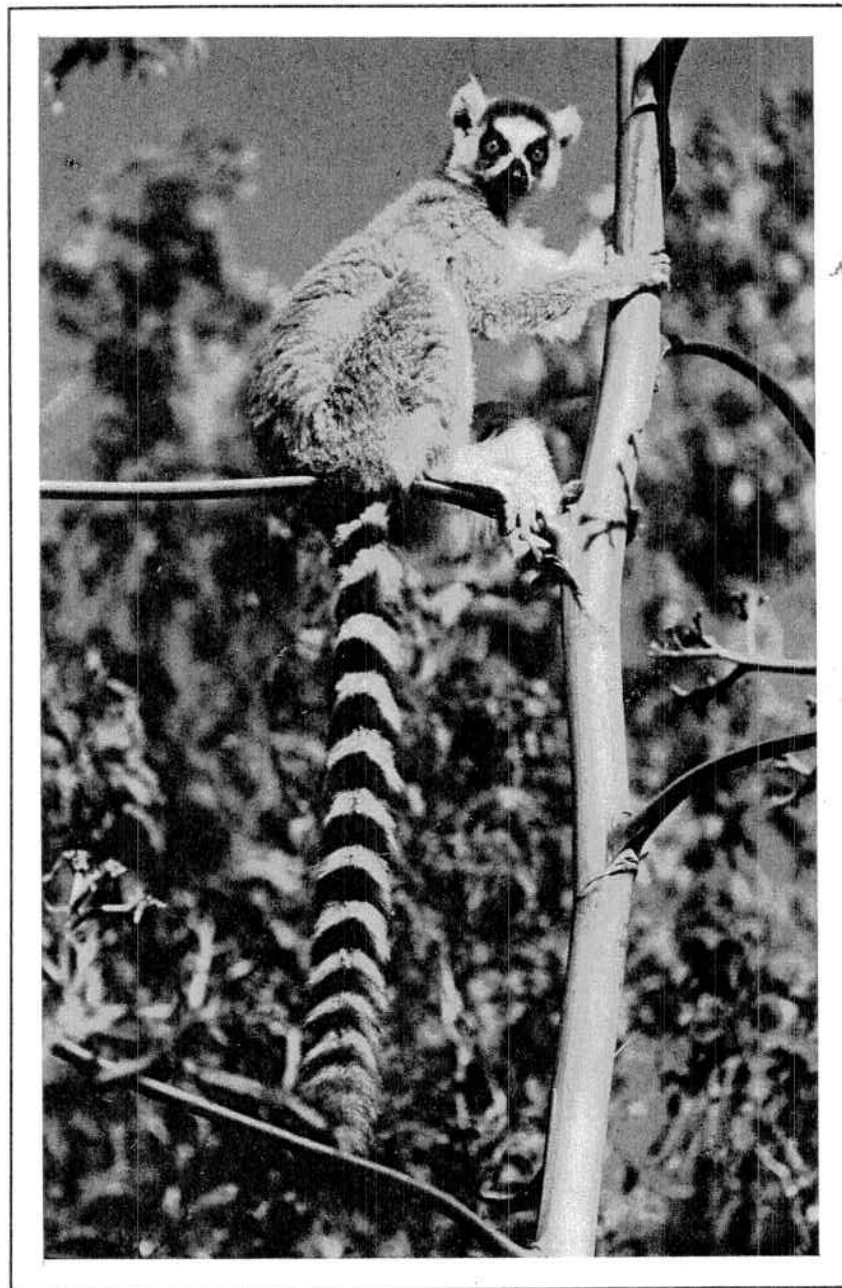


PRIMATE CONSERVATION

The Newsletter and Journal of
the IUCN/SSC Primate Specialist Group

Number 7

April 1986



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State University of New York at Stony Brook.



Front cover. Ringtailed lemur, *Lemur catta*, in sisal at the Berenty Reserve in southern Madagascar (photo by R. A. Mittermeier).

A Word from the Editors

As you can see below, there have been some changes in *Primate Conservation* personnel since the appearance of the last issue. Assistant Editor Bill Konstant left World Wildlife Fund to become Executive Director of Wildlife Preservation Trust International. We look forward to many contributions from him in the future. Editorial Assistant Isabel Constable has taken over principal responsibility for editing the journal, Stephen Nash continues being responsible for layout and design, and PSG Chairman Russ Mittermeier will provide input to *Primate Conservation* as needed.

As a result of these changes, this issue is later than planned, although we seem to have finally gotten to the point where we can produce two issues per calendar year. We are still in the process of setting up our Editorial Board, and several of you have already been asked to participate and have received articles to review. We had hoped to include a list of Editorial Board members in this issue, but we are still recruiting so that will have to wait until number 8.

As always, we welcome your input and would like to express our thanks to all of you that have contributed to *Primate Conservation* over the past year. Instructions to contributors are now being printed on the inside back page, so please refer to these if you have anything new that you would like to send in. And, once again if you have any suggestions as to how we might improve *Primate Conservation*, please let us know.

Finally, we hope to see many of you at the International Primatological Society meeting in Göttingen in July.

Thanks very much and looking forward to hearing from you.

Russell A. Mittermeier
Chairman, IUCN/SSC Primate
Specialist Group

Isabel D. Constable
Editor, *Primate Conservation*

Stephen D. Nash
Layout/Design

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ANNOUNCEMENTS

XIth Congress of the International Primatological Society in Göttingen, West Germany

As indicated in the last issue of *Primate Conservation*, the next meeting of the International Primatological Society will be held from July 20-25, 1986, at the Central Lecture Halls of the University of Göttingen. Included in the program will be a symposium organized by J. F. Oates and R. A. Mittermeier, on primate conservation around the world including some 35 presentations on primates in all the major regions in which they occur.

For further information, please write:

XIth Congress of the International
Primatological Society
German Primate Centre (DPZ)
Kellnerweg 4
D-3400 Göttingen
WEST GERMANY

World Wildlife Fund to Celebrate its 25th Anniversary with a Conference Entitled "Partners in Conservation"

World Wildlife Fund, the leading private organization working worldwide to protect the diversity of life on earth, is hosting a conference to help chart the future of U.S. involvement in Latin American conservation. The conference, to be held on Sept. 17 in Washington D.C., is intended for environmental, corporate, and philanthropic leaders; natural resource, economic development, and industrial planners; population specialists; officials from government, especially environmental, development, and international assistance agencies; wildlife biologists; and other specialists in Latin American affairs and regional studies. The conference will explore a number of issues central to the conservation agenda in the region: the future of parks and protected areas in the face of mounting population and development pressures; data collection vs. action; the consequences of industrialization (hazardous waste, pesticides, and emergency response problems); and the role of the United States in advancing conservation priorities.

The conference is open to pre-registered participants only, and there is a registration fee. For further information, please contact:

Conference Coordinator
World Wildlife Fund
1255 Twenty-Third Street, N.W.
Washington, D.C. 20037

Workshop at Wisconsin Regional Primate Center

The Wisconsin Regional Primate Research Center and the Milwaukee County Zoo are co-sponsoring a workshop entitled "The Zoo-University Connection: Collaborative Efforts in the Conservation of Endangered Primates" to be held in Madison, October 15-17, 1986. Topics to be discussed include reproductive biology, primate medicine, behavior, con-

servation, public awareness programs and exhibit design. Enrollment is limited. For registration information contact:

Anne Savage
Directors Office
Wisconsin Regional Primate Research
Center
University of Wisconsin
1223 Capitol Court
Madison, WI 53715-1299

Chimp Conference in November at Chicago Academy of Sciences

A symposium entitled "Understanding Chimpanzees" will be held by the Chicago Academy of Sciences, Nov. 6-10, 1986. The purpose of this symposium is to bring together researchers on the behavior and biology of chimpanzees from all over the world to share, to update and to review the last twenty-five years of work. Researchers from the Goodall Gombe project and the Japanese Mahale Field Station will attend, both of which have accumulated a quarter century of observations on East African chimpanzees.

Their experiences will be compared to those of West African chimp and pygmy chimpanzee researchers. Analyses of field projects will be complemented by contributions from captive studies, especially regarding the linguistic and symbolic characteristics of chimps. Also included will be discussions of distribution, evolution and conservation, and a new "Chimpanzoo" project.

For further information write:

Dr. Paul Heltne
The Chicago Academy of Sciences
2001 North Clark Street
Chicago, IL 60614

Conferences in Madagascar Focus on Conservation Priorities

From November 4-12, 1985, the government of Madagascar convened a conference to discuss the implementation of a National Conservation Strategy for the country. The nine day conference, held in Antananarivo, the capitol of Madagascar, was attended by many Malagasy officials and by over 200 representatives of various international environmental and aid organizations, such as WWF, World Bank, FAO, UNDP, USAID and Swiss and German foreign aid.

The conference, entitled "Conservation of Natural Resources in the Service of Development", focused international attention on the uniqueness of Madagascar's fauna and flora and stressed the importance of acting immediately to save what is left of the country's vanishing resources. The meeting brought together specialists from a variety of backgrounds to discuss resource planning objectives that address the often neglected integration of development and natural resources conservation strategies.

In addition to the presentations given by government officials and representatives of international organizations, the participants divided into four groups for workshops on: erosion, conservation of soil and water resources; forests, pastures, protected areas and protected species;

coastal and fishery resources; and education.

H.R.H., the Prince Philip, Duke of Edinburgh and President of WWF-International, also participated in the proceedings, offering both introductory remarks and closing comments on the critical status of wildlife in Madagascar and the necessity of close coordination of government and non-government organizations in natural resource planning.

Immediately prior to this Conference (October 28-31), there was a special Seminar on Equilibrium in Forest Ecosystems in Madagascar, organized by PSG member, Lala Rakotovo, of the Ministry of Scientific and Technological Research for Development (MRSTD). This meeting brought together many specialists from around the world to discuss the forests of Madagascar, their ecology and their conservation. As part of this meeting, the IUCN Species Survival Commission also held a Workshop entitled "Species Conservation Priorities in Madagascar." Organized by PSG Chairman Russ Mittermeier, this meeting included some 15 presentations on a wide variety of animal and plant species conservation priorities in Madagascar. As might be expected, there was considerable emphasis on the unique primate fauna of Madagascar, and English versions of several of the presentations on lemurs from this workshop are included in this issue of *Primate Conservation*. At the end of the workshop, the participants drafted a list of recommendations for species conservation, which were presented at the National Conservation Strategy Conference the following week.

Primate Research and Study Group Created in Madagascar

Given the importance of Madagascar's lemur fauna in international primate conservation and research, a number of primatologists working in Madagascar decided in 1985 to create a new organization called G.E.R.P., "Groupe d'Etude et de Recherche sur les Primates." The purpose of G.E.R.P. will be to promote research on and increase awareness of Malagasy primates, both to further scientific knowledge and to ensure the protection of these animals.

Several categories of research have already been identified as foci for the group, with members responsible for each:

Nutrition: Marlène Razanahoera
Eco-ethology and inventory: Solofo Andriatsarafara
Reproductive biology: Voara Randrianasolo
Lemur diseases: Lydia Rabetafika
Locomotion: Martine Randriamanantena
Subfossil lemurs: Martine Randriamanantena
Education: Bodo and Voara Randrianasolo

The founders of this group are professors and researchers from the Establishment for Higher Scientific Education (l'Établissement d'Enseignement Supérieur des Sciences) of the Université de Madagascar and from the Museum of Scientific Collections (Musée des Collections Scientifiques). Among the members of G.E.R.P. are university professors, researchers, technicians and students preparing their theses (3^e cycle).

G.E.R.P. will be supported by grants and by private donations. For further information, please contact:

G. E. R. P.
E. E. S. S.
B. P. 906
Antananarivo 101
MADAGASCAR

Australian Primate Society Established

An Australian Primate Society has now been established and already includes some 90 members (with over 150 on its mailing list). One of the aims of the Society is to make Australia an important center for primatological research. A number of Australian students are working in the field or have plans to do so, and Australia is also considered a

good place for captive breeding of primates and several Australian zoos are working towards this end.

The Society has started to produce a bulletin, entitled *Australian Primatology*. The president of the Society is David Langdon, Curator of the Zoological Gardens in Adelaide, and Vern Weitzel is Treasurer and Newsletter Editor. For further information on the Society, please write to:

Dr. Vern Weitzel
The Australian National University
Prehistory and Anthropology, Faculty
of Arts
GPO Box 4
Canberra, A.C.T. 2601
AUSTRALIA

Report on the Primate Society of Great Britain's Conservation Appeal

The Primate Society of Great Britain launched its Conservation Appeal in September, 1984. This was one of the results of the development of the Society, which included the gaining of charitable status and the introduction of Associate Membership, thus increasing the potential range of influence.



Fig. 1. Sticker depicting the marmoset (*Brachyteles arachnoides*) being distributed by the P.S.G.B.

In the first year we have raised over £1,500 which has been mainly distributed between two projects, although some funds are for more general use. The two projects on which we concentrated were Rwandan mountain gorilla and South American primates. The former project serves

to protect the 200 remaining animals of this subspecies of the gorilla, *Gorilla g. beringei*, and involves a country-wide education program as well as direct research on the animals. The second project involves work conserving some of the very endangered South American primates, particularly those of southeastern Brazil, like the golden lion tamarin and the muriqui.

Most of the money was raised in universities and zoos by selling merchandise, giving talks and showing films. Main venues have been: Twycross, Edinburgh, Chester and Pencynor zoos; Cambridge, Reading and London universities; and Oxford Polytechnic.

Now starting our second year we have sweatshirts, stickers, posters, and badges to sell. We hope to expand our help to other areas, such as Madagascar, endangered Asiatic primates and the Barbary macaque in north Africa. We are now investigating the possibility of supporting a field research project.

Our first leaflet, a general introduction to primate conservation, is presently being printed and will be sold and distributed free of charge for educational purposes.

We are especially grateful to WWF-U.S. for starting us off by providing posters and t-shirts free of charge, and also for allowing us to use the drawings of Stephen Nash, one of which decorates our first sticker (Fig. 1).

None of this would have been possible without the enthusiastic help of Council members and other members of the Society. More people are needed to help us raise even more funds in the second year. Anyone who wishes to help should contact the Convenor of the Conservation Working Party of the PSGB at the following address:

Dr. Miranda F. Stevenson
Royal Zoological Society of Scotland
Murrayfield
Edinburgh EH12 6TS
SCOTLAND

Nigerian Conservation Foundation Working to Protect the Endangered White-throated Guenon

The Nigerian Conservation Foundation has adopted the Okumu Forest Reserve as one of its priority projects, and plans to raise funds through World Wildlife Fund, British Caledonian Airways and KLM (both of which are celebrating their 25th anniversary in Nigeria). British Caledonian celebrations will begin first, and as part of the fund-raising campaign attention is being focused on endangered species including the white-throated guenon (*Cercopithecus erythrogaster*), an endangered monkey endemic to Nigeria.

Pupils of the PCT School of the International Institute of Tropical Agriculture in Ibadan, to end their Conservation Week Celebrations on June 15, 1985, staged a play with conservation as its basic theme. At the end of this presentation entitled 'Harmony', a sum of 1,267 Nigerian naira (approx. \$1,400 US) was collected by the students and presented to the Executive Director of the Nigerian Conservation Foundation for application towards conservation of *C. erythrogaster*. The PSG would like to express its appreciation to the school's headmaster, David Batten, and the staff and students of PCT School for their outstanding efforts on behalf of primate conservation.

Pius A. Anadu
John F. Oates
Department of Forestry and Wildlife
University of Benin
Private Mail Bag 1154
Benin City,
NIGERIA

Fellowship for Great Ape Research and Conservation

Applications are now being received for a fellowship for great ape research and conservation. This fellowship, co-sponsored by the L.S.B. Leakey Foundation and Wildlife Conservation International, a division of the New York Zoological Society, is awarded to promote long-term research on wild populations of great apes. Preference will be given to individuals whose work promises to improve significantly the conservation status of a population or species and elucidate causes of variation in ape behavior and our understanding of the origins of human behavior. Priority will be given to research in previously unstudied habitats. Awards will be made for field expenses only. One or two fellowships, worth together up to a total of \$40,000 US, will be awarded in November, 1986. Applicants should submit a curriculum vitae and a one-page statement of research goals by May 1, 1986, to:

Mary Pearl
Administrator of Conservation
Programs
Wildlife Conservation International
New York Zoological Society,
Bronx, NY 10460

Eligible candidates will be asked to submit a full proposal to either WCI or L.S.B. Leakey by August 1, 1986.

ISIS to Provide the PSG with Yearly Summary of the Status of Captive Primate Populations

Over the last few years ISIS (International Species Inventory System) has received numerous queries regarding the captive population of interest to specific IUCN/SSC Specialist Groups. ISIS has considerable data on captive populations, now covering 216 zoological institutions in 14 countries, a total of 65,000 living mammal and bird specimens of 2,500 species. Expansion to include more zoological institutions, and to include herps, is underway.

At the suggestion of Ulie Seal, Chair of the Captive Breeding Specialist Group, ISIS will annually provide basic information on the relevant captive population to Specialist Group Chairpersons.

A summary has been compiled showing institutional holdings, births during 1985, fraction captive-bred, and mortality during the first 30 days of life. The data are fairly current—as of Dec. 31, 1985, and are excerpted from a routine summary ("ISIS SDR Abstract"). Other more lengthy reports are produced periodically. ISIS's database contains detailed data on individual specimens which may be provided on request.

The PSG is most grateful to ISIS, and especially to Nate Flesness for making this information available. Any PSG member wishing to see this summary should contact:

Dr. Nate Flesness
ISIS—Minnesota Zoological Garden
12101 Johnny Cake Ridge Road
Apple Valley, MN 55124

New Primate Studbooks for the Cotton-top Tamarin and the Black Gibbon

Two new studbooks for endangered primates have been initiated. The first is for one of the most endangered Neotropical primates, the cotton-top tamarin (*Saguinus oedipus*) from northern Colombia, and the second is for the black gibbon (*Hylobates concolor*).

As discussed in the last issue of *Primate Conservation* (Tardif, 1986), there is now a large captive population of cotton-top tamarins, possibly

even exceeding that in the wild, and information on these captive populations urgently needs to be organized. The studbook keeper for the cotton-top tamarin is Suzette Tardif of the Oak Ridge Associated Universities. She will be working together with G. Aquilina, Curator of Mammals at the Buffalo Zoological Gardens.

Little is known of the status of the black gibbon in the wild, but at least some of the subspecies of this animal are thought to be endangered. There also exists a problem in subspecies identification, particularly with adult females, and in some cases there has been hybridization of subspecies. It appears that subspecies can be identified by their karyotypes, and a studbook should be of great help in sorting out the captive population and ensuring maximum breeding success. This studbook will be held by J. M. Lernoald, Director of the Parc Zoologique et Botanique in Mulhouse, France.

The addresses of both studbook keepers are given here:

Dr. Suzette D. Tardif
Marmoset Research Center
Oak Ridge Associated Universities
Oak Ridge, Tennessee 37831
UNITED STATES

Dr. J. M. Lernoald
Directeur, Parc Zoologique et
Botanique
A. M. Le Maire
B. P. 3089
68062 Mulhouse
FRANCE

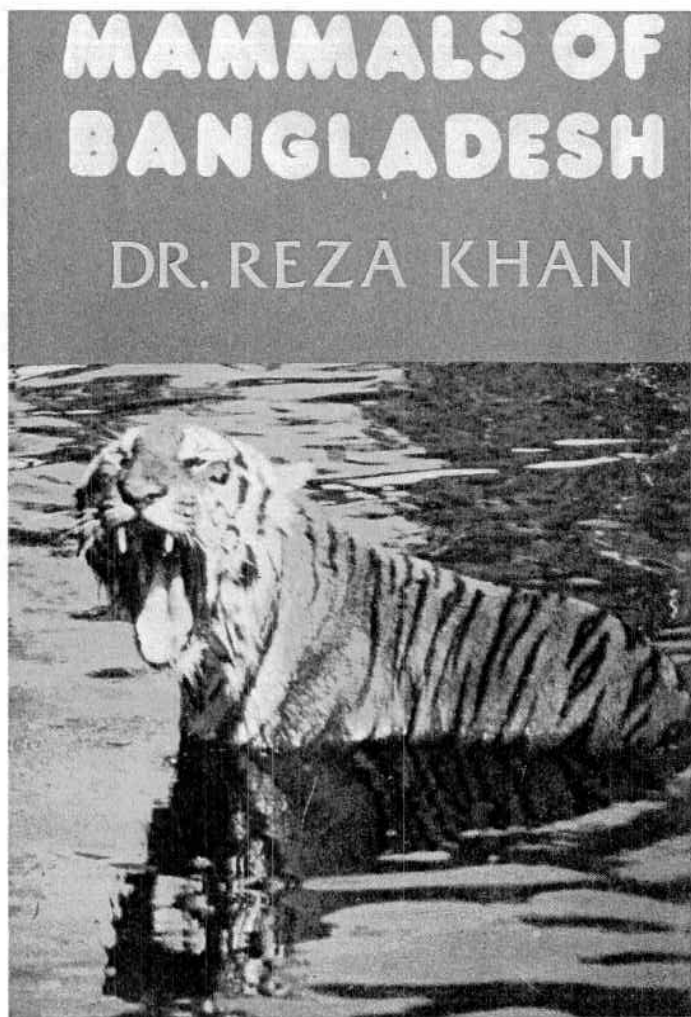


Fig. 2. *Mammals of Bangladesh* by R. Khan.

Three New Books by PSG Members

Three new books by PSG members have appeared recently. The first, entitled *Mammals of Bangladesh* (Fig. 2) is by M. A. Reza Khan. This 92 pp. book includes a discussion of the 10 primate species in Bangladesh, and can be obtained either from the author or from the publisher for \$5.00 US plus \$2.00 for postage:

Dr. M. A. Reza Khan
Curator, Al Ain Zoo & Aquarium
P.O. Box 1204 Al Ain
Abu Dhabi
UNITED ARAB EMIRATES

Nazma Reza
1st Floor
Dhanashi
House 25, Road 1
Dhanmandi
Dhaka-5
BANGLADESH

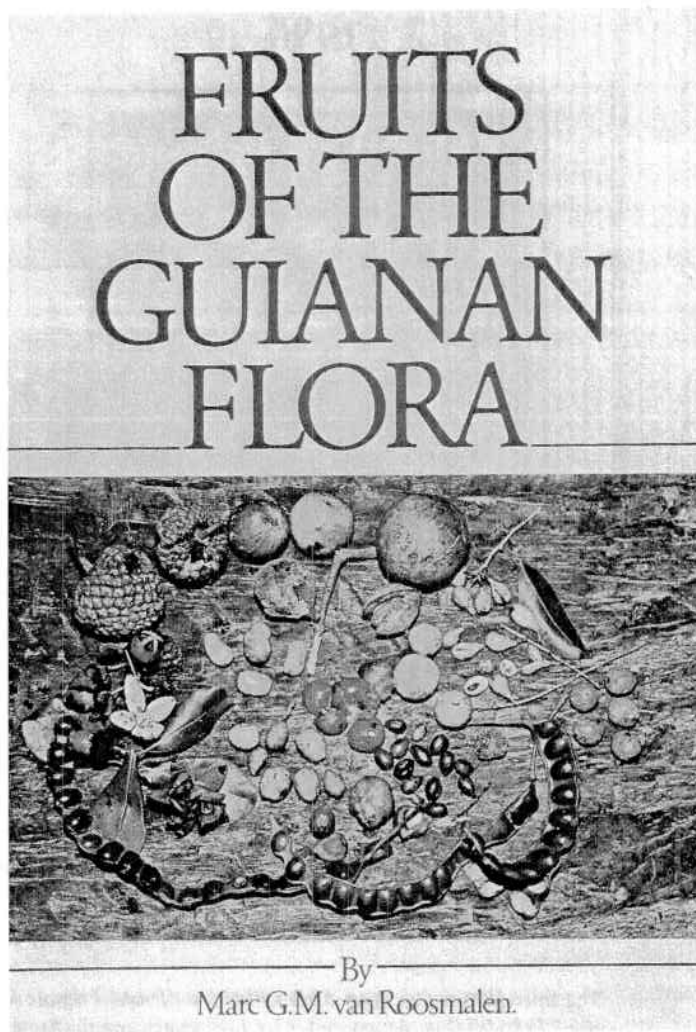


Fig. 3. *Fruits of the Guianan Flora* by M. G. M. van Roosmalen.

The second book, *Fruits of the Guianan Flora* (Fig. 3), is by Marc G. M. van Roosmalen, who worked for many years on the black spider monkeys and other primates of Suriname and French Guiana. This very useful, well-illustrated book includes nearly all fruits of the taller woody plants and lianas, and the palms of the Guianas, including 99 different families, 546 genera and 1,727 species. Every drawing is accompanied by a full description of the fruit and seed, with essential characters of the leaves, inflorescence, local names, distribution and ecology also included. This book is essential for anyone wanting to do research on primates in the Guianas, and is also quite useful for much lower Amazonia as well. *Fruits of the Guianan Flora* can be obtained for \$36.00 US hard-

bound and \$30.00 cloth cover from the Institute of Systematic Botany in Utrecht:

Institute of Systematic Botany
P.O. Box 80.102
3508 TC Utrecht
THE NETHERLANDS

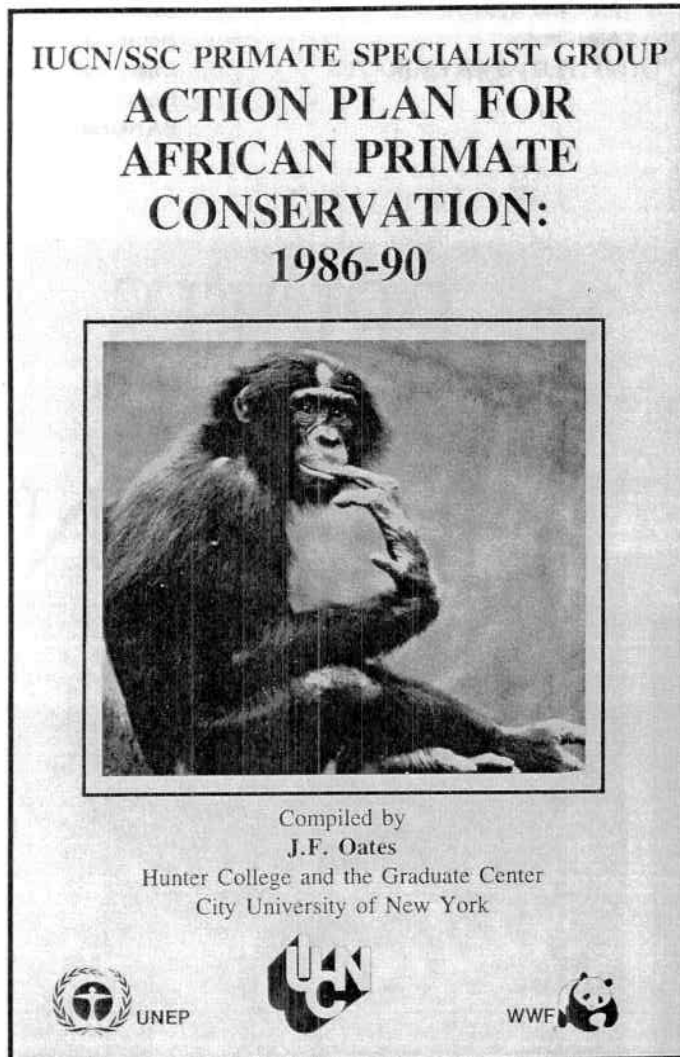


Fig. 4. The *Action Plan for African Primate Conservation: 1986-90*, compiled by J.F. Oates and illustrated by S. D. Nash.

The third publication is an *Action Plan for African Primate Conservation: 1986-90* (Fig. 4), compiled by J. F. Oates and illustrated by S. D. Nash. This 41 page booklet establishes priorities for surveys and reserve management programs to protect African primates, which are critical to the ecosystem as well as to the study of human evolution. African primates are listed, the degree of endangerment to each species assessed, and the distribution of distinct primate communities reviewed. Projects are then identified to protect primates and ranked for the purpose of establishing priorities for action. This publication, produced jointly by the WWF Primate Program and the IUCN/SSC Primate Specialist Group, is available for \$10.00 US plus \$1.00 postage from:

Publications Department-86
World Wildlife Fund
1255 Twenty-Third Street, N.W.
Washington, D.C. 20037

Booklet, Brochure and Sticker Produced on the Green Monkey of Barbados

A 40 page color booklet (Fig. 5) on the green monkey (*Cercopithecus aethiops sabaues*) of Barbados has just been published. Written by Jean Baulu and Julia Horrocks, it is aimed at tourists and residents and answers many questions that people might have about this interesting monkey population.

A brochure and sticker (Fig. 6) have also been produced on the Barbados Wildlife Reserve, located in a lush natural mahogany forest across the road from Farley Hill National Park in the parish of St. Peter. This reserve is primarily a monkey sanctuary, where visitors have the opportunity to see the Barbados green at close range in its adopted habitat.

The booklet on the green monkeys is available for \$4.00 postage included. Readers should write to the following address to obtain a copy:

The Barbados Wildlife Reserve
Farley Hill
BARBADOS

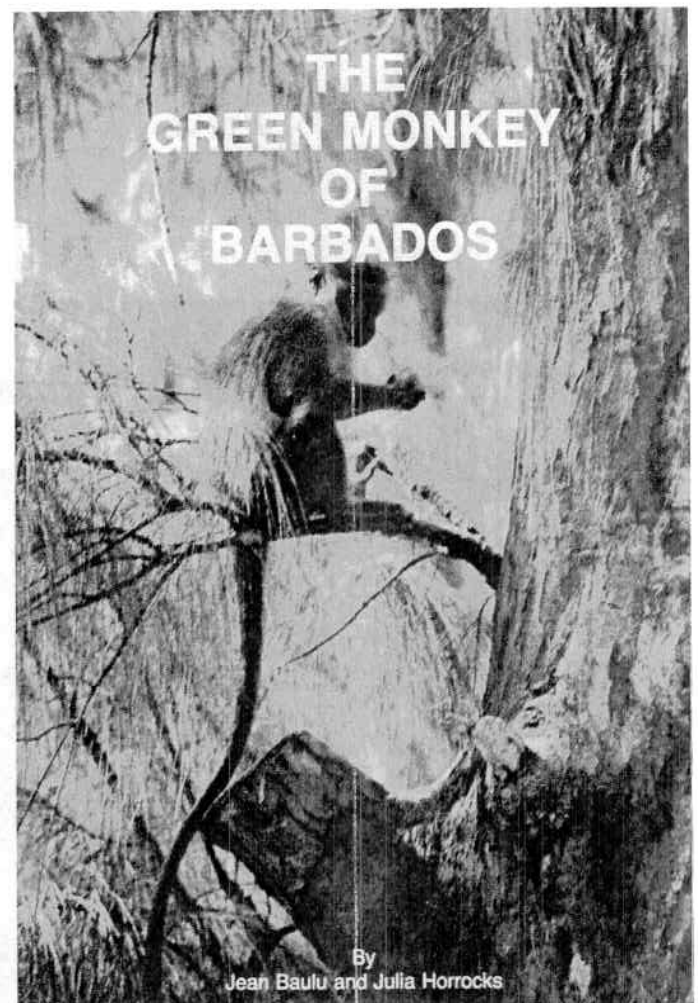


Fig. 5. *The Green Monkey of Barbados* by J. Baulu and J. Horrocks.

Kenya Issues New Stamp Depicting DeBrazza's Monkey

The government of Kenya issued a new series of four endangered species stamps on December 10, 1985. Included in the series is the DeBrazza's monkey (*Cercopithecus neglectus*, Fig. 7), an endangered species in Kenya (see Brennan, 1984, *Primate Conservation* no. 4), the cheetah, the black rhino and Grevy's zebra.

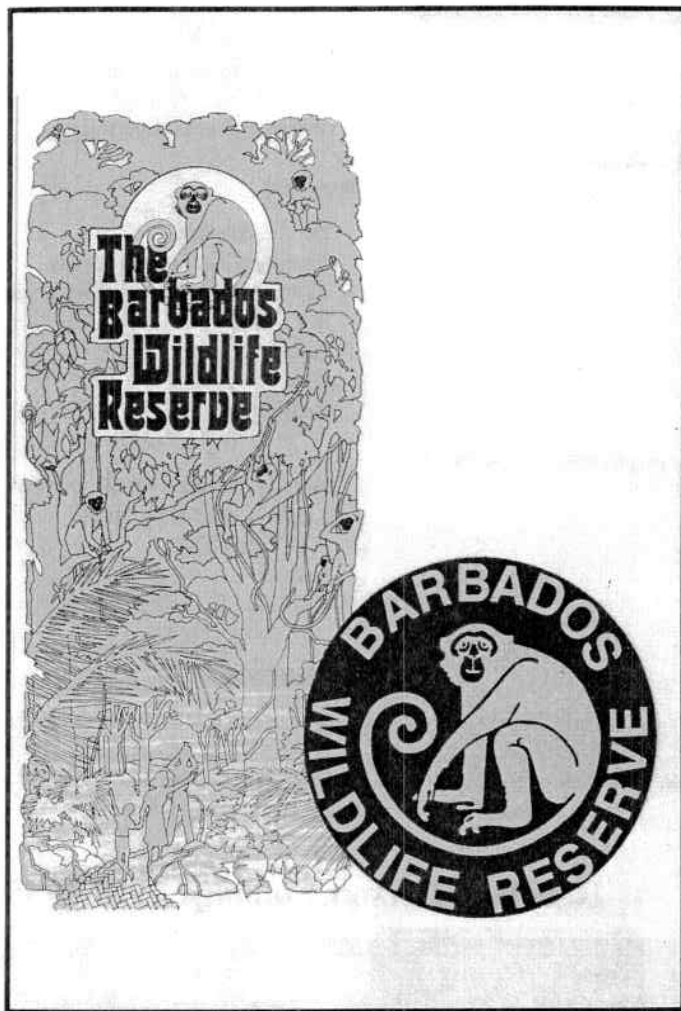


Fig. 6. Pamphlet and sticker celebrate the presence of green monkeys in the Barbados Wildlife Reserve.



Fig. 7. New postage stamp of DeBrazza's monkey issued by Kenya.

New Primate T-shirts Available from the WWF Primate Program

Five new t-shirts have been produced by the WWF Primate Program over the past year. They include three different styles for Madagascar, one for the mountain gorilla, and one for the Global Primate Conservation Campaign, launched in May, 1985. Two of the t-shirts for Madagascar were produced to commemorate the incorporation of the Beza-Mahafaly Reserve in southwestern Madagascar into the government network of protected areas as a Special Reserve (see article in News

from the Field section). The third was produced for the Parc Tsimbazaza in Antananarivo, the Zoo and Botanical Garden of the Malagasy capital. The gorilla t-shirts are in both English and French, for use in all three countries (Rwanda, Zaire, Uganda) in which this endangered animal still occurs.

Inquiries about the availability of these t-shirts should be sent to:

Joanna Viola
 WWF Primate Program
 Dept. of Anatomical Sciences, HSC
 S.U.N.Y. at Stony Brook
 Stony Brook, N.Y. 11794



Fig. 8,9: Beza Mahafaly t-shirts. The text on the front of both shirts reads: "The Forest Reserve Administered by the University — Beza Mahafaly." The text on the back of the shirts reads: "Protect Nature" (designs by S. D. Nash).

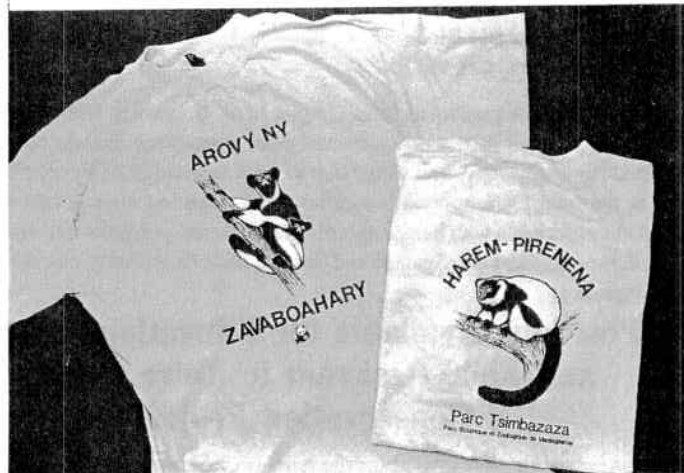


Fig. 10. Indri and black and white ruffed lemur t-shirt. The Malagasy text on the front reads: "Protect Nature." The text on the back reads: "National Treasure — Tsimbazaza Botanical and Zoological Park" (design by S. D. Nash).

Availability of Volunteer Field Assistants

As in past issues, we are continuing to list people interested in participating in primate field projects on a volunteer basis. We hope that PSG members with ongoing field projects will be able to place some of these people, and if any of you have request for assistants with specific skills, please feel free to advertise here.

Volunteer field assistants:

Ms. Fiona MacCallum
Newham College
Cambridge CB3 9DF
ENGLAND

Ms. MacCallum is a graduate of Cambridge University with a background in botany. She is interested in working on an ecology or conservation project in the tropics from Sept. 1986 — Sept. 1987. She speaks French, is willing to learn Spanish, and can fund herself if necessary.

Ms. Nancy McCorry
21 Old Homestead Road
Wayne, NJ 07470

Ms. McCorry writes that she is a hardworking graduate of the University of Massachusetts at Amherst, where she earned a B.A. in anthropology, specializing in primatology. She has worked at the Duke University Primate Center caring for prosimians, and has had some field experience tracking kangaroos on an Earthwatch expedition. She is available immediately and would be able to provide travel costs.

Ms. Sarah L. Toadvine
8610 Park Heights
Stevenson, MD 21153

Ms. Toadvine earned a B.A. in zoology with a concentration in botany from Miami University in Ohio. She became particularly interested in the brown lemur while working at the Seneca Park Zoo in Rochester, NY, and is looking for a field assistant position in Madagascar. She describes herself as "a serious, thorough person who possesses the stamina to work long hours." She has just completed an internship for the Animal Rehabilitation Center of The Conservancy Nature Center in Naples, Florida, and is now available for field work. She is able to finance her travel costs.

Ms. Karen C. Uphoff
1164 Camino Del Rio
Santa Barbara, CA 93110

Ms. Uphoff graduated from Oregon State University with a B.S. in zoology. She is particularly interested in orang-utan and siamang behavior and communication, and would like to work with either of these primates in the wild from now until autumn, 1987. She has already had some field experience with hummingbirds, harbor seals, porpoises and wolves. She speaks German, Spanish and French, and can probably pay her own expenses.

Positions Available for Education Officer and Field Assistant in Zaire Gorilla Conservation Project

Applications are invited for the posts of field assistant and education officer, both to be based in Kivu Province, Eastern Zaire.

A one year field assistant position is open to habituate mountain gorillas and possibly chimpanzees for a tourism program in the Virunga National Park. Candidates with french language ability and field experience

with primates are sought.

A two year education officer position is open to establish an environmental education program in the areas surrounding the National Parks of Virunga and Kahuzi-Biega. Candidates are sought with a fluency in french and experience of environmental education/training in less developed countries.

Applications should be addressed to:

Dr. C. Aveling,
Frankfurt Zoological Society
Zaire Gorilla Conservation Project
B.P. 106,
Goma
Kivu
ZAIRE

Please send a copy to:

Dr. C. Aveling / Dr. R. Malpas
I.U.C.N. Regional Office,
P.O. Box 68200
Nairobi
KENYA

Obituaries

During the past year, primatology lost some of its outstanding leaders, including Harold J. Coolidge, Dian Fossey and Jairo Ramirez Cerquera. The PSG would like to offer a tribute to them here, and to express what a great loss we feel now that they are no longer with us.

Harold Jefferson Coolidge 1904-1985



Harold Jefferson Coolidge photographed at home in March, 1983, by J. Lope.

Harold J. Coolidge was one of the true pioneers of both primate field research and conservation, as well as the international conservation movement. Hal started his zoology career in 1926, as an assistant mammalogist on the Harvard Medical Expedition across Africa. This was the first of many research expeditions throughout the world. At the request of Theodore and Kermit Roosevelt, he led the Indo-China Division of the Kelley-Roosevelt Asian Expedition 1,000 miles down the Mekong River, and later published an account of this trip with Theodore Roosevelt, Jr. entitled *Three Kingdoms of Indo-China*. In 1937, Hal conceived of, organized and led the famous Asiatic Expedition in which Clarence R. Carpenter, Adolph Schultz and Sherwood Washburn also participated and collected important data on Asian forest primates.

After studying primatology at Cambridge University, Hal conducted research on the taxonomy of the gorilla and other great apes under the guidance of Robert Yerkes. Hal was the first to recognize the pygmy chimp as a distinct species, *Pan paniscus*, and as a species of particular importance to understanding our own hominoid evolution.

Inspired by John C. Phillips, Hal established in 1930 the first American organization concerned with international conservation, the American Committee on International Wildlife Protection. This Committee was among the original organizations involved in the International Union for the Conservation of Nature and Natural Resources (IUCN) in 1948. Hal served successively as vice-president, president, and honorary president for the IUCN. He also founded and served as first Chairman of the Survival Service (now SSC) and the Commission on National Parks, positions which reflect his mutual concerns for species and their habitats. Hal helped create WWF-International and US, where he served as a director for many years. He was Secretary of the American National Parks Association, a long-term director of the L. S. B. Leakey Foundation, and the originator of ideas that eventually led to the Endangered Species Act and to the UNESCO World Heritage Trust.

In recognition of this immense contribution, Hal won the J. Paul Getty medal for wildlife conservation in 1980. President Jimmy Carter presented it to him with the following praise, "As the first American recipient of the prize, you exemplify the American tradition of seeing a need and organizing the means to respond to it. You gave very early warning of the plight of endangered species when few could even comprehend this concept . . . Your tireless dedication and concern have been matched by organizational genius that has brought together people from every part of the globe to protect threatened environments . . . I congratulate you for the well deserved recognition that your life has meant a better future for all of us."

Dian Fossey 1932-1985

Dian Fossey is largely responsible for telling us much that we know about the mountain gorilla, for protecting the few that remain, and perhaps more than anything, for publicizing the plight of these magnificent animals.

She worked first as a physical therapist in a children's hospital in Louisville, Ky. Inspired by reading George B. Schaller's observations of the gorilla as a shy, gentle, vegetarian, she made a seven week safari to Africa in 1963. On this visit she searched for and found gorillas in the Belgian Congo. She also visited Louis S. B. Leakey at Olduvai Gorge. Later he recommended that she return to Africa to do a long-term study of the mountain gorilla.

In 1967, she established the Karisoke Research Centre on the slopes of Mt. Visoke in Rwanda. Here she spent most of the next 18 years of her life researching gorilla behavior and defending gorillas from poachers. She earned her doctorate in zoology from Cambridge University, and acted as a visiting associate professor at Cornell University, teaching courses in neurobiology and animal behavior. In 1983, her popular book, *Gorillas in the Mist*, was published, a testimony of her



Dian Fossey coaxes a gorilla named Tuck to turn around for a photograph (photo by P. G. Veit, copyright National Geographic Society).

fierce dedication to these animals.

As Jane Goodall describes, it was "Dian's persistence, her determination to stay in the field whatever the cost, [which] led to her greatest scientific contribution: the carefully documented case-histories of individual gorillas that, in some instances, cover nearly twenty years. Each animal has his or her own unique personality and idiosyncracies of behavior, and so these records are invaluable for the understanding of many of the complex interactions between them. Her perseverance enabled her to document a series of rarely occurring events—such as conflicts between adults, interactions between neighboring groups, brutal infanticides—which can have profound influence on the subsequent behavior of the individuals or groups concerned.

Was this contribution to our scientific knowledge of gorillas her most important legacy? The fact that, through her work, our understanding of these apes has increased a hundred-fold? Or was her contribution towards the survival of the gorillas themselves even more important? History will be the ultimate judge of this, I suppose. But it is probably true to say that, had Dian never gone to Rwanda, there would be far fewer mountain gorillas in the Virungas than there are today. It is possible, even, that the last would be gone." We owe her our most sincere thanks.

A special issue of the International Primate Protection League Newsletter dedicated to the memory of Dian Fossey is available with this and other quotes from:

IPPL
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Summerville, S.C. 29484
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Jairo Ramirez Cerquera 1953-1985

On the night of November 13, 1985, the eruption of the Nevado del Ruiz volcano destroyed the Colombian town of Armero. Jairo Ramirez and his family lived in the town. Primatology lost a colleague, conservation lost a forceful advocate, and Colombia lost a leader. Many of us lost a friend. Jairo was the first student to enroll in the Program for Studies in Tropical Conservation at the University of Florida. He arrived from Colombia in August 1980 with his family, and proceeded to cope with an alien culture and educational system. He temporarily left a responsible position with the Ministry of Health in Bogota so that he could define in his own mind how he could effectively contribute to conservation efforts in Colombia.

Jairo's influence on the future of the Program at Florida cannot be overstated. He was the first student in a new program. Many looked askance at what he represented. He had to demonstrate to skeptical professors that good science and an applied orientation could be successfully intergrated. He had to convince cautious administrators that students from the tropical countries could blossom in the U.S. educational system. He had to illustrate to conservation organizations that funds spent on education could have a significant impact on the preservation and management of natural communities. He succeeded in doing all of these things.

When he returned to Colombia, he assumed the Directorship of the Bernardo Samper Sordo Field Station at Armero. The goal of the station, which was under the Colombian Ministry of Health, was to develop a captive rearing program for the night monkey *Aotus*. Within three years

he succeeded, and captive-born monkeys were being used in anti-malarial research in Colombia. In addition, he turned the station into a center of conservation efforts for northern Colombia. His appreciation for the natural ecosystems of this region began in 1977, when he spent a year running primate censuses with INDERENA, the Colombian natural resource development/national park agency. As Director of the field station, he could supervise the continued inventory of the mammal populations, advocate the preservation of blocks of tropical forests as "reservoirs" for the captive breeding program, and serve as a resource for researchers working in the general area.

It was this desire to devote his time directly to conservation efforts that convinced Jairo to resign his position at the field station and return to the United States to study for his Ph.D. He had just received a Fulbright Fellowship. His future was promising. He was bright, motivated, and charismatic, and he was totally dedicated to the conservation of the fauna and flora of his country. It was a future destined not to be realized.

In a short life, there were many accomplishments. We all expected many more. But when all is said and done, it is the person one remembers. A generous man. We all will miss him.

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NEWS FROM THE FIELD

Central and South America

A Community Baboon Sanctuary in Belize

The Community Baboon Sanctuary has been established to conserve the black howler monkey (*Alouatta pigra*), locally called baboon in Belize. It is a grass roots community sanctuary based on pledges of private landowners. Each landowner agrees to follow management plans for their property, which will enhance the habitat of the howlers. They are then asked to sign formal pledges of their agreement. Their actions are completely voluntary and without compensation, so we have created a certificate as a small recognition of each landowner's conservation efforts (Fig. 1). At present, eleven landowners of 50-200 acre farms have signed, and we expect to have pledges from forty to sixty more. A 60 page illustrated guidebook by R. Horwich and J. Lyon, is to be sold to tourists and villagers. It contains the text of an "Audubon Weekly" radio program aired on Radio Belize in 1985 as an introduction, and the following chapters: Importance of Tropical Rain Forests, Initiation of the Sanc-

tuary, A Brief History of the Area, Forest Types and Ecological Succession within the Community Baboon Sanctuary, The Baboon or Black Howler Monkey (*Alouatta pigra*), and an illustrated key to over forty trees commonly found in the sanctuary, with their local names. The book also contains maps of the general area, the private land boundaries, the vegetation in the sanctuary and surrounding areas, and the howler population with approximate troop locations. Other line drawings which illustrate the text include the worldwide distribution of tropical rain forest, the ranges of the black howler in Central America and Belize and six other howler species in Central and South America, a copy of the signed pledge, and a number of howler behaviors.

The book was printed inexpensively using only line drawings to make it affordable for sale in Belize. The printing was financed by Jim Rowell of Hinsdale, Illinois and WWF-U.S.. It is currently being sold to tourists for US \$3.00 and to villagers at cost in order to refinance the book's updating and further printings. A small number are available from the author for US \$3.00 plus postage or from the Belize Audubon Society, 49 Southern Foreshore, P.O. Box 1001, Belize City, Belize, Central America.

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COMMUNITY BABOON SANCTUARY



Belize

In recognition and appreciation,
this certifies that

by voluntarily pledging the use of private land
for the conservation of
the black howler monkey, *Alouatta pigra*,
is an active participant in
the Community Baboon Sanctuary

Date _____

President - Belize Audubon Society

President - World Wildlife Fund

Chairman - Village Council of

Operation Raleigh Primate Census in the Maya Mountains, Belize

Between April and June 1985, Operation Raleigh visited Belize on the second stage of its around the world expedition. Three primate species, the howler monkey *Alouatta pigra*, the spider monkey *Ateles geoffroyi yucatanensis*, and the capuchin *Cebus capucinus limitaneus* have been recorded in Belize, but there is only limited information on their present distribution and abundance.



Fig. 1. Certificate awarded to landowners participating in the conservation of the black howler monkey (designed by S. D. Nash).

Fig. 2. The author and venturers using the Quebrada-de-Oro River as a route through the forest (photo by M. Blake).



Fig. 3. Location of the Quebrada-de-Oro camp in the Chiquebul Forest, Belize (map by S. D. Nash based on author's original).

One region of importance for primate conservation in Belize lies between the Bladen and Trio Branch Rivers (Fig. 3). It is currently a forestry reserve of particular value as the forest of the Bladen Branch River valley was one of the few broadleaved primary forests sheltered from the worst effects of Hurricane Hattie. This hurricane caused as much as 95% windthrow and considerable crown damage to the forests in Belize in October, 1961. Dahl (1984) reported plans to upgrade the area's status to that of a wildlife reserve. It is well suited for this purpose as the topography of the Maya Mountains in general is extreme with steep slopes comprising 52% of the region. Access is difficult and the area provides a natural refuge for wildlife. Dahl (1984) sighted spider monkeys in this region, but there are no previous census data on *Ateles g. yucatanensis* and Dahl discussed the need for further primate surveys. The visit by Operation Raleigh provided an opportunity to carry out a primate census in the basin of the Quebrada-de-Oro tributary to the north of the Bladen Branch River (16°32' N, 88°49' W). Expedition members walked over 60 km through forest while crossing the southeastern foothills to the Quebrada-de-Oro camp, and in the course of patrols. Watercourses were often the easiest routes (Fig. 2), but although these provided a good

view of the surrounding forest and canopy, primates were only sighted once from a watercourse and twice by patrols in the forest. In each case the primates were spider monkeys.

Having confirmed that spider monkeys were present in the area, transect lines were used to estimate their density. The ruggedness of the terrain caused some difficulties but three lines totaling 3.4 km were cut and marked with fluorescent tape at 20 m intervals. The lines ranged in altitude from 140 m to 380 m and gradients along the line were up to 60%. Tree height averaged 20 m, but some 60 m trees were measured. The techniques used for walking the lines and collecting data were as described by Eisenberg (1981). From both outward and return journeys along the transect lines, the average number of *Ateles* seen per sighting was 4.43 s.d. 2.39 (n=23). *Ateles* were sighted at heights of 6-40 m, \bar{x} = 20.3 m. Perpendicular path distance ranged from 0-300 m, \bar{x} = 27 m. A density estimate was calculated on the data from outward journeys only (Table 1) using a Fourier series expansion of the probability density function as described by Burnham *et al.* (1980). Over a total distance surveyed of 144.6 km, a density estimate of 4.4 ± 3.86 gps km² (mean \pm s.e.m.) was obtained. The large variation we observed

Table 1: Transect Line Sightings (outward journeys only)

Line	1	2	3
Length (k)	1.2	1.0	1.2
No. of times walked	43	45	40
No. of <i>Ateles</i> subgroups seen	4	11	0

(coefficient of variation = 87.4%) was probably due to the ranging behavior of the species. Little could be done to remedy this, given the limitations of time and the topography of the area. For example, extrapolating from the data as described by Burnham *et al.* (1980), to obtain a c.v. of 10% a total of 337 km would have had to be surveyed which was clearly impractical. Bearing in mind the large standard error, it is still of interest to compare the results with data from previous studies. In a recent review of data from various sites (Wolfheim, 1983), *Ateles* population density ranged from 1-45 animals km². This study's average of 19.6 animals km² suggest that there may be a reasonable sized population of *Ateles g. yucatanensis* in the Bladen foothills; a valuable finding in view of the supposed population reduction as a result of a yellow fever epidemic in 1958.



Fig. 4. A male *Alouatta pigra* from the Belize River (photo by R. Hubrecht).

Horwich and Johnson (1984) observed that the howler appeared to be doing well in riparian forest but seemed to be limited by altitude, usually to below 330 m. Many of the areas that we covered were below this altitude and we were fairly certain that howlers were not present in these foothills. It is thought that yellow fever cut the primate populations in Belize, but it is not certain that howlers were living in the area before the epidemic.

Table 2: Large Mammals Sighted During the Study

jaguarundi	<i>Felis yagouaroundi</i>
puma	<i>Felis concolor</i>
ocelot	<i>Felis pardalis</i>
Deppe's squirrel	<i>Sciurus deppei</i>
neotropical river otter	<i>Lutra longicaudis</i>
tayra	<i>Eira barbara</i>
coatimundi	<i>Nasua nasua</i>
kinkajou	<i>Potos flavus</i>
agouti	<i>Dasyprocta punctata</i>

Both McCarthy (1982) and Dahl (1984) have obtained second hand accounts of sightings of animals presumed to be *C. capucinus* in the Maya mountains, but there have been no recent authenticated sightings of this species. A particular interest of the expedition was to find whether *Cebus* was present, as this would have verified its most northerly location in Central America (McCarthy, 1984). No confirmed sighting was

made. However, one venturer who was familiar with both howler and spider monkeys, did report seeing a monkey which he thought was neither of these. His description was of an animal with a body length of about half a meter, front limbs approximately equivalent in size to back limbs, body black (including the ventral area) with a white face. The body size, coloration and proportion of the limbs was consistent with the animal being a capuchin. On the other hand, the fact that only one individual was seen does cast doubts on the observation. Although we found no evidence of primate hunting, we met hunters and found shot-gun cartridges downstream of the study site. Konstant, Mittermeier and Nash (1985) have shown how vulnerable the Central American spider monkeys are, and point out that "only 2 of the 9 recognised subspecies (*A. g. vellerosus* and *A. g. frontatus*) appear to have any protection in parks and reserves." The results of the present study emphasize the value of this proposed wildlife reserve in that it provides an excellent refuge for *Ateles g. yucatanensis* and other large mammals (Table 2).

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Acknowledgements

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Monkeys of the Yucatán Peninsula, Mexico: Preliminary Survey of their Distribution and Status

The Yucatán Peninsula and adjacent areas to the immediate south and southeast are the home of two monkeys, *Alouatta pigra*, the black howler monkey (Horwich, 1983; Smith, 1970) and *Ateles geoffroyi yucatanensis*, the Yucatán black-handed spider monkey (Kellogg and Goldman, 1944). The taxonomic status of both species is controversial and little is known of their natural history and ecology. For these reasons, we undertook a survey of the remaining forested areas of the Yucatán peninsula (including the states of Campeche, Yucatán, and Quintana Roo) in order to gather information on the present distribution and conservation status of *Alouatta* and *Ateles* in this region of Mexico. Our study is complementary to those of Estrada and Coates-Estrada (1984) who report on the distribution of both genera in areas to the south and west

(in the states of Veracruz, Tabasco, Campeche and Chiapas), and Horwich and Johnson (1984) who surveyed *Alouatta* populations in Belize, Guatemala and Mexico.

This survey was carried out during March, 1984 and the months of May and August, 1985 with a total of 15 days spent in the field. The information presented here is preliminary, but the ongoing decline of the monkeys indicated by our work and that of the Estradas (1984) underscores the necessity for rapid dissemination of existing information. We hope that this will provide a basis for further study and conservation planning.

Our goals were to locate and visit as many feral monkey populations as possible in the three-state area of the peninsula. For each locality visited we attempted to verify the presence of monkeys by sight, to ascertain whether only one or both species were present, and to gather pertinent information on the nature of the habitat and pressures from humans. Initial information on localities with monkeys was provided primarily by people engaged in botanical and archaeological research on the peninsula who were familiar with the more remote forested areas. We subsequently visited each site, by vehicle or on foot, and attempted to find the monkeys. Further information about the animals and their habitats was obtained from our own assessments and from interviews with local people conducted in Maya and Spanish. We also examined all captive monkeys being kept as pets or being offered for sale that we encountered during the course of the survey, and tried to determine the general area of their origins.

From on-site and local interviews, we elicited information on the approximate size of the monkey population in the area, the number of social groups (for *Alouatta*), their physical appearance, approximate location of their home ranges, primary plant species comprising the diet, and whether the monkeys were being hunted and shot. We also recorded information on ownership of forested land and approximate extent, history, and present use of these forests. Whenever possible we verified interview data by our own examinations. In general, interview data proved to be consistent and accurate, with a few notable exceptions. For all sites, we classified the general forest type according to the criteria of Flores and Espejel (in press). We noted predominant plant species present and recorded potential food species present for the monkeys.

In all, we visited 18 sites in the three-state area. The location of these sites can be seen in Fig. 5, which also gives the reported and verified distributions of the two monkey species as determined by our survey. We were unable to visit two additional sites depicted in Fig. 1 (nos. 12 and 17), but are reasonably certain that both contain monkeys. Site no. 17, near Yohaltun in the Edzna Valley of Campeche, was unreachable because of an impassable road. However, we were able to establish the presence of *Alouatta* and to determine the forest type based on a previous visit (Rico-Gray *et al.*, 1985). The site no. 12, located in the center of Sian Ka'an Reserve near the coast of Quintana Roo, can only be easily approached by boat from the Caribbean coast. However, both *Ateles* and *Alouatta* are reported to be present in the faunal list published for the reserve (Garcia, 1983). We visited site no. 11, along a road running

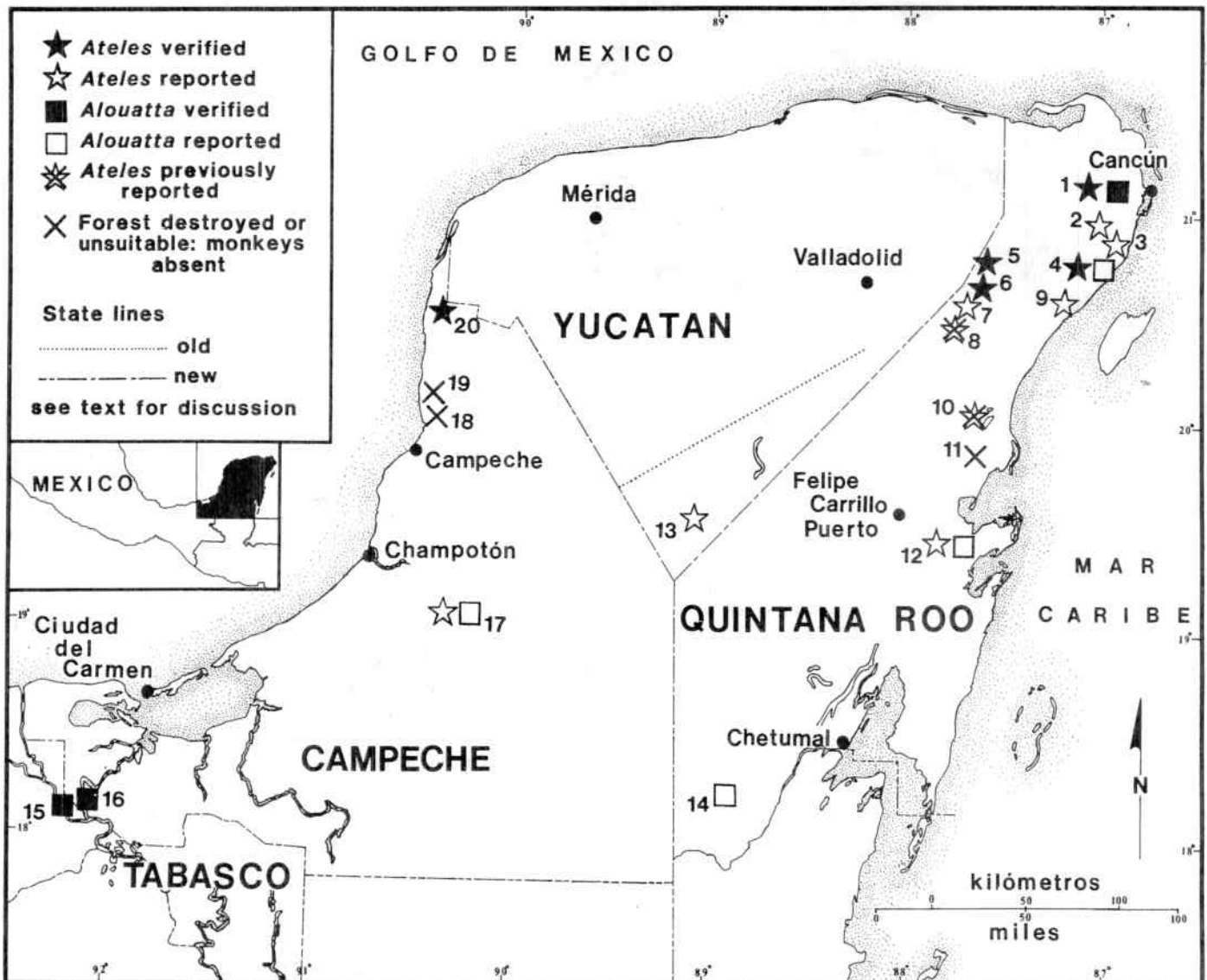


Fig. 5: Locations of feral monkey populations on the Yucatán Peninsula, Mexico.

to the coast in the northern end of the reserve but the forest there was deemed unsuitable for monkeys as it consisted primarily of stands of low forest and mangroves. In all we were able to personally verify the presence of monkeys at eight of the 20 sites depicted on the map. At two sites in Campeche (nos. 18 and 19), the forest had been almost completely cut down by March, 1984. Interview information indicates that monkeys were formerly present at sites 8 and 10 in Quintana Roo, but have now probably disappeared. We were unable to verify the presence of monkeys at the seven remaining sites in the brief time available, but we believe that most of them do have monkeys. There are two areas of the peninsula that probably also have monkeys, but were not covered during this survey. They are in the southern part of Campeche, along the border with Guatemala, and the extreme northeastern corner of Quintana Roo.

Monkeys are reported in all three states though the only site located in the state of Yucatán (no. 13) was formerly in Quintana Roo before the recent relocation of the state boundary (see Dundee, 1985; for discussion of this problem). To avoid confusion the locations of both the old and new state lines are indicated in Fig. 5. As expected the distribution of monkey populations is wide but patchy. Monkeys tend to be found in areas that are remote or peripheral to areas of denser human settlements and activities, though a few are surprisingly close to large population centers (e.g., site no. 1, located about 25 km from Cancun). It is our impression that until very recently most stands of suitable forest on the peninsula probably had resident monkey populations of one or both genera, and the majority still do. The numerous sites in Quintana Roo reflect both the greater extent of forest and the relatively recent expansion and impact of the human population in the state.



Fig. 6. Captive adult *Ateles geoffroyi yucatanensis* from Sabana San Francisco, Yucatá (photo by D. White).

We found *Ateles* to be more widespread and numerous than *Alouatta* on the peninsula and the two genera seem to be sympatric in only a few places today (see Fig. 5). The apparent greater abundance of *Ateles* was unexpected on the basis of earlier reports. Jones *et al.* (1974) found both genera present in the heavily forested areas of the peninsula. The Estradas (1984) conclude from their survey of the adjacent area of southern Mexico that *Ateles* is more endangered because of its feeding requirements and greater desirability to humans as a source of meat and pets.

The distribution of monkeys according to forest type is presented in Table 3. It is evident that both genera are able to occupy several kinds of forest habitat though, not unexpectedly, the majority of associations are with the moist subperennifolia type. The most unusual habitat associations are those of *Alouatta* with low, seasonally inundated riverine forest, and the occurrence of *Ateles* in the *petenes*. We found *Alouatta*, apparently doing well, in patches of seasonally inundated forest on cattle ranches along the Rio Palizada in southwestern Campeche. Horwich and Johnson (1984) also remark on the presence of *Alouatta* in this habitat in the same area (i.e., near Emiliano Zapata, Chiapas). They point out that *A. pigra* occurs in a similar riverine forest type in the Bermuda Landing area of Belize despite Smith's (1970) assertion that this species differs ecologically from *A. palliata* in its preference for "extensive undisturbed mesic tropical forest." The *petenes* of northern coastal Campeche are essentially islands of tall tropical forest surrounded by mangrove swamp (Rico-Gray, 1982). Their formation is due to the presence of fresh water percolating up through holes in the limestone crust in areas of otherwise brackish coastal marshland. There are literally hundreds of individual *petenes* of varying sizes in a total area of some 1,200 km² of coastal Campeche. Access to the *petenes* is difficult except in three areas where roads have been built, spanning the swampland, out to the coast. We investigated these three areas in March, 1984 and found that most of the trees had been cut out of the *petenes* along the two roads at the southern end of the zone (sites nos. 18 and 19 in Fig. 5). However, we sighted *Ateles* in *petenes* along the road at the northern end of the zone (site no. 20 on the map). Table 6 contains a list of the larger tree species present in the *petenes* where the monkeys were seen. On a return visit to this site in May, 1985 we found evidence of logging activity in these *petenes* and no monkeys were seen. However, monkeys were again sighted in September, 1985 by a colleague visiting these *petenes* (Marco Lazcano, pers. comm.). Fishermen from the village of Punta Arenas told us that monkeys are present in some of the other *petenes* but that access to them is difficult except on foot or by small boat. Due to limitations of time and equipment we were unable to verify this information. Thus, the remainder of the area within the zone de los *petenes* remains unsurveyed and the distribution of monkeys there is unknown.

Table 4 gives a partial list of plant species utilized by *Ateles* for food. This information comes from interviews with local residents at the various localities where *Ateles* were present. While it certainly does not represent a complete list of the plants being utilized it probably does include the main food sources. We found remarkable consistency in the items mentioned by all informants, *ramon* (*Brosimum alicastrum*) and *zapote* (*Manilkara zapota*) being the most frequently cited. *Ramon*, *zapote* and *Ficus* sp. were present at almost all sites visited while the other species were more variable.

During the course of our survey we found evidence of human threat to existing monkey populations from most of the usually cited sources. Habitat destruction due to land clearance for agriculture and lumbering is evident over the entire peninsula and is obviously occurring at a very rapid pace. Shooting of animals both for sport and to capture infants and juveniles for the pet trade is also commonplace. However, we found no evidence of monkeys being hunted for meat and informants claimed to have no knowledge of this practice in the local areas we visited. Table 5 gives a site-by-site accounting of our best estimate of the status of monkeys and their habitats. The information presented is based on data from interviews and our own observations.

Table 3. Monkeys of the Yucatán Peninsula and Forest Types in which they Occur.

Genera	Site *1	Forest type *2	Comments
<i>Alouatta</i>	Tres Garantías (14)	selva alta-mediana subperennifolia	monkeys unverified
	Rancho San Martín (15)	selva baja inundable	verified
	Rancho San Andrés (16)	selva baja inundable	verified
<i>Ateles</i>	Camino Vallarta (2)	selva mediana subperennifolia	monkeys unverified
	Jardín Botánico de CIQRO (3)	selva baja subperennifolia	monkeys unverified
	Laguna Madera (5)	selva mediana subperennifolia	verified
	Punta Laguna (6)	selva mediana subperennifolia	verified
	Campamento Ydalgoycortes (7)	selva baja-mediana subperennifolia	monkeys unverified
	Cobá (8)	selva mediana subperennifolia	monkeys unverified
	Rancho Los Dos Compadres (9)	selva baja-mediana subperennifolia	monkeys unverified
	Chunyaxché (10)	selva mediana subperennifolia	monkeys unverified
	Sabana San Francisco (13)	selva mediana subcaducifolia	monkeys unverified
	El Remate (20)	petenes	verified
<i>Ateles and Alouatta</i>	Estación de Bombeo y Purificación de Agua (1)	selva mediana subperennifolia	Both genera verified
	Rancho Culiacán (4)	selva mediana subperennifolia	<i>Ateles</i> verified
	Sian ka'an (12)	selva mediana subcaducifolia	monkeys unverified
	Yohaltún (17)	selva mediana subcaducifolia	<i>Alouatta</i> verified

*1 Numbers in parentheses refer to locations on map in Fig. 5.

*2 According to classification of Flores and Espejel (in press)

Table 4. Main Plant Species Used as Food Sources by *Ateles*

Taxonomic Name	Local Names	Fruiting Season
<i>Annona</i> spp. (Annonaceae)	<i>anona</i>	spring
<i>Brosimum alicastrum</i> (Moraceae)	<i>ramón, ox</i>	late summer
<i>Chrysophyllum</i> spp. (Sapotaceae)	<i>cayumito, caimito, ni'keej</i>	spring
<i>Enterolobium cyclocarpum</i> (Jacq.) Griseb. (Leguminosae)	<i>guanacaste, parota, pich</i>	spring, summer
<i>Ficus</i> spp. (Moraceae)	<i>koopó'</i>	year round (different spp.)
<i>Manilkara achras</i> (Mill.) Fosberg (Sapotaceae)	<i>sapote, ya', sak ya'</i>	spring
<i>Talisia olivaeformis</i> (Sapindaceae)	<i>huaya, uaum, guaya</i>	late summer

The nonhuman primates of the Yucatán peninsula have had a long period of co-existence with human populations. In pre-Columbian times and in the more recent historic past, humans and their activities have doubtless had an effect on the demography and ecology of the monkeys. The impact of human species on the monkeys may not always have been detrimental. At least two of the tree species serving as major food sources for the monkeys, the *ramon* and *zapote*, have been of considerable economic importance to human inhabitants of the area and continue to be today. Our survey found a strong association between the present distribution of monkeys and large groves of *ramon* trees, or *ramonals*. This is not surprising since Coelho *et al.* (1976) found heavy utilization of *ramon* leaves, fruit and seeds by both *Ateles* and *Alouatta* (as well as *Homo sapiens*) at Tikal, Guatemala. Their bioenergetic calculations show that *ramon* groves are capable of supporting dense monkey populations because of their high nutritional yield and because they provide food throughout the year. *Ramon* trees are concentrated around archaeological sites and unexcavated Maya ruins today both because they grow there in greater abundance and because forests around archaeological sites are often protected. It is also possible that *ramon* trees were heavily concentrated around Maya occupation sites in prehistoric times as well because of their utilization by humans (Puleston, 1968), or because of some practice that may have favored the growth of this species (Rico-Gray *et al.*, 1985). While agricultural activities, such as widespread use of slash-and-burn maize cultivation undoubtedly have a negative effect on the peninsula's monkeys, they may benefit from other vegetational changes, caused either directly or indirectly by humans, such as an increased abundance of *ramon*. Another example is the *zapote*

tree, which was heavily exploited for its gum during the earlier part of this century. For many years, it was valued and protected by humans so that they could extract the sap. Now, with changing economic emphasis, *zapote* has become a valued timber tree and is being selectively cut. Thus, it seems likely that the monkey populations of Yucatán may have waxed and waned in relation to human activities in the past. The nature and extent of these changes could be better understood from a more thorough study of the vegetational history of the peninsula.

The present limited data do not allow us to document the current rate of decline of the feral monkey populations but it is evidently rapid from the amount of land clearance, logging and hunting activity we encountered even in this brief survey and from the data presented in Table 5. Likewise it is difficult to assess the relative impact of various kinds of human activities on their overall decline. Habitat destruction is obviously the major factor. However, Table 5 shows that there are areas where, according to informants, monkeys have been shot out of "protected" forest. Likewise there are accounts of monkeys currently being hunted and shot for sport in forests that are protected by law. It is clear that preservation of forest is necessary, but not sufficient, to protect the monkeys. In unprotected areas, monkeys are considered fair game for target practice and for capture and sale as pets. We encountered one group of men who claimed to have captured and sold ten infants from a single area over a six-month period.

It would appear that monkeys are less threatened in areas that are both protected and remote from human settlement, such as in some parts of the Sian Ka'an Reserve of coastal Quintana Roo. However, this may always not be the case since both we and Horwich and Johnson (1984)

Table 5. Current (1985) Estimate of Conservation Status of Localities Visited in Survey

Site	Status of Forest	Status of Monkeys	Comments
1. Estación de Bombeo y Purificación	protected only by security maintained at water works	no immediate threat evident	People are regularly visiting the site for tourism but apparently not harming the monkeys, little disturbance of forest at present
2. Camino Vallarta	unprotected	unknown	No monkeys seen
3. Jardín Botánico de CIQRO	protected	unknown	Observed men with rifles hunting in park on the week-end
4. Rancho Culiacán	unprotected	no immediate threat evident	Cattle have been in forest
5. Laguna Madera	unprotected	seriously threatened	Very active logging and hunting of monkeys for pet trade
6. Punta Laguna	protected	somewhat threatened	Occasional shooting of animals for sport by non-residents
7. Campamento Ydalgo y Cortes	unprotected	unknown	Little disturbance of forest but no monkeys seen on two visits
8. Cobá	protected	probably decimated	Forest relatively good but monkeys rarely seen any more
9. Rancho los Dos Compadres	unprotected	probably decimated	Cattle have been in forest, <i>ramon</i> trees show cutting damage, no monkeys seen on three visits
10. Chunyaxché	protected	probably decimated	Forest relatively good but monkeys have not been seen for last 8 years or so
11. Sian Ka'an (north)	protected	absent	Forest not suitable
12. Sian Ka'an	protected	no immediate threat evident	Remoteness and difficulty of access probably beneficial
13. Sabana San Francisco	unprotected	unknown	A good deal of forest clearance going on in the area
14. Três Garantiás	unprotected	unknown	
15. Rancho San Martín	unprotected	no immediate threat evident	Cattle have been in forest
16. Rancho San Andrés	unprotected	no immediate threat evident	Cattle have been in forest, occasional shooting of monkeys for sport
17. Yohaltún	unprotected	unknown	About 1/3 of original forest has been cleared for agriculture in the last 4 years
18. Camino Tenabo	unprotected	absent	Forest along road almost completely cut
19. Camino Pomuch	unprotected	absent	Forest along road almost completely cut
20. El Remate	unprotected	threatened	Active logging, especially of <i>zapote</i> trees, in <i>petenes</i> along road

Table 6. Inventory of Larger Tree Species Present in *Petenes* where *Ateles* were Sighted.

ACANTHACEAE <i>Bravaisia tubiflora</i> Hemsley	MORACEAE <i>Ficus</i> sp. <i>Cecropia</i> sp.
ANACARDIACEAE <i>Metopium brownei</i> (Jacq.) Urban	PALMAE <i>Sabal</i> sp.
BIGNONIACEAE <i>Tabebuia rosea</i> (Bertol.) DC.	RHIZOPHORACEAE <i>Rhizophora mangle</i> L.
BURSERACEAE <i>Bursera simaruba</i> (L.) Sarg.	SAPOTACEAE <i>Manilkara achras</i> (Mill.) Fosberg
COMBRETACEAE <i>Conocarpus erecta</i> L. <i>Laguncularia racemosa</i> (L.) Gaertn.	STERCULIACEAE <i>Guazuma ulmifolia</i> Lam.
MALVACEAE <i>Malvaviscus arboreus</i> Cav.	VERBENACEAE <i>Avicennia germinans</i> (L.) L.
MELIACEAE <i>Swietenia macrophylla</i> King	

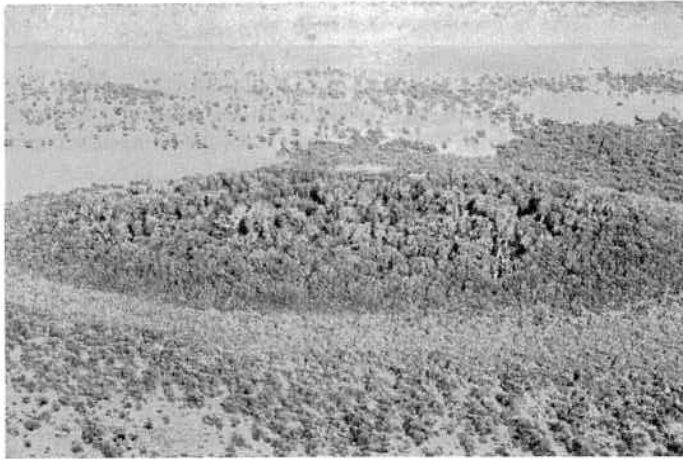


Fig. 7. An aerial view of one of the *petenes* of coastal Campeche (photo by V. Rico-Gray).

have observed *Alouatta* apparently coexisting quite well in close proximity to humans in areas of ranching and farming. These cases should be examined more closely before any conclusions can be reached about the long term welfare of the monkeys.

While the issue of conservation of the Yucatán's monkeys is of pressing concern, there are also a number of interesting questions concerning their evolution and ecology that merit further investigation. More thorough study of the systematics of both *Ateles* and *Alouatta* on the peninsula is needed to clarify the questions of their taxonomic distinctiveness and their relationships with congeners to the south, southeast, and southwest. For example, we observed considerable coat color variability among different groups of *Ateles geoffroyi yucatanensis* that does not conform to the type description given by Kellogg and Goldman (1944), but is similar to what has been observed in *A. g. vellerosus* (Konstant *et al.*, 1985). Further study of the ecology of both types of monkeys would be of interest because of the unusual nature of some of the habitats in which they occur on the peninsula. Comparative ecological studies might explain the apparent greater abundance of *Ateles* in the area as well as augment our knowledge of the evolutionary adaptations of both genera. In sum, the results of this preliminary investigation indicate that both protection and further study of these monkeys are urgently needed.

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The Conservation Status of the White Uakari

White uakaris, *Cacajao c. calvus*, (Fig. 7) have remained a mystery to those interested in Amazonian wildlife until very recently. These strange monkeys with their white fur, scarlet faces and short tails, were known mostly from the accounts of nineteenth century naturalists (e.g. Bates, 1863). Their preference for habitat with an annual 11 m variation in water level and prolonged seasonal flooding, is partly responsible for the lack of information about these primates. Until two decades ago white uakaris were known from only one location in the wild (Hershkovitz, 1972). Bates (1863) who lived for several years near Tefé, the white uakaris' geographical range, stated that these animals are rare even within their range. Recently, Mittermeier and Coimbra-Filho (1977) confirmed the findings of this English naturalist. Despite few changes in human population densities, increasing economic activities have been taking place within the uakaris' habitat. The small geographical range

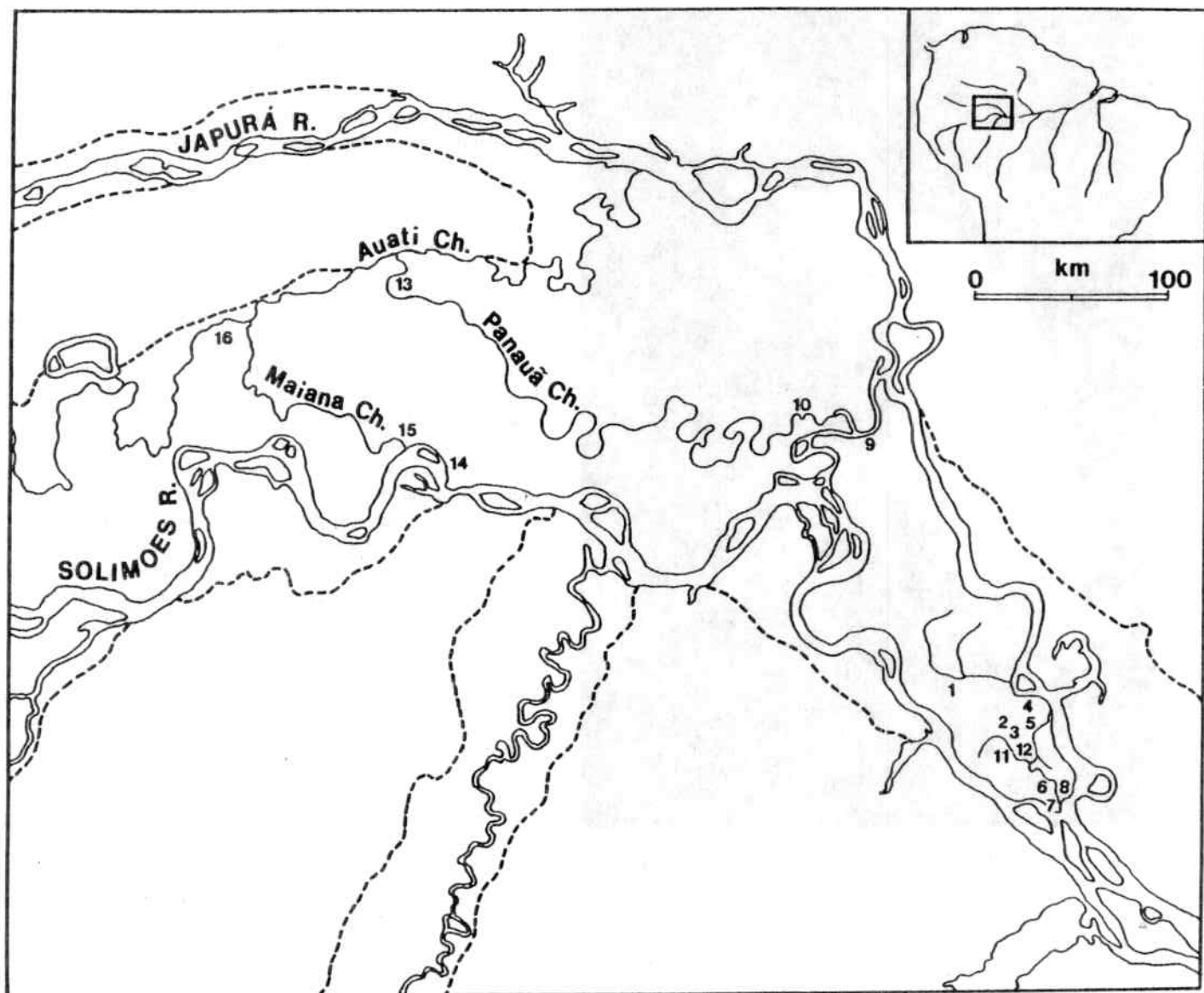


Table 7. Recorded Localities for *Cacajao calvus calvus* at the Lower Rio Japurá and Upper Rio Solimões in *Varzea* Habitat

Locality	Group size	No. of newborn (1983-1984)	Source
1. Lago Campaninha, Jarauá	6 (+)	NI	JMA, pers. obs.
2. Lago Acácio, area of Lago Mamirauá (a)	25-30 (+)	1/3	JMA, pers. obs.
3. Lago Teiú, area of Lago Mamirauá (b)	49-50	1/5	JMA, pers. obs.
4. Lago Jacitara, Paraná do Apará	8-10 (+)	NI	JMA, pers. obs.
5. Lago Teiú, area of Lago Mamirauá (c)	15-20 (+)	NI	JMA, pers. obs.
6. Vila São Francisco, area of Lago Mamirauá	—	—	ADJ, pers. obs.
7. Ressaca Vila Alencar	20-25 (+)	NI	JMA, pers. obs.; and 3 skins at MZUSP (nos. 17537, 17536, 17542)
8. Lago Tracajá, Paraná do Maiana	8	NI	JMA, pers. obs.; and 2 skins at MZUSP (nos. 17535, 17539)
9. Lago da Fortuna, Paraná do Aranapu	13 (+)	NI	JMA, pers. obs.
10. Lago Viola, Paraná do Panauá	—	—	Information from residents
11. Lago Branco	—	—	Information from residents
12. Lago Mamirauá	NI/1	16	JMA, pers. obs.
13. —	—	—	Mittermeier (1973)
14. São José	—	—	Almeida and Deane (1970)
15. Paraná do Maiana, opposite Fonte Boa	—	—	Napier (1976)
16. Buiussu, Auati Paraná	—	—	U. Bessa, pers. comm. to JMA; and 2 skins at MZUSP (nos. 17552, 17553)

Key:

- (a) main study group
 (b) comparative study group
 (c) group from the northern edge of the lake

NI no information available

(+) more individuals were present than the ones counted

dashed lines indicate approximate extent of seasonally-inundated vegetation (*varzea*)



Fig. 8. A white uakari (*Cacajao c. calvus*) at the São Paulo zoo (photo by L. C. Marigo).

of this primate species together with human pressures in the area, have made it necessary to give the white uakari the status of "vulnerable" (IUCN, 1982). I recommend this status soon be changed to "endangered", especially if no measures are taken now to ensure its preservation.

In this article I will summarize some results of a field study on the white uakari, *Cacajao c. calvus*, which are relevant to the conservation of this subspecies. The 20 month study was carried out between March, 1983 and December, 1984 on the lower Rio Japurá.

The geographical range of the white uakari is reported to be within the "island" formed by the lower section of the right bank of the lower Rio Japurá, the left bank of the Rio Solimões and the Auati-Paraná. This "island" is covered by the unique and unstable várzea forest. Várzea is vegetation covering the floodplain of "white-water" rivers which carry an enormous load of sediments from the Andes (Fig. 9). Thus várzea has an annual input of nutrients and is an especially dynamic environment due to these variable sedimentation and erosion episodes. The geographical range of *Cacajao c. calvus* is located entirely within the várzea forest. Analysis of RADAM maps shows that the geographical range of *Cacajao c. calvus* can be divided into two sections by geological age; a section west of Paraná do Aranapu with relatively higher and older soil of Pleistocene origin (more than 100,000 years old), and a section east of Paraná do Aranapu with more recent soil perhaps of Holocene origin (Irion, pers. comm.; Klammer, 1984). There is variation in floral and faunal composition between these two areas. For example, there are only 4 sympatric primate species in the younger section while in the western section more than 7 sympatric species are reported by reliable locals. Therefore differences in primate population densities might be expected because of differences in soil fertility, plant composition and higher numbers of arboreal vertebrates.

Two skins of the red uakari, *Cacajao c. rubicundus*, collected in 1984 (now at the Museu de Zoologia USP — São Paul), were reported to be from an area within the known geographical range of *Cacajao c. calvus*. The two specimens (which were brought to Tefé by Mr. U. Bessa, owner of Fazenda Buiussu) came from a locality on the western side of the Auati-Paraná near its Rio Solimões end. This corner must be an area of interbreeding between the two subspecies. It perhaps also indicates that the geographical range of the white uakari might be smaller than previously thought.

The várzea forest inhabited by *Cacajao c. calvus* is characterized by both forested and open plant communities. Forested areas (*restingas*) are associated with higher ground which is flooded less than six months of the year. Open areas (*chavascal*) are concentrated on lower ground which is flooded over six months of the year. *Restingas* are usually found on the banks of lakes, channels or rivers, especially abandoned ones. These are areas of more stable vegetation because the coarser sediments are laid first, near the sides of a water course. *Cacajao c. calvus* usually inhabits areas where the higher *restingas* are found. Its population density in these areas is nearly 20 individuals per km². In areas where lower *restinga* and *chavascal* predominate, the population density of the species is almost null. The distribution of each vegetation type varies with the age of the várzea habitat, in the older várzea higher *restinga* is more abundant. At the study site in the vicinity of Lakes Mamirauá and Teiú, higher *restingas* account for approximately 20-30% of the total area (Brazilian RADAM maps are quite useful in locating the *restinga* areas where groups of *Cacajao c. calvus* may occur).

Cacajao c. calvus lives in multimale troops of up to 50 individuals. Groups frequently fragment during foraging. Their diet consists mainly of immature seeds (69.7%), but they also eat mesocarps of ripe fruits and arils (18.4%), nectar (6.2%) and insects (5.2%). The diet is dominated by some tree species, the top six plant species accounting for more than 50% of the annual diet. White Uakaris have larger home ranges (c.a. 500-600 ha) than expected for frugivores of their size (Milton and May, 1976), and their population densities are lower than that of most other primates. A low reproductive rate was found in the study group, where only one individual was born in 1983, and five in 1984.

The human population density is very low in the várzea but there is relatively high commercial activity. Fishing is important mostly during the low water season, and hunting and logging during the high water season. Temporary crops such as maize and manioc are cultivated especially in areas of higher ground. These areas are suitable for agriculture due to better aerated soil and a shorter period of flooding. Settlement areas are also located on higher ground and there are at least six small villages (less than 30 huts each) in the eastern portion of the geographical range of *Cacajao c. calvus*.

White uakaris are not usually hunted for food. Although there are some reports of animals being shot for food in the dry season when individuals are heavier, it is not a common practice in this area of Amazonia. This is probably due to their human appearance and local beliefs.

Selective logging has occurred for over 30 years in the geographical range of *Cacajao c. calvus*. Even though the tree species logged are not potential foods for the white uakaris, other consequences of logging suggest that it should be regarded as the single most important threat to natural populations of white uakaris (Table 8). There are three principal threats which result from logging. First, the removal of one tree destroys surrounding trees and also requires taking two additional trees to float the dense valuable species to market. *Apeiba cf. burchelli* is among the most common species used for this purpose and accounts for 10.5% of the uakari's diet in August. Second, with the increasing scarcity of the more valuable tree species and the growth of a plywood industry in Manaus, loggers are being less selective and are removing other trees such as *Ceiba pentandra* and *Hevea spruceana* which are among the top 20 foods in the white uakari's annual diet. Third, fallen trees dam water currents changing patterns of sediment deposition and erosion, and thus altering local plant communities. This last consequence



Fig. 9. Aerial view of the várzea on the lower Rio Japurá (photo by R. C. Best).

of logging I consider to be the most serious threat of logging to the white uakari population. Logging is more intense in the older várzea, west of Paran do Aranapu (especially in the Paran do Panaua and Auati-Paran), where the number of commercially valuable trees is greater.

A proposal for transforming part of this area into an Ecological Station was sent to SEMA (Ministerio do Interior, Brasil) at the end of 1984. The area proposed is the eastern end of the uakaris' range, an area of approximately 950 km² between the rivers Japur, Solimes and the Paran do Jaraua. This area comprises the whole geographical range of a new form of squirrel monkey, *Saimiri vanzolinii* (Ayres, 1985), and would preserve an estimated 3,000 white uakaris.

The data discussed above indicate that white uakaris have a small geographical range, are limited to the várzea forest habitat and show a preference for specific vegetation communities which cover only a small part of the total várzea. The species's small natural populations are now under increasing threat by an expanding human population and, most seriously, a logging industry which is becoming more generalized. For these reasons I recommend that *Cacajo c. calvus* should soon be listed as endangered and an area within its range established as a reserve.

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Table 8. Trees removed from the forests of Lake Mamiraua area in 1984 by loggers based in Vila Alencar; and these trees' relative importance to the diet of *Cacajao c. calvus*.

Tree species	Number of trees removed	Price in US\$ per m ³ (1984)	Importance in uakaris' diet/ part eaten	Utility	Vegetation type
<i>Ceiba pentandra</i> Samauma	200	5.8	none	plywood	higher <i>restinga</i>
<i>Couratari sp.</i> Macacaricuia	77	2.4	none	plywood	higher <i>restinga</i>
<i>Hura crepitans</i> Assacu	73	2.4	seeds	floating houses	higher <i>restinga</i>
<i>Virola surinamensis</i> Ucuuba verdadeira	87	2.4	none (a)	floating houses	higher <i>restinga</i>
<i>Schizolobium amazonicum</i> Paricarana	16	2.4	base petiole (b)	plywood	higher <i>restinga</i>
<i>Moraceae</i> (NI) Muiratinga	53	5.8	none	plywood	?
<i>Licaria amara</i> Louro inamui	234	8.6	none	hardwood canoe	higher <i>restinga</i>
<i>Macrolobium sp.</i> Arapari	3	2.4	seeds (c)	plywood	higher <i>restinga</i>
<i>Leguminosae</i> (NI) Copaiba	14	2.4	none	plywood	higher <i>restinga</i>
<i>Nectandra sp.</i> Louro preto	26	6.7	none	hardwood canoe	?
<i>Leguminosae</i> (NI) Cedro da Varzea	8	7.1	none	hardwood	higher <i>restinga</i>
<i>Leguminosae</i> (NI) Mulateiro	34	7.6	none	hardwood	lower <i>restinga</i>
<i>Calophyllum brasiliense</i> Jacareuba	68	7.6	none	hardwood canoe	lower <i>restinga</i>
<i>Hevea spruceana</i> Seringa barriguda	47	—	seeds (d)	plywood	lower <i>restinga</i>
<i>Piranhea trifoliata</i> Piranheira	60	0.8*	lepidoptera larvae (e)	beam	lower <i>restinga chavascal</i>
<i>Apeiba cf. burchelli</i> Boeiraira	200	—	ripe pulp (d)	floating logs	higher <i>restinga</i>
<i>Guarea subsessiliflora</i> Gito	—	—	seeds (d)	canoe	higher <i>restinga</i>
<i>Xylopia frutescens</i> Envira vassourinha	—	—	ripe pulp and aril (e)	boat construction	higher <i>restinga</i>

Key:

NI not identified to species

— no price or amount taken from Lake Mamiraua area was available

* price per metre (not m³)

(a) potential food but monkeys were not observed eating it

(b) eaten but not important

(c) not in the top 20 foods

(d) important

(e) very important

Notes on the Ecology and Current Status of the Buffy Saki, *Pithecia albicans*

Introduction

Pithecia albicans is one of the least known Neotropical primates. Its existence was first recorded by Bates (1863), who saw a captive animal and collected a few skins during his visit to the town of Tefé (Ega) in the 1850's. Its specific status, first awarded by J.E. Gray in 1860, was reinstated by Hershkovitz (1979).

The geographical range of the species is believed to be limited to the region between the Juruá and Purus Rivers, south of the Solimões River, in Amazonas state, Brazil. Below around 6°S it is replaced by *P. hirsuta* (Hershkovitz, 1979) (Fig. 10). Precise information is lacking since even today the species has been observed by only a handful of primatologists.

Sakis are notoriously difficult to observe in continuous forest due to their rapid travel rate and habit of adopting cryptic behavior in response to the presence of observers. *P. albicans* also shares *P. pithecia*'s distrac-

tion display, whereby an adult animal, identified as a male in *P. pithecia*, leads the observer away from the rest of the group (Oliveira *et al.*, in press; ADJ, unpubl. data).

P. albicans has never been studied in the wild and has never been observed in captivity; apart from a single juvenile animal that survived for a short time in Brazil's National Primate Centre in Belém, no animals have been captured. This note records observations made of *P. albicans* during a 12-month synecological study of primates in *terra firme* forest in western Brazilian Amazonia.

Location of study

Observations were made in a populated region on the west bank of Tefé Lake, close to the settlement of Ponta da Castanha (3°32'S, 64°58'W). A variety of habitats were examined at this site: tall primary forest; 11 year-old selectively logged forest with extraction levels of 3-5 trees/hectare, and total loss through felling and incidental damage of 61% of standing trees; crop mosaic arising from shifting manioc cultivation, containing stands of regenerating 'capoeira' of up to 15 years of age, and plantations of Brazil-nut trees, *Bertholletia excelsa*, up to 40 years of age; a 35 h forest 'island' of partly logged, partly primary forest, surrounded by crop mosaic.

P. albicans was observed a total of 85 times. Data were collected by 10-minute interval scan sampling. The animals were under observation for a total period of 71 hours 50 minutes. Some additional data are available from 18 further sightings by reliable field assistants.

P. albicans was sympatric with 11 other primate species at this site (Johns, 1985).

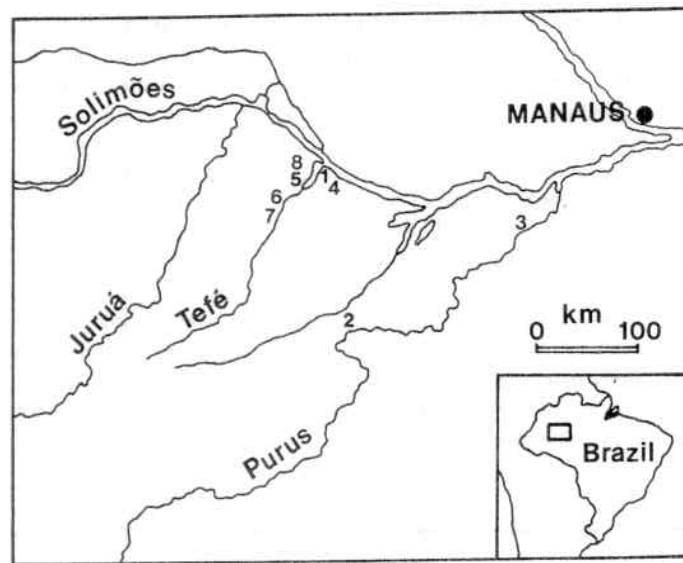


Fig. 10. Geographical range of *P. albicans* (map by author).

Key

1. Tefé, type locality
 2. Jaburú, Purus River
 3. Ayapuá Lake, Purus River
 4. Vila Vale, mouth of Tefé Lake (juvenile sent to National Primate Centre)
 5. Ponta da Castanha, Tefé Lake
 6. West bank of Tefé Lake, 10 km south of Assaituba
 7. Boiá Lake, west bank of Tefé River
 8. Lower Bauana River (A.B. Rylands, pers. comm.)
- Localities 1-3 are recorded by Hershkovitz (1979);
localities 4-7 were recorded during recent WWF-US surveys in the region.

Population density

Estimates of population density (Table 9) are derived by Fourier series analysis (see Burnham *et al.*, 1980). Data were collected throughout the study period at Ponta da Castanha; additional data are available from one other site, Assaituba, 60 km further south on the west bank of the Tefé River.

Area and habitat	\bar{x}		encounters		
	group size	n*	km surveyed	/10 km walked	individuals / km ²
Ponta da Castanha:					
primary forest	5.2	39	554.3	0.9	9.0
logged forest	3.9	18	170.1	1.2	18.3
forest island	3.7	3	96.9	0.3	2.4
crop mosaic	2.5	6	560.1	0.1	0.9
Assaituba:					
primary forest	2.0	5	63.2	0.8	2.3

*number of accurate group counts

Births and maturity

Recorded births were in mid-December (two), mid-March, night of 25-26th June, and mid-November. They did not appear clumped and do not correlate with seasonality of fruiting activity within the forest (Johns, 1986).

Infants are dark chocolate brown when born, with naked tails, and are carried in the flexure of the mother's thigh. After about three weeks adult coloration is attained, although the fur is still short, and the infant changes to riding on the back of an adult. Independent activity was observed in four-month old animals. Total independence was evident after six months, and difficulty in separating the young animals from older members of an association experienced after 11 months. No infant mortality was recorded.

Adult animals carrying infants typically associate and travel together, as do independent juveniles. The extent of male care of infants, if any, is not known since adults can rarely be sexed.

Locomotor behavior and ranging patterns

P. albicans characteristically travels quadrupedally, with frequent strong leaps or 'bounces' (propulsion supplied by all four limbs) from one bough to another. The pithecin bipedal hop, a characteristic locomotor pattern of *P. pithecia*, was not observed. Locomotor behavior was not quantified during this study.

Animals appear to spend a large proportion of their day in an inactive state (83% of observations were of inactive individuals, although some may have been 'hiding' from the observer). In the longest follow achieved, an association of seven adult animals and one infant, which remained unaware of the observer, travelled 1.05 km in just over four hours. On another occasion an association of seven adults and two infants did not move at all for three hours, at which point they detected the observer and fled 600 m in less than five minutes.

There is no evidence to suggest that regular sleeping sites are used. One solitary animal was observed to climb into the upper branches of a Brazil-nut tree to sleep, another solitary animal slept in low cliff-top scrub on the edge of Tefé Lake. Groups did not appear to travel to selected sites.

Canopy use

The forest at Ponta da Castanha is generally around 30 m in height, with occasional emergents reaching 45 m. The height distribution of activity in *P. albicans* tends to be concentrated in the middle canopy (the continuous layer composed of the majority of trees: generally 15-25 m above ground) and the upper canopy (the discontinuous layer above the level of continuous vegetation but encompassing the upper parts of most large trees). Little use was made of emergents and the lower canopy (the discontinuous level below the middle canopy), and the sakis were never seen on or near to the ground. The distribution of activity reflects the density of substrata and thus, to a large extent, of food resources: it suggests that the animals are not selecting particular levels.

Although occurring in the crop mosaic fringing Tefé Lake, *P. albicans* generally avoided low vegetation, restricting their activity to the corridors of tall forest and the forest island. They were rarely observed in *capoeira*. This is not surprising since the young regenerating vegetation holds few food sources, especially large-seeded fruit which are characteristic of more stable environments (Foster and Janson, 1985).

Diet

Most data on the diet of *P. albicans* result from observations of conspicuous group feeding activity in fruiting trees. A good deal of feeding activity may be cryptic and under-represented in the sample, as indicated by the very low numbers of feeding observations that are common to studies of *Pithecia* spp. Feeding data (Table 10) are expressed as the number of observations of individuals feeding on each item. Broad categories of food items show some similarities with other species of *Pithecia* (Fig. 11), but it should be noted that techniques for collecting feeding data vary between studies. Insufficient data exist to attempt an analysis of the time spent feeding on each item, but mesocarps and arials require processing and occupy more time than does feeding on leaves or insect material.

The stomach of an adult male shot by local residents on the lower Tefé River contained equal quantities of leaf material and fruit pulp and large numbers of arthropods (mostly lepidopteran larvae, arachnids and hymenoptera).

Food category	Species	Family	No. obs.	%	
Unripe seeds	<i>Inga</i> sp.	Leguminosae	1	18.5	
	<i>Brosimum</i> sp.	Moraceae	2		
	"cipo ferro"	Loganiaceae	4		
	?	?	3		
Fruits: mesocarps	<i>Oenocarpus bacaba</i>	Palmae	4	50.0	
	<i>Inga</i> sp.	Leguminosae	1		
	arils	<i>Virola surinamensis</i>	Myristicaceae		8
		<i>Irianthera</i> spp.	Myristicaceae		3
	whole fruit	<i>Ficus</i> sp.	Moraceae		5
		<i>Simarouba amara</i>	Simaroubaceae		5
<i>Lacunaria jenmani</i>		Quinaceae	1		
Young leaves	? (tree)	?	15	29.6	
	? (liana)	?	1		
Bark	? (inner cambial layer, liana)	?	1	1.9	
No. observations			54		

Discussion

P. albicans appeared to be common in several habitats but of very variable population density. To some extent this may be due to patchiness of distribution. The highest density of *P. albicans* was observed in regenerating logged forest, however, indicating that a high density of early successional patches may favor this species. Why this should be so is unclear. Unlike *P. pithecia* it is not a species of the lower story, although it is able to move through early regenerating growth without difficulty, and the major component of its diet is the fruit of canopy trees. The commonness of suitable food trees among remnant tall trees in the logged area at Ponta da Castanha may have been important, but they were also observed to feed from the common colonizing trees *Inga* spp.

In contrast to the other pithecines, *Chiropotes* spp. and *Cacajó* spp., which incorporate little or no leaf material into their diet (Ayres, in press), *Pithecia* spp. are partly folivorous. Anatomical measurements indicate little enlargement of the caecum and colon for any pithecine (J.M. Ayres, D.J. Chivers and ADJ, unpublished data). An enlargement of these is usually associated with folivory. It appears, however, that digestion of leaf material may be facilitated by unusually long retention times in *Pithecia* spp. Milton (1984) reports *Pithecia (monachus)* as unique in this respect, both among pithecines and among other small, partially frugivorous species.

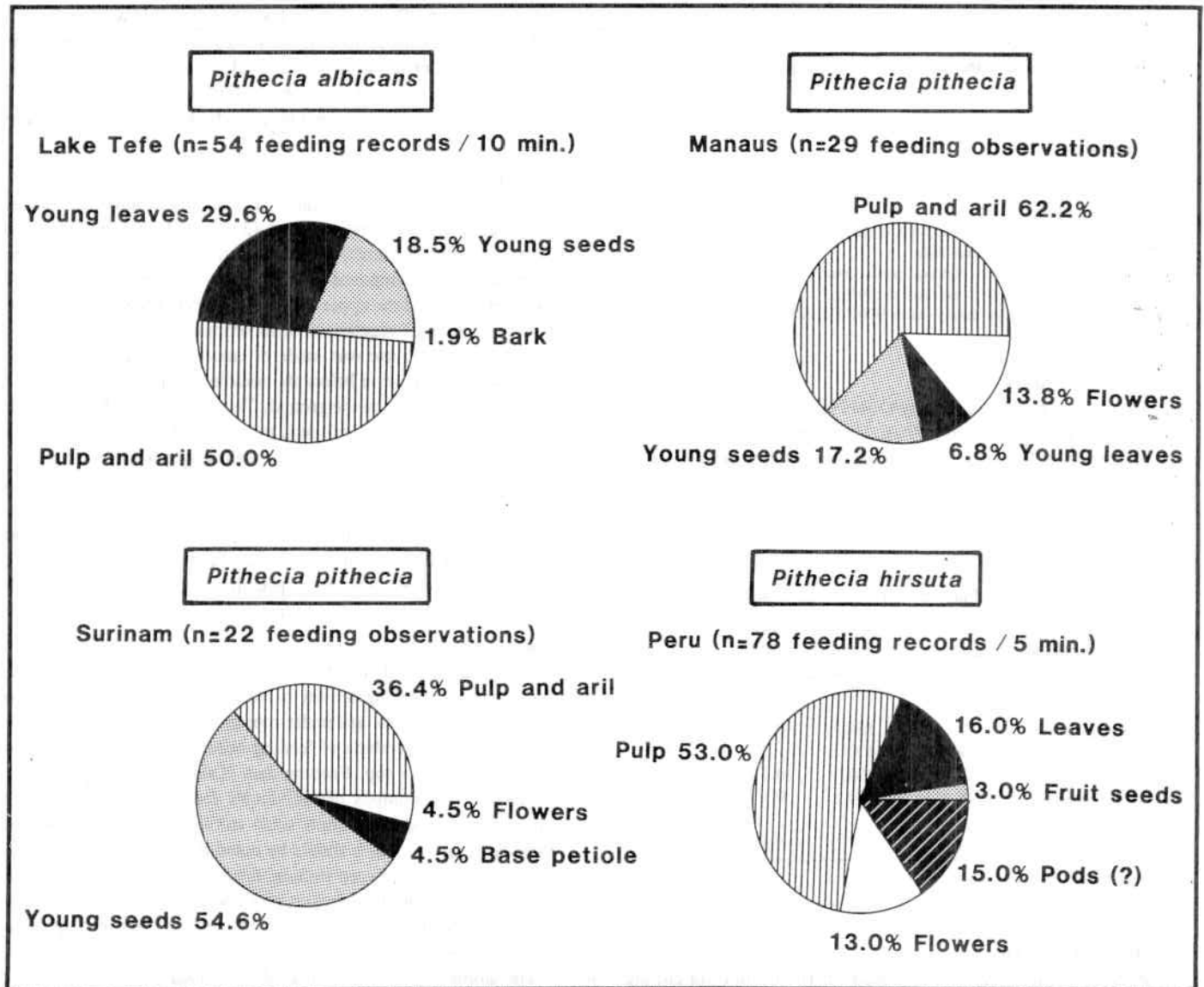


Fig. 11. Broad categories of food in the diets of species of the genus *Pithecia* (figure by S. D. Nash based on author's original).

P. albicans: this study; *P. pithecia*, Manaus: Oliveira et al. (in press); *P. pithecia*, Surinam: Buchanan et al. (1981); *P. hirsuta*: Happel (1982). See original references for details of data collection.

Pithecia spp. are also unique among pitheciines in their ability to persist in moderate to heavily disturbed habitat (John, 1986). Periodic fruit shortages in disturbed forest may well be overcome in *P. albicans* because of its ability to incorporate leaves into its diet.

The region between the Juruá and Purus Rivers is very little disturbed at present. The rural population is less than 1 person/km² and a very small percentage of the land is claimed. Clearance for agriculture or cattle ranching is limited to the vicinity of a few towns and riverside communities, usually in seasonally-flooding *várzea*. At the present time, selective timber logging and plantation silviculture are uneconomic in *terra firme* forests in the region. It is probable that this state of affairs will change in the near future, however, since international interest in Amazonian timbers is increasing and because the Brazilian government has been considering new waves of colonization into Amazonia (Johns, 1986).

P. albicans is a fairly small monkey and is not often shot for food, except in heavily populated areas around towns and along the banks of principal rivers. Its tail is used as a duster or cleaner for shotgun barrels, but it is not killed just to obtain this. In view of the large areas of *terra firme* forest remaining, casual hunting is unlikely to be a significant drain on the wild population: species more preferred by hunters are still numerous.

P. albicans is not threatened at present. It occurred in every *terra firme* forest area examined in the Tefé region and was generally common. Its status will require re-examination in the event of a highway being built through the region, which would accelerate the development of logging industries. Fortunately, this is highly unlikely in the near future.

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Illegal Trade in Golden-headed Lion Tamarins

Golden-headed lion tamarins (*Leontopithecus chrysomelas*, Fig. 12) are small, beautiful Brazilian primates that have probably always been rare and restricted to the Atlantic forest in southern Bahia. The species was first described by the German explorer, Prince Maximilian zu Wied, 160 years ago; yet even today little is known about it. In 1972, six animals were collected to found part of a rare primate breeding colony at the Tijuca Bank of Lion Marmosets just outside the city of Rio de Janeiro. This colony was transferred in 1979, to its present location at the Rio de Janeiro Primate Center at the foot of the Serra dos Orgãos. According to Brazilian and international law, the golden-headed lion tamarin is an endangered species and cannot legally be exported from Brazil. However, during the winter of 1983/84, relatively large numbers of these primates were smuggled from Brazil via Bolivia and Guyana, into Europe and Asia.

On November 16, 1983, a Belgian animal dealer, Rene Corten, advertised the sale of *L. chrysomelas*. Two pairs were offered to Jersey Wildlife Preservation Trust at a total cost of £4,000. Following this of-

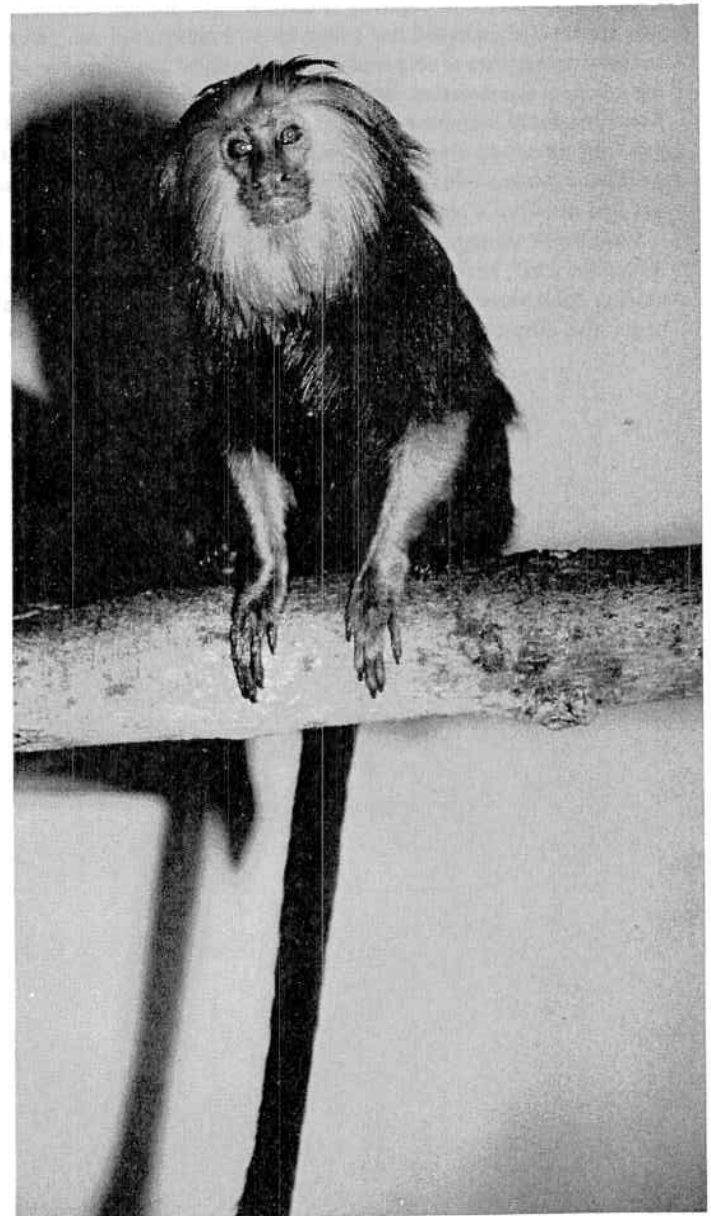


Fig. 12. Golden-headed lion tamarin (*Leontopithecus chrysomelas*) (photo by R. A. Mittermeier).

fer, an investigation by WWF-Belgium established that Mr. Corten had imported 29 *L. chrysomelas* in the autumn of 1983, three of which had died, 26 of which he still possessed. Also in late 1983, TRAFFIC-Japan learned that earlier that year, golden-headed lion tamarins had been smuggled to Japan via Guyana and these animals were distributed between the Okinawa, Shizuoka and Hong Kong zoos, and the Japan Monkey Center. In addition, French CITES authorities discovered that more than a dozen animals were being kept in France at the La Palmyre Zoo and by a private collector, Dr. Quinque. These animals had apparently been imported in 1977. All told, authorities believed that perhaps as many as 60 *L. chrysomelas* were being held illegally outside Brazil. This represented a significant percentage of the species' total world population; only several hundred were believed to survive in the wild at that time. Because the situation involved animals either already in transit or in established colonies in three foreign countries, it appeared irresolvable. Jeremy Mallinson, Zoological Director at JWPT, has helped direct efforts in the now two-year campaign to have the smuggled tamarins and their progeny returned to the trusteeship of the Brazilian government.

In March 1984, the Captive Breeding Specialist Group of the IUCN's Species Survival Commission developed a strategy to recover some of the animals. In September 1984, at the 4th World Conference on Breeding Endangered Species in Captivity (Flevohof, Netherlands) a resolution was unanimously adopted that called for all international and national conservation agencies to cooperate with the Brazilian government in seeking return of the tamarins. Brazil was urged to set up an International Recovery and Management Committee for the species. In March 1985, this Committee was formed, co-chaired by Jeremy Mallinson and Dr. Ademar Coimbra-Filho, Director of the Rio de Janeiro Primate Center and one of Brazil's leading primatologists.

Mallinson's strategy of "quiet diplomacy" has met with success. In November 1985, France's La Palmyre Zoo and the Japanese institutions holding golden-headed lion tamarins all agreed to place these animals under the auspices of the Brazilian government. Assistance from

TRAFFIC-Japan was critical in convincing the Japanese zoos. Thanks to the influence of the Belgium Ministry of Agriculture and WWF-Belgium, European zoos and private collectors that potentially were interested in purchasing Mr. Corten's animals have been convinced that such action would jeopardize the future of this species. On November 30, 1985, 16 of the tamarins remaining in Mr. Corten's possession were flown from Amsterdam to Rio de Janeiro, accompanied by a representative of the Brazilian government.

At this point, several problems still remain. First, the Recovery and Management Committee must decide whether any of the foreign tamarin collections represent viable captive breeding units for the species. Those that do will likely be maintained, while those that do not will be asked to relinquish their tamarins to the Brazilian government. Second, the ultimate disposition of any tamarins returned to Brazil is problematic. At one time it was suggested that all animals be released in the Una Biological Reserve in the state of Bahia. Unfortunately, this reserve currently suffers from human encroachment and released tamarins would be at risk. Consultants from the National Zoo and World Wildlife Fund have strongly advised the Brazilian government against reintroduction at the present time. The Belgian animals are currently being held at the Rio de Janeiro Primate Center and some will be incorporated into the existing colony there. The Center, however, is not equipped to accommodate all the tamarins being returned (and should not for basic management considerations). It will be necessary to identify other institutions that would be willing and able to maintain this species. The Los Angeles Zoo and the National Zoo, based on their success at breeding *L. rosalia*, are both to receive five pairs of *L. chrysomelas* this spring from the Rio Primate Center.

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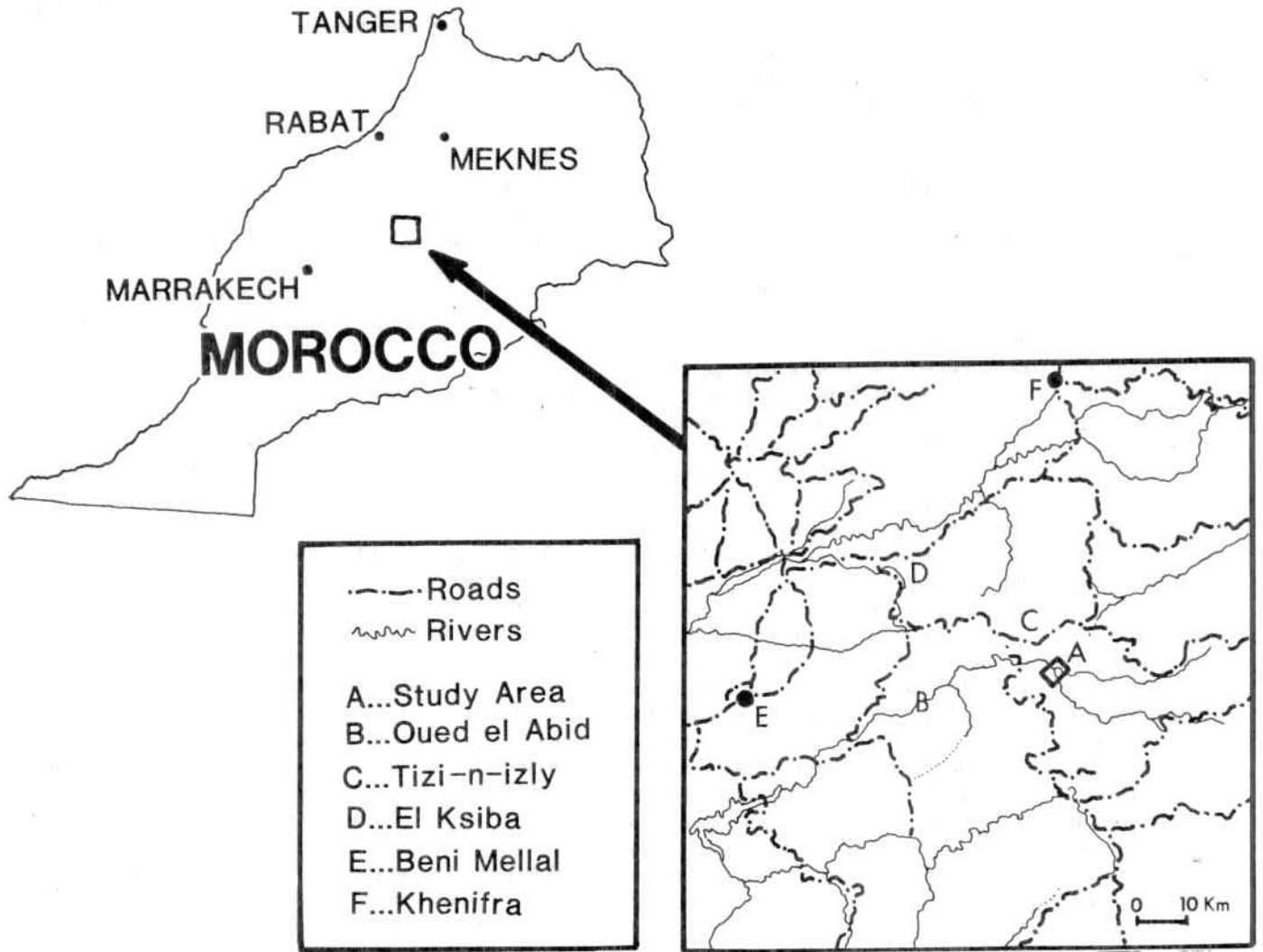


Fig. 13. Location of the study area at Oued-el-Abid gorge in Morocco (map by S. D. Nash from author's original).

An Important New Locality for the Barbary Macaque (*Macaca sylvanus*) in Morocco

The Barbary macaque (*Macaca sylvanus*) is known to occur in the wild in five main regions in Morocco and Algeria in a number of habitats. Population and distribution data on the species are now well documented (Deag, 1977; Taub, 1977; Fa *et al.*, 1984) but information is still sparse on "marginal" sites, localities away from the main distribution block. These pockets of monkey populations constitute important study sites, serving as evidence not only of a more widespread distribution (see Fa, 1984) of the species, but often representing remnants of intact ecosystems. This paper reports the discovery of one such locality at Oued-el-Abid, Bou Tferda region, in the south of Morocco. Here the macaque still survives in a relatively undisturbed condition coexisting with its large cat predator, the Barbary leopard (*Panthera pardus barbarus*). This area is of considerable conservation interest since it holds the last remaining leopard population in Morocco, and is of particular interest as a focus of predator-prey interrelationships for the Barbary macaque in its natural state.

The gorge of the Oued-el-Abid/Bou Tferda region was visited under the auspices of the Moroccan nature conservation authorities (Eaux et Forêts, Rabat) to investigate the possibility of releasing captive-bred Bar-

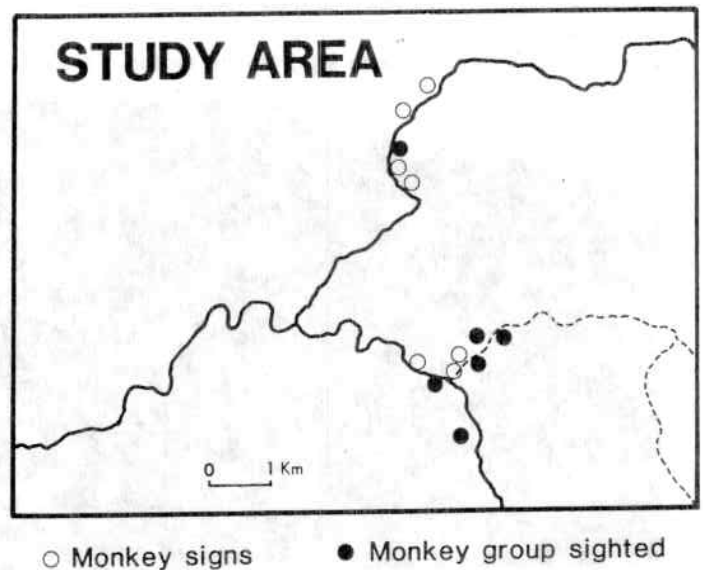


Fig. 14. The study area showing location of monkey signs and monkey groups (figure by S. D. Nash based on author's original).

bary macaques from the monkey enclosures belonging to Baron Gilbert de Turckheim (see Turckheim and Merz, 1984). The area was known to be the last refuge of the Barbary leopard, but macaques were reputedly absent. However, a four-day survey in this region, Nov. 20-24, 1984, revealed the presence of monkeys in the gorge. Systematic surveys of the habitat characteristics and counts of monkey groups were carried out to assess the condition of the monkey populations. Searches for leopard tracks and signs were also made and local villagers interviewed about the presence of leopards and any predator pressure on the monkeys and livestock.

The gorge of the Oued-el-Abid at Bou Tferda lies at the junction of the Assif Ouirine and Oued Attach that forms the Oued-el-Abid proper near the village of Bou Tferda, in the province of Beni Mellal. The gorge area is approximately 14 km²; the gorge's depth ranging from 200-400 m.

The gorge is inaccessible by road except from the north via a dirt track from Bou Tferda. The Ben Noual road to the northwest of the gorge leads to the same track. Descent to the river at the bottom of the gorge is only possible via a number of goat paths leading down from the plateau.

The people of the area immediately surrounding the gorge are almost entirely of Berber stock, speaking mostly Berber and only some Arabic. The largest concentration of people is in the village of Bou Tferda. About 25 houses make up the village settlement; the estimated population size of the village is 200-300 inhabitants. There are only a few isolated cluster of houses away from Bou Tferda.

The predominant land use in the area is traditional goat and sheep raising (in the gorge itself too), and there is cereal cultivation on the surrounding plateau. The agricultural land is very stony and largely of poor quality. Cultivation is not intense and continues in areas which may have been cleared of forest in some distant past. Most of the crop land lies adjacent to the village of Bou Tferda and the smaller settlement of Idis but cultivated plots are generally no larger than a few hectares. Livestock raising is thus an important element of the region's rural economy. Most shepherds from the villages possess around 100-200 smallstock heads (around two-thirds goats, one-third sheep) and perhaps one or two cows. All goats and sheep are herded daily to graze and browse in the gorge and on the land adjacent to the village. Within the gorge four main grazing rights zones are identified. Fifty shepherds may use this area daily, bringing with them a total of about 10,000 goats and sheep. No pasturing takes place in the gorge from July-October when the stock is taken to the adjoining foothills for the summer dry period.

The structure and composition of the vegetation within the gorge is relatively complex in relation to changes of orientation of the sides of the gorge (and thus insulation levels) and moisture. The latter varies according to the depth of the gorge and to proximity to water. A definite altitudinal zonation is nonetheless apparent where riparian and moisture-loving species border the river and where holm oak (*Quercus ilex*) forest gives way to juniper (*Juniperus* spp.) towards the top of the gorge.

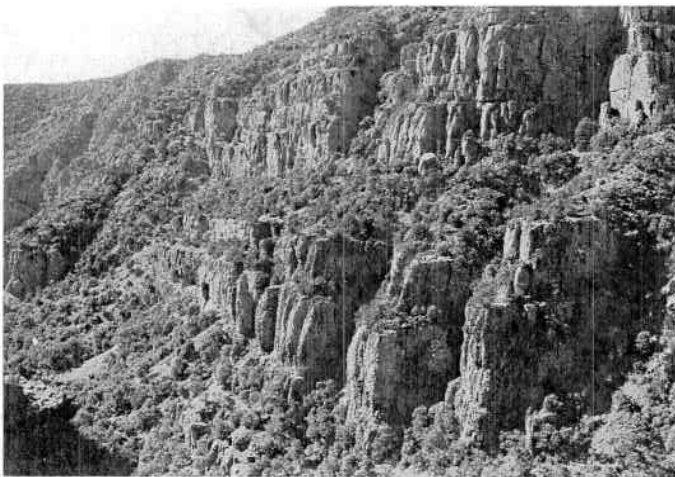


Fig. 15. The steep walls of the gorge contain many caves which can be used by leopards (photo provided by the author).

Throughout the gorge the dominant tree species is the holm oak which forms sizeable forests, up to 15 m in height. Junipers (*Juniperus phoenicea*, *J. thurifera*, *J. oxycedrus*) are common, mixed with holm oak. Some tree species are more locally distributed. Aleppo pine (*Pinus halepensis*), ash (*Sorbus domestica*), black poplar (*Populus nigra*) and, to a lesser extent, strawberry tree (*Arbustus unedo*) are found only in certain ecotones. Laurustinus (*Viburnum tinus*), wild rose (*Rosa micrantha*) and blackberry (*Rubus ulmifolius*) form extensive shrub in some parts near the river. Large ivy patches (*Hedera helix*) are found on the bare cliff walls.

The state of the habitats is generally satisfactory, but areas nearest to the village show signs of intense use. Tree-felling and over-grazing is a problem in some parts. Although no precise estimates of species diversity within the gorge can be given here, it was nonetheless obvious, even from the short survey conducted, that both bird and mammal species diversity and numbers were high. For the purposes of this paper, the status of the leopard and the macaque shall be considered in more detail below.

The Leopard Population

The Oued-el-Abid gorge is now recognised as being the last refuge for the Barbary leopard. Hafdaoui (1984) gives a population figure of 5-10 individuals for the area. According to Myers (1976), leopards in tropical Africa seem able to only maintain a density of 1 animal to 10 km² in moderately suitable habitats, 1 to 5 km² in favorable habitats, with perhaps even 1 to 1 km² in very suitable conditions. The Oued-el-Abid area may be too small and without exceptionally abundant prey to support a population as large as that suggested by Hafdaoui (1984).

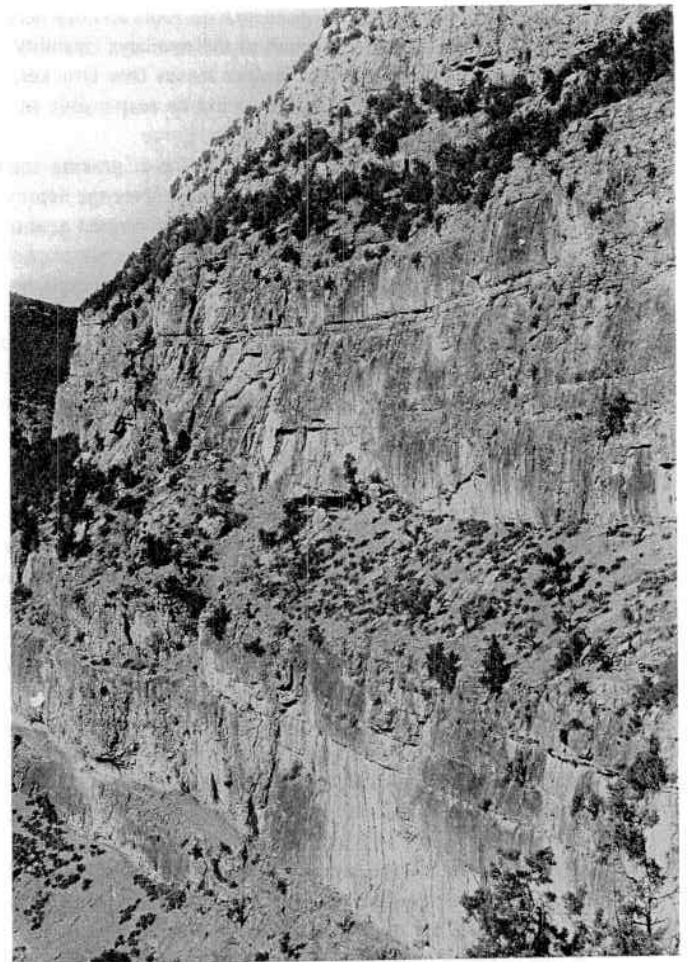
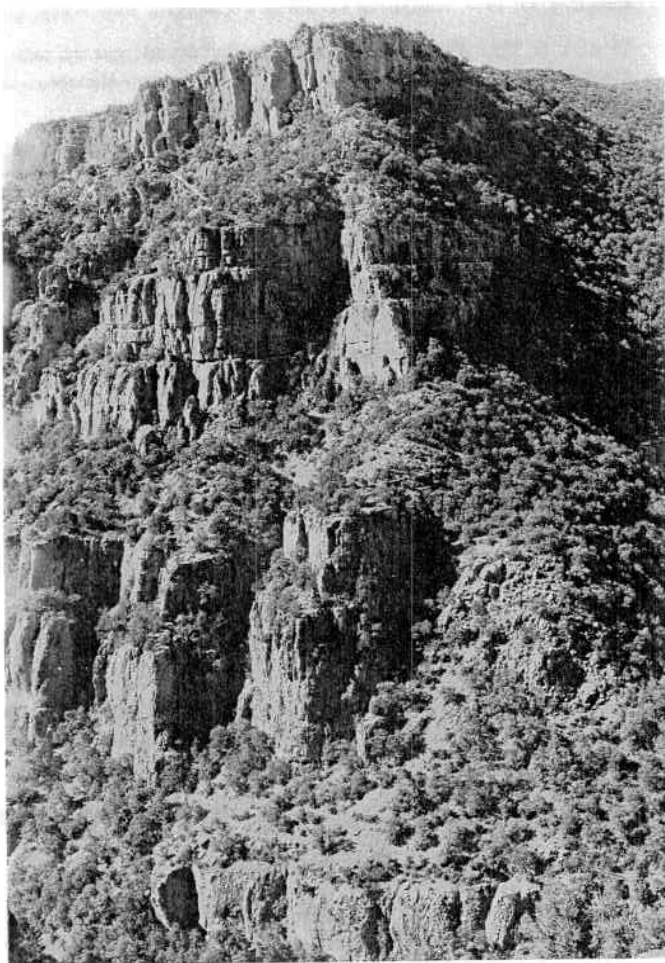
Fresh leopard signs were discovered during the survey. Villagers interviewed at Bou Tferda all claimed the presence of 2 to 3 animals in the gorge, and substantiated losses of livestock due to leopard predation, one person having lost a total of 30 cattle, sheep, goats, dogs and 2 donkeys in a period of 29 years (1955-1984). The most recent case of leopard predation occurred in June, 1983, when a sheep was killed and leopard tracks were found. All recorded predations have taken place no more than 300 m away from the gorge's edge.

Two persons from Bou Tferda claim to have recently come in contact with leopards. One shepherd described being attacked by a leopard in Feb. 1979, while a second surprised a leopard at a kill in Sept.- Oct., 1983. In the case of the attack, the victim believed that the resting cat was provoked by his attempt to disperse his flock. An officially recorded report of a leopard being killed by a group of people at Aghbalou Nirouman is dated October 31, 1983 (Hafdaoui, 1984).

The Barbary macaque population

The discovery of macaques in the Oued-el-Abid/Bou Tferda gorge extends the known range of this monkey in the Southern Moyen Atlas. Fa *et al.* (1984) recorded the presence of Barbary macaques in the Oued-el-Abid by the Cascades d'Ouzoud, but there were no records of monkeys to the southeast, in the same river system. Taub (1978) and Fa *et al.* (1984) estimate moderate numbers of monkeys in the holm oak forests around el Ksiba and in the forests south, east and west of Sidi Yahia ou Youssef, Taguelft, Azrar; Ait M'hammed and Tilouggilte; all areas to the north of the Bou Tferda region.

A total of six monkey groups were contacted within the gorge system in the present survey. Monkey signs in the form of tracks, dung and food remains were also noted. The distribution of both signs and contacts is shown in Fig. 14. Most monkey troops were found in areas which are relatively free of human disturbance. Group composition was difficult to estimate except for one group which moved along the cliff edge where visibility was good and where the animals could be seen traversing from one point to another unobstructed by vegetation. Three adult males, five adult females, six juveniles and four infants were counted — a total group size of 18 animals. Counts between 6-10 monkeys were made for the other groups contacted, but this may be an underestimate given the dense vegetation cover the animals were observed in. The total number of groups in the area was estimated by the random stratified



Figs. 16,17. Sheer cliffs are the predominant feature of the gorge. A standing man would be barely the height of one of the bushes (photos provided by the author).

sampling method employed by Fa (1982). This uses counts of groups within each block assigned above and estimates density by dividing an area of heterogeneous density into a number of strata within which density is relatively homogenous. This process increases the precision of the estimate because it is now a function of variability across the entire area (Caughley, 1977). A total number of 7 groups (SE 1.33) were estimated for the gorge area. If each group contained around 20 monkeys, assuming the whole group count made is representative of others, an estimate of 150 animals for the entire area can be made. However, there is the possibility that the survey did not sample all groups present. If 25% of all groups in the gorge were missed, a total maximum population of around 200 monkeys is possible.

General appraisal of conservation status — can the area sustain more monkeys?

The main concern of the Department of Eaux et Forêts in the Oued-el-Abid project is the protection and survival of the Barbary leopard. There are two possible ways of approaching an effective policy for the conservation of the leopard: one of these is to adopt short-term actions such as providing abundant prey, e.g. the macaque, in the hope that this will benefit the leopard population; the other is to maintain a satisfactory population of all taxa of plants and animals in the area from which the leopard will ultimately gain. To achieve the long-term survival of the leopard, it is obvious that the first alternative, notwithstanding other considerations on the validity of such an action, could never safeguard the future of the target species.

Irrespective of the alternative adopted, similar judgements of quality and quantity are to be made. Perhaps the most crucial question is whether the ecosystem of the gorge would be able to sustain a larger macaque population. Given that the release of monkeys into the gorge is not solely

an exercise in providing bait for the endangered cat, nor a convenient disposal for surplus captive-bred stock, the question requires some attention. The difficulty in answering it concisely here arises from the brevity of the survey. An accurate assessment of whether empty niches (abundant food resources) are available for more monkeys must be made. Some points may serve as useful guidelines to support the proposed release of macaques into the area.

From the vegetation survey conducted, there is no doubt that there is a superabundance of some food items, namely holm oak and juniper. There is an obvious diversity of grassy edges and some significant productivity of fruits such as strawberry tree, ivy, blackberry and *Laurustunus*. Assuming that the estimates made of monkey abundance are accurate, can we consider the habitat as having reached an "ecological carrying capacity" for macaques? Does this estimate conform with an expected value for this habitat type? Although the area has obviously been a refuge site for leopards and monkeys, can human factors (disturbance) be implicated in determining the present monkey population?

Monkey density in the gorge is around 11 animals per km². This is comparable to the mean density of monkey populations in fir and mixed oak forest habitats (Fa, 1984). However, since most of these sites are largely affected by human pressures, it is difficult to determine if the monkey density estimated in the gorge reflects a maximum carrying capacity equilibrium. The investigation of what mechanisms are responsible for explaining the gorge population of macaques must be left to a further study. However, two main considerations which could explain some important demographic constraints on the growth of the monkey population must be considered:

1. The macaques are likely to be dependent on fruit from the holm oak, juniper and ivy during all seasons except during the summer (evidence of this comes from direct observation and from dung found).

There is likely to be a forced dependence on roots and dry herbaceous plants during the summer as a result of the monkeys' inability to feed on the tannin rich holm oak and juniper leaves (see Drucker, 1984). Such a contraction of food resources could be responsible for setting the upper limit of monkey numbers in the gorge.

2. Given that the above is true, the presence of grazing smallstock for several months of the year is likely to exacerbate the depression of the standing plant biomass available to monkeys. Since a goat or sheep will consume 16 times more calories than a macaque, the impact on the habitat caused by a population of 10,000 goats and sheep is severe. A goat needs to consume around 0.66 kg of graze per day to satisfy its requirements; a sheep has a daily requirement of 1.27 kgs (estimated from standard works by Abrams 1968 and Eadie, 1970). The largely deteriorated sections of the gorge nearest the villages may attest to an over-stocking problem.

Recommendations

1. The release of monkeys into the Oued-el-Abid/Bou Tferda gorge should be seen as an important boost to the protection of the entire area.
2. If human disturbance (hunting, tree-felling) is kept to a realistic minimum, the habitat seems likely to be able to sustain a larger monkey population.

3. No accurate figures for the productivity of the area and, hence, for the number of monkeys that can be introduced can be given here. However, it seems reasonable to suggest that a manageable number of animals (around 200 in 3 to 4 groups) could be released. It is essential, however, that certain measures be taken to safeguard the habitat by:

i) Enforcing more legal and wardening procedures to protect the forest from further deterioration.

ii) Carrying out research on the ecology of the forest and its fauna.

4. A research program that envisages the following aspects should be drawn up prior to the release of any monkeys in the gorge:

i) A one to two month ecological study of the gorge establishing the abundance and diversity of all plants and animals in the area. A university might be persuaded to undertake this as an expedition for the project.

ii) Two to four mammal ecologists, with a sound knowledge of botany, should be employed to undertake a thorough quantitative study of the release of the macaques and at least a two year follow-up program. The study should focus primarily on the ecological impact of the monkeys on the area and their adaptations to the new site. To make valuable assessments of the adaptation of the captive-bred monkeys, the ecology of wild groups must also be studied. Records of human use of the area and of the presence of leopards should be given high priority.

iii) Any discussion of the region's grazing problems must be based on the premise that, while scientific data may be useful in grazing control, the social problems of over-stocking and uncontrolled grazing are by far the most difficult to tackle. The local human population should be encouraged to exert some grazing control.

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Action from Morocco to Protect Wildlife, Including the Barbary Macaque

A most positive action program initiated by the Director of the Eaux et Forêts in Rabat, Morocco, and also due largely to the appointment of Youssef Alaoui, is now focusing great attention on the protection of Morocco's natural resources. The Nature Conservation Department, of which Youssef Alaoui is director, has opened channels for the protection of Moroccan Endangered species, including the Barbary macaque (*Macaca sylvanus*). Public awareness campaigns (posters, calendars, etc.) and research on forest and wildlife conservation have been initiated. M. Alaoui has also been a main force promoting the planned reintroduction of macaques into the Oued-el-Abid area (see preceding article) from Baron de Turckheim's parks in France and Germany.

During his field survey of the proposed reintroduction site in Nov. last year, PSG member John Fa presented the Nature Conservation Department in Rabat with a copy of the book "The Barbary Macaque — A Case Study in Conservation" (Fig. 18).

The PSG would like to offer all possible support to aid in this new move by Morocco to protect its endangered primate.

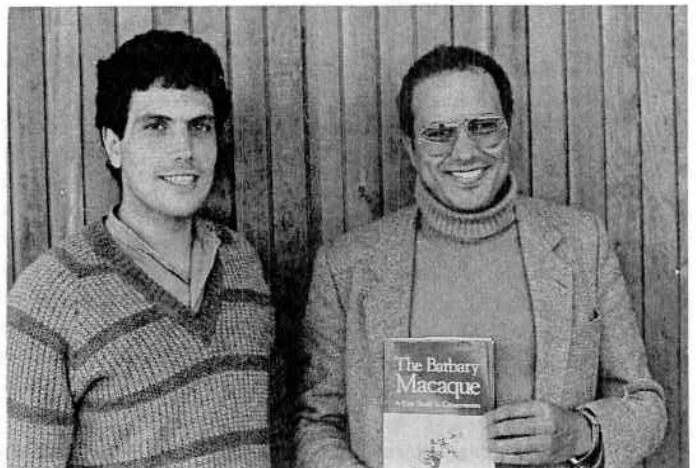


Fig. 18. John E. Fa (left) with the Director of the Nature Conservation Department of Morocco, Youssef Alaoui (photo provided by J. E. Fa).

Status of the Barbary Macaque (*Macaca sylvanus*) in Tikjda Forest, Algeria

The distribution of the Barbary macaque population in Algeria is not well known. It is evident, however, that during the last fifty years the total number of macaques has greatly decreased as a result of climatic changes and human pressures (Joleaud, 1931a, 1931b; Taub, 1977, 1984). These pressures are forest destruction and capturing of animals for commercial purposes. The monkey population is now fragmented into isolated groups inhabiting more or less degraded environments: cedar forest, evergreen or deciduous oak forest, maquis, and rocky outcrops (Fa, *et al.*, 1984; Ménard, *et al.*, 1985). Concern for the precarious situation of this population has placed *M. sylvanus* on the list of animals in need of urgent protection.

The species is already protected in Algeria. Our team of Algerian and French researchers has undertaken a demographic study of a small population of Barbary macaques to evaluate the efficacy of such protection for the first time. Although short-term, we hope the results will be helpful for the development of future conservation policies.

Tikjda Forest (4°8' E, 36°27' N) is one of the four forested zones of Djurdjura National Park. These zones are separated by large treeless rocky outcrops and pseudo-alpine pastures (Fig. 19). The forest represents one area in Algeria where both monkeys and habitat are effectively protected. Covering about 10 km² in area, and situated between

1,200-1,900 m, the forest consists mainly of cedars (*Cedrus atlantica*), mixed with evergreen oak (*Quercus ilex*). Representatives of other forest species such as *Pinus clusiana*, *Populus nigra* and *Taxus baccata* are also present in small numbers. The understory consists of various shrubs, and the herbaceous level is rich because of the sparse undergrowth (see Ménard, *et al.*, 1985; Ménard and Vallet, 1986; Fig. 20).

Tree-felling is forbidden. However, domestic stock are pastured in the traditional manner. Bovids are released in the mountains, unaccompanied by herders, from April to the first snows in November-December. Sheep and goats are herded by shepherds and their dogs over established circuits. The number of flocks is now so high that the understory is being persistently degraded. In certain zones trampling and overgrazing have turned the herbaceous level into stony ground with only a few plants. Tree and shrub regeneration is very slow. Three troops of Barbary macaques have been followed; the first (T1) for three consecutive years (Ménard, Vallet, Gautier), the second (T3) for two years (Amroun), the third (T4) for one year (Mohamed-Said).

The Troops increased in size at different rates (Table 11). T1 achieved a 62% increase over three years, with a very low rate in 1984. In 1985, the total number of members in T1 and T4 increased by 30% and 14% respectively, while T3 remained stable. The total count for 1985 showed an overall increase of 14.75%.

Regardless of troop or year, the birth season takes place between April and July. The reproductive rate (number of females giving birth in relation to number of mature females) is 60.6% over six seasons for the three troops together (that is 40 births for 60 females). Inter-annual variations are important but seem to affect all troops similarly. In 1984, there was a low reproductive rate of 4 births for 23 females but in 1985, 28

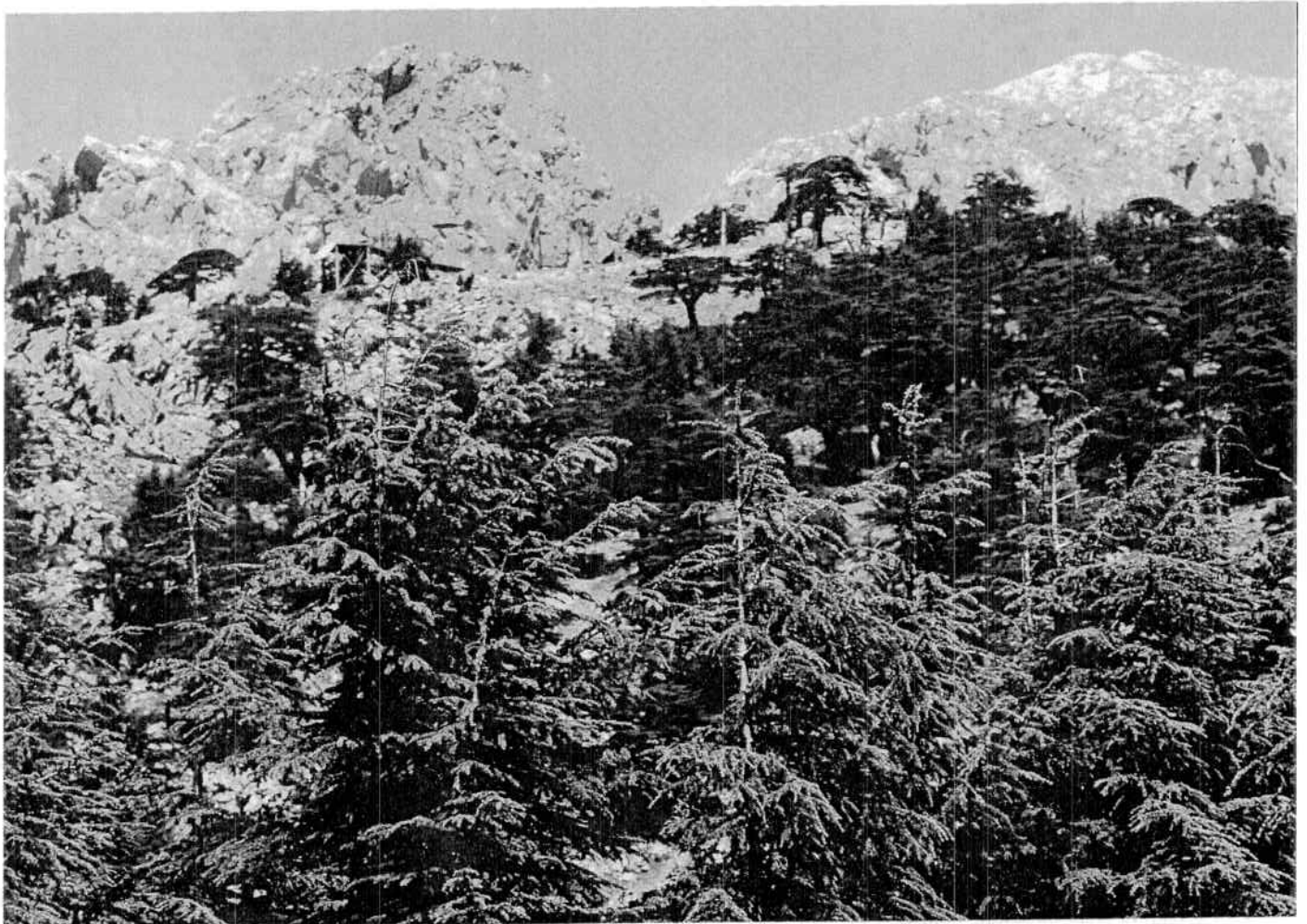


Fig. 19. The Parc National du Djurdjura includes four forest zones separated by open areas of pseudo-alpine vegetation and rocky outcroppings. This view shows the Ictecifene summit near the forested home range of T1 troop (photo by A. Gautier-Hion).

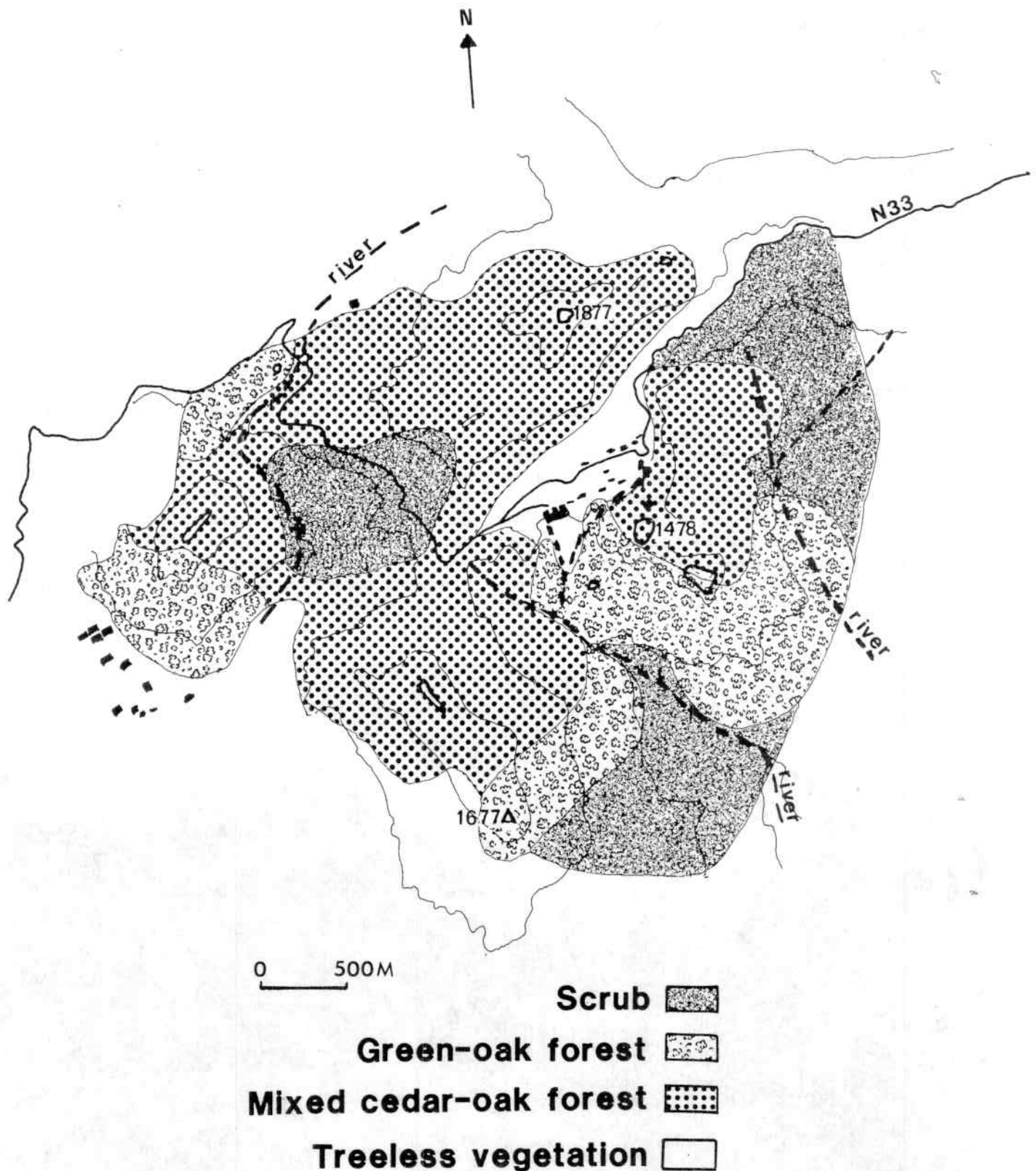


Fig. 20. The different vegetation types of Tikjda Forest in Djurdjura National Park (figure by authors).

infants were born to 33 females, an increased reproductive rate of 84.85%.

The survival rate of infants up to six months is high, reaching almost 90% (5 deaths in 41 births).

Troop composition shows a variable but balanced overall adult sex-ratio. In 1985, the sex ratio was 28 adult males to 33 females. The animals' average age is equally variable. At the end of 1985, there was a 75% ratio of adult/immature animals.

Inter-troop transfers vary according to the year and the troop. From February 1983 to October 1984, T1 neither lost nor gained a single

animal. However, from October 1984 to the end of the study period, three individuals emigrated and three immigrated from this troop. During 1985, T4 lost three monkeys. T3 appeared to be particularly unstable, with 9 animals joining and 12 abandoning it within 18 months.

A total of 31 migrations have been observed; 63% of these relating to adult or sub-adult males and 37% to adult or sub-adult females. It cannot be excluded, however, that some of these animals might have been taken by predators or died of natural causes. No attacks by predators were observed, in spite of the presence of a large number of jackals. Only two aged individuals, in obviously bad physical condition, appear

to have died naturally.

Differences in the duration and quantity of observations obtained for each troop make it difficult to compare with exactness the areas each troop used. However, it appears that the significance of the differences observed cannot be explained simply in terms of differences in observation frequency.

The area exploited varies from about 1.1 km² for T3 and T4, to 2.96 km² for T1. It should be noted, however, that the area exploited by the latter troop remained practically unchanged from 1983-1985, inspite of persistent and important increases in monkey numbers.

Overlap between neighboring home ranges is very variable. For T1 there is an overlap percentage of 11%, and this between two troops which exploit the forest milieu only partially. In contrast, the home ranges of troops T3 and T4 are largely overlapping; the home range of T3 is also overlapped by two other troops. This overlap is significant in that it explains the large number of observed inter-troop contacts as well as the importance of exchanges among individuals.

A total of 8 troops of Barbary macaques occupy the 10 km² of forest. Two of these (T2 and especially T8) live in the forest only part of the time. T8 visits the forest only very occasionally, and instead frequents neighboring rocky outcrops. The total number of individuals present in the three troops followed was 140 monkeys at the end of 1985, and at least 80 individuals can be estimated for two neighboring troops. It is not unreasonable, therefore, to assume that the total number of macaques in Tikjda averages 300 individuals (between 285-350), with an average density of 30 animals per km².

Tikjda Forest supports a macaque population of significant size, whose troop size and compositions are comparable to those observed in Moroccan cedar forests (Deag, 1984; Fa, *et al.*, 1984). This population is larger than was previously estimated following a rapid census (Fa, *et al.*, 1984).

Table 11. Demographic Parameters of the Three Troops Studied

Demographic parameters	1983			1984			1985		
	Jan.	Jul.	Aug. Dec.	Jan.	Jul.	Aug. Dec.	Jan.	Jul.	Aug. Dec.
Troop size	T1	37	45	45	47	46	60	60	
	T3	-	-	31	33	37	40	36	
	T4	-	-	-	-	39	46	44	
Growth rate, %	T1	-	-	21.5	-	2.2	-	30.4	
	T3	-	-	-	-	19	-	-2.7	
	T4	-	-	-	-	-	-	12.8	
Birth rate, %	T1	-	80	-	14.3	-	77.8	-	
	T3	-	-	-	22.2	-	85.7	-	
	T4	-	-	-	-	-	100	-	
Infant survival %	T1	-	-	100	-	50	-	85.7	
	T3	-	-	-	-	100	-	100	
	T4	-	-	-	-	-	-	100	
Adult sex-ratio %	T1	0.78	0.8	0.8	0.64	0.57	0.55	0.66	
	T3	-	-	-	1.0	1.5	1.0	1.16	
	T4	-	-	-	-	1.25	1.25	0.63	
Age ratio %	T1	0.76	0.66	0.66	0.95	0.91	0.87	1.0	
	T3	-	-	-	0.54	0.68	0.53	0.68	
	T4	-	-	-	-	0.86	0.90	0.63	
Nb. of emigrants	T1	0	0	0	0	3+1*	0	0	
	T3	-	-	-	-	3+1*	3	5	
	T4	-	-	-	-	-	1	2	
Nb. of immigrants	T1	0	0	1	0	3	0	0	
	T3	-	-	-	-	8	0	1	
	T4	-	-	-	-	-	0	0	

Key

birth rate: number of births / number of adult females

infant survival: % of infants surviving at 6 months

sex-ratio: adult males / adult females

age-ratio: all adults / all immatures

* death

migration events are given for periods of six months

The population appears to be in good health and to be increasing slightly. In spite of annual fluctuations, birth rates are relatively high and infant mortality particularly low. Natural mortality seems to be the result of old age. In the central zone of the forest, however, the environment seems to have reached its limited supportive capacity. Monkey troops here have restricted and largely overlapping home ranges. The numerous migrations of individuals observed in T3 seem to indicate that the troop can not continue to expand. Indeed everything points to competition for occupation of the forest's central zones.

Differences in population densities between this central zone and those on the periphery of the forest, seem to confirm that cedar/oak forests constitute the species' optimal habitat, and rocky outcrops only a refuge (Ménard, *et al.*, 1985). Density pressure causes peripheral troops to be progressively pushed towards these refuge zones which, as observations show, are restrictive habitats for the monkeys, because of the low availability of food and the strong competition with flocks of domestic sheep and goats. Here macaque troops are unstable and low in numbers, and density per square kilometer is particularly low (Ménard, *et al.*, 1984).

Genetic diversity is ensured by the numerous inter-troop exchanges. In this respect, the troops inhabiting denuded rocky outcrops play an important role in maintaining gene flow between populations that live in forest islands.

To sum up, protection of the Tikjda Forest appears to be effective in ensuring macaque survival. Nevertheless, our observations show that because of its limitations in size, the forest is close to its carrying capacity and the monkey population cannot be expected to continue to grow.

Furthermore, in order to maintain this small population, all tree felling which affects the forested areas must continue to be rigorously prohibited. Grazing should also be immediately restrained before the undergrowth is further reduced and regeneration of the forest inhibited. Moreover in consideration for the importance that rocky outcrops have for the population as a whole, flocks of domestic stock should be urgently reduced, particularly goats which inhibit regrowth of vegetation at the shrub level.

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Status of the Lowland Gorilla and other Wildlife in the Dzanga-Sangha Region of Southwestern Central African Republic

The density and distribution of the lowland gorilla (*Gorilla g. gorilla*, Savage & Wyman), the forest elephant (*Loxodonta africana cyclotis*) and associated fauna in the dense forest of the Haute Sanga Prefecture of southwestern Central African Republic (CAR) were studied from November, 1984 through May, 1985. The goal of the study was to determine potential areas for the conservation of these species and their habitat, and to gather ecological information on the lowland gorilla. This work was supported by the WWF-U.S., the New York Zoological Society and the Anders Cleasens Fund. The data presented here are condensed from the final project report (Carroll, 1986).

The dense forests of CAR represent the northern extension of the great Congo Basin. Approximately 3,500,000 ha of dense forest cover southern CAR; however, 48% are being exploited by forestry societies. Prior to this study, no reserve existed in CAR to protect this dense forest ecosystem. The study confirmed that this southern region contains outstanding examples of the range of dense forest habitats and some of CAR's last important strongholds for the lowland gorilla, forest elephant, bongo (*Boocercus euryceros*), dwarf forest buffalo (*Syncerus caffer nanus*), chimpanzee (*Pan troglodytes*), and many other dense forest species. The flora and fauna of this region represent a richness of great natural, scientific, economic, aesthetic and cultural value. This is currently severely threatened by logging and an encroaching human population, with subsequent heavy illegal poaching for meat and ivory. From the results of this study, the Dzanga-Sangha Dense Forest Reserve was proposed to the CAR government and completely accepted. This reserve of approximately 3,000 km² (Fig. 21), will compliment CAR's existing system of savanna parks and reserves, and demonstrates the CAR government's efforts to conserve significant representative segments of all its natural environments. The plans include a wildlife protection program, tourism development and efforts to ensure the cultural integrity of the BaBinga (Aka) Pygmies of the region. The reserve will be managed in an integrated manner allowing limited traditional hunting and logging in certain areas, as well as regions of total preservation of natural forest ecosystems.

Previously it was thought that the eastern distributional limit of the western lowland gorilla was the west bank of the Sangha River in the vicinity of Nola (Gartlan, in Dixon, 1981). During this study, populations of gorillas were observed east of the Sangha to the Congo border and beyond. This represents a significant range extension for this

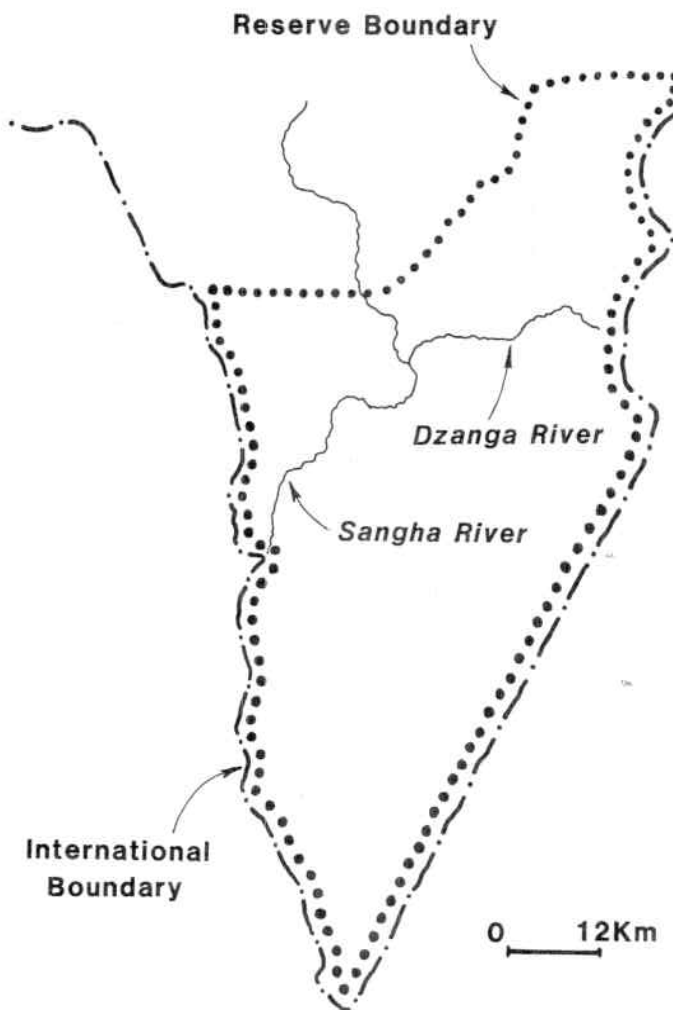
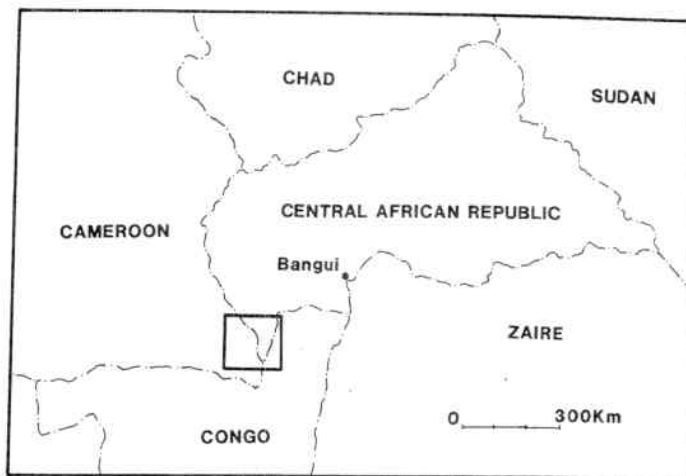


Fig. 21. Map of the Dzanga-Sangha region of southwestern Central African Republic, showing the author's study area (map by S. D. Nash from the author's original).

subspecies. There is no reason to believe that they do not extend through the Congolese forests at least to the Ubangui River.

The overall study area consisted of approximately 6,000 km², with this phase of the work concentrating on an area of 3,300 km² mostly on the east bank of the Sangha River to the Congo border.

This study area was chosen for five reasons.

1. Confirmation of gorilla populations in this area would substantiate my 1982 preliminary reports (conducted mostly by interview), and would represent a range extension for this subspecies of gorilla.

2. The region had been proposed by Spinage (1981) as a bongo sanctuary, but he had done little fieldwork to substantiate its classification. The CAR High Commissioner of Tourism, Waters, Forests, Hunting and Fishing withheld the classification of the region pending an in-depth field study.
3. A forestry operation had been established in the area undertaking selective logging. Logging alters the structure of the forest and logging roads open remote areas of interior forests to poachers, making conservation action a priority.
4. An array of logged and unlogged dense forest habitats exist in the area making possible a comparison of wildlife densities and ecology in these habitats. From this information, a management plan concerning logging impacts could be drawn.
5. The tri-country region holds great potential for international conservation cooperation between CAR, Cameroun, and the Congo.

The method for estimating gorilla density was based on nest counts from line transects from which the population density of weaned (nest building) individuals was derived. For a complete description of this method see Tutin and Fernandez (1985), and Ghiglieri (1979). Twelve habitats were identified and related to four logging status types (Table 13). A total of 1,420 gorilla nests and 100 chimpanzee nests were recorded in 783 km of transects in 7,100 km² sample blocks. Relative densities in the various habitat/logging status combinations were estimated and the mean gorilla density ranged between .89 and 1.45 gorillas/km². These figures are high in comparison to other areas in Africa, possibly due to large areas of regrowth of herbaceous vegetation in logged areas, especially *Aframomum sulcatum*. Gorillas nested primarily in thickets of this species, however 33 nests were observed along the savanna/forest edge, 18 of which had grass as a major construction material. Six of these nests were actually in the savanna itself, up to 10 m from the forest edge, and constructed solely of grass. Gorillas favored secondary forest habitats, but they used all forest habitats for feeding and/or nesting. Light gaps, herbaceous inundated forest, and depleted forest habitats exhibited high relative densities of gorillas.

The list of gorilla food items consists of 33 species of plants and three types of insect foods. Their primary food consisted of *Aframomum sulcatum* pith which comprised 29% of all gorilla food observations. Of the 33 plant food items, 25 (or 75.8%) were observed in the secondary, depleted and inundated forest habitats. The abundant herbaceous material in these habitats, especially *Aframomum sulcatum*, support the highest nesting densities and largest group sizes.

In contrast, only 13 plant food items were used by gorillas in the dense forest, *Gilbertiodendron dewevrei*, and wooded riparian habitats. In these habitats the gorillas depended on the islands of herbaceous vegetation in the light gaps. However, in habitats devoid of herbaceous materials,



Fig. 22. The author in a stand of *Aframomum sulcatum*, gorilla preferred food (photo by R. Carroll).

forest termites, *Cubitermes* sp., were often used as food, and accounted for 23.3% of all food item observations. Gorillas also scraped the forest floor in search of insect larva for food. All 13 observations of this activity were in the *G. dewevrei* habitat and account for 2.3% of all food item recordings. In the dense forest and *G. dewevrei* habitats, insects accounted for 84.2% of gorilla food observations.

Termites were also a major food item in the interior savanna habitat. In 8 km of transects in this habitat, 96 termite mounds broken by gorillas were observed, with associated nearby nests of grass, tracks, and scats. These savanna termites accounted for 17% of the total gorilla food items observed.



Fig. 23. Forest of *Gilbertiodendron dewevrei* forming pure stands with little understory (photo by R. Carroll).

In all habitats, 241 of the 566 gorilla food recordings were of insects. This accounts for 42.6% of all foods used by gorillas in the study area. Table 14 indicates the estimated gorilla density for each habitat type, the mean group size, principal foods, and the percent composition of each food item in each habitat and in the total observed gorilla food sample.

Tutin and Fernandez (1983), surveying gorillas in Gabon, found fragments of the non-reproductive casts of *Cubitermes* in 30.5% of gorilla fecal samples. Termite remains were found in fecal samples in 9 of the 14 months of their survey. The relatively high proportion of feces containing termite remains and the fact that termites were consumed in the majority of months indicate that they formed a regular part of the gorilla's diet in the Gabon study area (Tutin and Fernandez, 1983).

Chimpanzee densities in the study area ranged from .01-.13/km². The highest relative densities of chimpanzees in this study were found in forests of *G. dewevrei* and recently logged depleted forests. All the densities calculated for chimpanzees are low in comparison to those of similar habitats in other areas of Africa. The small sample size and limited ecological information on this species prohibit speculation on the factors contributing to its distribution in the study area.

Table 12. Habitat Associations of Primate Group Sightings

Species / Habitat	1	3	5	6	8	9	10	11	#	%
	Obs.Total									
<i>Cercocebus galeritus</i> ...	3	...	2	...	...	...	...	...	5	6.0
<i>C. albigena</i>	9	...	...	1	2	...	1	...	13	15.7
<i>Papio anubis</i> .....	...	...	...	...	...	1	...	...	1	0.12
<i>Cercopithecus neglectus</i> ...	...	...	...	...	2	...	...	1	3	3.6
<i>C. nictitans</i>	17	...	2	1	7	1	3	...	31	37.0
<i>C. ascanius</i>	11	...	1	...	4	...	1	...	17	20.5
<i>C. pogonias</i>	7	...	...	...	1	...	...	...	8	9.6
<i>Colobus guereza</i>	1	1	...	...	...	...	1	...	3	3.6
Unknown .....	...	...	2	...	...	...	...	...	2	2.4
Total	47	1	7	2	16	2	6	1	83	



Fig. 24. Gorilla nest of *Aframomum sulcatum* (photo by R. Carroll).

The majority of the primate species, 16 out of 20, listed by Mittermeier and Oates (1985) for CAR are found in this dense forest zone. Table shows the distribution of primate group sightings in the various habitat types of the study area.

Of the 83 groups of monkeys observed, 31 (or 37%) were greater white-nosed monkeys (*Cercopithecus nictitans*). Black-cheeked white-nosed monkeys (*C. ascanius*) were observed 17 times comprising 20.5% of the sightings. The next most frequently observed species was the grey-cheeked mangabey (*Cercocebus albigena*), of which 13 groups were observed or 15.7% of the observations.

Forty-seven observations, or 56.6%, of all monkey groups observed were in the dense forest habitat. The majority of all individual species except DeBrazza's monkey (*Cercopithecus neglectus*), olive baboon (*Papio anubis*), and the black and white colobus (*Colobus guereza*) were observed in the dense forest habitat. Sixteen groups of monkeys representing 19.3% of all sightings were in depleted forests. *Papio anubis* was recorded from the large interior savannas of the far north of the study area in the Manasau sample block.

Mixed groups of monkeys were recorded on six occasions. *Cercopithecus nictitans* and *C. ascanius* were seen in association on 5 occasions. *C. ascanius* was associated with *Cercocebus albigena* once as was *C. nictitans*. Crowned guenon (*Cercopithecus pogonias*) were associated with *Cercocebus albigena* twice and with *C. nictitans* once.

Elephants play an important role in shaping the dense forest habitats. In areas of high elephant density, their passage creates a vast network of open trails throughout the forest. In their foraging and feeding, many large trees are killed and knocked down creating a secondary forest

Habitats	Logging Status
1. dense forest	1. unlogged
2. <i>Gilbertiodendron dewevrei</i>	2. old logged :exploited 1972-77
3. <i>Raphia</i> marsh	3. recently logged : 1978-83
4. herbaceous marshy clearing	4. currently logged : 1984
5. secondary forest	
6. secondary forest in light gaps	
7. secondary forest along logging roads	
8. depleted forests	
9. savanna/forest edge	
10. wooded riparian forests	
11. dense inundated forests	
12. native cultivation	

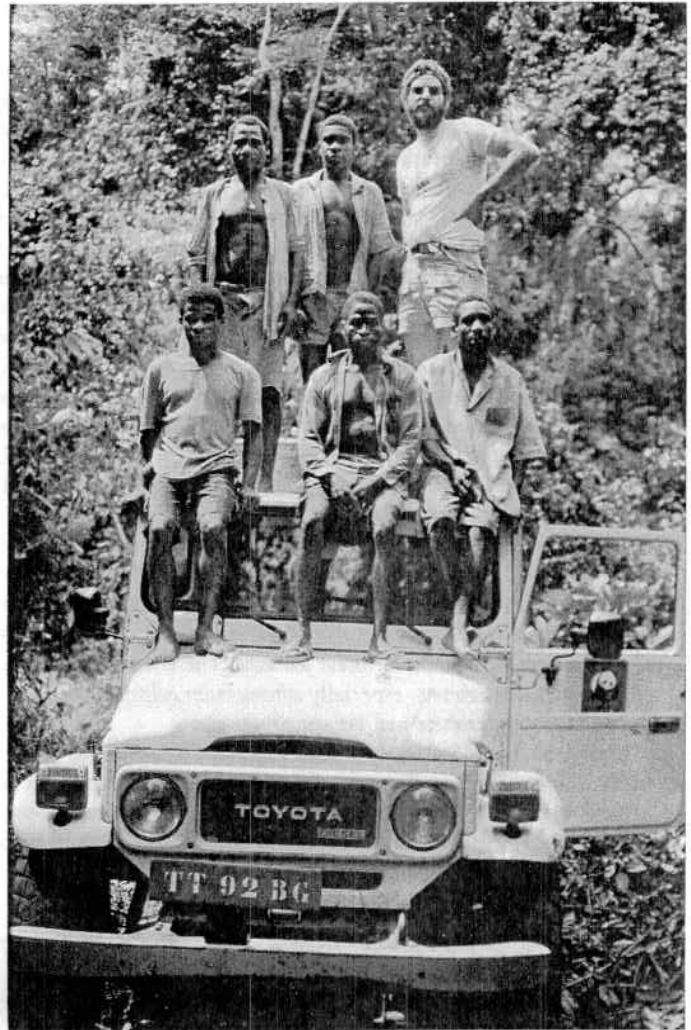


Fig. 25. The author and BaBinga Pygmy guides (photo by R. Carroll).

aspect. In their search for minerals, forage and water, they maintain, enlargen and perhaps create many of the herbaceous marshy clearings in the study area. Dzanga, one of the principal clearings in the study area, hosts a large concentration of elephants and is known to the Pygmies as "the village of elephants."

The highest densities of elephants in the study area were in the region of these marshy clearings. The mean elephant density for the entire study area, determined by dropping counts (Wing and Buss, 1970; Short, 1983; Jachman and Bell, 1979), ranged between .016-2.63, with an overall mean of .86 elephants/km².

These marshy clearings are also important to bongo, dwarf forest buffalo, sitatunga and other illusive dense forest wildlife which come for

Table 14. Gorilla Density, Group Size, and Principal Foods in Each Habitat in the Study Area

Habitat	Gorilla density	Gorilla nest gp.	Principal gorilla food items	Part eaten	% Total sample
Dense forest	0.27	5.2	<i>Cubitermes</i> sp. (termites)		9
<i>Gilbertiodendron dewevrei</i>	0.23	4	<i>Orthopichonia</i> sp.	pith, bark	3
			<i>Cubitermes</i> sp.		8.7
			<i>Palisota hirsuta</i>	pith	1.2
			Insect larva		2.3
<i>Raphia</i> marsh	0.98	1	<i>Raphia</i> sp.	rachis	1.8
Herbaceous marshy clearings	0	0	<i>Rynchospora corymbosa</i>	lower stem	3.5
Light gaps (in unlogged forest)	5.6	3.8	<i>Aframomum sulcatum</i>	pith	4.6
			<i>Palisota hirsuta</i>	pith	0.8
			<i>Costus afer</i> ; <i>C. lucanusianus</i>	pith	0.9
Light gaps (forest logged 1972-1978)	0.32	3	<i>A. sulcatum</i>	pith	0.35
Light gaps (forest logged 1978-1983)	0.59	10.7	<i>Orthopichonia</i> sp.	pith, bark	0.35
Secondary forest — logging road (forest logged 1972-1978)	4.18	6	<i>A. sulcatum</i>	pith	1.2
			<i>P. hirsuta</i>		2.3
Secondary forest — logging road (forest logged 1978-1983)	10.96	6.1	<i>A. sulcatum</i>	pith	0.9
			<i>A. sulcatum</i>	pith	13
			<i>Cubitermes</i>		1.6
			<i>Orthopichonia</i> sp.	pith, bark	0.9
Depleted forest (logged 1972-1977)	0.08	1.7	Unidentified species	bark	3.4
			<i>A. sulcatum</i>	pith	0.9
Depleted forest (logged 1979-1983)	2.08	3.7	<i>Cubitermes</i> sp.		1.8
			<i>A. sulcatum</i>	pith	3.7
			<i>Cubitermes</i> sp.		2.12
			<i>Orthopichonia</i> sp.	pith, bark	0.5
Interior savanna/forest edge	4.49	6.6	Savanna termites		17
Wooded riparian (logged 1972-1977)	0.27	2			
Wooded riparian (logged 1978-1983)	0.19	2			
Inundated forest	3.74	5.5	<i>A. sulcatum</i>	pith	2.7
			<i>Laccosperma laeva</i>	stem	0.35

food, water, and minerals. With careful management these marshy clearings offer great tourist potential. The elephant trails are major thoroughfares for the BaBinga (Aka) Pygmies who hunt and gather throughout the forest.

The results of this survey reveal the great wildlife conservation and touristic potential of this dense forest region of southwestern CAR. The area holds substantial gorilla populations and likely the last major population of elephants in CAR. It has been shown that carefully managed, limited, selective logging, which recreates a mosaic of herbaceous secondary growth, can be beneficial to gorillas if subsequent poaching can be controlled. The BaBinga Pygmies have demonstrated their willingness to participate in a plan to ensure the future of their forest.

Classification of this important area as the Dzanga-Sangha Dense Forest Reserve awaits only the funding to enact a protection program. The CAR government has recently closed the hunting of elephants and the collection of ivory, and gorillas and bongo are protected species in CAR, but the government lacks the means to enforce these laws. Urgent action is needed as professional poachers have discovered this area and the fluid borders make international trafficking of wildlife products relatively easy.

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The Ituri Forest of Zaire: Primate Diversity and Prospects for Conservation

Thirteen species of diurnal anthropoid primates occur in the Ituri Forest of northeastern Zaire, the richest assemblage recorded from any forest in Africa. Despite the importance of this forest, the ecology and status of its primates remain little known. In this paper we will present preliminary information on the distribution and relative abundance of all species, provide initial field observations on the little known *Cercopithecus hamlyni*, and discuss current threats to primates and prospects for their conservation.

Observations on primates were made in three sections of the Ituri Forest: south, central, and north (Fig. 26). Between 1973-1975, observations were made in the southern Ituri Forest on primate group size, composition and habitat associations, in conjunction with a study of human hunting (Hart, 1978). In the central Ituri Forest incidental observations on primates were made between 1981-1983, in the forests surrounding the town of Epulu. These were followed in 1986, by systematic counts along transects in representative habitats. Similar transects were censused in the northern Ituri Forest near the town of Malembi over a seven month period between 1985-1986 (S. Thomas, unpublished data).

The Ituri Forest contains a number of distinct primary forest types. Most noteworthy is the *mbau* forest in which a single species, *Gilbertiodendron dewevrei* comprises up to 90% of the canopy (Hart, 1985). Stands of *G. dewevrei* cover hundreds of square kilometers, particularly in the southern and western parts of the forest. Mixed forests in which

one to two species of caesalpiniaceous trees, *Brachystegia laurentii* and *Cynometra alexandri*, may comprise up to 35% of the canopy, predominate in the northern and eastern forest. Smaller areas of secondary forest of varying age, and swamp and riverine forest occur on all three study areas. Steep hill slopes on the southern and northern study areas are covered with a distinctive, more broken forest.

Twelve to thirteen species of anthropoid primates were recorded present in all three study areas (Table 15). These included three species of *Colobus*, six *Cercopithecus*, two mangabeys *Cercocebus*, the olive baboon *Papio anubis*, and chimpanzee *Pan troglodytes*. Vervets, *Cercopithecus aethiops*, may also occur at the savanna/forest ecotone to the north and east.

No other African forest studied to date contains as rich an assemblage of *Colobus* and *Cercopithecus*. Total species number in the Ituri Forest is considerably greater than that recorded from the adjacent forest islands of Uganda (Struhsaker, 1981). It is greater than that recorded from the forests of West Africa (Gartlan and Struhsaker, 1972; Gautier-Hion and Gautier, 1979) and comparable to the richest recorded New World site (Terborgh, 1983).

Relative abundance of the different species was similar in all three study areas. Differences in relative abundance between areas were mainly noted for species which were uncommon or rare at all sites. *Cercopithecus neglectus* was not recorded from the southern and northern study areas, probably due to lack of suitable riverine habitat. *Cercocebus galeritus* was notably rare in the southern Ituri Forest. Only one small group was seen in over two and a half years. In the northern and central study areas this species was recorded in infrequent but large groups (50-100 individuals).

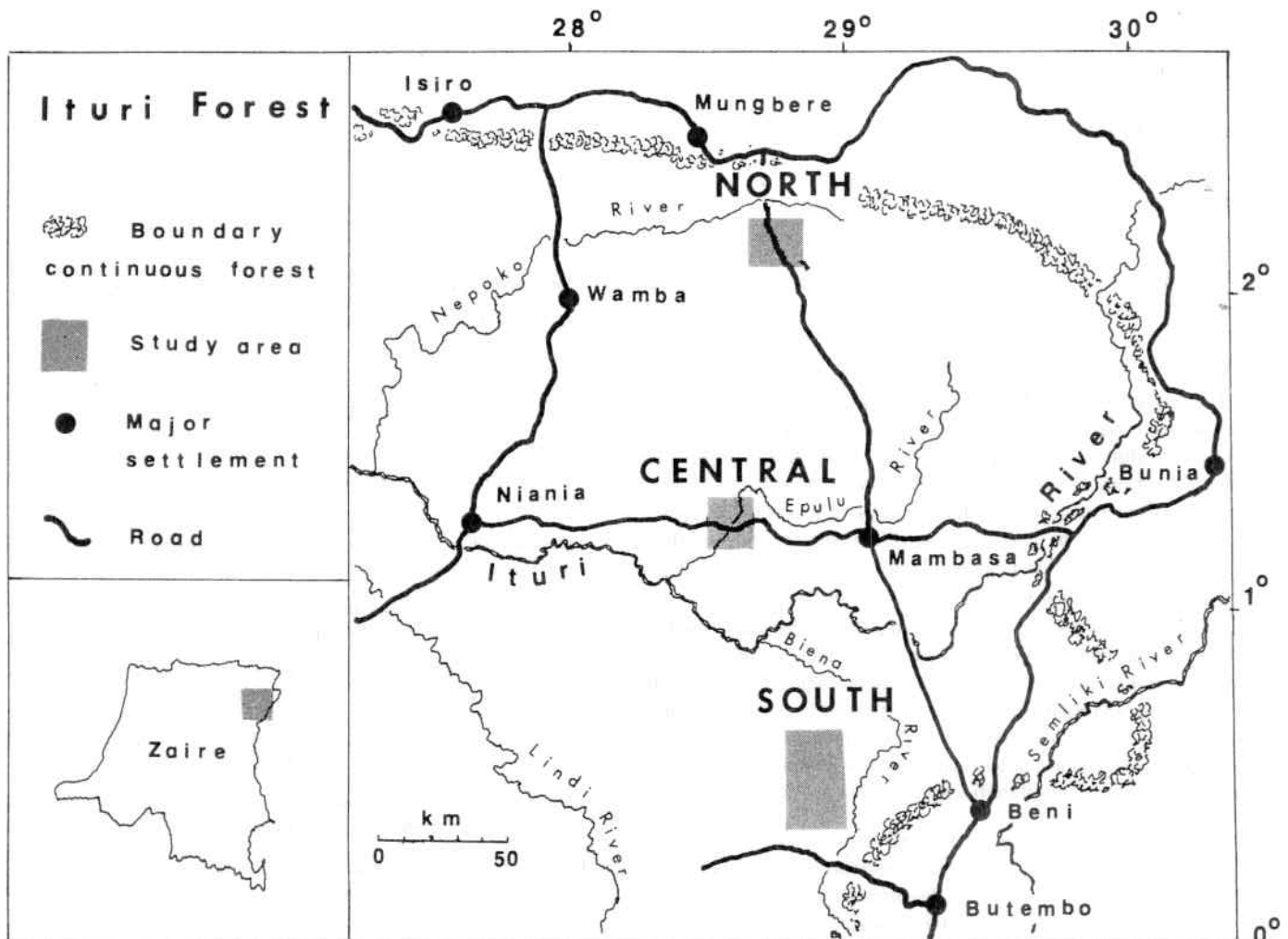


Fig. 26. The Ituri Forest of Zaire showing areas surveyed for primates (map provided by authors).

It is difficult to attribute the diversity of primates in the Ituri Forest directly to a diversity of habitat types. Only two species exhibited marked habitat associations. *Cercopithecus neglectus* was confined to forest fringing larger water courses (Epulu, Ituri, Nepoko, Biema and Nduye Rivers). *Papio anubis* was most commonly encountered in, though not restricted to, broken forests, edge environments and secondary forest. Most species co-occurred in both mixed and *mbau* primary forests. Mixed groups of six to seven species were occasionally recorded. However, overall primate densities in species-dominant forest may be lower than in mixed forest (S. Thomas, unpublished data).

Table 15. Relative Abundance of Anthropoid Primates in Three Study Areas, Ituri Forest, Zaire

Species*	Relative Abundance		
	Southern	Central	Northern
<i>Colobus badius</i>	C	C	C
<i>Colobus guereza</i>	UC	UC	UC
<i>Colobus angolensis</i>	R	UC	UC
<i>Cercopithecus ascanius</i>	C	C	C
<i>Cercopithecus mitis</i>	C	C	C
<i>Cercopithecus mitis</i>	C	C	C
<i>Cercopithecus lhoesti</i>	R	UC	R
<i>Cercopithecus pogonius (mona) denti</i>	C	C	UC
<i>Cercopithecus neglectus</i>	NR	UC	NR
<i>Cercopithecus hamlyni</i>	R	R	R
<i>Cercocebus albigena</i>	C	C	C
<i>Cercocebus galeritus</i>	R	UC	UC
<i>Papio anubis</i>	C	C	C
<i>Pan troglodytes</i>	UC	UC	R

Key

* Names follow Struhsaker (1981) and for species not listed here, Dorst and Dandelot (1972).

C common, groups seen frequently

UC uncommon, group infrequently seen

R rare, small groups infrequently seen

NR not recorded

An important element of the primate diversity in the Ituri Forest is the preponderance of terrestrial species. Five of the thirteen species were often encountered on the ground, including *Cercopithecus hamlyni*, *C. lhoesti*, *Cercocebus galeritus*, *Pan* and *Papio*. The diversity of terrestrial primates is especially interesting given the potential competition with seven species of small to medium frugivorous ungulates which also occur in this forest (Hart, 1985).

The owl-faced monkey, *Cercopithecus hamlyni*, endemic to the forests of eastern Zaire and neighboring Rwanda, is among the least known of the guenons. The species has a wider range than previously supposed, occurring throughout the Ituri Forest and irregularly westward through lowland forest perhaps as far as Kisangani on the Zaire River. Larger rivers apparently do not represent barriers to this species' range as was previously hypothesized (Rham, 1970).

In the southern Ituri Forest, *C. hamlyni* was seen primarily in hill forest areas. In the central and northern study areas, it was recorded in lowland mixed and *mbau* forests. Some accounts (Haltenorth and Diller, 1980) describe the species as nocturnal. We have found it, however, active during the day. *C. hamlyni* is the most terrestrial of the Ituri guenons. Animals were invariably seen on the ground and even fled along the ground when pursued by hunters. *C. hamlyni* were generally seen in pairs or small groups of three to five. They were shy and generally silent, although they have a loud and distinctive, descending call. The only stomach examined contained primarily fungi. *C. hamlyni* were also seen beneath groups of arboreal primates where they may have been feeding on fallen fruits. The species is rare everywhere in the Ituri Forest, and has an irregular, patchy distribution. A study of this species, along with the other predominantly terrestrial guenon, *C. lhoesti*, is a priority.

There currently exists no formal protection for primates in the Ituri Forest. Primate populations are directly affected by deforestation and hunting. Current levels of deforestation are low over most of the Ituri Forest area. Large blocks of forest remain which are not immediately threatened by settlement or logging. Deforestation has taken place locally, however, especially in areas of colonization along roads. As the agricultural frontier extends into the Ituri Forest from neighboring settled areas, deforestation can be expected to increase. The forest remains vulnerable to logging by national and multinational companies as well.

The Ituri Forest was traditionally occupied by small, dispersed populations of hunter-gatherers and shifting cultivators. These people hunt primates in some areas today, and presumably have done so for some time. There is no indication that this hunting pressure has eliminated any species. The northern study area where primates are hunted by archers, contains the same array of species as the central and southern study areas where primates are not traditionally hunted.

Two recent trends of concern are the increasing use of shotguns, and the advent of intensive hunting for commercial markets. Shotguns are owned by businessmen and government administrators who hire local villagers as hunters. Primates are the major target, and where hunting pressure is intense, primates are no longer evident. Much of the current hunting is directed toward supplying urban markets as far away as Kisangani, where primates make up a substantial portion of the wild meat sold by vendors (Nlamba, 1980).

Despite these trends, prospects for primate conservation in the Ituri Forest are good if action is taken soon. Primates remain little disturbed over large areas of remote forest. An added impetus for conservation in the Ituri Forest is the presence of other significant mammals, particularly the endemic okapi (*Okapia johnstonia*). National and international initiatives promoting forest conservation for this species may be possible. In order to assure that any conservation effort includes adequate protection for the primate fauna, further research on primate ecology is urgently needed.

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Skins of Virungas Golden Monkey Confiscated in Raid by Rwandan Authorities

A number of skins of the very rare and poorly known golden monkey of the Virunga Volcanoes (*Cercopithecus mitis kandti*) were found among a other illegal trophies confiscated by Rwandan authorities in the town of Gisenyi near the Zaire border. The raid was conducted on February 22, 1986, by the Chief Warden of the Parc des Volcans, Canesius Shyirambere, and his rangers. Several curio shops were investigated simultaneously. Among the items confiscated were two serval cat skins, one leopard skin, and several large blankets made from otter, jackal, hyrax and golden monkey. This last blanket consisted of at least 30 primate skins according to Diana McMeekin of the African Wildlife Foundation (Fig. 27). In addition to these and many other loose skins, there were two large bags filled with carved ivory ornaments and jewelry.

Little is known of the status of the Virunga golden monkey, and a survey is urgently needed to determine how many remain in the Virungas. In any case, it is almost certain that 30 individuals represents a rather significant portion of the population of this rare animal.

The PSG would like to congratulate the Rwandan authorities and especially Mr. Shyirambere and his rangers for their outstanding efforts in controlling the trade.



Fig. 27. Blanket (arrowed) made up of as many as thirty skins of the very rare Virunga golden monkey (*Cercopithecus mitis kandti*) among other confiscated trophies (photo by D. McMeekin/African Wildlife Foundation).

Plans for the Future of the Karisoke Research Center

Dian Fossey's camp, the Karisoke Research Center (KRC), has continued to function since her tragic death in December, 1985. KRC staff participation in the anti-poaching work of the Mountain Gorilla Project (MGP) was not interrupted. Rwandan personnel of the MGP have been aiding KRC staff in monitoring the four well-habituated research groups of mountain gorillas on an almost daily basis. Wayne McGuire, a graduate

student at the University of Oklahoma, and Joseph Muayaneza, a graduate student at the Université National du Rwanda, have continued with research that was underway at the time of Dian's death. There has not been much research activity at KRC in recent years, however, despite the important role of research in the development and implementation of long-term conservation and park management policy. Since there is concern for this situation and more general concern for the future of KRC, a meeting was held in March at National Geographic headquarters in Washington, D.C., to discuss plans to reorganize the KRC and to build a structure for a secure future. In attendance were representatives from the Digit Fund, the L.S.B. Leakey Foundation, WWF-U.S., the African Wildlife Foundation, the National Zoo, the Baltimore Zoo, the Morris Animal Foundation, and the National Geographic Society, as well as several primatologists who have had direct or indirect KRC experience.

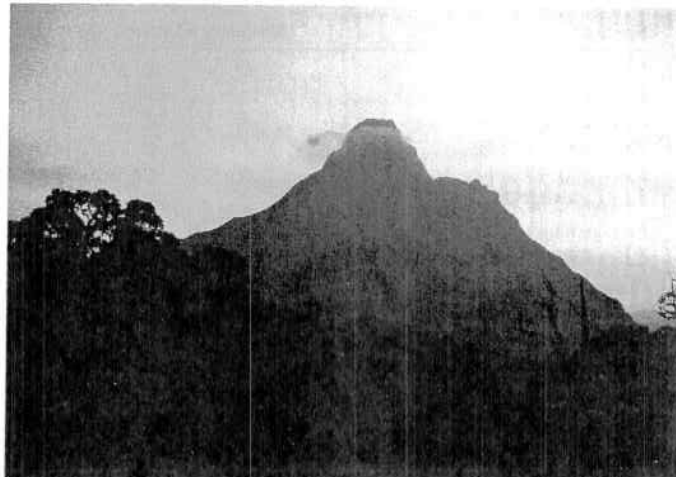


Fig. 28. One of the quiet volcanic cones of the Virungas, Mt. Mikeno (14,782 ft), as viewed from the meadow behind Karisoke (photo by R. A. Mittermeier).

All parties agreed that there is a very important role to be played by a research center in Rwanda's Parc National des Volcans, and all wish to see KRC continue. This would allow continued monitoring of a considerable part of the gorilla population and continued study of their behavior, ecology, and life histories. Additionally, the presence of researchers and field assistants helps to curb poaching, and expatriate researchers would contribute valuable foreign exchange to the government.

There was a strong consensus that the scope of research, until now focused almost exclusively on the mountain gorillas, must be expanded. This view is shared by the Rwandan Government, which has expressed its desire to see the KRC continue on this basis. There are still gaps in our basic knowledge of the region's ecology and many topics should be investigated not only because of their intrinsic biological interest, but also to provide data necessary for planning a conservation strategy. The Virungas ecosystem, part of a chain of relict Afro-montane forest islands, offers tremendous opportunities for conservation biologists, animal behaviorists, community ecologists, etc. Some of these opportunities are relevant to immediate park management concerns.

Among the most important research priorities are:

- work on basic community ecology (e.g., effects of altitudinal zonation and topography on plant communities);
- study of the ecology, behavior, and conservation status of the regions other large mammals. This includes the golden monkey (*Cercopithecus mitis kandti*, thought to be endemic), as well as black-fronted duiker, elephant, buffalo, bushbuck, etc.;
- study of the effects of the large herbivores on the composition and regeneration patterns of the vegetation;
- work on climatology and hydrology, especially with regard to the role of the natural vegetation cover as a barrier against soil erosion outside of the park and in regulating the region's water flow;
- study of the floristics and population dynamics of plant species.



Fig. 29. *Hagenia* woodland at Karisoke Field Station (photo by R. A. Mittermeier).

A consensus also emerged at the meeting that there is a need for greater Rwandan involvement in the research effort. The practice of having Rwandan students from the National University do short-term projects at the KRC, something that has been done occasionally in the past, will be institutionalized under the auspices of the Digit Fund, which will be responsible for the general operating expenses of the KRC. As a longer-term goal, the board of the Digit Fund is seeking to establish a fellowship program whereby Rwandan students will be able to get Ph.D. level training in biology at a U.S. university. Closer ties of KRC to the Rwandan Office of Parks and Tourism are also planned, and other possibilities for outreach to the general public will be explored.

In the past, the KRC served as a semi-autonomous base for anti-poaching efforts. Despite the extremely valuable contribution of KRC personnel, it is an unworkable situation to have two anti-poaching forces in the same park. In the future, the KRC anti-poaching force will work more directly under the MGP and Office of Parks and Tourism, which have jointly been responsible for most of the park policing effort.

One extremely important issue raised at the meeting was what is to be done when infant gorillas are confiscated, as unfortunately occasionally happens. There is a good possibility that juveniles could be successfully introduced into a research group that contains only males (this has been done once), but unweaned infants present a very different problem. There is no possibility of allowing any mountain gorillas to be exported to zoos. Contingency plans for in-country care of any such infants must be developed, and steps are being taken in this direction. It is hoped that zoos will play an important field role in this regard by supplying personnel experienced in nursery care of great apes.

Veterinary input into monitoring of the gorilla population and into interventions during life-threatening emergencies (*e.g.*, when a gorilla is caught in a poacher's snare) is also highly desirable. This need was addressed at the meeting and should soon be resolved.

On the whole, the Washington meeting was a good exercise in the kind of cooperation that must continue in Rwanda between the KRC, the MGP, the Rwandan Government and National University, and the conservation agencies involved. This cooperation now extends across the border into Zaire (where there is an ongoing WWF / Frankfurt Zoo sponsored gorilla conservation project), and should soon embrace the entire range of the mountain gorilla when the WWF-U.S. sponsored Bwindi Forest conservation project starts. The conservation work started by Dian Fossey has grown into a successful international effort, to which the Rwandan Government is thoroughly committed despite tremendous demographic pressure and socioeconomic difficulties. The conservation

challenges remain great, however, and the information and publicity generated by a research station at Karisoke would be very valuable in confronting these challenges.

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Sightings of Aye-eyes in the Eastern Rainforest of Madagascar

The nocturnal aye-aye (*Daubentonia madagascariensis*) is rarely seen on Madagascar. Most recorded sightings are on Nosy Mangabé where some animals were introduced in 1967, and in the eastern lowland forest around Maroantsetra (Constable *et al.*, 1985; Petter, 1977; A. Peyrieras, pers. comm.). Though the species might be more widely distributed than generally thought (Tattersall, 1982), the existence of the aye-aye at higher elevations is considered to be unusual (Petter, 1977).

During the course of a study on the ecology of nocturnal lemurs, aye-eyes were found several times in the Forêt de Analamazoatra, near Perinet (18° 56' S, 48° 24' E, altitude around 900m). Their presence was first noted by J. Pollock (pers. comm.) who was presented with a dead aye-aye in 1972, and by M. Nicoll (pers. comm.), who in the summer of 1985, found aye-aye gnaw marks on a *Eugenia* tree.

Between December, 1985 and February, 1986, we saw aye-eyes and signs of aye-eyes several times in an area of about 4 ha. Other animals were found in two areas some 2-3 km away. Despite intensive night work, no animals had been seen during a three month study in summer 1984, or from September to the beginning of December, 1985. It is not clear whether the aye-eyes are permanent residents or transients in Perinet, or whether they are more active and thus are found more easily or shift their home ranges during the warmer times of the year, December-January. In any case, the range of the aye-aye certainly includes forests at higher elevations. Also we found three animals at three different sites within a single night. These findings suggest that, though at low population densities, the aye-aye might have a wider range and may be more abundant than thought previously.

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Beza-Mahafaly Special Reserve Created in Madagascar

After years of hard work, PSG members Alison Richard of Yale University, Robert Sussman of Washington University, and Ravelojaona Gilbert, Rakotomanga Pothin and Andriamampianina Joseph of the University of Madagascar, saw their efforts bear fruit when the Beza-Mahafaly Reserve that they helped to create was incorporated into Madagascar's protected area network as a Special Reserve. This reserve project was first initiated in 1977, when Sussman and Richard approached WWF with the idea for Beza-Mahafaly, a research and training field site created with land donated by the local Mahafaly people who live in southwestern Madagascar. World Wildlife Fund agreed to provide support, and has funded this project for the past seven years. The reserve was established in 1978, and since then has hosted a number of field courses for Malagasy students from the University of Madagascar's School of Agronomy (EESSA), which is headed by project co-principal investigator, Ravelojaona Gilbert.

The inclusion of Beza-Mahafaly into the government protected area network was especially gratifying, since it showed that the Malagasy government has recognized the importance of this area for the future of conservation in this part of Madagascar and its role as a training site for students from all over the country.

The inauguration was marked by a special two day ceremony on Nov. 1 and 2, attended by some 300 people, including most of the Mahafaly villagers living in the area. Also present was the Minister of Waters and Forests (Eaux et Forêts, MPAEF) that is responsible for the reserve network in Madagascar, a number of provincial officials, and representatives from US AID (which is interested in the reserve as a model for the integration of conservation and development) and the World Bank.

The PSG would like to congratulate those who helped in the creation of this reserve for their outstanding efforts.



Fig. 30. The people who made the Beza-Mahafaly Reserve possible celebrate beside the plaque officially declaring the reserve. From left to right: Andriamampianina Joseph, Ravelojaona Gilbert, Alison Richard, Radotomanga Pothin, Robert Sussman, and Bealigno, head guard of the reserve.

The Lemurs of Zahamena Reserve

Zahamena, created in 1927 as Reserve Naturelle Integrale No. 3, is Madagascar's largest rainforest reserve. Within its limits are protected some 730 km² of undisturbed, mid-altitude (700 — 1,500 m) rainforest (Fig. 31). In August-September 1985, a student team from the University of London undertook a six week biological survey of the birds, rep-

tiles, amphibians, mammals and plants of this region. The reserve is a two day walk from the nearest reasonable road, and not surprisingly few biologists have visited it. Much of the forest remains unexplored because of the lack of paths. We were able to explore the central-south and northeast areas, where we established six camps (Fig. 33). The center of the reserve contains about 10 villages and 2,000 people living in the deforested valley of the enclave.

Soon after entering the reserve we were greeted by brown lemurs, *Lemur fulvus*, which proved to be common throughout the forest. These lemurs were frequently encountered moving in small groups of 3-6 animals high in the canopy. Also distributed throughout the reserve was the indri or babakoto, *Indri indri*. This large lemur's characteristic call was heard close to camps 1, 2, 4 and 5. The first bout of singing usually started near 10:00 am, and would generate a response from neighboring troops in the area. At camp 5, we were closely surrounded by 4 troops. However, our general impression was that densities of indri at Zahamena were lower than at Perinet (Reserve Speciale). The indri of Zahamena were also much more secretive. During the survey none of us actually saw an indri, partly because it was unsafe to follow the calls by straying far off the main (and only!) path. By contrast, in a single day at Perinet, I saw three troops of indri. The size of Zahamena would indicate that the population of indri may exceed 1,000 troops, based upon the territory size of 20-100 h given by Paulian (1981).

For all of us, the most exciting moment of the expedition was the discovery of a troop of diademed sifaka, *Propithecus diadema diadema*, close to camp 5. This beautiful sifaka, with its brilliant orange, black and white coat (Fig. 32), occurs only in the eastern rainforest, and at present is poorly known. Five distinct subspecies have been described, all of which depend on rainforest. Only one other troop was seen close to camp 2, indicating that sifaka occur in at least two well separated



Fig. 31. Location of the Zahamena Reserve in eastern Madagascar (map by S. D. Nash based on author's original).



Fig. 32. Diademed sifaka (*Propithecus diadema diadema*) in the Zahamena Reserve (photo by P. Thompson).

areas of the reserve. It is now thought that this species has become extinct in Perinet, since it has not been observed there for many years. Jolly, Albignac and Petter (1984) note that the diademed sifaka is hunted for food more than any other lemur.

As well as diurnal lemurs, the reserve also has its nocturnal species. The avahi, *Avahi laniger* (Fig. 34), was seen close to camp 6, as well as a species of *Lepilemur*. Because of a lack of batteries, night torching was restricted but it seems likely that *Microcebus*, *Hapalemur* and *Cheirogaleus* all occur within the protection of the reserve.

The forests of Zahamena have so far suffered little at the hands of man, although deforestation is continuing along the edges of the central enclave, and in a clearing in the northeast. Close to this clearing three lemur traps were found similar to those described by Constable *et al.* (1985). Zahamena, despite its size, is warded by only two foresters, and is vulnerable to both felling and fires at its boundaries. A two kilometer fire break was financed by the expedition to protect the southwest of the reserve, and we recommend that boundary trails be cut around the enclave to prevent accidental encroachment. Provided Zahamena is protected now, we can look forward to this large and undisturbed rainforest reserve providing a secure future for some of Madagascar's lemurs.

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ZAHAMENA Reserve Naturelle Integrale No.3

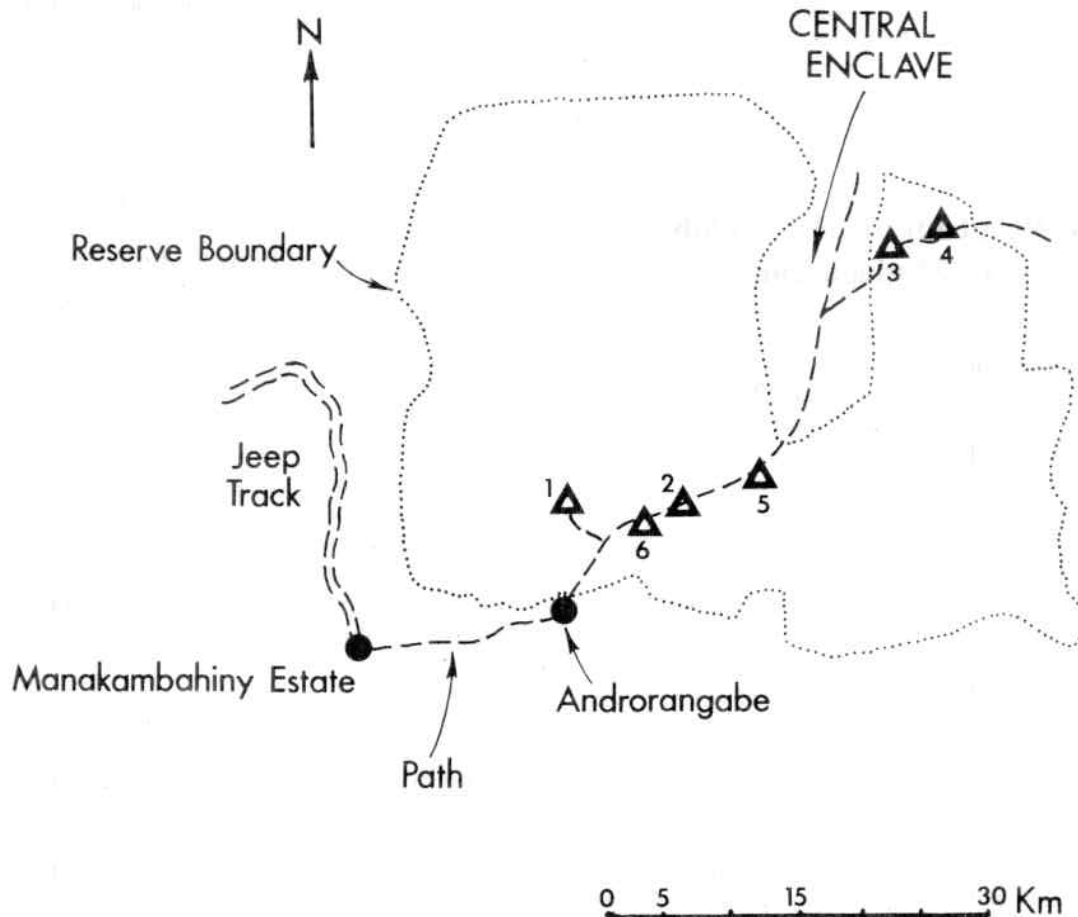


Fig. 33. Zahamena Reserve showing base camps (triangles) (map by S. D. Nash based on author's original).



Fig. 34. Two avahis, *Avahi laniger*, in the Zahamena Reserve (photo by C. Raxworthy).

Acknowledgements

The expedition was given tremendous support while in Madagascar from the Ministère de l'Enseignement Supérieur and the Direction des Eaux et Forêt, to whom we are very grateful. We also thank the International Advisory Group of Scientists who cleared and advised the project from its early beginnings. Finally special thanks to all the sponsors, without whose help the expedition would not have been possible.

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Conservation Program for the Andohahela Reserve, Madagascar

Andohahela, Reserve Naturelle Intégrale No. 11, is the second largest reserve and one of the largest protected areas in Madagascar (Andriampianana and Peyrieras, 1972). It has a total area of 76,020 ha, and is made up of three parcels. All three are located north of the national route, RN 13, from Fort Dauphin (Tolagnaro) to Ambovombe (Fig. 36).

The reserve was created June 11, 1939, and revised in 1966, to increase the area from an original 30,000 ha to its current size. At present the boundaries are in question because the markers in Parcel 1 were incorrectly placed making the area too large. There are many sections which do not have forest cover and these should be reviewed to decide if they should be removed from the reserve or if they function as a buffer zone. The original reason for creating the reserve was to protect a cross section of the dry forests of the Mandrare and Menanara River valleys, the humid forests of the east, and the transitional vegetation between these two forest types, including in particular, *Neodypsis decaryi*, an endangered palm (Randria, 1985).

From a faunal point of view, Reserve 11 is extremely interesting and diverse. There are at least 23 species of mammals not including rodents or bats, fourteen of which are primates (Table 16). The bird fauna easily exceeds 100 species, about half the total number of species which breed in Madagascar. Documentation on the amphibians and reptiles is minimal and the invertebrate life is still virtually unknown.

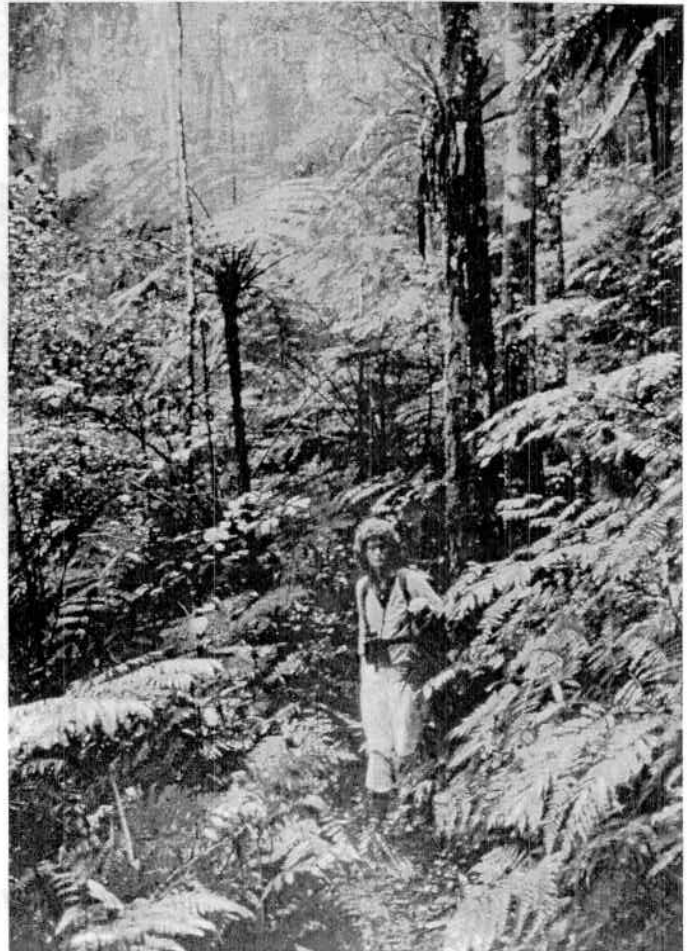


Fig. 35. Author S. O'Connor in the rainforest of Parcel 1 (photo provided by the authors).

The reserve is under the "situation juridique" of the Fivondrona (similar to a district council) of Fort Dauphin and Amboasary-Sud. The protection of the reserve is coordinated by the "Chef de Cantonnement Forestier et Poste RN 11", ZigZag Randria, who is located in Amboasary-Sud. There is one active "poste de surveillance" at Eminiminy (eastern side of Parcel 1) where a "chef de secteur", Edmond Manamboatsy, is stationed. A "poste" also exists at Imoty (western side of Parcel 1) but it is vacant and is presently being looked after by the Chef de Cantonnement Forestier.

Our report is based on several surveys to sections of all three parcels in August and October, 1985.

Parcel 1

Parcel 1 of Andohahela is located 35 km northwest of Fort Dauphin and 84 km northeast of Amboasary-Sud by road. Access to the reserve is difficult on both the road going north from RN 13 towards Ranomafana and the road going northeast from Amboasary to Esomony. Further access to the reserve is from four paths, three of which follow the boundaries and a fourth which cuts through the reserve from east to west. This inaccessibility has undoubtedly protected the reserve from heavy exploitation.

The vegetation of this parcel is evergreen, typical of submontane tropical rain forest (Fig. 35). The altitude of the reserve varies from about 100 m in the valleys to 1,956 m at the peak of Andohahela, which is likely to have a montane or high-altitude lichen forest (Guillaumet, 1981, 1984; Koechlin, 1972). There is a mean annual temperature of approximately 23 °C, and an average annual rainfall greater than 2,000 mm (Donque, 1972).

The forested areas of this parcel are largely intact. However, there are substantial areas within the boundaries of the reserve which for some

RESERVE No.11 - ANDOHAHELA

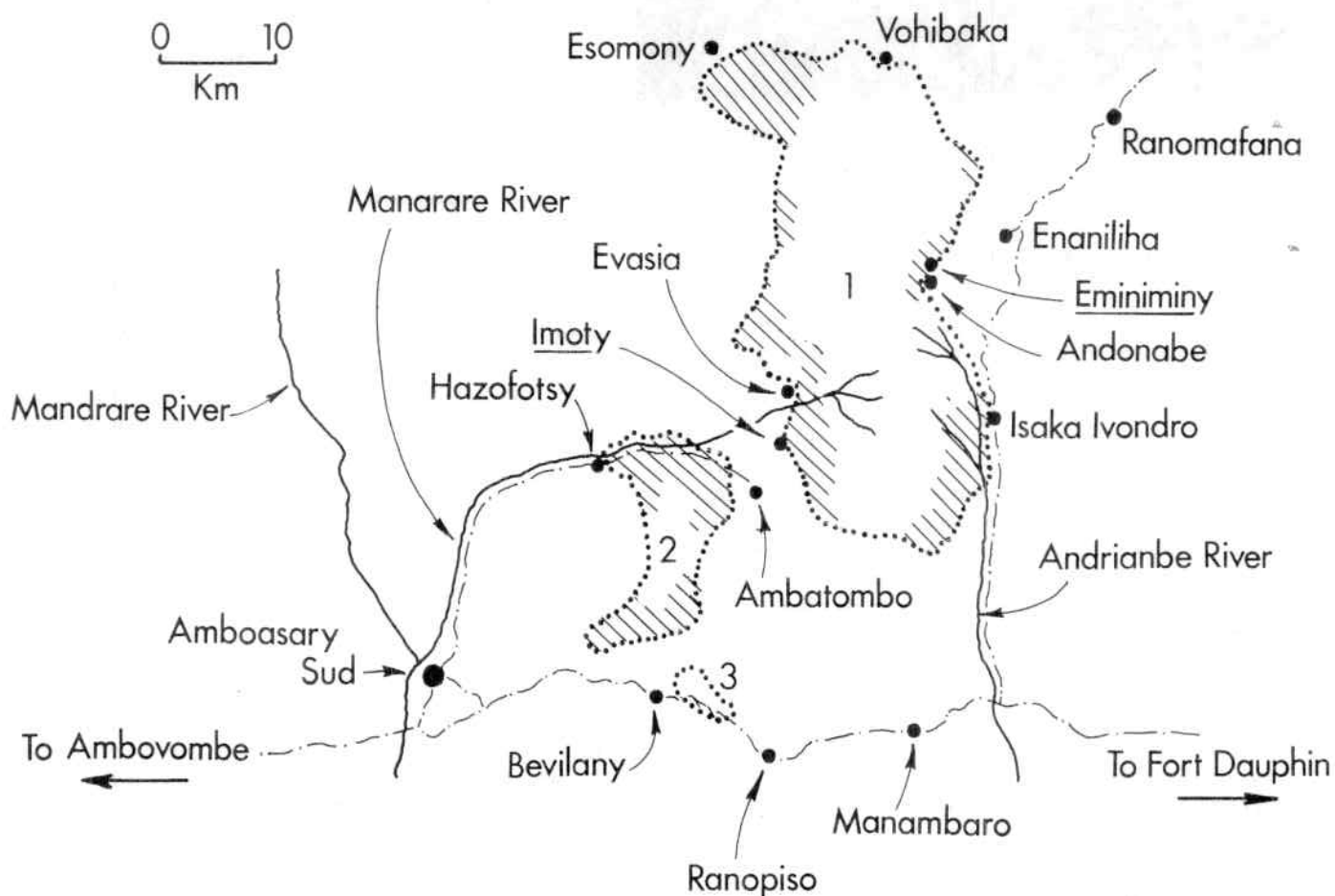
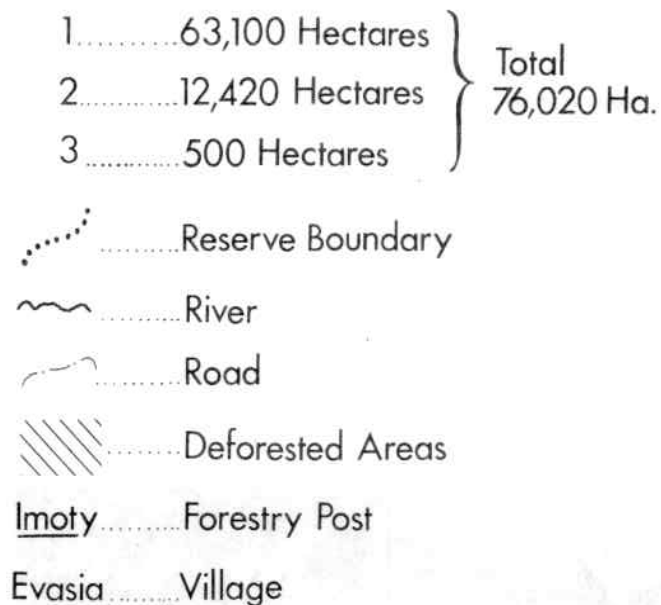
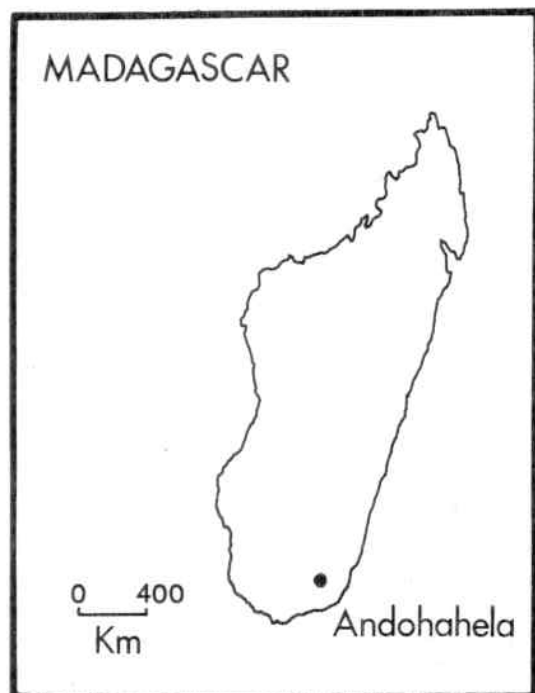


Fig. 36. The location and size of Reserve 11 and its three parcels (map by S. D. Nash from author's original and a map by Randrianjafy, 1957, Dept. des Eaux et Forêts, No. 57).

Table 16. The Primates of Reserve 11

Species	Malagasy name	English name	Occurance
<i>Lemur fulvus collaris</i>	varika	collared lemur	1C
<i>Lemur catta</i>	maki, hira	ring-tail lemur	1S, 2C, 3S
<i>Hapalemur griseus</i>	halo	grey gentle lemur	1C
<i>Lepilemur mustelinus mustelinus</i>	mahiabeala	sportive lemur	1CP
<i>Lepilemur mustelinus leucopus</i>	songiky	sportive lemur	2C, 3P
<i>Microcebus murinus</i>	pondiky, hataka	lesser mouse lemur	2C, 3P
<i>Microcebus rufus</i>	pondiky, tsidy	rufous mouse lemur	1C
<i>Cheirogaleus medius</i>	—	fat-tail dwarf lemur	2S, 3P
<i>Cheirogaleus major</i>	tsytsy	greater dwarf lemur	1S
<i>Phaner furcifer</i>	—	fork-marked lemur	2P
<i>Avahi laniger laniger</i>	fotsyfe	woolly lemur	1C
<i>Propithecus diadema holomelas</i>	sifaka mainty, simpona	black sifaka	1C
<i>Propithecus verreauxi verreauxi</i>	sifaka	Verreaux's sifaka	1S, 2C, 3P
<i>Daubentonia madagascariensis</i>	haihay, aiay	aye-aye	1S

Key:

1, 2, 3, refer to particular parcels (see Fig. 36)

C confirmed present — seen by the authors

S suspected present — seen by a forest guard or villager

P probably present — based on distribution maps and other sources of information: Albignac (1972, 1973, 1984), Eisenberg and Gould (1984), Heim de Balsac (1973), Nicoll (pers. comm.), Paulian (1981), Petter *et al.* (1977), Richard (pers. comm.), Tattersall (1982).

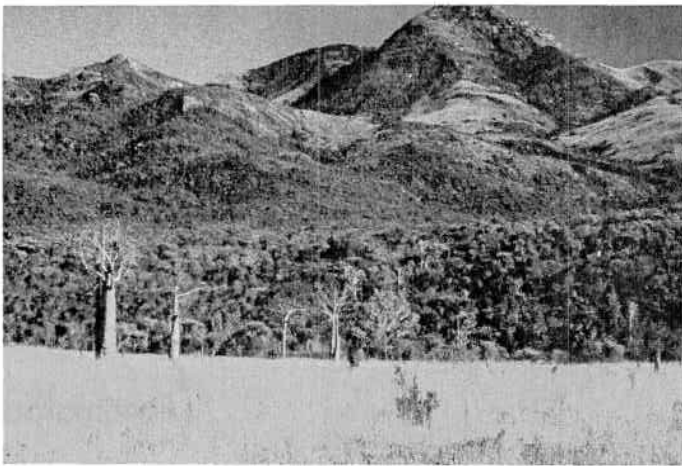


Fig. 37. A view from the eastern boundary of Parcel 2, looking west into the reserve (photo provided by the authors).

time have been cleared for firewood and *tavy* (shifting agriculture). The lower flat areas are used to cultivate rice and the upper slopes are burned yearly to make grass for cattle pasture (Fig. 40). To the northeast of this parcel near the village of Vohibaka, Randria has begun a scheme to prevent fires from moving into the reserve. In exchange for food (which until now Randria has been providing personally), the villagers work at making back fires to clear a swathe along the border. This swathe then acts as both a fire break and boundary marker.

Parcel 1 includes many trees characteristic of rain forest with large buttress roots and huge boles, averaging about 25 m in height but occasionally reaching over 35 m. Epiphytes are abundant and at higher altitudes, mosses and lichens occur. An interesting endemic plant family, Humbertaceae, occurs within the reserve. Tree ferns, Cycathaceae, and orchids, Orchidaceae, are common, and *Rhipsalis*, the endemic member of Cactaceae, also is present. According to Koechlin (1972), some representative plant genera found in this type of forest are *Tambourissa*, *Symphonia* and *Dalbergia*. On the higher slopes the plant families Lauraceae, Compositaceae and Rubiaceae are represented (Guillaumet, 1981, 1984; Koechlin, 1972).

This parcel of the reserve has the most diverse fauna, including representatives from strictly rain forest species such as *Propithecus diadema* as well as species more typically from the deciduous forests further west such as *Propithecus verreauxi*.

Parcel 2

The second parcel primarily consists of spiny desert vegetation with some bush and scrub, and also gallery forest along the Menanara River in the north. The highest hills are devoid of forest and are covered with tussock grass and other medium-high altitude herbaceous growth (Fig. 37). Dwarf *Aloe*, and some species of *Pachypodium* grow on the higher slopes. The altitude in this parcel varies from about 110 — 1,005 m on the summit of Vohidagoro. On the flat plains around the hills a variety of xerophytic vegetation occurs. This vegetation is characterized by plant forms well adapted to prolonged drought.

Didiereaceae, a family of plants endemic to Madagascar, is well represented in this parcel by the genera *Alluaudia* and *Didierea*. Euphorbiaceae, Leguminosae, and Crassulaceae are also commonly found. *Adansonia za* (Bombacaceae) one of Madagascar's most impressive trees, is restricted to this section of the reserve (Fig. 38). The spiny desert in this region of Madagascar is different in species diversity and composition to that in the southwest and *Adansonia* is not the only endemic plant to the Mandrare valley (Rabesandratano, 1984). This forest is disappearing because of increasing local demands for charcoal and wood planking, and species such as *Alluaudia procera*, popular for charcoal, are particularly vulnerable along roads.

Parcel 2 is more accessible than Parcel 1 by following the road from Amboasary-Sud to Hazofotsy on the west which is passable most of the year. This road continues across the northern boundary to Ambatoabo, and a path goes directly south to join RN 13 near Bevilany. There are extensive tracts of spiny forest around the reserve especially to the west and these should be reviewed for possible inclusion in this parcel.

The edaphic conditions in this western parcel are harsh. Rainfall is low, usually not more than 500 mm per annum, and although the average annual temperature is similar to Parcel 1, about 23 °C, the range is much greater (Donque, 1972).

Parcel 3

This parcel was included in the reserve because of the high density of the endemic palm, *Neodypsis decaryi* (Fig. 39), and the presence of a transitional belt of vegetation between the spiny forest to the west and the rain forest to the east. Other plant families represented include Leguminosae, in particular Mimosaceae, Cucurbitaceae and Euphorbiaceae. There is some deciduous forest with *Tamarindus indica* along one of the non-permanent rivers, the Andehamara. *Eucalyptus* has also become established at the eastern end of this parcel.

The forest, although disturbed by livestock and fires, is largely covered with woody growth, but its proximity to RN 13 is cause for concern.

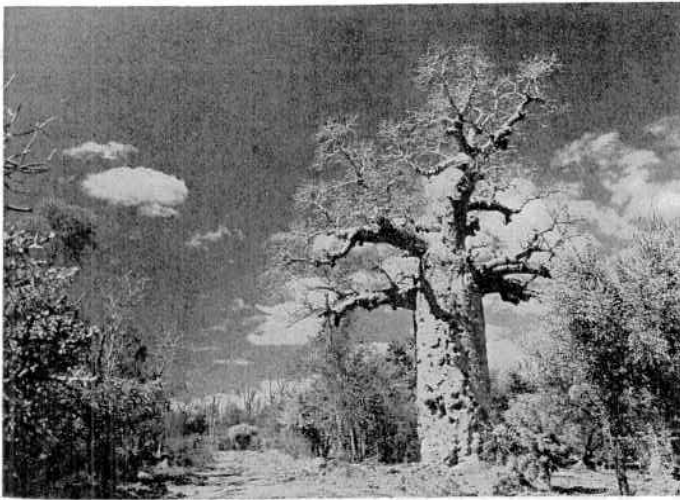


Fig. 38. A baobab (*Adansonia za*) typical of parcel 3 (photo by R. A. Mittermeier).

The small size of this parcel (500 ha) makes it especially vulnerable to ecological disturbances. Cattle are frequently observed in the area and people also habitually use the path on the western border.

Parcel 3 is located just west of the Col of Ranopiso and mostly to the north of the main road. The climatic conditions are similar to the second parcel with an average annual temperature of about 23 °C, and a rainfall in between the averages for the other two parcels (Dunque, 1972).

The fauna of this parcel is not well known. *Lemur catta* have been observed by a forest guard, and it may be that this section has representatives of both rain forest and spiny desert species.

Forest Disturbances

There are several threats common to the forests of all three parcels. Livestock habitually graze within the reserve boundaries. All three areas have large sections with herbaceous ground cover and no trees, presumably as a result of "feu de brousse" in the past. In the first two parcels, these areas are extensive. Fires are a more common problem in Parcel 1 near border villages. This was particularly evident on slopes near the village of Eminiminy which are within the reserve's boundaries. These slopes are already devoid of forest and it is likely that the villagers no longer consider them part of the reserve. Fires have also been observed in the vicinity of Parcel 3 and these could be dangerous if not controlled.

There is some evidence that the extent of cultivated land is expanding in the southern end of Parcel 1, north of the village of Isaka Ivondro. Houses were noted within the reserve in the areas of Varinadambo and some new clearings also were observed along the Ambahibe River. As mentioned some of these hillside clearings are old and their inclusion in the reserve should be reconsidered as they promote access to the forest.

Wood cutting is a problem where villages occur on the edge of the forest. Wood taken from Parcel 1 is used mainly as a source of fuel in homes, whereas felled trees in Parcel 2 are used not only for fuel but also for house building and planks which are sold to markets in Ambovombe, Amboasary-Sud, and Fort Dauphin. Logging trucks have been seen on the roads near this section of the reserve although there are as yet no reports of logging within the reserve.

Hunting occurs, but is not a major problem. The local food staples are rice and manioc in the wet regions, and manioc, maize and sweet potato in drier areas. Protein is provided by livestock and domestic fowl. Hunting lemurs and birds is more of a diversion than a serious attempt to acquire protein. Some animals are probably caught alive to be sold as pets and occasionally we were offered animals, particularly lemurs, for sale. In some cases people seem unaware that all animals are protected by reserve status; one author was told by a villager that birds did not matter. Hunting is a more serious problem in the north and east of Parcel 1 where Malaso or cattle thieves hide. The Malaso probably hunt more often for food than the border villagers.



Fig. 39. the endemic palm, *Neodypsis decaryi*, of Parcel 3 (photo by R. A. Mittermeier).



Fig. 40. Forest destruction and cultivation in the southern section of Parcel 1 (photo provided by the authors).

Recommendations

1. Review the present boundaries

There are large areas devoid of forest along the boundaries which could be excluded in exchange for equivalent areas of climax forest. As the spiny desert is heavily exploited for *Alluaudia*, an addition of this vegetation type is advisable.

2. Delineate the boundaries clearly

Where the boundaries are paths or roads they should be marked by several means: signs, paint, and stone or cement bornes. These should be maintained regularly. In Parcel 1, Randria has begun to make fire breaks. This project needs to be developed on a larger scale to facilitate surveillance. Parcel 3 should be fenced because of its small size and close proximity to the main road.

3. Employ more guards

The Chef de Cantonnement Forestier and the Chef de Secteur Est can not guard 76,020 ha. An addition of five guards for Parcel 1, three guards for Parcel 2, and one guard for Parcel 3 is advised. These guards should be hired from border villages as these people already know the forest, know local customs, can influence other villagers, and will appreciate an outside source of income. Guards would also benefit from uniforms.

4. Provide transport for the Chef de Cantonnement Forestier

No transport exists at the present time for the Chef who is 84 km from Parcel 1 by road and 35 km from Parcel 2. Transportation would greatly improve surveillance of the reserve, supervision of other guards and communication between the parcels and the central office.

5. Promote local development schemes

An exchange of cultivated lands within the reserve for forested lands outside, should be coupled with an effort to improve agricultural production. Saboreau (1966) has suggested improving standards of agricultural development as a way of facilitating better relations, and a scheme like this has been initiated at the Beza-Mahafaly Reserve in the southwest. One possible project to consider is tree plantations on already deforested slopes. These could provide timber for fuel and construction; and, if a legume species, fodder for livestock and food for humans while fixing the soil and countering erosion.

Conclusion

Reserve Naturelle Integrale 11, Andohahela, is one of the most important and interesting sites for conservation in Madagascar. The diversity of flora and fauna within the reserve's three parcels is phenomenal and still poorly documented. There are only two other areas in Madagascar which protect spiny forest; Lac Tsimanampetsotsa (may include 30,000 ha of spiny forest), and the small (500 ha) reserve of Beza-Mahafaly; and no other area which protects the species endemic to the Mandrare region such as *Alluaudia ascendens* and *Adansonia za*, or the rare and endemic palm, *Neodypsis decaryi*.

The conservation of Reserve 11 is not only important for its biological diversity, but also as a watershed. More than ten rivers have their source within Parcel 1. Reserves play an important role in the protection of hydrographic areas and are, therefore, essential for the rational utilization of natural resources (Saboreau, 1966). However, funding is necessary for better protection of this area. With sufficient funds a conservation management plan can be drawn up in more detail and implemented to protect Reserve 11 for the benefit of the Malagasy people and the world.

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Asia

Population Trends of Hanuman Langur in Agricultural Areas of Midnapur District, West Bengal, India

The Midnapur district of West Bengal is situated almost 130 km west of Calcutta between 21°36' – 22°57' N and 86°33' – 86°11' E. The district's total area of about 1,361 km² is subdivided into five sections; Midnapur, Ghatal, Tamluk, Contai and Jhargram, and is inhabited by 4.3 million people. The average rainfall of the district varies from 1,400 to 1,600 mm. The main agricultural crops are rice, wheat, vegetables and betel. The common trees are *sal* (*Shorea robusta*), *mohua* (*Madhuca indica*), and *polash* (*Butea monosperma*).

The district was first surveyed in January-February, 1978 under a project censusing non-human primates of India. It was resurveyed from September-October, 1985 to study the population trend of the hanuman langurs, *Presbytis entellus*, particularly in agricultural areas. During the resurvey twenty hanuman langur groups from the first survey, representative of the entire district (Fig. 41), were selected to study the population dynamics over this seven and a half year period.

The two surveys of 1978 and 1985, revealed that villages contained 97% and 91% respectively, of the total hanuman langur population. Out of the twenty groups, eighteen were village groups and the others inhabited a forest and a town. In 1978, a total population of 299 langurs were counted in the twenty groups; this figure dropped in 1985 to 286 langurs. In the latest count of the eighteen village groups, six of the groups showed an increase between three and sixteen monkeys, ten groups

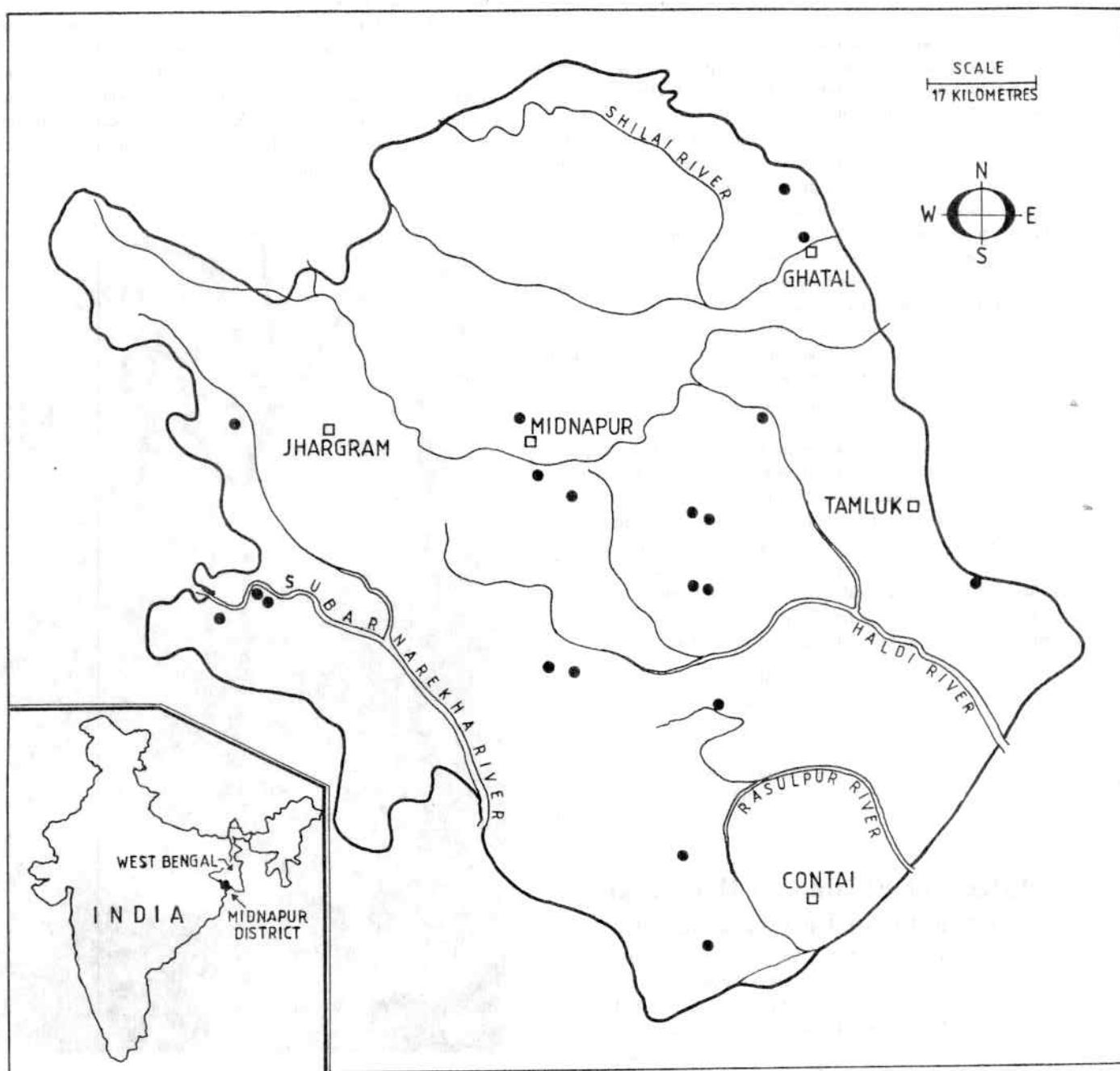


Fig. 41. Location of the 20 hanuman langur groups selected to study population dynamics in the Midnapur District of West Bengal (map provided by authors).



Fig. 42. Female hanuman langur (*Presbytis entellus*) with an infant (photo provided by authors).

decreased from between two and eleven monkeys, and two village groups did not change in number. The forest and town groups showed a decline of one and four langurs respectively during this period. The groups ranged in size from 2-25 animals in 1978, and from 1-32 animals in 1985. The mean and the standard error of the groups size of the two surveys calculated to be 14.95 ± 1.44 and 14.30 ± 1.78 respectively. No significant difference in the mean of the group size of the two separate surveys (using the student "t" test) was noticed.

The decline in male, female and juvenile populations were 21%, 14%, and 10% respectively. The infant population showed an increase of 92%. In the first survey 16% of the females were with infants, whereas in the second survey 35% of the females had infants. In 1978, juveniles constituted 20% of the population; whereas in 1985, they constituted 19%. The increase in the infant population is due to the increased number of females with infants, but the overall decline in the population may be explained by a higher rate of mortality or loss at the post-weaned stages.

The factors contributing to the decline in the hanuman langur population in the agricultural areas of Midnapur are the changing attitude of the villagers, the expansion of agriculture, and the cutting of trees particularly along roadsides. The younger generation of agriculturists have no sentimental attachment to hanuman langurs and are no longer protecting the monkeys. Greater emphasis is now attached to pest control, including both invertebrates and vertebrates. These same changes in social attitudes and environmental factors are now threatening many of the nonhuman primates in India and the rest of the world.

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Effects of El Niño on Habitat and Primates in East Kalimantan

From June, 1982 through May, 1983 the El Niño Southern Oscillation Event (ENSO) caused severe drought in the Malaysian state of Sabah in northern Borneo and the Indonesian province of East Kalimantan in eastern Borneo. Rainfall in East Kalimantan during the drought was 60-77% below normal, and for one three-month period dropped to 85% below normal. The moist forests of the region desiccated, and fires started by slash and burn agriculturalists spread into these dry, flammable

woodlands. The drought and fire damaged an estimated 1 to 2 million ha in Sabah, and approximately 3 million ha of forest and 750,000 ha of settlements and shifting cultivation in East Kalimantan. In selectively logged areas, the tinders wood debris resulting from mechanized logging kindled the fires, causing them to burn hotter and faster. Consequently, selectively logged forests were damaged much more severely than unlogged forests (Leighton and Wirawan, in press).

Data on the effects of the drought and fire on habitat and primates in a primary forest site, Mentoko Camp, in Kutai National Park, East Kalimantan, are available through studies by Berenstain (in press), Leighton and Wirawan (in press), and Mitani. Rainfall at Mentoko Camp during the drought year was only 881 mm, compared to a mean of 2200 mm in normal years (Berenstain, in press).

The fire that burned through Mentoko started 20 km to the southwest, at the village of Sengata. It reached Mentoko on April 21, 1983, and during the next ten days it damaged the entire 3 km² of the Mentoko study site (Berenstain, in press). In burned forest at Mentoko approximately 25% of the canopy trees were killed, mostly from drought, and over 90% of both large lianas (less than 4 cm stem diameter) and small understory trees (more than 5 cm dbh) were killed, mostly from fire (Leighton and Wirawan, in press). Many of the liana and canopy tree species that were killed produced fruit eaten by primates.

Seventy percent of the canopy trees that survived the drought and fire suffered drought-induced crown dieback. This reduction in volume of the forest canopy in turn reduced shading of the subcanopy environment, interrupted arboreal travel pathways, and obliterated many food sources of canopy folivores and frugivores (Leighton and Wirawan, in press).

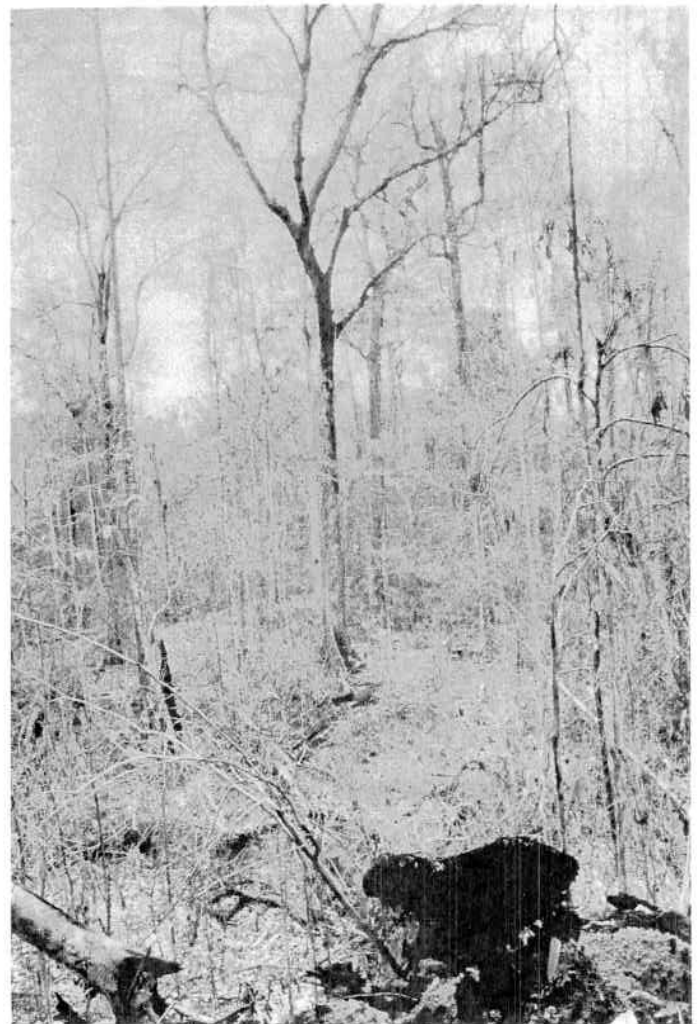


Fig. 43. Severely fire-damaged forest in hand-logged sector of the Mentoko study area three months after the fire, July 11, 1983 (photo by R. Berenstain).



Fig. 44. Ground litter burning in the Mentoko study area, April 22, 1983 (photo by R. Berenstain).

Canopy trees killed by the drought and fire included 44% of those producing fruit eaten by resident orang-utans (*Pongo pygmaeus*), gibbons (*Hylobates muelleri*), and macaques (*Macaca fascicularis* and *M. nemestrina*). However, of the two most important primate fruit trees in the canopy, *Koordersiodendron pinnatum* and *Dracontomelon dao* (both Anacardiaceae), only 25% perished. On the other hand, 90% or more of the fig trees and woody lianas producing fruit for primates died (Leighton and Wirawan, in press).

Resightings of individually known orang-utans (8 individuals), gibbons (4 families), and longtailed macaques (a group of 13 to 20) in the Mentoko Research Center, established that none of their populations had declined 12 to 16 months after the fire. Other primates that use the Mentoko area at least some of the time are the pigtailed macaque (*Macaca nemestrina*), the grey leaf monkey (*Presbytis hosei*), the maroon leaf monkey (*P. rubicunda*), the white-fronted leaf monkey (*P. frontata*), and the proboscis monkey (*Nasalis larvatus*). It is not known whether populations of any of these species were altered by the drought and fire.

Berenstain (in press) studied behavioral ecology of the longtailed macaque group at Mentoko from January, 1982 through September, 1983. This period spanned the entire drought, the fire at Mentoko, and 5 months after the fire.

The macaques altered much of their behavior after the fire. Changes included: decreased day ranges and foraging time; increased time spent resting; a change in sleeping sites; more terrestrial and less arboreal travel; a tendency towards wider scattering of group members during the day; and a switch from a prefire dietary emphasis on pulp and seeds of fruit, young shoots of creepers, and grass corms to a postfire dependence on lepidopteran larvae, wood-boring beetle grubs, and foliage and seeds of dipterocarps. The macaques began losing weight when the drought started, and appeared emaciated prior to the outbreak of caterpillars and grubs in June and July; they appeared to regain weight on the insects. Despite the apparent hardships suffered by this group of macaques, two infants born in the group in January and February, 1983, lived through the drought and fire, and appeared healthy in September, 1983. By May of 1984, additional infants had been born in the group (Berenstain, in press).

Mitani compared singing behavior of two pairs of gibbons (*Hylobates muelleri*) at Mentoko from October, 1980 through September, 1981, prior to the drought and fire, to their behavior from March through May of 1984, after the fire. He found the following: audible range of songs decreased, frequency of singing declined, the gibbons sang from lower heights, and they sang from new locations. The population, however, remained stable, with one infant born and the disappearance of one juvenile for unknown reasons.

In contrast to the primates, which showed no immediate decline in populations after the drought and fire, other vertebrates that were monitored did decline. Two of the five species of hornbills present at Mentoko before the fire disappeared from the area after the fire; the remaining three species all declined in numbers. The three species of diurnal seed-eating squirrels that were common at Mentoko before the fire also declined conspicuously afterwards (Leighton and Wirawan, in press).

Because of the fire, Leighton and Mitani have moved their projects to a site in the Gunung Palung Nature Reserve, Western Kalimantan. Judith Campbell, a predoctoral graduate student at Pennsylvania State University, will begin observations in June, 1986 to assess the long-term effects of the drought and fire on Mentoko primate populations.

Conclusions

1. Selective logging can increase the probability of damage from forest fires even in tropical rainforests.
2. Dead wood from the 1983 fires leaves Bornean forests that were affected more vulnerable to future fire damage, even with less severe droughts than the one that occurred.
3. Although primate populations that were monitored at Mentoko did not decline immediately following the drought and fire, continued monitoring will be conducted to detect any long term effects.

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Conservation of the Monkeys and Forests of Yakushima, Japan

One of the last and largest natural forests of Japan is found on the island of Yakushima, 60 km south of Kyushu (Fig. 45). Much of Yakushima's forests are largely undisturbed primary forests, providing an invaluable natural laboratory for zoologists and botanists. Primatologists from Kyoto University have been studying the ecology and behavior of the Japanese macaques (*Macaca fuscata*, Fig. 46) of Yakushima for over ten years (Azuma, 1974; Maruhashi, 1982; Furuichi, 1983). The island is part of Kirishima-Yaku National Park and has been designated by UNESCO as a reserve within the Man and Biosphere Program. However, conservation of the forests and monkeys of Yakushima has met with mixed results.

Tourist brochures proclaim that Yakushima is the "Alps of the South Seas and home of the 7000 year old Yaku cedar tree." Both claims are only slight exaggerations. The five highest peaks of the Kyushu region are located on Yakushima, including Mt. Miyamura at 1935 m. Because

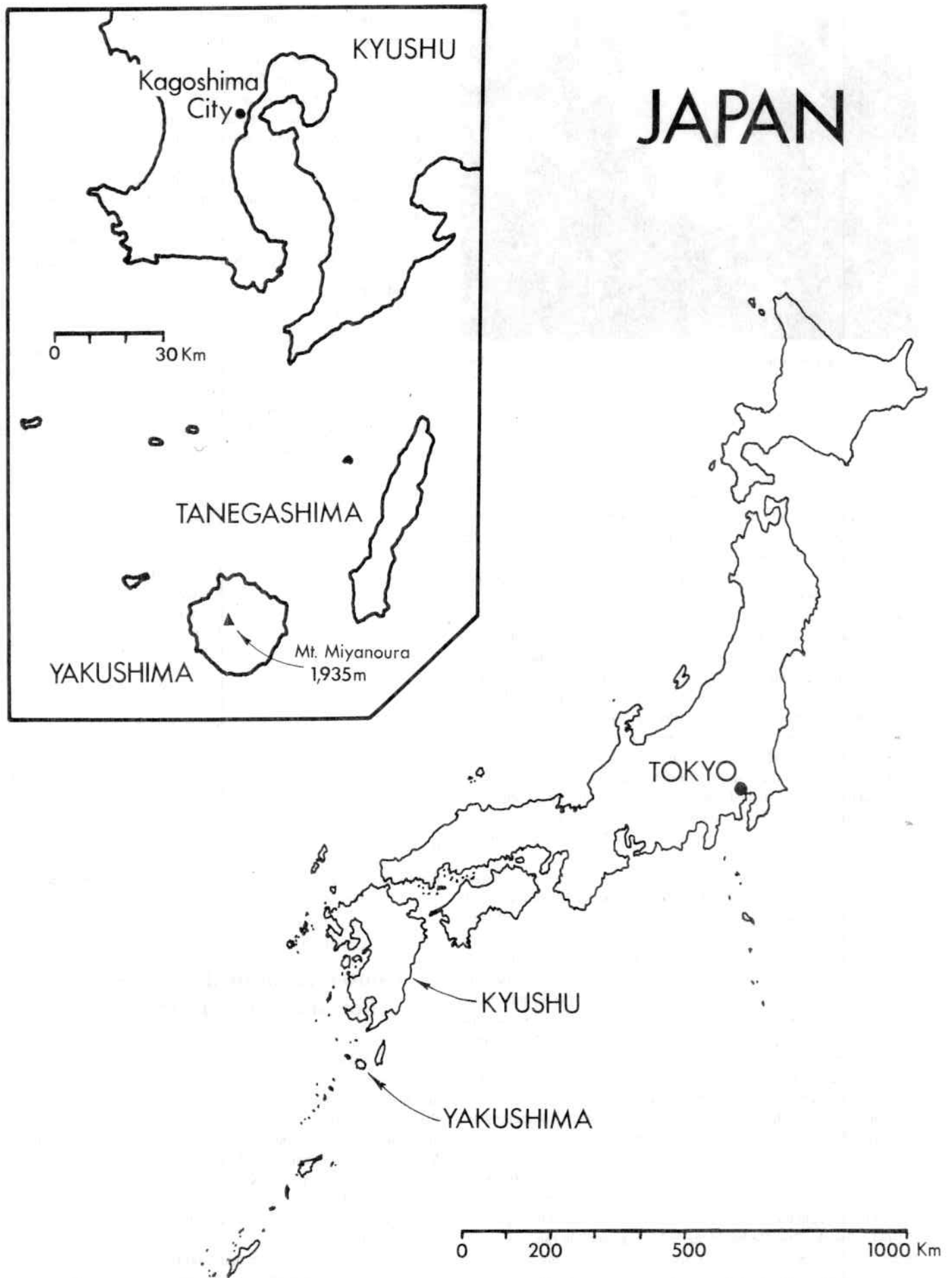


Fig. 45. Southern Kyushu and the islands of Tanegashima and Yakushima. The highest peak in the Kyushu region is Mt. Miyanoura. Tanegashima is well known to historians as the first Japanese island reached by Europeans in the 16th century (map by S. D. Nash based on author's original).

of the high mountains, Yakushima duplicates much of the ecological variation of the Japanese island arc. The vegetation of Yakushima ranges from alpine grassland on the mountain peaks, through mixed deciduous-coniferous forest at high altitudes, broad-leaved evergreen forest at middle altitudes, to subtropical forest along the coast. The island represents a southern limit to the distribution of many plant and animal species being at the southern limit of frost, and the southern rim of the continental shelf comprising the main islands. The Japanese cedar, or *sugi*, (*Cryptomeria japonica*) reaches its southern limit at about 600 m on Yakushima. Many of these cedars are extremely old. A tree must be at least 1,000 years old to be designated a *Yaku-sugi*, and several hundred such trees are believed to survive on Yakushima, the only place in Japan where these ancient trees are known to remain.

The Japanese macaque also finds its southern limit on Yakushima. A slightly smaller variant of its main island conspecifics, the Yaku monkey is classified as a subspecies (*Macaca fuscata yakui*). The monkeys are distributed over the entire island, from the peak areas covered in snow in winter, down to the coastal subtropical forests which experience temperatures below freezing only a few days each decade. Kyoto University primatologists have been studying troops of unprovisioned Yaku monkeys for over ten years, primarily along a coastal road on the northwestern corner of the island within the national park.

In 1982, the forests where the monkey study site is located were almost logged despite their status as part of the national park. This logging was prevented by the vigorous opposition of local people and conservationists. The area has since been upgraded to a higher status within the national park framework which prohibits logging. Recently, however, conservationists and primatologists have been concerned by a plan to rebuild and expand the road which passes through the study site. The present road is a single lane mostly unpaved. The plan calls for paving the road with asphalt, widening it for two way traffic and straightening curves. Because a wide road passing through mountainous terrain requires considerable reinforcement, this could result in a 30-40 m swath dividing the forest. In addition to unpredictable effects upon the monkey study troops, the road may seriously disturb the altitudinal continuity of the forest. The area is uninhabited and the last area on the island where coastal subtropical forest remains. Thus, the road passes through the last area in Yakushima, and possibly southern Japan, where the forest is continuous from sea level to 1,900 m.

An additional threat to the Yaku monkeys is presented by a combination of logging and live capture. Much of Yakushima's middle altitude forests have already been logged by the Forest Agency and replanted with commercially important coniferous species which are inedible to the macaques. Consequently, monkey troops have moved downhill, often into orange plantations where they consume a large and monetarily

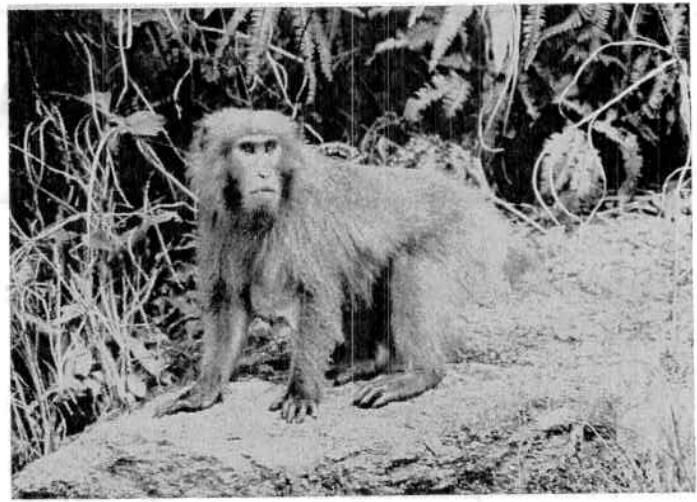


Fig. 46. A young male Yaku-monkey (*Macaca fuscata yakui*) (photo by D. Sprague).

devastating proportion of the orange crop. The farmers have responded with the few means available to them, including capture. Kagoshima and Kyoto University researchers estimate that about 20% of the island's macaque population has been captured in the last three years.

Coming to grips with the conservation issues is difficult because of complex laws, diffuse decision making responsibilities, and overlapping jurisdictions involving multiple levels of government which have no long-term vision for the conservation of the island. As always, immediate economic factors are paramount. The strategy for local people and conservationists is to show that saving the forests and animals is necessary for the future economic and social viability of Yakushima.

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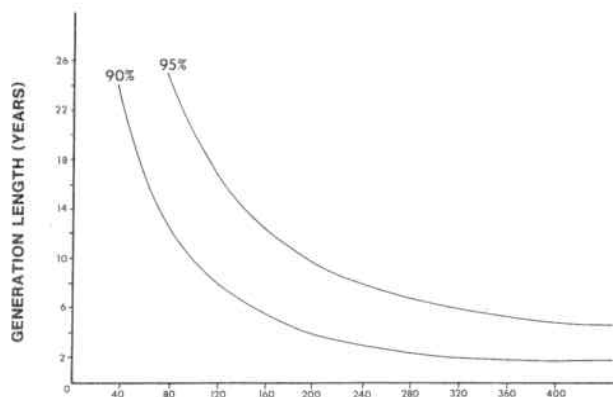
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NEWS FROM CAPTIVITY

Captive Breeding of Endangered Primates: Planning Resource Allocation

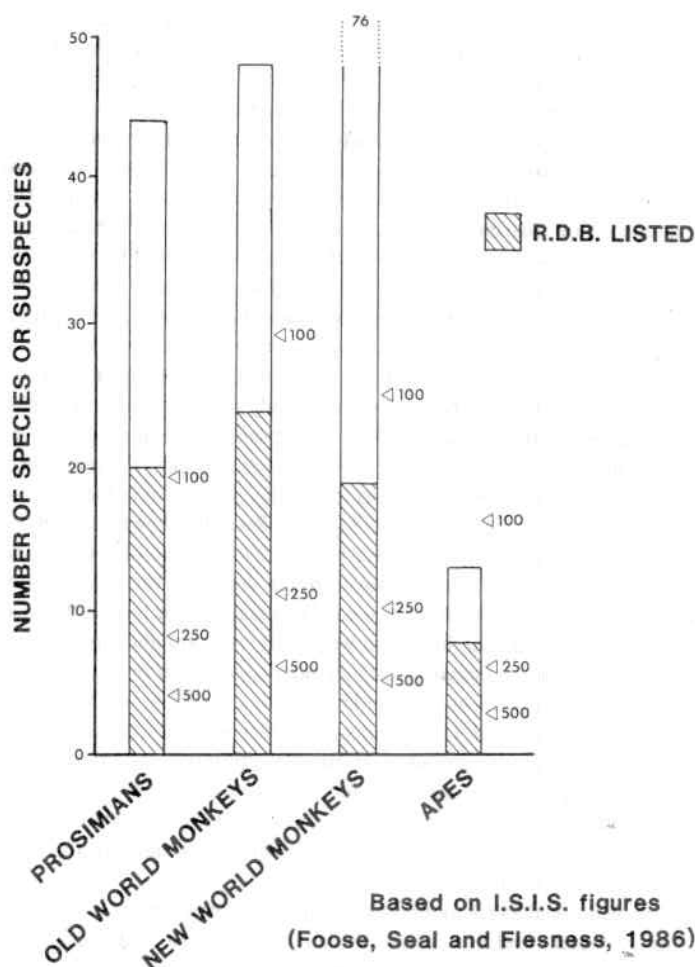
Habitat protection will always be the most directly effective method for species conservation. However, increasingly there are species for which the loss of habitat or the extent of habitat subdivision is so severe that it is hard to be optimistic about survival in the wild. While habitat restoration may be a realistic proposition, there will be species for which captive breeding will be necessary, at least to tide the population over the most difficult periods. Captive breeding programs can provide reinforcements for beleaguered wild populations, or act as insurance against the total loss of the wild population. More problematically, they can provide a means for maintaining genetic diversity and population numbers in relict wild populations which would otherwise have a continuously high expectation of random extinction. This latter approach is more difficult to envisage than broadly separate wild and captive populations, because it requires a continuous interplay between the wild and captive populations (Foose, 1983); in terms of maintenance of genetic and behavioral diversity, however, it is a highly effective approach. The allocation of limited resources among competing high priority demands is a common problem for conservationists. As we show in this article, planning for captive breeding is no exception.

A general aim of breeding programs for endangered species is the maintenance of genetic diversity in a demographically stable population. Genetic variation is important because it can represent the potential for the population to adapt to future environmental challenges (Frankel and Soulé, 1981) and its maintenance will tend to reduce overall levels of inbreeding, which has been shown to influence survival in a number of species (Ralls and Ballou, 1982, 1983). In addition, captive breeding over a number of generations inevitably leads to some adaptation to captivity (Frankham *et al.*, in press) and these traits may become genetically fixed in the population. The rate of adaptation to captivity can be slowed by the kinds of breeding strategies that maximize genetic variation. A second general aim is to maintain a stable population size and structure (Foose, 1980). Fluctuating or declining populations result in increased loss of variation and the ever present possibility of extinction.



N_E REQUIRED TO MAINTAIN 90% OR 95% HETEROZYGOSITY OVER 200 YEARS

Fig. 1. The relationship between effective population size (N_e) and generation length. The curves illustrate the effective population size required to maintain 90% or 95% heterozygosity over a period of 200 years (redrawn from Soulé *et al.*, 1986, by S. D. Nash).



Based on I.S.I.S. figures
(Foose, Seal and Flesness, 1986)

Fig. 2. Histograms represent the number of species or subspecies of each major primate grouping, with hatched areas denoting the proportion that are listed in the IUCN Red Data Book. The arrows show for each group how many species could be maintained in captivity in ISIS accommodation if the population size of 100, 250, or 500 was deemed necessary for each one (data from Foose *et al.*, 1986; figure by S. D. Nash based on authors' original).

The number of individuals needed to achieve these aims depends on a variety of factors (Soulé *et al.*, in press). The time scale of the captive breeding program is particularly important because loss of genetic variation increases with each generation. Over a fixed time interval, the number of individuals needed to meet genetic criteria decreases exponentially with generation length. Figure 1 shows genetic variation measured as heterozygosity, and will generally underestimate the total genetic variation lost. Similarly, effective population size (N_e) is generally much less than the census population size (N) when breeding success is skewed or breeding sex ratios are biased (Crow and Kimura, 1970), so the values in Fig. 1 should ideally be taken as absolute minimum numbers for populations of endangered species. In general, therefore, several hundreds of individuals will be needed to preserve a reasonable proportion of genetic variation and to ensure demographic stability.

Facilities and resources available for captive breeding are finite, and with increasing numbers of species at risk in the wild, careful management will be needed so that available resources are not swamped by a few species (Conway, in press). Some recent figures compiled from the International Species Inventory System (ISIS; see Flesness *et al.*, 1984) give an indication of the number of species (or subspecies) that could be accommodated in ISIS collections if the required population size was 100, 250 or 500 (Foose *et al.*, in press). The data (Fig. 2) show that even with populations worldwide of 100, there is presently not enough accommodation available for all Red Data Book species. Clearly ISIS figures underestimate total resources and captive breeding may not be essential or realizable for all species, but other factors will further reduce available resources. For a number of endangered species, captive breeding should be encouraged in areas in close proximity to the natural range and therefore away from the zoos and breeding centers largely contributing to ISIS estimates of available accommodation. In addition, only a proportion of the captive accommodation included in these figures will be available to species breeding programs, and other resources within captive facilities may prove limiting before accommodation does (Conway, in press). Thus, the general conclusion, that available resources may prove inadequate for the needs of many endangered species, is probably reasonable. In any case, the logistical and practical difficulties in distributing resources appropriately among different projects will make the optimal use of resources very difficult to achieve in the short time span available. Where species have significant variation below the species level, and need to be maintained in separate populations (e.g. orangutans, Seuanez, 1982; chromosome races of *Aotus*, de Boer, 1983), the situation will become worse.

Good communication between field workers and those involved in captive breeding is therefore essential if limited resources are to be used in an efficient manner. This will help in choosing appropriate species for attention, understanding the importance of different subspecies, races, etc., and in establishing appropriate aims for the species concerned, especially in terms of establishing a time scale for the captive breeding program and maintaining appropriate behavioral and social repertoires.

Finally, many of the studies on captive populations can have implications for relict wild populations, which with small numbers of individuals and extremely limited gene flow, share important characteristics. Minimum viable population sizes, techniques for maintaining diversity without major translocation programs, as well as monitoring and treatment of veterinary and reproductive problems, can be learnt from study of captive populations and usefully applied to the wild.

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Program for the Confiscation and Protection of Contraband Pygmy and Common Chimpanzees in the Republic of Zaire

The Lomako Forest Pygmy Chimpanzee Project has been active for several years in the field study of wild pygmy chimpanzees in undisturbed rain forest of central Zaire. Recently members of the project have become involved in calling attention to the illegal trafficking in both pygmy and common chimpanzees. This trafficking begins in central Zaire and is routed through Kinshasa and Kisangani to other countries. For some time now we have been aware of efforts by individuals in Zaire to stop the flow of contraband animals. In 1983, one of us met with customs officials to discuss confiscation of contraband pygmy chimpanzees. Customs officials expressed a desire to halt the flow of animals but were frustrated that there was no place to house confiscated apes nor a program to care for them in Zaire.



Fig. 3. René Henrion, Director of P.P.M., with Frances White and two juvenile pygmy chimps, "Romeo" and "Juliette" (photo by C. Ihnatowicz).

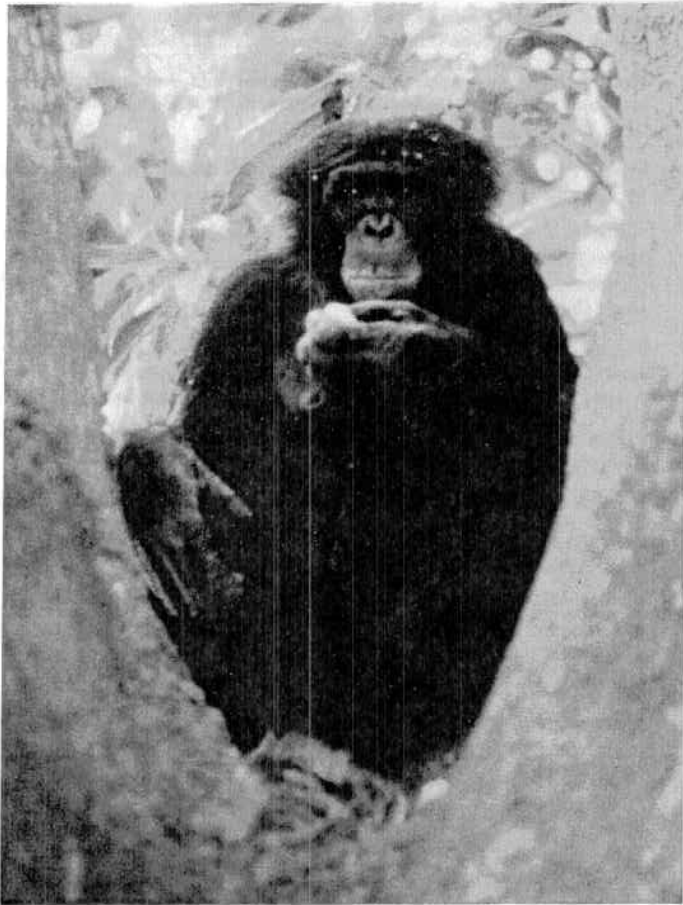


Fig. 4. Ten-year-old female pygmy chimp, "Alexandrie" at P.P.M. (photo by F. White).

Shortly thereafter discussions were undertaken with officials at the Parc President Mobutu (P.P.M.) at N'Sele. The P.P.M. is a privately run wildlife park managed by Mr. Rene Henrion (Fig. 3) and funded mainly by Bralima s.a.r.l., the Kinshasa brewery. The park includes a small zoological garden as well as 5,000 ha of mostly fenced, open grassland along the N'Sele River. It is located 25 km from the capital of Kinshasa on the airport road and is open to the public. Its facilities include housing for large and small mammals, reptiles and birds, veterinary facilities, kitchens and maintenance buildings.

The Parc President Mobutu presently houses 15 species of primates, including several breeding pairs of guenons and mangabeys. There are around ten juvenile and adult common chimpanzees, many of which were brought to the park when they became unmanageable as pets. Many Zairois are now aware of the park's willingness to house orphaned or unwanted apes, and as the news spreads more chimpanzees arrive. In 1983, there was a single female pygmy chimpanzee at the park (Fig. 4). There are now four pygmy chimpanzees, including one adolescent female, a male and a female juvenile, and a male infant. Last year, before the juveniles arrived, we helped in the temporary transfer of an adolescent male pygmy chimpanzee from a zoo in the capital. The female at the park is between 9-10 years old and although she has started sexual cycling, she is still presumably in a period of adolescent sterility and no matings have been observed yet. We are hopeful, however, that the pygmy chimpanzees at the P.P.M. will eventually form a social group. The adolescent female and the two juveniles are housed together, the infant is housed with an infant common chimpanzee of comparable age, and we are hopeful that all the pygmy chimpanzees will eventually be housed in a single facility.

The illegal trade in chimpanzees continues, and many animals which are confiscated at the airport have no place to go. The Parc President Mobutu has great potential for expansion, and would provide an excellent

repository for confiscated chimpanzees. Unfortunately the chimpanzees are presently confined to cages. However, Mr. Henrion has drawn up plans for the development of better housing facilities in the form of an open enclosure surrounded by a moat for both the chimpanzees and the lions at the park, and we are presently engaged in the search for funds in the United States. Concerned zoo officials in the United States have expressed interest in supporting the pygmy chimpanzee project at the park. The Lomako Forest Pygmy Chimpanzee Project will continue to work closely with Mr. Henrion and the park both in the housing of chimpanzees from private individuals and confiscations from illegal trade. We will continue to push for the establishment of future liaisons between the park and zoos in the United States and Europe who are concerned with the survival of pygmy chimpanzees.

Any individuals or organization interested in giving financial support to pygmy chimpanzee conservation can do so by sending a tax deductible contribution to: The Pygmy Chimpanzee Fund, c/o The Georgia State University Foundation, Georgia State University, Atlanta, GA 30303, U.S.A.

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Lemurs in a Natural Habitat in North Carolina: A Crucial Step in Reintroduction to the Wild

Lemur conservation activities at Duke University are centered in the mixed hardwood and pine forests near Durham, North Carolina. Two "natural habitat" enclosures have been constructed to the west of the Duke Primate Center building complex; one of about one and a half acres, and another near nine acres in size. The smaller enclosure, named "Ambohikely" (meaning in Malagasy small place or village), was built in 1981, through a grant from WWF-U.S. The second, called "Ambohivé" (big place or village), was completed in 1983, with funds awarded by the Wildlife Preservation Trust International. These enclosures provide both valuable information about reintroduction needs of lemurs, and a natural environment for research into their social dynamics. The world's first prosimian release into such natural habitats took place in 1981, when fifteen *Lemur fulvus* (Aug. 4) and eight *Lemur catta* (Oct. 14) were released into Ambohikely. A review of the first two and a half years of this highly interesting project was videotaped by Dr. K. E. Glander. [Editors' note: copies of this 38 minute tape can be purchased for \$25.00 by writing to Dr. Glander, Dept. of Anthropology, 114 Social Sciences Building, Duke University, Durham, North Carolina 27706]

The Duke program is one of very few projects of its kind in the world for primates, and the only one involving endangered prosimians. Reintroduction of Asian and African apes has shown that a lengthy period of habituation or re-habituation to forest fruits and plants is necessary before these animals are able to survive on their own. A pioneering program in South America involving the golden lion tamarin in the Brazilian state of Rio de Janeiro, has provided important findings on reintroducing callitrichids. In general, however, the use of reintroduction as a protection for endangered, small primate species, whether monkeys or prosimians, has hardly begun. To date, no prosimian has ever been reintroduced to the wild anywhere in its native range.

Reintroduction is a complex issue. Captive and captive-born animals not only have to adapt to dietary changes and to adjust to possibly novel predators, but they must learn to be wary of humans. In captivity, they