceae	*Sanchezia pennellii* *	Desconocido	H	No.
Apocinaceae	*Allamanda* sp. *	Desconocido	H, T	No.
Araceae	*Philodendron* sp.	Desconocido	H,T	No.
Arecaceae	*Astrocaryum standleyanum*	Guerregue	F, S	Si.
Arecaceae	*Raphia taedigera*	Pangana	F	Si.
Amarantaceae	*Cyathula prostatra* *	Desconocido	H	No.
Amarantaceae	*Iresine* sp. *	Desconocido	H	No.
Asteraceae	*Bidens* sp.	Desconocido	H	No.
Asteraceae	*Veronia* sp. *	Desconocido	H	No.
Caricaceae	*Carica* sp.	Desconocido	H, T	No.
Cecropiaceae	*Cecropia* sp.	yarumo	T, H	No.
Euphorbiaceae	*Aparistmium* sp.	Desconocido	H	No.
Euphorbiaceae	*Acalipha diversifolia*	Desconocido	T H	No.
Fabaceae	Indeterminada	Desconocido	F	Si.
Fabaceae	*Diptevix panamensis* *	Choibá	F	Si.
Laganiaceae	*Strichnos* sp. *	Desconocido	F	Si.
Mimosaceae	*Inga* sp.	Guamo	H	No.
Moraceae	*Ficus* sp.	Desconocido	H	No.
Passifloraceae	Indeterminada	Bejuquillo	H	No.
Piperaceae	*Piper marginatum*	Desconocido	H	No.
Rubiaceae	Indeterminada	Desconocido	H	No.
Sapindaceae	*Paullinia* sp.	Desconocido	H	No.
Sapotaceae	*Manilkara sapota*	Caimito	F	Depredación.
Urticaceae	*Urera* sp.	Pringamoza	H, T	No.
Sterculiaceae	*Bytheria* sp.	Desconocido	H	No.
Tiliaceae	*Triunfetta* sp.	Desconocido	H	No.
Tiliaceae	*Corchorus* sp.	Desconocido	H	No.

* Nuevo reporte de consumo para la especie. H = hojas, F = frutos, S = semilla, T = tallos.

rido durante los 59 días consecutivos de observación a lo largo del Río Tendal. Se encontraron indicios de la presencia de tapir en todo el rango altitudinal (50 -600 m.s.n.m aproximadamente), pero se evidencio de forma subjetiva una mayor cantidad de indicios (observaciones directas e indirectas) en las zonas bajas con presencia de fuentes de agua. No se encontraron indicios de la presencia de tapires en zonas muy pendientes ni en zonas pendientes y pedregosas.

Aproximación de la estructura poblacional: de las 19 observaciones, 17 correspondieron a adultos y dos a infantes acompañados de adultos; no se observó la presencia de juveniles. En el total de avistamientos se logró determinar el sexo de cinco machos y seis hembras. Entre los animales diferenciados por características externas, dos fueron machos y tres fueron hembras. No fue posible diferenciar individualmente ni por sexo ni por rasgos externos a los dos infantes que aun tenían pelaje moteado.

De los seis tapires diferenciados individualmente (Tabla 4), las características externas más conspicuas fueron: genitales, edad relativa (según el tamaño, acompañamiento de adultos y presencia de manchas claras en el pelaje) y presencia de cicatrices. Sin embargo, también fue posible diferenciar otras características como el tamaño corporal, coloración, y fisonomía, que con el tiempo se fueron haciendo más fácilmente apreciables debido a la experiencia adquirida por el observador. El sexo se logró determinar por observación de los genitales y mediante la observación de micciones.

Discusión

Identificación de la especie: diferencias externas como la falta de una cresta muscular notoria sobre la cabeza y una probosis más larga y voluminosa en *T. bairdii* pueden diferenciar esta especie de *T. terrestris* (Hershkovitz 1954). No obstante, la detección de estas

Tabla 4. Tapires diferenciados en el área de estudio en el Parque Nacional Natural Los Katíos mediante observación de características externas.

Individuo	Edad relativa	Sexo	Características externas
1	Adulto	Macho	Cicatriz alargada en la espalda, cicatriz en las orejas y heridas en el lomo.
2	Adulto	Macho	Sin cicatrices.
3	Adulto	Hembra	Presencia de dos nuches en el anca.
4	Adulto	Hembra	Sin nuches ni cicatrices, tamaño mayor a los otros tapires observados, coloración mas clara.
5	Adulto	Hembra	Tamaño similar a los tres primeros individuos, se ve acompañada de un infante.
6	Infante (o juvenil ?)	Desconocido	Color grisáceo con coloración mas clara poco conspicua en los costados.

características *in situ* puede ser subjetiva, aun por observadores expertos, debido a que es difícil observar los tapires - animales sigilosos y esquivos. Fue posible determinar la especie de tapir presente en la zona de estudio mediante la observación repetida y meticulosa por un tiempo relativamente prolongado utilizando únicamente la observación del carácter de la cresta muscular sobre la cabeza, un método alternativo que permitió confirmar la presencia de una de estas dos especies, sin necesidad de recurrir a métodos invasivos o al sacrificio de especimenes.

La presencia confirmada de *T. bairdii* en el Parque Nacional Natural Los Katíos llevada a cabo en el presente estudio, así como su posible presencia en el Río Salaquí cerca de la Serranía De Los Saltos (Matola *et al.* 1997, Emilio Constantino com. Pers 2001) y en el Parque Nacional el Darién en Panamá, podría estar indicando la conformación de una población de esta especie a nivel regional. Esta población estaría formada por al menos 450 tapires según la estimación hecha por Constantino (2002) basado en el hábitat disponible en esos lugares. Dicha población podría ser una fuente de dispersión y recolonización de la especie hacia otros sitios donde actualmente se encuentra extinta o abundantemente explotada, y que presentan condiciones para que la especie vuelva a colonizar; uno de estos sitios es el Parque Nacional Natural Ensenada De Utría en Colombia. Deben priorizasen los esfuerzos para la conservación de esta especie debido a que *Tapirus bairdii* se encuentra en peligro de extinción (EN) segun la IUCN (IUCN 2003); dentro de Colombia se ubica en la categoría En Peligro Crítico (CR) segun Rodríguez (1998).

Alimentación: el aumento del porcentaje de frutos en las excretas al usar el método del peso (47%) contrastado con los resultados hallados usando el método de frecuencia (27%), se puede deber a que las partículas de frutos y semillas tienen mayor peso que las partículas de hojas de área similar. Tal vez se pudo apreciar más el mayor peso de las partículas de los frutos debido a que en el presente estudio se encontró una mayor cantidad de este tipo de alimento.

El alto porcentaje de frutos encontrados en las heces de tapir indica que durante el periodo de estudio este tipo de alimento es de gran importancia para estos mamíferos. Lo anterior concuerda con los reportes de consumo de 33% de frutos en la dieta de *T. terrestris* en la amazonía peruana (Downer 1990) y de 24% de frutos consumidos por esa misma especie en la estación seca de la Guyana Francesa (Henry *et al*. 2000); este último autor encontró una proporción similar entre hojas y frutos. Williams (1984) observó que *T. bairdii* consumió grandes cantidades de frutos durante la estación seca en Costa Rica, mientras que Terwillinger (1978), en Barro Colorado, encontró que los frutos son un componente menor en la dieta de esta misma especie. Puede ser que la época seca esté influyendo en un mayor consumo de frutos, ya que esta última autora realizó el estudio en un periodo que comprendía tanto la estación seca como la lluviosa. Lo anterior se podría sustentar con lo hallado por Naranjo (1995a), quien encontró en Costa Rica que la composición de frutos en las heces de *T. bairdii* fue de 3.8% en la estación lluviosa y de un 12% en la estación seca. Naranjo & Cruz (1998) en La Sepultura, México, no encontraron diferencias significativas en el contenido de frutos en las heces de *T. bairdii* comparando ambas estaciones (seca y lluviosa); no obstante ellos aclaran que allí existe una mayor heterogeneidad y entremezclas de tipos de hábitats que permite una dieta mas estable a lo largo del año. Lira *et al*. (2004) hallaron una proporción de frutos en las excretas de 3.9 % mientras que la proporción de tallos y hojas fue de 50.6% y 45.5 % respectivamente. Esas excretas (n = 90) fueron colectadas en la estación seca (n = 40) y en la estación lluviosa (n = 50), y encontraron que la frecuencia de hojas y tallos variaron mensual y estacionalmente, mientras que los frutos mostraron cambios mensuales pero no estacionales.

En el presente estudio el tapir consumió una gran variedad de vegetales, sin embargo se observó mayor consumo de especies como *Sanchesia penellii* y *Acalipha diversifolia*, las cuales presentan distribución

en conglomerados, especialmente en bordes y claros de bosque de tierras bajas. También se observó el consumo de especies pioneras en géneros como *Cecropia* y *Urera,* entre otros. Esto puede estar relacionado con la apreciación de Fragoso (1987) que comenta que los tapires prefieren plantas de crecimiento rápido y vida corta ya que estos tienen altos valores nutricionales y menos compuestos secundarios tóxicos. Además, Olmos (1997) comenta que al parecer las defensas de las plantas influyen en la selección del alimento por parte de los tapires. Este mismo autor manifiesta que, según observaciones en cautiverio, los tapires son susceptibles al prolapso rectal debido a la ingesta de comida áspera e indigerible (Crandall 1964, Deutsh & Puglia 1988), y esto puede ser evidencia de una alimentación selectiva.

Todas las excretas frescas (n = 33) se encontraron dentro de fuentes de agua o muy cerca a ellas (a una distancia inferior a un metro), concordando con Naranjo (1995b) quien encontró un 96% (n = 136) de las heces de *T. bairdii* en cuerpos de agua. El hábito que tienen los tapires de defecar en el agua puede generar pérdida de plántulas debido a la humedad excesiva pero también puede por dispersión secundaria llevar a la semilla a un ambiente más favorable con pocos predadores de semillas (Janzen 1981). Aunque no se encontraron excretas alejadas de los cuerpos de agua o a lo largo de senderos de tapir como lo reporta Naranjo (1995a), no quiere decir que los tapires en la presente área de estudio no defequen en estos sitios.

Horario de actividad: Se observó que los tapires presentaron un horario de actividad diurno y nocturno. La mayor parte del tiempo se observó a los tapires caminando y comiendo. Esto concuerda con los resultados de Terwillinger (1978) quien observó que en la Isla de Barro Colorado los tapires utilizan el 89% de su tiempo en alimentarse. En la noche los tapires pueden tener un mayor desplazamiento, como lo observó Williams (1984), quien encontró que el ámbito nocturno de un macho adulto y un juvenil, fue 12 y 6 veces mayor, respectivamente, que el ámbito diurno. *T. pinchaque* tiene un patrón de actividad crepuscular (Cavelier *et al.* 2000). *T. terrestris* visita salados con más frecuencia durante la noche (Montenegro 1998 y 1999); quizás las diferencias en este comportamiento comparadas con *T. bairdii* se podría deber a diferencias comportamentales entre especies. Sin embargo se ha observado que en algunas áreas de Argentina *T. terrestris* es típicamente diurno, posiblemente por la ausencia del disturbio humano (Chalukian in lit citado por Bodmer & Brooks 1997).

Frecuencia de presencia: Aunque los tapires estén usando todo el rango altitudinal del parque, se observó que al parecer prefieren las zonas bajas que además presenten fuentes de agua. Esto coincide con lo reportado por Naranjo (1995b), Naranjo & Cruz 1998) y Salas (1996). Este último punto es de gran importancia para la conservación de la especie, ya que la extensión de un terreno por si sola no define cuantos ni cuales individuos la estén habitando, siendo mas relevante para tomar decisiones de conservación la calidad del hábitat, teniendo en cuenta también que este factor puede variar con la estacionalidad. Los valles aluviales son los terrenos preferidos por los tapires (Fragoso 1997, Peña *et al.* 1996, observación en el presente estudio), siendo también los únicos sitios factibles para la agricultura en las serranías del Baudó y Los Saltos en el Darién, ya que ofrecen suelos más fértiles y terrenos planos (Matola et al. 1997). Ésto de algún modo en un futuro puede restringir la dispersión de los tapires o fragmentar sus poblaciones y puede poner en peligro su permanencia en el área a largo plazo, o su posible recolonización en las áreas donde se ha extirpado. Por ende, se hace necesaria la realización de planes concertados con las comunidades afro-colombianas e indígenas, que permitan la sobrevivencia de estas y otras poblaciones animales en la zona.

Aproximación de la estructura poblacional: los individuos adultos observados evidencian una ligera mayoría de hembras con respecto a los machos. Este resultado es similar a lo observado por Montenegro (1999) para *T. terrestris*. Sin embargo, como lo sugiere la mismo autor, es difícil afirmar esto si no se conoce con certeza qué porcentaje de la población real representan los tapires observados. La mayor proporción de hembras adultas con respecto a machos adultos podría deberse a una mayor mortalidad de machos ya que ellos se dispersan a terrenos desconocidos quedando más expuestos a los depredadores (Owensmith 1988). Pero también se puede deber a que los nacimientos estén sesgados a favor de las hembras o simplemente a que los machos se dispersen antes de llegar a la edad adulta (Clutton-Brock & Albon 1982).

La composición de edad encontrada en el presente estudio es similar a la encontrada por Naranjo (en Montenegro 1999) quien obtuvo una mayor proporción de adultos (80%) que de juveniles (12%) y crías (8%), lo cual puede estar indicando una baja tasa de nacimientos o una alta mortalidad en infantes y juveniles. Para la fecha del presente estudio, en la zona no se observaron faenas de caza por parte de los humanos, pero el león venado o puma (*Puma concolor)* y el jaguar o tigre mariposo (*Panthera onca*), que al parecer atacan especialmente a crías y a tapires viejos o enfermos (Downer 1995, Tapia 1998, Tirira 1999), y que están presentes en la zona de estudio, pueden estar controlando la población de infantes. La ausencia de avistamientos de juveniles quizás también se deba a que estos se dispersan para disminuir la competencia por espacio y alimento, o tal vez presentan un comportamiento más cauteloso y por esto no se lograron observar.

Agradecimientos

Este estudio se pudo realizar gracias al apoyo de la sección Territorial Noroccidental de la Unidad Administrativa Especial del Sistema de Parques Nacionales Naturales de Colombia (U.A.E.S.P.N.N), a través del Área de Manejo Especial del Darien (AME-DARIEN), debido a su apoyo logístico y financiero; al jefe del Parque Nacional Natural los Katíos, Harold Moreno, por su colaboración y permiso para trabajar en el parque; al funcionario Roberto Yépez por su colaboración y enseñanza en campo, y a la colaboración y hospitalidad de todos los funcionarios del Parque Nacional Natural Los Katíos; a Abel Díaz por su asesoría estadística, y a la Bióloga Maribell Duque Builes por su colaboración en el trabajo de campo; a Ramiro Fonnegra, Francisco Javier Roldan y demás personas del Herbario de la Universidad de Antioquia por su desinteresada colaboración en la determinación del material vegetal colectado; a Eduardo Naranjo por su colaboración en la confirmación de la especie mediante registro fílmico.

Literatura Citada

Alberico, M., A. Cadena., J. Hernández-Camacho., & Muñoz-Saba. 2000. Mamíferos (Synapsida: theria) de Colombia. Biota Colombiana. Bogotá. 1 (1): 43-75.

Aranda, J.M. 1988. *Manual del curso de interpretación e identificación de rastros de mamíferos*. Instituto de Ecología A.C., Xalapa, Veracruz, México. 35 pp. Inédito.

AZOBIONAL. 1988. *Plan guía de manejo del Parque Nacional Natural los Katíos*. Instituto Nacional de Desarrollo de los Recursos Naturales Renobables, INDERENA, Bogotá.

Bodmer, R.E. 1991. Strategics of seed dispersal and seed predation in amazonian ungulates. Biotropica. 23:255-261.

Bodmer, R.E. & D.M. Brooks. 1997. Evaluación del estado y plan de acción del tapir de tierra baja (*Tapirus terestris).* Pp. 107-117. En: D.M. Brook, R. Bodmer. & S. Matola. (compilers) *Tapirs-status survey and conservation Action plan IUCN/SSC*. Tapir specialist Group. IUCN. Gland Switzerland and Cambridg. UK. Viii+164pp.

Cavelier, J.D., D. Lizcano., V. Pizarro. & J. Carmona. 2000. Distribución, tamaño poblacional y actividad de la danta de montaña (*Tapirus pinchaque)* en Colombia, Informe final presentado a: Fundación para la promoción de la investigación y la tecnología. Bogotá. 22pp.

Chanrad, A.D. & T.W. Box. 1964. A point frame for sampling rumen contents. *J Wild Manag*. 28: 473-477.

CITES. 2002. Convención Sobre el Comercio Internacional de Especies Amenazadas de Fauna y Flora Silvestres. http://www.cites.org/esp/disc/how.shtml. Consultada el 15 de junio de 2002.

Constantino, E. 2002. Tapir surveys in Colombia. Tapir Conservation. News letter of the UICN/SCS, Tapir Specialist Group. 11 (1): 14-16.

Crandall, L.S. 1964. The Management of Wild animals in captivity. Fam Tapiridae Uni Chicago press, Chicago.

Clutton-Brock, T.H. & S.D. Albon. 1982. Parental investment in male and female offspring in mammals. Pp. 223-224. En: College Sociobiology Group (Eds). Cambridge University. Press. Current problems in sociobiology kings, Cambrige.

Deutsch, L.A. & L.R, Puglia. 1988. *os animais silvestres: protecao doencas e manejo*. Editora Globo, Rio de Janeiro.

Downer, C.C. 1990. Informe sobre purshi Parq Nac. Sangay. Ministerio deAgricultura y Ganadería (Nat park), Quito, Ecuador.

Downer, C.C. 1995. The gentle botanist. Wildlife Conservation. 98 (4): 30-35.

Downer, C.C. 1996. The mountain tapir, endangered "flagship" species of the high Andes. Oryx. vol 30, num1 january, 45-59.

Downer, C.C. 1999. Un caso de mutualismo en los Andes: observaciones sobre dieta-hábitat del tapir de montaña. Pp. 415-427. En: T. Fang, O. Montenegro & R. Bodmer (compilers) Manejo y Conservación de fauna Silvestre en América Latina. WCS-NYZS, University of Florida e Instituto de Ecología, Santacruz, Bolivia.

Eisenberg, J.F. 1989. *Mammals of the neotropics: vol 1 the northern neotropics Panama, Colombia, Venezuela, Guyana, Suriname, French Guiana*. University of Chicago press, Chicago. 658pp.

Eisenberg, J.F. 1997. Introducción. En: D.M. Brook, R. Bodmer, S. Matola (compilers) *Tapirs-status survey and conservation Action plan. IUCN/SSC*. Tapir specialist. IUCN, Gland Switzerland and Cambridg. UK. Viii+164pp.

Fragoso, J.M. 1994. *Large mammals and the community dynamics of amazonian rain forest*. PhD thesis. University of Florida Gainesville, Florida, USA. 210 pp.

Fragoso, J.M. 1997. Efectos de la caza de los tapires en Belice. Pp. 191-200. En: J.G. Robinson & K.H. Redford (Eds) *Uso y conservación de la vida silvestre neotropical*. Fondo de Cultura Económica, México.

Fundación Natura. 2000. *Evaluación integrada del Darién Colombiano*, propuesta de zonificación para la vida y la convivencia. Fundación Natura, Bogotá. 70pp.

Garcés, D.M. & D.S. de la Zerda. 1994. Gran *libro de los Parques Nacionales Naturales de Colombia*. Intermedio editores, Santafe de Bogotá. 230pp.

Hershkovitz, P. 1954. Mammals of Northern Colombia, preliminary report nº 7: tapirs (genus *Tapirus*), with a systematic review of American species. Proceeding of the United States National Museum 103: 465-496.

Henry, O., F. Feer. & D. Sabatier. 2000. Diet of the lowland tapir (*Tapirus terrestris* L.) French Guiana. Biotropica. 32 (2): 364-368.

Howe, H.H. & J. Smallwood. 1982. Ecology of seed dispersal. *Ann. Rey. Ecol. Sist*.13: 201-218.

INDERENA. 1988. Parque Nacional Natural los Katíos. Folleto. 9 pp.

Janzen, D.H. 1981. Digestive seed predation by Costa Rican Baird'. Biotropica. 13:59-63.

Janzen, D.H. & P.S. Martin. 1982. Neotropical anachronisms: fruits the gomphotheres ate. Science 215: 19-27.

Janzen, D.H. 1982. Seeds in tapir dung in Sant Rosa National Park, Costa Rica. Brenesia. 19/20: 129-135.

Matola, S., A.D. Carón. & H. Rubio-Togler. 1997. Evaluación del estado y plan de acción del tapir mesoamericano (*Tapirus bairdii).* Pp. 89-106. En: D.M. Brooks, R. Bodmer. & S. Matola (compilers) *Tapirs-status survey and conservation Action plan IUCN/SSC.Tapir specialist Group*. IUCN, Gland Switzerland and Cambridg. UK. Viii+164pp.

Mejía, C.A. 1995. *Fauna de la Serranía de la Macarena*. Amazonas Editores, Ediciones Unidas. Impreso en Colombia. 176 pp.

Molano, A., M. Ramírez., C. Monje. & R. Emblin. 1996. *El Tapón del Darién. Diario de una travesía*. El Sello Editorial. 174pp.

Montenegro, O.L. 1998. *The behavior of lowland tapir (Tapirus terestris) at a natural mineral lick in the Peruvian Amazon*. Master Thesis. University of Florida, Gainesville.

Montenegro, O.L. 1999. Observaciones sobre la estructura de una población de tapires (*Tapirus terrestris)* en el sureste de la Amazonía peruana. Pp. 437-442. En: T. Fang, O. Montenegro. & R. Bodmer (Eds) *Manejo y Conservación de fauna Silvestre en América Latina*. WCS-NYZS, University of Florida e Instituto de Ecología, Santacruz, Bolivia.

Naranjo, E.J. 1995a. Hábitos de alimentación del tapir (*Tapirus terrestris)* en un bosque tropical húmedo de Costa Rica. Vida silvestre neotropical. 34: 32-37.

Naranjo, E.J. 1995 b. Abundancia y uso de hábitat del tapir (*Tapirus bairdii)* en un bosque húmedo tropical de Costa Rica. Vida silvestre neotropical 4: 20-31.

Naranjo, E.J. & E. Cruz. 1998. Ecología del tapir (*Tapirus bairdii)* en la reserva de la biosfera La Sepultura, Chiapas México. Acta zoológica mexicana (ns) 73: 111-125.

Olmos, F. 1997 Tapires como dispersores y depredadores de semillas. Pp67-73. En: D.M. Brook, R. Bodmer. & S. Matola (compilers) *Tapirs-Status Survey and Conservation Action Plan IUCN/SSC*. Tapir Specialist Group. IUCN, Gland Switzerland and Cambridge. UK. Viii+164pp.

Owen-Smith, R.N. 1988. *Mega herbivores, The influence of very large size on ecology*. Cambridge University press, Cambridge.

Peña, J.A., C.L. Solano. & N.T. Vargas. 1996. Aspectos ecológicos del tapir de tierras bajas *Tapirus terrestris* en el sector del río Duda, Parque Nacional Natural Tinigua, Colombia. Pp. 157-163. En: C. Campos, A. Ulloa. & H. Rubio (Eds) *Manejo de fauna con comunidades rurales*. Fundación Natura, Santa Fe de Bogotá.

Rodríguez, J. V. 1998. Listas preliminares de mamíferos colombianos con algún riesgo a la extinción. Informe final presentado al Instituto de Investigación de Recursos Biológicos Alexander von Humboldt. [on-line]. URL: http://www.humboldt.org.co/conservacion/Listas_ Preliminares.htm. consultada el 11 de diciembre de 2005.

Rubio, H., A. Ulloa. & M. Rubio. 1998. *Tras las huellas de los animales, 23 especies del Chocó Biogeográfico*. Fundación Natura, Bogotá, Colombia. 167pp.

Salas, L.A. 1996. Habitat use by lowland tapirs (*Tapirus terrestris)* in the Tabaro River Valley southern Venezuela. *Can. J zool*. 74: 1452-1458.

Tapia, M. 1998. Manejo de mamíferos amazónicos en cautiverio y semicautiverio en el centro experimental Fátima. Pp. 155-198. En: D. Tirira (ed) *Biología sistemática y conservación de los mamíferos del Ecuador, Memorias Museo de Zoología*. Centro de biodiversidad y ambiente Pontificia Universidad Católica del Ecuador, Publicación 1, Quito.

Terwilliger, V.J. 1978. Natural history of baird"s tapir on Barro Colorado Island, Panama canal zone. Biotropica 10 (3): 211-220.

Tirira, D. 1999. *Mamíferos del Ecuador*. Museo de Zoología, Centro de Biodiversidad y Ambiente, Pontificia Universidad Católica del Ecuador. SIBLOE Publicación especial 2, Quito. 392 pp.

IUCN. 2003. IUCN Red List of Threatened Species. www.redlist.org. Visitada el 11 de mayo de 2004.

Ulloa, A., H. Rubio. & C. Campos. 1996. *Trua Wandra*, estrategias *para el manejo de fauna con comunidades Embera en el Parque Nacional Natural Utría, Chocó, Colombia*. Orewa, Fundación Natura, Ministerio del Medio Ambiente y OEI, Bogotá. 288pp.

Williams, K.D. 1984. *The central american tapir (Tapirus bairdii) in northwestern Costa Rica*. PhD thesis, Michigan State University, East Lansing, USA. 84pp.

Baird's tapir (*Tapirus bairdii*).

Using PCR-SSCP as Tool to Detect Polymorphism in Tapirs

Andrés Tapia[1-2], Melissa Arévalo[2], María Eugenia Sánchez[2], Tannia Witte[2], William Llumipanta[1-2], César Paz-y-Miño[2-3]

[1] Universidad Central del Ecuador. Escuela de Biología y Química. Quito-Ecuador
[2] Laboratorio de Genética Molecular y Citogenética Humana. Pontificia Universidad Católica del Ecuador
[3] Universidad Central del Ecuador. Facultad de Medicina. Quito-Ecuador

Information on genetic variation is essential for the conservation and management of wildlife, as it allows for the design of captive-breeding plans, wildlife management plans, and translocation and re-introduction of individuals, in ways that minimize inbreeding and outbreeding depression (Benirschke & Kumamoto, 1991). There are many techniques available to evaluate genetic variation in both captive and wild populations, varying in both cost and sensitivity. Here we report on the potential use of PCR-SSCP, a cheap and highly sensitive technique, in the lowland tapir (*Tapirus terrestris*) using both fragments of mitochondrial genes and microsatellites of 150-1200bp in length.

PCR-SSCP (Polymerase Chain Reaction – Single-Stranded Conformation Polymorphism) has become an important molecular tool to study polymorphism in a great number of species (Sunnucks et al. 2000) including humans (Paz-y-Miño & Leone, 2002; Orita et al., 1989; Estrada-Cuzcano et al., 2005), mice (Hunter et al., 1993), oysters (Li & Hedgecock, 1998), donkeys (Ivankovic et al., 2002) and horses (Mirol et al., 2002; Hill et al., 2002; Kavar et al., 1999). The technique is based on the principle that a comparison of the genome of any two individuals would reveal millions of mutations across all chromosomes. The majority of which are only one-base differences, spaced out every 500-1000 bases on average, frequently on non-coding regions and sometime on coding ones (Estrada-Cuzcano et al., 2005). These single base differences cause changes in the specific tertiary (3-dimensional) conformation of single-stranded DNA molecules allowing for the detection of both inter- and intra-specific variation. The specific conformation of any single-strand of DNA is dependent on how the molecule self-hybridizes (Estrada-Cuzcano et al., 2005), which in turn, leads to changes in its migration pattern on a polyacrylamide gel (Orita et al., 1989).

The main factors that influence the detection of polymorphism are: the length of the DNA fragment, the concentration of the gel and the electrophoresis buffer, the use of glycerol, the voltage and, the time allowed for the migration of the fragments along the gel. Another important factor contributing to the detection of polymorphism is the G+C (Guanine+Cytosine) content. As mentioned above, the detection of polymorphism in SSCP relies on the tertiary conformation of a single strand of DNA and the interaction between the conformation and the polyacrylamide gel matrix (i.e. bulkier structures migrate slower than more compact ones). The higher the G+C content in a single strand of DNA, the more hydrogen bonds there are, and the more stable the tertiary structure will be in normal electrophoretic, non-denaturing conditions. Therefore the G+C content will be fundamental to the detection of polymorphism. Estrada-Cuzcano et al. (2005), for instance, had difficulty detecting variation in human sequences with G+C contents inferior to 40%. In another study, Nataraj et al. (1999) easily detected polymorphism in fragments of 100-300pb with 60% G+C using gels at room temperature; yet, polymorphism at similarly sized sequences with only 40% G+C was not so easily resolved.

The mitochondrial genome is an ideal candidate for SSCP due to its high mutation rate (Weinrich, 2001). Polymorphism has been detected in several mitochondrial genes (Naviaux, 2000); for instance, more than 70 haplotypes have been reported for the cytB, with 39 synonymous and 35 non-synonymous mutations (Howell, 1993). Furthermore, mitochondrial genes have been widely used as an important source of information about the population genetic structure of a great range of vertebrate species due to their semi-autonomous character (self replicating organelle), their high rate of evolution and their highly conserved pattern across species (Copeland, 2004). The mitochondrial genome mutates 10 to 100 times more frequently than the nuclear genome (Garesse & Vallejo, 2001), and the genetic information contained in it has become very useful to study animal species that disperse over large distances and are hard to observe in the wildlife, such as the tapir.

For this study, DNA was obtained from blood samples of 24 tapirs (*Tapirus terrestris aenigmaticus*) collected in six provinces of the Ecuadorian Amazon Region using modified protocols with NaCl (Sambrook et al., 1989). PCR reactions were carried out as described by Santos (2001) using primers described by

Kocher et al. (1989), Goebel et al. (1999), Palumbi et al. (1991), Rueda & Morales (2005), Norton & Ashley (2004) and Richards et al. (1998). Following PCR, 8-10 μL of the samples were mixed with 4 μL of SSCP dye (formamide, bromofenol blue 0.25%, xilen-cianol 0.25% and sucrosa 40%), denatured at 95ºC for 5 minutes and cooled on ice for 5 minutes. Samples were run in 8, 10, and 12% acrylamide-bisacrylamide (49:1) gels at 280-600V over 3-8 hours. Variants were recognized after Silver Nitrate staining as described by Sambrook et al (1989). The resolution of the gels has allowed us to resolve three control region variants, four 12S, one 16S, three cytB, and three COI, showing a high polymorphic variability among tapirs sampled.

However preliminary our results, we are confident in the utility of the technique for tapir genetic studies. Studies in horses, for instance, have detected similar levels of polymorphism, using SSCP, to the ones reported here. Mirol et al. (2002) identified 14 haplotypes in 100 individuals of four different breeds using a 466pb fragment of the control region. Kavar et al. (1999), using a 444bp fragment of the same region, found three haplotypes in 49 Lipizziano horses. But there is the potential to find much more, as has been demonstrated by Ivankovic et al. (2001), who identified 19 haplotypes in three donkey populations using microsatellite sequences and the proximal region of the control region. And, finally, in other studies using the same region, five haplotypes were found in Zemaitukai horses (Cothram et al., 2005), 27 in 145 individuals of the Portuguese horse (Lopes et al., 2005), and 93 in domestic horses (Jansen et al., 2002).

Further demonstrating the utility of the technique for tapirs, it has been noted that polymorphism in fragments larger than 200 nucleotides are less likely to be detected using SSCP (Sheffield et al., 1993). Contrasting with other techniques, PCR-SSCP can be extremely sensitive, allowing for the detection of changes as small as 1 bp (base-pair) in fragments that are several hundreds of bases long. Yet, because of this, PCR-SSCP is much more sensitive to detect errors in replication that happen during PCR (Hayashi, 1991). As such, in ideal conditions, SSCP is able to detect mutations in fragments of 200bp or less in 80-90% of the time (Sheffield et al., 1993). However, we have been able to obtain good resolution gels with two long fragments of mitochondrial genes, a 600pb fragment of the 16S gene and the complete 12S gene (1200pb).

These are only preliminary results and the number of variants still needs to be repeated and confirmed. We hope to contribute with final results in the first semester of the next year. Nevertheless, our results suggest that PCR-SSCP can be a useful and cheap technique to detect and quantify polymorphisms in tapirs, giving us information about the current level of genetic heterogeneity of mtDNA of *Tapirus terrestris aenigmaticus* and its population genetic structure, which is a priority goal for the conservation genetics of this vulnerable species.

Acknowledgements

This work has been supported by ODEPLAN-PUCE-UC project. We are grateful to Anders Gonçalvez da Silva who provided some of the primers used in this study and made important comments on an early version of this report.

Literature Cited

Benirschke, K. & Kumamoto, A. T. 1991. Mammalian cytogenetics and conservation of species. J Hered 82: 187–191.

Copeland, W. C. 2002. Mitochondrial DNA: Methods and Protocols. Humana Press. New Jersey, USA.

Cothram, E., Juras, R. & Macijauskiene, V. 2005. Mitochondrial DNA D-loop sequence variation among 5 maternal lines of the Zemaitukai horse breed. Genetics and Molecular Biology 28(4): 677-681.

Estrada-Cuzcano, A., Sandoval, J., Guevara-Fujita, M. L., Fujita, R. 2005. Uso de la técnica SSCP para detectar mutaciones puntuales del ADN mitocondrial humano. Rev. peru. biol. 12(3): 349- 358.

Garesse, R., Vallejo, C. G. 2001. Animal mitochondria biogenesis and function: a regulatory cross-talk between two genomes. Gene 263: 1–16.

Goebel, A. M., Donnelly, J. M. & Atz, M. E. 1999. PCR Primers and Amplification Methods for 12S Ribosomal DNA, the Control Region, Cytochrome Oxidase I, and Cytochrome *b* in Bufonids and Other Frogs, and an Overview of PCR Primers which Have Amplified DNA in Amphibians Successfully. Molecular Phylogenetics and Evolution 11(1):163–199.

Hayashi, K. 1991. PCR-SSCP: a simple and sensitive meted for detection of mutations in the genomic DNA. PCR Methodologies and Applications 1: 34–38.

Hill, E. W., Bradley, D. G., Al-Barody, M., Ertugrul, O., Splan, R. K., Zakharov, I. & Cunningham, E. P. 2002. History and integrity of thoroughbred dam lines revealed in equine mtDNA variation. Animal Genetics 33: 287–294.

Howell, N. 1993. The evolution of the Cytochrome b protein: how many regions are conserved? Mol Biol Evol 10(2): 488–491.

Hunter, K. W., Watson, M. L., Rochelle, J., Ontiveros, S., Munroe, D., Seldin, M. F. & Housman, D. E. 1993. Single-Strand Conformational Polymorphism (SSCP) Mapping of the Mouse Genome: Integration of the SSCP, Microsatellite, and Gene Maps of Mouse Chromosome 1. Genomics 18:510-519.

Ivankovic, A., Kavar, T., Caput, P., Mioc, B., Pavic, V. & Dovč, P. 2002. Genetic diversity of three donkey populations in the Croatian coastal region. Animal Genetics 33: 169–177.

Jansen, T., Forster, P., Levine, M. A., Oelke, H., Hurles, M., Renfrew, C., Weber, J. & Olek, K. 2002. Mitochondrial DNA and the origins of the domestic horse. PNAS 99(16): 10905–10910

Kavar, T., Habe, F., Brem, G., & Dovč, P. 1999. Mitochondrial D-loop sequence variation among the 16 maternal lines of the Lipizzan horse breed. Animal Genetics 1999(30): 423-430.

Kocher, T. D., Thomas, W. K., Meyer, A., Edwards, S. V., Pääbo, S., Villablanca, F. X. & Wilson, A. C. 1989. Dynamics of mitochondrial DNA evolution in animals: Amplification and sequencing with conserved primers. Proc. Nati. Acad. Sci. 86: 6196-6200.

Li, G. & Hedgecock, D. 1998. Genetic heterogeneity, detected by PCR SSCP, among samples of larval Pacific oysters (*Crassostrea gigas*) supports the hypothesis of large variance in reproductive success. Can. J. Fish. Aquat. Sci. 55: 1025-1033.

Lopes, M. S., Mendonça, D., Cymbron, T., Valera, M., da Costa-Ferreira, J. & da Câmara Machado, A. 2005. The Lusitano horse maternal lineage based on mitochondrial D-loop sequence variation. Animal Genetics 36: 196–202.

Mirol, P., Peral García, P. & Dulout, F. N. 2002. Mitochondrial variability in the D-loop of four equine breeds shown by PCR-SSCP analysis. Genetics and Molecular Biology 25(1): 25-28.

Nataraj, A., Olivos-Glander, I., Kusukawa, N. & Highsmith, E. 1999. Single-strand conformation polymorphism and heteroduplex analysis for gel-based mutation detection. Electrophoresis 20: 1117-1185.

Naviaux, R. K. 2000. Mitochondrial DNA disorders. European Journal of Pediatrics 159 (3): 219–226.

Norton, J. E. & Ashley, M. V. 2004. Genetic variability and population structure among wild Baird´s tapirs. Animal Conservation 7: 211–220.

Orita M., Iwahana, H., Kanazana, H., Hayashi, K. & Sekiya, T. 1989. Detection of polymorphisms of human DNA by electrophoresis as single strand conformation polimorphisms. Proc. Natl. Acad. Sci. USA. 86: 2766-2770.

Palumbi, S. R., Martin, A., Romano, S., McMillan, W. O., Stice, L., & Grabowski, G. 1991. The Simple Fool's Guide to PCR, Version 2.0. S. Palumbi, Dept. Zoology. Univ. Hawaii. Honolulu.

Paz-y-Mino, C., Leone, P. E. 2002. Three novel somatic mutations in the NF2 tumor suppressor gene [g816T>A; g1159A>G; gIVS11-1G>T]. Human Mutation 15 (5): 487.

Richards, M. B., Macaulay, V. A., Bandelt, H. J., Sykes, M. B. Phylogeography of mitochondrial DNA in western Europe. Ann. Hum. Genet 62(3): 241-260.

Rueda, L. A. & Morales, J. C. 2005. Evolutionary relationships among genera of Phalangeridae (Metatheria: Diprotodontia) inferred from mitochondrial DNA. Journal of Mammalogy 86(2):353–365.

Sambrook, J., Fristch, E. F. & Maniatis, T. 1989. Molecular Cloning: A Laboratory Manual. Cold Spring Harbor Publications. New York, USA.

Santos, J. C. 2001. Relaciones filogenéticas de *Colostethus bocagei* y *Epipedobates tricolor* (Anura: Dendrobatidae) inferidas de secuencias de genes mitocondriales 12S, 16S y Citocromo b. Graduation Thesis. Pontificia Universidad Católica del Ecuador, Quito, Ecuador.

Sheffield V., Beck, J., Kwitek, A., Sandstrom, D & Stone, E. 1993. The sensitivity of single strand conformation polymorphism analysis for detection of single base substitutions. Genomics (16): 325-332.

Sunnucks, P., Wilson, A. C. C., Beheregaray, B., Zenger, K., French, J. & Taylor, A. C. 2000. SSCP is not so difficult: the application and utility of single-stranded conformation polymorphism in evolutionary biology and molecular ecology. Molecular Ecology 9:1699–1710

Weinreich, D. M. 2001. The rates of molecular evolution in rodent and primate mitochondrial DNA. Journal of Molecular Evolution 52: 40–50.

TSG on the Web: www.tapirs.org

For more information about the Tapir Specialist Group, please visit our website, now easy to remember at www.tapirs.org.

This page provides news and background about all aspects of conservation of the four recent tapir species. People, pojects, fundraising, photos and videos, and document downloads, including all back issues of *Tapir Conservation*, can be found. Have a look at it!

TSG MEMBERSHIP DIRECTORY

Currently, the TSG has **104** members, including field researchers, educators, veterinarians, governmental agencies and NGO representatives, zoo personnel, university professors and students, from **27** different countries worldwide (Argentina, Australia, Belize, Bolivia, Brazil, Canada, Colombia, Costa Rica, Denmark, Ecuador, France, French Guiana, Germany, Guatemala, Honduras, Indonesia, Malaysia, Mexico, Myanmar, Republic of Panama, Paraguay, Peru, Thailand, The Netherlands, United Kingdom, United States, and Venezuela).

ABD GHANI, SITI KHADIJAH (Malaysia)
PERHILITAN Bukit Rengit, Krau Wildlife Reserve
E-mail: cobra7512081@hotmail.com

AMANZO, JESSICA (Peru)
Seccion Ecologia, Sistematica y Evolucion, Departamento Academico de Ciencias Biologicas y Fisiologicas
Facultad de Ciencias y Filosofia, Universidad Peruana Cayetano Heredia
E-mail: jessica_amanzo@yahoo.com

ANGELL, GILIA (United States)
Designer, Amazon.com
E-mail: gilia_angell@earthlink.net

APARICIO, KARLA (Republic of Panama)
M.Sc. Specialist in Wildlife Conservation and Management
Scientific Committee, Patronato "Amigos del Águila Harpia"
Associate Researcher, Earthmatters.Org
E-mail: k_aparicio@yahoo.com

BARONGI, RICK (United States)
Director, Houston Zoo Inc.
Former Chair / Member, American Zoo and Aquarium Association (AZA) Tapir Taxon Advisory Group (TAG)
E-mail: RBarongi@aol.com; rbarongi@houstonzoo.org

BAUER, KENDRA (United States)
Ph.D. Graduate Student, University of Texas at Austin
Integrative Biology
E-mail: kendrabauer@mail.utexas.edu

BECK, HARALD (Germany / United States / Peru)
Ph.D. Assistant Professor & Curator of the Mammal Museum
Department of Biological Sciences, Towson University
E-mail: hbeck@towson.edu

BENEDETTI, ADRIÁN (Republic of Panama)
Director, Summit Zoo
E-mail: arbs3@hotmail.com

BLANCO MÁRQUEZ, PILAR ALEXANDER (Venezuela)
D.V.M. Director Técnico, Fundación Nacional de Parques Zoológicos e Acuários (FUNPZA) - Ministerio del Ambiente (MARN)
E-mail: albla69@yahoo.com.mx; funpza@marn.gov.ve

BODMER, RICHARD E. (England)
Ph.D. Lecturer in Biodiversity Conservation, Durrell Institute of Conservation and Ecology (DICE), University of Kent
E-mail: R.Bodmer@ukc.ac.uk

BUSTOS, SOLEDAD DE (Argentina)
Licenciada en Ciencias Biológicas, Proyecto de Investigación y Conservación del Tapir Noroeste Argentina
E-mail: soledaddebustos@yahoo.com.ar

CAMACHO, JAIME (Ecuador)
Coordinator, Programa Parques en Peligro, Fundación Ecuatoriana de Estudios Ecológicos - EcoCiencia
E-mail: pep@ecociencia.org

CARBONELL TORRES, FABRICIO (Costa Rica)
Coordinador de Proyectos Ambientales, Asociación Meralvis
E-mail: carbon_f@yahoo.com.mx

CARTES, JOSÉ LUIS (Paraguay)
M.Sc. Coordinador de Conservación de Sítios, Guyra Paraguay
E-mail: jlcartes@guyra.org.py

CASTELLANOS PEÑAFIEL, ARMANDO XAVIER (Ecuador)
Director, Andean Bear Project, Fundación Espíritu del Bosque
E-mail: iznachi@yahoo.com.mx; zoobreviven@hotmail.com

CHALUKIAN, SILVIA C. (Argentina)
M.Sc. Proyecto de Investigación y Conservación del Tapir Noroeste Argentina
E-mail: schalukian@yahoo.com.ar

COLBERT, MATTHEW (United States)
Ph.D. Research Associate, Jackson School of Geological Sciences, University of Texas at Austin
E-mail: colbert@mail.utexas.edu

CONSTANTINO, EMILIO (Colombia)
E-mail: econch@gmail.com

CRUZ ALDÁN, EPIGMENIO (Mexico)
M.Sc. Researcher, Instituto de Historia Natural y Ecología
E-mail: pimecruz5910@hotmail.com; cruz5910@tgz.megared.net.mx

CUARÓN, ALFREDO D. (Mexico)
Ph.D. Departamento de Ecología de los Recursos Naturales, Instituto de Ecología, UNAM
E-mail: cuaron@oikos.unam.mx

DEE, MICHAEL (United States)
General Curator, Los Angeles Zoo
Member, American Zoo and Aquarium Association (AZA) Tapir Taxon Advisory Group (TAG)
E-mail: mdee@zoo.lacity.org

DESMOULINS, AUDE (France)
Assistant Director, ZooParc de Beauval
Lowland Tapir Studbook Keeper, European Association of Zoos and Aquaria (EAZA) Tapir Taxon Advisory Group (TAG)
E-mail: aude.desmoulins@zoobeauval.com

DOWNER, CRAIG C. (United States)
BA, M.Sc., President, Andean Tapir Fund
E-mail: ccdowner@terra.es; ccdowner@yahoo.com

ESTRADA ANDINO, NEREYDA (Honduras)
M.Sc. USAID - MIRA
E-mail: nerestr@yahoo.com

FLESHER, KEVIN (United States / Brazil)
E-mail: KevinFlesher@yahoo.com

FLOCKEN, JEFFREY (United States)
International Affairs Specialist, Division of International Conservation, U.S. Fish & Wildlife Service
E-mail: jeff_flocken@fws.gov

FOERSTER, CHARLES R. (United States / Costa Rica)
M.Sc. Leader, Baird's Tapir Project, Corcovado National Park, Costa Rica
E-mail: CRFoerster@aol.com; foerster@racsa.co.cr

FRANKLIN, NEIL (Indonesia)
Director, Indonesia Program, The Tiger Foundation (Canada) - The Sumatran Tiger Trust (United Kingdom)
E-mail: franklin@pacific.net.id

GARCÍA VETTORAZZI, MANOLO JOSÉ (Guatemala)
Licenciado, Investigador, Escuela de Biologia, Universidad de San Carlos de Guatemala
E-mail: manelgato@gmail.com

GARRELLE, DELLA (United States)
D.V.M. Director of Conservation and Animal Health, Cheyenne Mountain Zoo
E-mail: dgarelle@cmzoo.org; dgarelle@yahoo.com

GLATSTON, ANGELA (The Netherlands)
Ph.D. Curator of Mammals, Rotterdam Zoo
Member, European Association of Zoos and Aquaria (EAZA) Tapir Taxon Advisory Group (TAG)
E-mail: a.glatston@rotterdamzoo.nl

GOFF, DON (United States)
Director of Animal Programs, Beardsley Zoological Gardens
Lowland Tapir Studbook Keeper, American Zoo and Aquarium Association (AZA) Tapir Taxon Advisory Group (TAG)
E-mail: dgoff@beardsleyzoo.org

GONÇALVES DA SILVA, ANDERS (Brazil / United States)
Ph.D. Graduate Student, Ecology and Evolutionary Biology Program
Center for Environmental Research and Conservation (CERC)
Department of Ecology, Evolution and Environmental Biology (E3B), Columbia University
E-mail: ag2057@columbia.edu

GREENE, LEWIS (United States)
Director, Fresno Chaffee Zoo
E-mail: lgreene@fresnochaffeezoo.com

GUERRERO SÁNCHEZ, SERGIO (Mexico)
D.V.M. Manager, Clinic Laboratory, Zoológico Regional Miguel Álvarez del Toro (ZooMat)
Instituto de Historia Natural y Ecología
E-mail: ekio@yahoo.com

GUIRIS ANDRADE, DARIO MARCELINO (Mexico)
D.V.M. M.Sc. Jefe de Operaciones, UN.A.CH., Policlinica y Diagnóstico Veterinario
E-mail: dmguiris@hotmail.com

HANDRUS, ELLIOT (Canada)
Curator, Mountain View Conservation Center
E-mail: elliot@mtnviewfarms.com

HERNANDEZ DIVERS, SONIA (United States)
D.V.M. Adjunct Professor, College of Veterinary Medicine, University of Georgia
E-mail: shernz@aol.com

HOLDEN, JEREMY (Indonesia)
Photographer, Flora and Fauna International
E-mail: pop@padang.wasantara.net.id; jeremy_holden1@yahoo.co.uk

HOLST, BENGT (Denmark)
M.Sc. Vice Director and Director of Conservation and Science, Copenhagen Zoo
Convener, IUCN/SSC Conservation Breeding Specialist Group (CBSG) - Europe Regional Network
Chair, European Association of Zoos and Aquaria (EAZA) Tapir Taxon Advisory Group (TAG)
E-mail: beh@zoo.dk

JANSSEN, DONALD L. (United States)
D.V.M. Ph.D. Director, Veterinary Services, San Diego Wild Animal Park
E-mail: djanssen@sandiegozoo.org

JULIÁ, JUAN PABLO (Argentina)
Ph.D. Coordinador, Reserva Experimental Horco Molle
Universidad National de Tucumán
E-mail: jupaju@yahoo.es

KAEWSIRISUK, SUWAT (Thailand)
Chief, Hala-Bala Wildlife Sanctuary - Department of National Parks, Wildlife and Plant Conservation
Royal Forest Department of Thailand
E-mail: king@btv.co.th

KANCHANASAKA, BUDSABONG (Thailand)
Wildlife Research Division - Department of National Parks, Wildlife and Plant Conservation
Royal Forestry Department of Thailand
E-mail: Budsa@hotmail.com

KASTON FLÓREZ, FRANZ (Colombia)
D.V.M. Scientific Director, Fundación Nativa
E-mail: tapirlanudo@hotmail.com

KAWANISHI, KAE (Malaysia)
Ph.D. Technical Advisor, Division of Research and Conservation
Department of Wildlife and National Parks (DWNP)
E-mail: kae@wildlife.gov.my; kae2000@tm.net.my

KONSTANT, WILLIAM (United States)
Director of Conservation and Science, Houston Zoo Inc.
E-mail: bkonstant@houstonzoo.org

LIRA TORRES, IVÁN (Mexico)
D.V.M. M.Sc. Research Associate, Universidad del Mar - Campus Puerto Escondido
E-mail: ilira@zicatela.umar.mx; ilira_12@hotmail.com

LIZCANO, DIEGO J. (Colombia)
Ph.D. Universidad de Pamplona
E-mail: dl36@ukc.ac.uk

LUÍS, CRISTINA (Portugal)
Ph.D. Graduate Student, Centro de Biologia Animal, Departamento de Biologia Animal Faculdade de Ciências, Universidade de Lisboa
E-mail: cmluis@fc.ul.pt

LYNAM, ANTONY (Thailand)
Ph.D. Associate Conservation Scientist & Regional Advisor, Wildlife Conservation Society - Asia Program
E-mail: tlynam@wcs.org

MANGINI, PAULO ROGERIO (Brazil)
D.V.M. M.Sc. Research Associate, IPÊ - Instituto de Pesquisas Ecológicas (Institute for Ecological Research)
Scientific Coordinator, Vida Livre - Medicina de Animais Selvagens
E-mail: pmangini@uol.com.br; pmangini@ipe.org.br

MANOPAWITR, PETCH (Thailand)
Deputy Director, Wildlife Conservation Society - Thailand Program
E-mail: pmanopawitr@wcs.org; pmanopawitr@hotmail.com

MARTYR, DEBORAH (Indonesia)
Team Leader, Flora and Fauna International
E-mail: ffitigers@telkom.net

MATOLA, SHARON (United States / Belize)
Director, Belize Zoo and Tropical Education Center
E-mail: matola@belizezoo.org

MEDICI, PATRÍCIA (Brazil)
M.Sc. Wildlife Ecology, Conservation and Management
Research Coordinator, IPÊ - Instituto de Pesquisas Ecológicas (Institute for Ecological Research)
Ph.D. Candidate, Durrell Institute of Conservation and Ecology (DICE), University of Kent, United Kingdom
Convener, IUCN/SSC Conservation Breeding Specialist Group (CBSG) - Brazil Regional Network
E-mail: epmedici@uol.com.br; medici@ipe.org.br

MEIJAARD, ERIK (The Netherlands / Indonesia)
Ph.D. Senior Forest Ecologist, The Nature Conservancy (TNC), East Kalimantan Provincial Office
E-mail: emeijaard@tnc.org

MENDOZA, ALBERTO (Mexico / United States)
D.V.M. Manager, Latin American Programs, Houston Zoo Inc.
Chair, American Zoo and Aquarium Association (AZA) Tapir Taxon Advisory Group (TAG)
E-mail: amendoza@houstonzoo.org

MOLLINEDO, MANUEL A. (United States)
Director, San Francisco Zoological Gardens
E-mail: manuelm@sfzoo.org

MONTENEGRO, OLGA LUCIA (Colombia)
Ph.D. Universidad Nacional de Colombia (UNAL)
E-mail: olmdco@yahoo.com; olmontenegrod@unal.edu.co

MORALES, MIGUEL A. (Paraguay / United States)
Ph.D. Graduate Student, Land Resources Program
Gaylord Nelson Institute for Environmental Studies, University of Wisconsin
E-mail: mamorales@wisc.edu

NARANJO PIÑERA, EDUARDO J. (Mexico)
Ph.D. El Colegio de la Frontera Sur (ECOSUR)
E-mail: enaranjo@sclc.ecosur.mx

NOGALES, FERNANDO (Ecuador)
Researcher, Fundación Ecológica Arcoiris
Professor, Escuela de Gestión Ambiental de la Universidad Técnica Particular de Loja
E-mail: fernogales@yahoo.com

NOVARINO, WILSON (Indonesia)
Lecturer, Jurusan Biologi FMIPA, Universitas Andalas
E-mail: wilson_n_id@yahoo.com

O'FARRILL, GEORGINA (Mexico / Canada)
Ph.D. Graduate Student, Biology Department, McGill University
E-mail: xoxo_ofarrill@yahoo.com.mx

ORDÓÑEZ DELGADO, LEONARDO (Ecuador)
Coordinator, Proyecto Corredores de Conservación, Fundación Ecológica Arcoiris
E-mail: paramos@arcoiris.org.ec; tsg.ecuador@gmail.com

PARÁS GARCIA, ALBERTO (Mexico)
D.V.M. Gerente del Departamento de Veterinaria, Africam Safari
E-mail: pago@servidor.unam.mx; pago@africamsafari.com.mx

PAVIOLO, AGUSTÍN (Argentina)
Biologist, Ph.D. Graduate Student, CONICET-LIEY, Universidad Nacional de Tucumán
E-mail: paviolo4@arnet.com.ar

PEDRAZA PEÑALOSA, CARLOS ALBERTO (Colombia)
Instituto de Investigación de Recursos Biológicos "Alexander von Humboldt"
Calle 138 Bis # 25-37, Bogotá, Cundinamarca, COLOMBIA
Phone: +57-1-626-1098 / E-mail: cpedraz@gmail.com

PRAYURASIDDHI, THEERAPAT (Thailand)
Ph.D. Technical Forest Official - Department of National Parks, Wildlife and Plant Conservation
Royal Forest Department of Thailand
E-mail: theerapat@hotmail.com

QUSE, VIVIANA BEATRIZ (Argentina)
D.V.M. Senior Veterinarian, Fundación Temaikén
E-mail: vquse@temaiken.com.ar

RESTREPO, HECTOR FRANCISCO (Colombia)
M.Sc. Fundación Wii
E-mail: restrepof@gmail.com

RODRÍGUEZ ORTIZ, JULIANA (Colombia)
Instituto de Ciencias Naturales, Universidad Nacional de Colombia (UNAL)
E-mail: mjuli2@gmail.com

ROMAN, JOSEPH (United States)
Curator, Virginia Zoological Park
Baird's Tapir Studbook Keeper, American Zoo and Aquarium Association (AZA) Tapir Taxon Advisory Group (TAG)
E-mail: Joseph.Roman@norfolk.gov

RUBIANO, ASTRITH (Colombia / United States)
University of Connecticut / Conservation and Research Center, Smithsonian Institution
E-mail: astrith.rubiano@uconn.edu; astrithrubiano@yahoo.com

RUIZ FUAMAGALLI, JOSÉ ROBERTO (Guatemala)
Professor & Researcher, Escuela de Biologia, Universidad de San Carlos de Guatemala
E-mail: rruizf@yahoo.com

RUSSO, KELLY J. (United States)
Manager of Interactive Marketing, Web Communications Department, Houston Zoo Inc
E-mail: krusso@houstonzoo.org

SALAS, LEONARDO (Venezuela / United States)
Ph.D. Animal Population Biologist
Wildlife Conservation Society (WCS) - Papua New Guinea Program
E-mail: leoasalas@netscape.net

SAMUDIO JR., RAFAEL (Panama)
Ph.D. Presidente, Sociedad Mastozoologica de Panamá (SOMASPA)
Director, Proyecto de Biodiversidad de Mamíferos (PROBIOMA)
E-mail: samudior@si.edu

SANDOVAL ARENAS, SERGIO (Colombia)
Vice-President, Tapir Preservation Fund (TPF)
E-mail: dantascol@yahoo.com.mx

SANDOVAL CAÑAS, LUIS FERNANDO (Ecuador)
Licenciado en Ciencias Biológicas, Escuela de Biología, Universidad Central del Ecuador
E-mail: lfsandoval_c@hotmail.com

SARMIENTO DUEÑAS, ADRIANA MERCEDES (Colombia)
M.Sc. Candidate, Universidad Nacional de Colombia
E-mail: adrianasarmi@hotmail.com; adriana-s@wildmail.com

SARRIA PEREA, JAVIER ADOLFO (Colombia)
D.V.M. M.Sc. Genetics & Animal Improvement Coordinator, Mamapacha Project
E-mail: jasarrip@yahoo.com

SEITZ, STEFAN (Germany)
Ph.D. Captive Research on Tapirs: Behavior and Management, 4TAPIRS Information Centre
E-mail: dr.stefan.seitz@t-online.de; info@4tapirs.de

SHOEMAKER, ALAN H. (United States)
Permit Advisor, American Zoo and Aquarium Association (AZA) Tapir Taxon Advisory Group (TAG)
E-mail: sshoe@mindspring.com

SMITH, BRANDIE (United States)
Assistant Director, Conservation and Science, American Zoo and Aquarium Association (AZA)
Advisor, American Zoo and Aquarium Association (AZA) Tapir Taxon Advisory Group (TAG)
E-mail: bsmith@aza.org

SUÁREZ MEJÍA, JAIME ANDRÉS (Colombia)
Jardin Botanico, Universidad Tecnológica de Pereira
E-mail: suarmatta@yahoo.com; jsuarezmejia@gmail.com

TAPIA, ANDRÉS (Ecuador)
Centro Tecnológico de Recursos Amazónicos de la Organización de Pueblos Indígenas de Pastaza (OPIP) - CENTRO FÁTIMA
E-mail: centrofatima@andinanet.net; centrofati@panchonet.net

THOISY, BENOIT DE (French Guiana)
D.V.M. Ph.D. Kwata Association
E-mail: thoisy@nplus.gf; bdethoisy@pasteur-cayenne.fr

TOBLER, MATHIAS (United States / Peru)
Ph.D. Graduate Student, Botanical Research Institute of Texas
E-mail: matobler@gmx.net

TODD, SHERYL (United States)
President, Tapir Preservation Fund (TPF)
E-mail: tapir@tapirback.com

TÓFOLI, CRISTINA F. (Brazil)
M.Sc. Graduate Student, São Paulo University (USP - Universidade de São Paulo)
Researcher, IPÊ - Instituto de Pesquisas Ecológicas (Institute for Ecological Research)
E-mail: cftofoli@yahoo.com.br

TORRES, NATALIA (Ecuador)
Estudiante, Escuela de Gestión Ambiental, Universidad Técnica Particular de Loja
E-mail: naty175@yahoo.com; naty175@hotmail.com

TRAEHOLT, CARL (Denmark / Malaysia / Cambodia)
Ph.D. Research Coordinator, Malayan Tapir Project, Krau Wildlife Reserve, Copenhagen Zoo
E-mail: ctraeholt@pd.jaring.my

ULLOA, OSCAR (Belize)
Wildlife Officer, Conservation Division, Ministry of Natural Resources
E-mail: belgreens@yahoo.com

VALDEZ LEAL, JUAN DE DIOS (Mexico / Costa Rica)
E-mail: jdvaldezleal@yahoo.com.mx

VAN STRIEN, NICO (The Netherlands / Indonesia)
Ph.D. SE Asia Coordinator, International Rhino Foundation
E-mail: strien@compuserve.com; Strien@indo.net.id

VARELA, DIEGO (Argentina)
Licenciado Ciencias Biologicas, Ph.D. Graduate Student, Universidad de Buenos Aires / Conservación Argentina
E-mail: diegomv@arnet.com.ar

VIEIRA FRAGOSO, JOSÉ MANUEL (United States)
Ph.D. Associate Professor, Botany Department, University of Hawaii at Manoa
E-mail: fragoso@hawaii.edu

WALLACE, ROBERT B. (England / Bolivia)
Ph.D. Associate Conservation Ecologist, Wildlife Conservation Society (WCS) - Madidi
E-mail: rwallace@wcs.org

WATERS, SIÂN S. (United Kingdom)
BA, M.Phil. Conservation Zoologist
E-mail: sian_s_waters@hotmail.com; sian_s_waters@yahoo.co.uk

WILLIAMS, KEITH (Australia)
Ph.D. Private Consultant
E-mail: kdwilliams56@yahoo.co.uk

WOHLERS, HUMBERTO (Belize)
General Curator, Belize Zoo
E-mail: animalmgt@belizezoo.org; humbertowohlers@yahoo.com

ZAINUDDIN, ZAINAL ZAHARI (Malaysia)
Malaysian Department of Wildlife and National Parks (DWNP)
E-mail: rhinosrcc@hotmail.com; zainal@wildlife.gov.my

TAPIR SPECIALIST GROUP

TSG STRUCTURE

Chair
Patrícia Medici, Brazil, epmedici@uol.com.br

Deputy-Chair
William Konstant, United States, bkonstant@houstonzoo.org

Baird's Tapir Coordinator
Eduardo J. Naranjo Piñera, Mexico, enaranjo@sclc.ecosur.mx

Lowland Tapir Coordinator
Viviana Beatriz Quse, Argentina, vquse@temaiken.com.ar

Malay Tapir Coordinator
Carl Traeholt, Denmark / Malaysia, ctraeholt@pd.jaring.my

Mountain Tapir Coordinator
Diego J. Lizcano, Colombia, dj.lizcano@gmail.com

Red List Authority
Alan H. Shoemaker, United States, sshoe@mindspring.com

Tapir Conservation Newsletter Editors
Leonardo Salas, Venezuela / Papua New Guinea, leoasalas@netscape.net
Stefan Seitz, Germany, info@4tapirs.de
Kelly J. Russo, United States, krusso@houstonzoo.org
Rick Barongi, United States, rbarongi@houstonzoo.org

Virtual Library Manager
Harald Beck, Germany / United States, hbeck@towson.edu
Mathias Tobler, United States / Peru, matobler@gmx.net

Fundraising Committee Coordinator
Patrícia Medici, Brazil, epmedici@uol.com.br
William Konstant, United States, bkonstant@houstonzoo.org

Action Planning Committee Coordinator
Patrícia Medici, Brazil, epmedici@uol.com.br

Zoo Committee Coordinator
Viviana Beatriz Quse, Argentina, vquse@temaiken.com.ar

Veterinary Committee Coordinator
D.V.M. Javier Adolfo Sarria Perea, Colombia, jasarrip@yahoo.com

Genetics Committee Coordinators
Anders Gonçalves da Silva, Brazil / United States, ag2057@columbia.edu
Cristina Luis, Portugal, cmluis@fc.ul.pt

Education & Outreach Committee Coordinator
Kelly J. Russo, United States, krusso@houstonzoo.org

Marketing Committee & Website Coordinator
Gilia Angell, United States, gilia_angell@earthlink.net

Ethics Committee

Task Force Re-Introduction & Translocation
Patrícia Medici, Brazil, epmedici@uol.com.br
Anders Gonçalves da Silva, Brazil / United States, ag2057@columbia.edu

Task Force Action Plan Implementation
Patrícia Medici, Brazil, epmedici@uol.com.br

Task Force Confiscated Animals
Rick Barongi, United States, rbarongi@houstonzoo.org

Working Group Human/Tapir Conflict
Siân S. Waters, United Kingdom, sian_s_waters@hotmail.com

Working Group Malay Tapir

Evolution Consultant
Matthew Colbert, United States, colbert@mail.utexas.edu

NOTES FOR CONTRIBUTORS

Scope
This newsletter aims to provide information regarding all aspects of tapir natural history. Items of news, recent events, recent publications, thesis abstracts, workshop proceedings etc concerning tapirs are welcome. Manuscripts should be submitted in MS Word.

Deadlines
There are two deadlines per year: 31 March for publication in June and 30 September for publication in December.

Please include the full name and address of the authors underneath the title of the article and specify who is the corresponding author.

Full length articles on any aspect of tapir natural history are accepted in English, Spanish or Portuguese language. They should not be more than 5,000 words (all text included). In any case, an English abstract up to 250 words is required.

Figures and Maps
Contributions can include black and white photographs, high quality figures and high quality maps and tables. Please send them as separate files (formats preferred: jpg, pdf, cdr, xls).

References
Please refer to these examples when listing references:

Journal Article
Herrera, J.C., Taber, A., Wallace, R.B. & Painter, L. 1999. Lowland tapir (*Tapirus terrestris*) behavioural ecology in a southern Amazonian tropical forest. Vida Silv. Tropicale 8:31-37.

Chapter in Book
Janssen, D.L., Rideout, B.A. & Edwards, M.S. 1999. Tapir Medicine. In: M.E. Fowler & R. E. Miller (eds.) Zoo and Wild Animal Medicine, pp.562-568. W.B. Saunders Co., Philadelphia, USA.

Book
Brooks, D.M., Bodmer, R.E. & Matola, S. 1997. Tapirs: Status, Survey and Conservation Action Plan. IUCN, Gland, Switzerland.

Thesis/Dissertation
Foerster. C.R. 1998. Ambito de Hogar, Patron de Movimentso y Dieta de la Danta Centroamericana (*Tapirus bairdii*) en el Parque Nacional Corcovado, Costa Rica. M.S. thesis. Universidad Nacional, Heredia, Costa Rica.

Report
Santiapilli, C. & Ramono, W.S. 1989. The Status and Conservation of the Malayan tapir (*Tapirus indicus*) in Sumatra, Indonesia. Unpublished Report, Worldwide Fund for Nature, Bogor, Indonesia.

Contact
Please send all contributions to Leonardo Salas, e-mail: LeoASalas@netscape.net

Tapir Conservation

The Newsletter of the IUCN/SSC Tapir Specialist Group

Volume 15/2 ■ No. 20 ■ **December 2006**

Contents

1513 North MacGregor
Houston, Texas 77030
www.houstonzoo.org