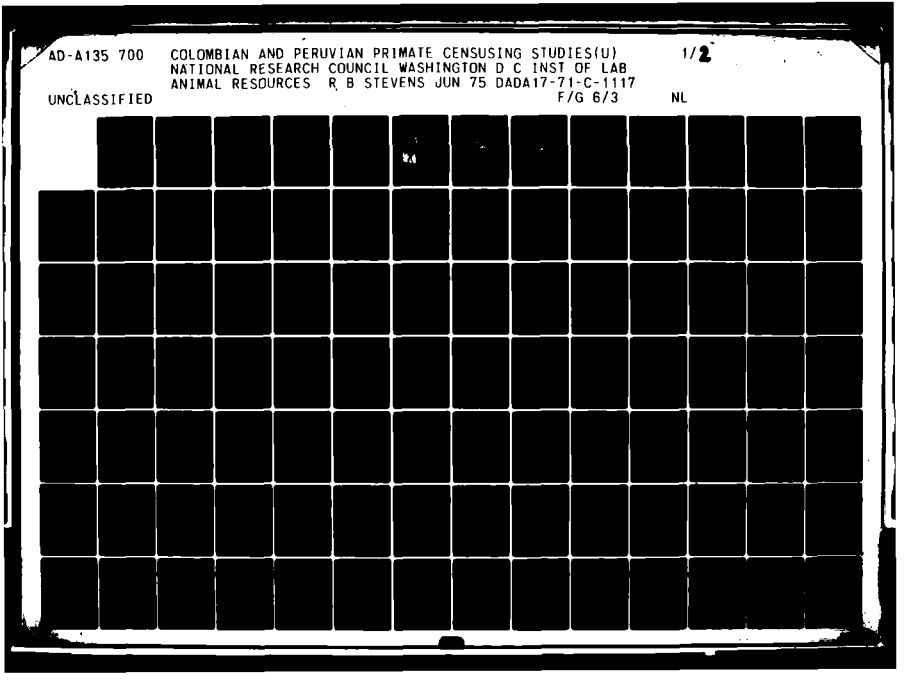
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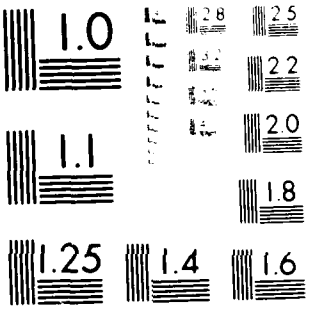
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REPORT ON THE COLOMBIAN AND PERUVIAN PRIMATE CENSUSING STUDIES

Russell B. Stevens, Ph.D.

DADA 17-71-C-1117

COMMITTEE ON CONSERVATION OF NONHUMAN PRIMATES
Institute of Laboratory Animal Resources
Assembly of Life Sciences
National Research Council

NATIONAL ACADEMY OF SCIENCES

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DEC 1 3 1983
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June, 1975

Approved for public release; distribution unlimited

The findings in this report are not to be construed as an official Department of the Army position unless so designated by other authorized documents.

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NOTICE: The project which is the subject of this report was approved by the Governing Board of the National Research Council, acting in behalf of the National Academy of Sciences. Such approval reflects the Board's judgment that the project is of national importance and appropriate with respect to both the purposes and resources of the National Research Council.

The members of the committee selected to undertake this project and prepare this report were chosen for recognized scholary competence and with due consideration for the balance of disciplines appropriate to the project. Responsibility for the detailed aspects of this report rests with that committee.

Each report issuing from a study committee of the National Research Council is reviewed by an independent group of qualified individuals according to procedures established and monitored by the Report Review Committee of the National Academy of Sciences. Distribution of the report is approved, by the President of the Academy, upon satisfactory completion of the review process.

A-1

Under Subcontract No. BA 22/23-72-30 with the National Academy of Sciences, the Pan American Health Organization has prepared a report on field surveys conducted in Peru and Colombia during 1972 through 1974 (see Appendix A). In fulfillment of Contracts PH 43-66-44 with the National Institutes of Health and DADA 17-71-C-1117 with the U.S. Army Medical Research and Development Command, the Committee on Conservation of Nonhuman Primates has reviewed the report and transmits the following findings and recommendations:

FINDINGS

We concur with the conclusions and recommendations as summarized by R. W. Thorington in Annex 5 of Appendix A. We emphasize that field surveys provide data on relative species abundance but typically omit estimates of absolute densities. Repeated surveys using more standardized census methods and studies conducted over more extended periods are necessary to provide detailed analyses of populations and the population dynamics of individual species. Field studies upon which the present findings were developed are cited in Appendix B.

We find that habitat loss resulting from deforestation is becoming increasingly widespread throughout the tropics. The rate of deforestation has been especially rapid in Northern Colombia during the past decade as is illustrated in the attached map (Figure 1).

We find that market hunting for local meat consumption is extensive and consider this factor has contributed to a serious reduction in primate populations in the Iquitos region. In many areas, capture of animals to be exported for use in research is a relatively minor factor compared to hunting for food.

We recognize that to conserve primates it will be necessary to develop alternative protein sources in human diets and to exercise great care in selection and use of animal models in biomedical research programs.

RECOMMENDATIONS

We recommend greater efforts in forest conservation and greater use of selective cutting rather than clear cutting.

We urge support for sanctuaries and national parks as critical to protect habitats in which primates occur.

We advocate the development of principles of habitat and wildlife management for tropical ecosystems and application of these principles to primate populations. We do not advocate the exploitation of primate populations for biomedical research to the extent that their breeding potential and survival is impaired.

We recommend that actions be taken to reduce the use of primates for biomedical programs in the United States, and selection of species other than primates whenever possible.

We urge continued research in ecology of primates and forested habitats.

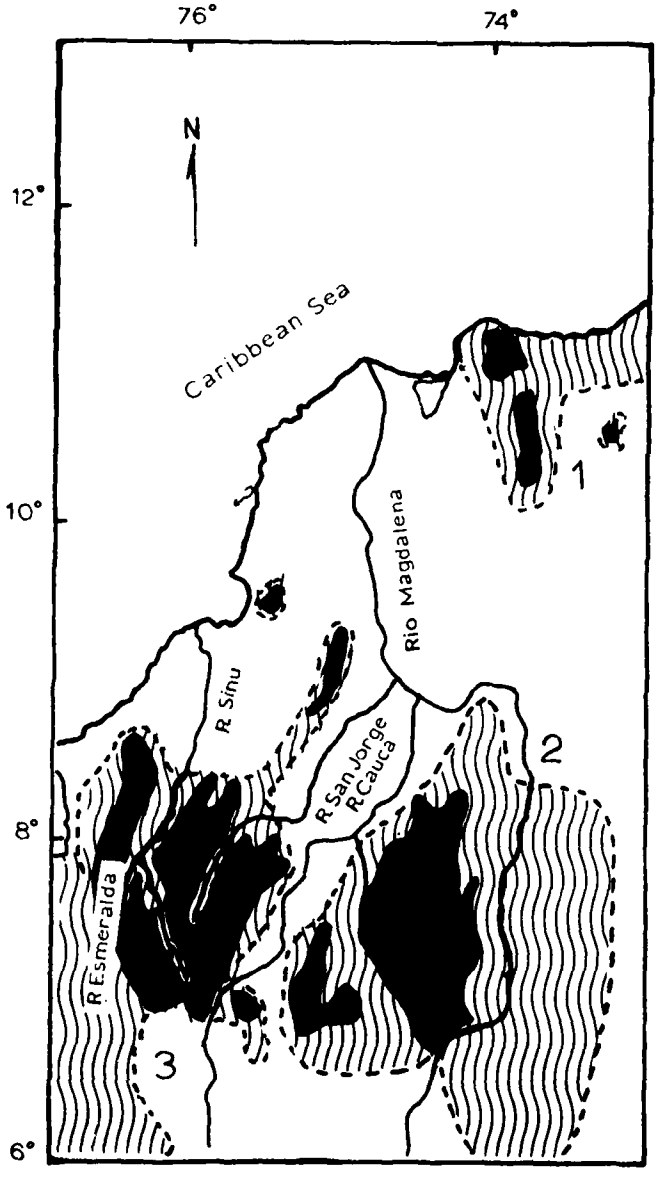
We urge immediate initiation of studies on the impact of controlled harvesting for scientific and medical purposes on the population dynamics of selected species. Because of the world-wide importance of hepatitis and malaria, such studies should concentrate initially on marmosets and night monkeys, which are essential resources for the study of these diseases.

We encourage the development of breeding programs in countries of origin that include both captive colony breeding and management of free-ranging animals. The United States, as a major importer and user of nonhuman primates in research, should provide financial or scientific support for such such breeding programs.

Due to the many serious problems associated with exotic introductions, we recommend against the breeding of nonendemic species in countries with an indigenous primate fauna.

COMMITTEE ON CONSERVATION OF NONHUMAN PRIMATES

Dr. Charles Southwick, Chairman, Johns Hopkins University
Dr. John Eisenberg, Smithsonian Institution
Dr. Paul Heltne, Johns Hopkins University
Dr. Arnold Kaufmann, Center for Disease Control
Dr. Donald Lindburg, Georgia State University
Dr. Gary Moore, Southwest Foundation for Research and Education
Dr. Thelma Rowell, University of California
Dr. Richard Thorington, Smithsonian Institution
Dr. John Vandenbergh, North Carolina Department of Mental Health
Dr. Nancy Muckenhirn, Staff Officer



Forest prior to 1966. Mapa General de Bosques. Instituto Geografico "Agustin Codazzi". 1967. Vol. III, No. 2. Departamento Agrologico, Bogotá, D.E.

Distribution of remnant forests based on satellite photographs and reports of N. Scott, 1974.

Forested areas

1. Sierra Nevada de Santa Marta
2. Serrania de San Lucas
3. Rios Sinu, Esmeralda, and San Jorge

0 100

Scale in kilometers

Figure 1. Forests of Northern Colombia

APPENDIX A

PRIMATE CENSUSING STUDIES IN PERU AND COLOMBIA

Report to the National Academy of Sciences on the activities of project AMRO-0719

PAN AMERICAN HEALTH ORGANIZATION
Pan American Sanitary Bureau, Regional Office of the
WORLD HEALTH ORGANIZATION
1975

PRIMATE CENSUSING STUDIES IN PERU AND COLOMBIA

Report to the National Academy of Sciences
on the activities of project AMRO-0719

PAN AMERICAN HEALTH ORGANIZATION
Pan American Sanitary Bureau, Regional Office of the
WOLRD HEALTH ORGANIZATION
525 Twenty-Third Street, N.W.
Washington, D.C. 20037, U.S.A.

1975

Population Density of Non-human Primates in Peru and Colombia
(Preliminary studies)

Report to the National Academy of Sciences
on the activities of proyect AMRO-0719
March 1975

These studies were done under Subcontract No. BA 22/23-72-30 from the National Academy of Sciences.

This report contains the information obtained during the years 1973-1974 in studies on population densities of non-human primates in Peru and Colombia.

Important recommendations for the continuation of the studies described as well as for new programs will be found in the pertinent sections and in the report to the Director of the Pan American Health Organization Mission on Evaluation of the Regional Project AMRO-0719 (now 3170).

CONTENTS

"CENSUS OF PRIMATES" IN PERU. 3 JUNE 1974

by Melvin Neville, Ph.D.

SUMMARY[1]

Project AMRO 0719, which effectively began in December 1972 and will continue through December 1974, is concerned with the populations of monkeys in the Peruvian Amazon, with its prime motivation being the ultimate management and protection of these populations to assure their conservation and supply for biomedical research. The objectives include the obtainment of population data on as many species as possible, evaluation of the factors which affect the populations, including human activities and the basic ecological needs and behavior of the species, training of Peruvian nationals, and the obtainment of ecological and behavioral data on any useful forest animals.

The project has three main branches: a field camp "Callicebus" in the Nanay River basin near Iquitos, a program of expeditions based off a launch, and expeditions to sites outside the range of the launch. The third aspect of the project is about to be initiated by my reemplacement, Curtis Freese, while the other two branches will continue. Outside of the representatives of the Pan American Health Organization (PAHO), the project's scientific field staff consists of one biologist from the Instituto Veterinario de Investigaciones Tropicales y de Altura (IVITA) and three students from the Universidad Nacional Mayor de San Marcos.

We have worked to date in the river basins of the Nanay, Samiria, and Pacaya and in the Iquitos markets and the city's surroundings. Our results indicate that the commerce of "carne de monte" (forest meat) is the major factor affecting population levels for most species, and that the intermediate-sized and above all the large monkeys (especially the spider monkeys or "maquisapas", Ateles) are reduced in numbers or disappearing in many parts of their former geographical range.

Chief among our recommendations are the establishment of a national park in Loreto (in the area between the rivers Napo and Putumayo) and a reserved area to protect our field station Callicebus as part of a system of parks and reserves, and, most importantly, a continuation of the project in expanded form after the sponsorship of PAHO ceases. Our plan for the revised project consists of a nucleus of five Peruvian investigators working in IVITA and based principally in Iquitos; the project could be funded by the Ministry of Agriculture. The scope of the work would include other animals in addition to monkeys and has added possibilities for further training of Peruvian personnel and for the development of techniques for wildlife management and breeding.

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[1] I have presented the report in greater length than usual because of the varied facets of the work and the recommendations including that for a continuation of the project under another agency. This summary should therefore be helpful.

1. DESCRIPTION OF THE PROJECT

1.1. Scientific personnel

I was selected in June 1972 by Dr. Pedro Acha, Chief of the Department of Human and Animal Health of the Pan American Health Organization (PAHO), in consultation with a committee of scientists chaired by Dr. Richard Thorington of the Smithsonian Institution. I arrived in Peru on 7 December 1972, and reported to my duty station, Iquitos, on January 3 to start to organize and run the project according to the objectives listed in section 1.4. My employment in PAHO terminates 1 June 1974; I have been replaced at Iquitos by Mr. Curtis Freese, who arrived in Peru on April 3 and who will continue PAHO's participation through December. My participation was accomplished by means of a two-year's leave-of-absence from the Department of Anthropology of the University of California, Davis campus.

The Peruvian investigators involved in the project are listed below:

- Norman Rogerio CASTRO Coronado: biologist and Auxiliary Professor at the Universidad Nacional Mayor de San Marcos of Lima (UNMSM), assigned to the UNMSM's Instituto Veterinario de Investigaciones Tropicales y de Altura (IVITA) to collaborate with the project. Rogerio Castro has assisted me since my arrival in Peru and, in in addition to other activities, has acted as director of our field station "Callicebus".
- Napoleon CASTRO Rodriguez: graduate ("egresado") of the Department of Biological Sciences of the UNMSM and involved in the project since February 1973. He has had charge of a series of investigations in the vicinity of Iquitos and of some of the launch expeditions listed in section 2.1.1.
- Juan REVILLA Cardenas: student in the Department of Biological Sciences at the UNMSM.
  He has participated in the project as a biologist and particularly as the project's botanist since March 1973.
- Andres MARMOL Burgos: "Licenciado" in zoology of the Universidad Nacional de la Plata in Argentina and student in the Department of Biological Sciences at the UNMSM. He has participated in the project as a zoologist since October 1973.

1.2. Participating organizations

PAHO administers the project with funds obtained on a subcontract from the National Academy of Sciences of the United States of America. The committee of scientists mentioned in section 1.1. is organized by the Institute of Laboratory Animal Resources (ILAR) of the National Academy, which itself obtained the funds for the project through contracts from the National Institutes of Health and the U.S. Army Medical Research and Development Counsel.

In Peru the project functions through an agreement ("cartal convenio") between PAHO and the government of Peru as represented by the Ministry of Health. The agreement specifically authorizes the participation of the UNMSM through IVITA and the Universidad Nacional de la Amazonia (UNAP) of Iquitos. The UNMSM loaned the project the services of one of its biologists, Rogerio Castro, who was assigned through IVITA to collaborate with me (section 1.1.).

The Ministry of Agriculture through its regional division in Loreto and its "Direccion General de Forestal y Fauna" in Lima has also provided much assistance. The government fisheries service (EPSEP) has authorized expeditions to its reserved area of the rivers Samiria and Pacay, even providing transportation once.

1.3. Motivation

The primary motivation behind the original grant was concerned with supplies of monkeys used in biomedical research. Peru through Iquitos has been one of the major exporting countries for South American monkeys, and a number of the species have assumed major importance in research programs. However, it has become apparent through experiences with African and Asian monkeys that unless export programs are managed with respect to maintaining adequate population levels, supplies are endangered. This project therefore had a definite conservation and management motivation.

The various cooperating organizations had a variety of secondary reasons for encouraging the project: these can be seen in the aims listed in section 1.4. and had such aspects as training of Peruvian personnel, investigation of zoonoses, acquiring basic ecological and behavioral knowledge which could then be used for better management of forest resources, etc.

1.4. Objectives and methodology

The following list covers and amplifies the points listed in the PAHO Post Description and follows the same sequence as the accomplishments described in section 2.2.

1.4.1. The obtainment of population level data on as many monkey species as possible

Some Peruvian monkey species are currently much more in demand for research than others, the most important being the squirrel monkey ("fraile" or "frailecito", Saimiri sciureus), the capuchin monkeys ("machin negro", Cebus apella, and "machin blanco", C. albifrons), the spider monkeys ("maquisapas", A Ateles balzebuth and A. paniscus), the night monkey ("musmuqui", Aotus trivirgatus), the woolly monkey ("choro", Lagothrix lagotricha and L. flavicauda), and the tamarins ("pichicos", Saguinus mystax, S. fusciollis, and S. nigricollis). However, we collected data on all monkey species we encountered on the grounds that in the future some of the lesser-used species will probably assume importance and because of the interrelation of fauna in the jungle.

The approach has been mixed: (1) explorations by canoe or from the moving base of the launch "Maquisapa" using observations in the forest and along the waterways and inquiries of locals to gather qualitative ideas of abundances and the factors affecting them, and (2) selection of a few sites for intensive, repeated studies. The second method yields the best data, but is much more expensive in terms of time and energy. Until now only two sites have been studies in this way: a small peninsula in Lake Maldonado along the Samiria River and, more importantly, our field station "Callicebus".

1.4.2. <u>The evaluation of factors influencing population levels.</u>

This involves an examination of the kind of habitat in which each species lives and a study of human alterations in the environment and the exploitation of the animals. A botanist has therefore [illegible] assist in the description of the environment; it must be remembered [illegible] environment is effectively different for each species, even if various [illegible] forest, for each occupies a different niche.

Human influence on monkeys enters through habitat destruction and alteration, from such activities as farming and lumber extraction and through hunting to secure animals for live export, for the internal pet trade, and for food ("carne de monte"). We have collected data on these various points, and we have made a special analysis of the "carne de monte" trade as seen in the markets of Iquitos.

1.4.3. <u>The proposal of management and conservation measures</u>

Our ability to provide advice has depended upon acquiring the basic ecological and behavioral facts. There has been a sense of urgency about developing this information base, as exploitation and development of the jungle is going on at a very rapid pace, especially with the current exploration for petroleum, and critical decisions could be imminent on many conservation and management issues.

1.4.4. <u>The training of nationals</u>

A major aim has been the desire to leave behind a nucleus of knowledgeable and interested personnel to continue the ecological investigations necessary for rational utilization of the wildlife and to provide advice and experiments concerning proper management. The training of my assistants has been through readings, discussions, and field work and analysis. I have also attempted to attract advanced students from various universities (primarily the UNMSM and the UNAP) to involve them in the project either on a long-range basis or in shorter training sessions while, for example, doing their thesis work.

1.4.5. <u>The obtainment of other behavioral and ecological data</u>

Such data are usually indirectly if not directly related to the primary interest in population levels and management. I had also hoped to combine behavior study with some investigations into zoonoses by trapping selected social groupings, examining the members, marking the monkeys for later identification, and releasing them; however, we have not yet reached this phase.

Project members have gathered data on animals other than monkeys when it was convenient, as many animals are of actual or potential value, and the project provided a natural system for such observations.

2. <u>ACTIVITIES AND ACCOMPLISHMENTS</u>

2.1. <u>Activities</u>

2.1.1. <u>The project launch "Maquisapa"</u>

The 10-meter wooden boat was built to solve the problem of mobility and to provide floating living quarters and a laboratory base for explorations. Con-

struction was ordered on 20 March 1973, but the boat was not launched until July 31st, and the final major correction to a faulty installation of the boat's motor (a 16 hp Briggs-Stratton gasoline motor mounted within the boat) occurred on September 15th.

The first expedition of the launch was to the hamlet of Mishana on the Nanay River for the purpose of transporting personnel and equipment to set up our field station "Callicebus" (August 28-31). Thereafter the launch served for a variety of operations around Iquitos, various expeditions to Mishana, and the more distant expeditions indicated below:

- Oct. 13-Nov. 3, 1973: Expedition to the Samiria R. Scientific personnel: Neville (director), Andres Marmol, Juan Revilla.
- Dec. 13-Dec. 23, 1973: Expedition up the Nanay River. Scientific personnel: Napoleon Castro (director), Andres Marmol, Juan Revilla.
- Jan. 30-Feb. 17, 1974: Expedition to the Pacaya R. Scientific personnel: Napoleon Castro (director), Andres Marmol.
- Marc. 12-Marc. 26, 1974: Expedition to the Samiria R. Scientific personnel: Napoleon Castro (director), Andres Marmol.
- May 6-May 20, 1974: Expedition to the upper Nanay R. Scientific personnel: Curtis Freese (director), Napoleon Castro.

The trips to the R. Samiria repeated an earlier expedition by Napoleon Castro and myself courtesy of the government fishing service EPSEP on the boat "Raimondi", Feb. 22-March 9, 1973.

2.1.2. The field station "Callicebus"

My attention was first brought to the Mishana area by the naturalist, Pekka Soini. Mishana combines the useful features of being relatively close to Iquitos (2 hours by speedboat) but sufficiently far enough so that exploitive influence from the city is sporadic, a forest area accessible by trail but which still contains many mammals and offers a variety of habitats, and inhabitants disposed to cooperate immediately with the project because of their friendship with Mr. Soini.

My first visit to Mishana was Feb. 6-9, 1973, but project members made many other visits to the area before the installation of the project's tent in the "Camp Callicebus" area in late August. Rogerio Castro has been the administrative and scientific director of the camp's activities. At the camp we have an extensive system of marked and surveyed trails, which assist in our mobility and in mapping the location of animals, plant zones, etc. The camp has attracted considerable attention, and various scientists passing through Iquitos have paid it a visit.

2.1.3. Studies in Iquitos on "carne de monte" and exportations

Since February 1973 we have carried on investigations on the market of "carne de monte" in Iquitos with special emphasis on the monkeys. Project investigators have visited the three main Iquitos open markets on a regular basis, often daily over extended periods of time, in order to ascertain by observation and inquiry the fluctuations of the trade. We have compared these

data with information on the importance of the trade elsewhere, as gathered during our expeditions and from some studies by other scientists.

We have also collected the official export records and paid occasional visits to the major Iquitos exporters of live animals. Rogerio Castro has also attempted to elicit information from the Iquitos hide merchants on animals other than monkeys.

2.1.4. Recruitment and training of Peruvian students

This is one of the basic objectives of the project (section 1.4.4.). Juan Revilla and Andres Marmol are both students from the UNMSM; they and Napoleon Castro (section 1.1.) have been paid a liberal per diem by the project, and all three are simply considered students in training. We have attempted to attract other students from Lima and have had a number of enquiries. Our present lack of funds for assistance may prevent most from utilizing the opportunity.

I attempted to initiate a seminar in Iquitos and involve UNAP students in the project. However, the seminar terminated after a few weeks through lack of interest, and I was never able to attract any students into the field despite a talk at the UNAP on the project on June 22, 1973.

2.2. Accomplishments

2.2.1. Population level data on monkey species

The following summarizes my impressions on the monkey species in the northern Peruvian Amazon based on our work in the river basins of the Nanay, Samirin and Pacaya. Quantitative data are left for technical reports and papers.

In general one can say that all monkey species, because of their close relationship to man, are of potential if not present bio-medical interest and therefore of value as a national resource. If for no other reason, hunting rapidly erradicates the presence of the large and intermediate species from areas close to human residence centers, with the larger disappearing first.

- Spider monkeys ("maquisapas", Ateles paniscus and A. belzebuth): large monkeys, probably the species most endangered, have disappeared from many (most?) areas where they were formerly to be found. Valuable as an export and highly appreciated as a food.
- Woolly monkeys ("choros", Lagothrix lagotricha and L. flavicaudus): large monkeys, also rapidly disappearing, potentially very valuable as an export but also favored pets and prized foods. (L. flavicaudus was rediscovered in the Department of Amazonas in May 1974 by an expedition comprised of Dr. Hernando de Macedo R. of the Museum Javier Prado of the UNMSM, the naturalist Tony Luscombe, volunteer at Lima's zoo, the Parque de las Leyendas, and the zoologist Russell Mittermeir of Harvard University. Its geographic range is probably severely limited.)
- Howler monkey ("coto", Alouatta seniculus): large monkeys, not exported but much hunted for food. More abundant than the woolly and spider monkeys.

- Titi monkeys ("tocones", Callicebus torquatus and C. moloch): intermediate-sized, not exported yet, but scientifically very interesting and rurally much utilized as a food. Not present in some areas, but C. moloch at least may be abundant in others.
- Saky monkey ("huapo negro", Pithecia monachus): intermediate-sized, not exported yet, but much utilized as a food. Our census data is insufficient.
- Capuchin monkeys ("machin negro", Cebus apella, and machin blanco, C. albifrons): intermediate-sized monkeys, extremely important for research and much hunted for food. Probably rarer than the other intermediate-sized monkeys above.
- Uakari monkey ("huapo rojo", Cacajao rubicundus): intermediate-sized, does not occur in the areas where we have worked to date. Protected by Peruvian law since 1970.
- Squirrel monkey ("fraile", Saimiri sciureus): small monkeys, very valuable in research and the most exported (e.g., 9,470 during the period Feb.-Aug. 1973). Fairly abundant still, but perhaps locally threatened.
- Owl monkey ("musmuqui", Aotus trivirgatus): small monkeys, of great importance in research. We do not have data on abundance, although it occurs in the river basins we have studied.
- Callimico ("supay pichico", Callimico goeldii): small monkeys: not utilized, probably because very rare though distribution may be wide.
- Tamarins ("pichicos", Saguinus fuscicollis, S. nigricollis, and S. mystax): small monkeys, very valuable in bio-medical research. S. mystax does not occur in the areas where we have worked, and we have no data yet on S. nigricollis, which in this case may indicate that it is scarce. S. fuscicollis appears to be abundant.
- Pygmy marmoset ("leoncito", Cebuella pygmaea): the world's smallest monkey. We do not have data on abundance, although it occurs in the river basins we have studied. Protected by Peruvian law since 1970.

2.2.2. Factors influencing population levels

I commenced the project expecting to find exports as the major factor influencing population levels, but the use of monkeys as food seems to be more important. Even only considering the sale of monkeys in Iquitos, "carne de monte" according to our estimates accounts for more sakis and howler monkeys than do exports, while the number of woollies and spider monkeys consumed approaches the number exported. In rural settlements "carne de monte" is much more important as a protein source, and the exploration for petroleum, which is penetrating most of the Peruvian tropical forest, makes heavy use of "carne de monte". Our project has produced a number of reports on the subject including one manuscript submitted for publication to the Revista Forestal del Peru (" 'Carne de Monte' como una fuente de proteinas en Iquitos con referencia especial a monos", by Napoleon Castro, Juan Revilla, and Melvin Neville).

Exportations may have been locally critical for such monkeys as the capuchins, may have been putting added pressure on those species much used for

food (especially the spider monkeys and the woollies), and were very high for tamarins and especially squirrel monkeys. Exportation effectively ceased after the appearance of Supreme Decree No. 934-73-AG (Oct. 8, 1973), which prohibited except for scientific purposes the hunting and trade of many forest animals including all monkeys. Ministerial Resolution No. 0537-74-AG (25 Feb. 1974) establishes the procedures to be followed for scientific exportation, but so far as I know no organization has reestablished the trade yet.

The Supreme Decree has still not been implemented in regard to "carne de monte", even in Iquitos. Enforcement would be difficult outside of the major urban centers in addition to perhaps causing hardships in regard to protein supply. We noted, for example, that the very guards responsible for protecting the Samiria and Pacaya basins (reserved areas for EPSEP) were unfamiliar with the decree and, in any case, dependent upon hunting for an important part of their food.

Destruction or alteration of the environment is a feature which is locally important but to which we have not yet devoted much attention. Alteration of the forest to make garden plots ("chacras") of course changes the favorability of the habitat in the sense of food supply and protection, but the major effect probable comes from the hunting of the humans involved in the changes.

2.2.3. Proposal of management and conservation measures

The project has developed sufficient experience and has now begun to act as an advisory body for governmental agencies concerned with management and conservation problems. My actual recommendations are listed in section 3.1.

2.2.4. Training of nationals

The list of Peruvians involved in the project to date is given in section 1.1., and the limited success of attempts to attract students is indicated in that section and 2.1.4. However, one student from the UNMSM is now going to the field station for about three months of thesis field work.

2.2.5. The obtainment of other behavioral and ecological data

We are developing an analysis of the botanical structure of the environments we have studied, particularly that of the camp; several preliminary reports have already been produced. Members of the project and guests have also taken data on such animals as dolphins, manatees, birds, and mosquitos.

We have not yet begun any trapping program along the lines mentioned in section 1.4.5.

2.3. Future activities in 1974

Work at the field station "Callicebus" and surveys based from the launch will continue until December, when data analysis and report termination will be emphasized. Among other expeditions of the launch, work south of the Amazon and a return to the R. Samiria are scheduled. Freese will conduct special expeditions to the Pucallpa area (to IVITA and to the camp of Dr. Koepke), to Madre de Dios Department and the National Park Manu, and to the northern Andean foothills.

At least one student from UNMSM will be working on a thesis at our field station, and we are sure that we will continue to have the opportunity to collaborate with visiting scientists.

3. RECOMMENDATIONS FOR THE FUTURE

3.1. Recommendations concerning conservation and management

3.1.1. Parks and reserves

Several monkey species are in urgent need of protection (see section 2.2.1.), and the best way to protect them is to establish areas where exploitation of the fauna and flora is prevented. Probably the most critical situation obtains for the spider monkeys; others which deserve special attention include the woolly monkeys (especially the newly rediscovered species Lagothrix flavicaudus), which probably occupies a very limited range in an area in which intensive development is just beginning, the uakari and pygmy marmoset, the capuchins, the mysterious callimico, and some of the tamarins. All monkey species and, in some cases, subspecies, eventually should be included in protected areas, for scientific and medical interest in these animals is enormous.

We have been asked by the Eighth Agricultural Region to suggest a location for a national park in Loreto. We (Freese, Neville, R. Castro and the naturalist Soini) are suggesting the area between the rivers Napo and Putumayo, especially the more eastern part, at an area with an interesting fauna, which would be markedly different from that which is protected by the National Park of Manu in Madre de Dios. We have suggested as an additional (not alternative) area the region of the rivers Morona and Santiago in the extreme northwest of the Peruvian Amazon. Smaller reserves could be erected for a variety of purposes; thus we recommend one to protect the field station "Callicebus".

In setting up a national park it is vital to budget for well-trained, equipped and supplied guards; without such a provision, the establishment of the park is almost useless.

3.1.2. "Carne de monte"

The hunting of wild animals for meat is on the one hand a threat to the populations of many jungle species and on the other a major source of proteins for much of the rural human population (However, a diminishing supply of forest animals will be increasingly inadequate for an expanding human population). With these conflicting aspects in mind, I recommend the following:

- Eliminate the commerce of theoretically protected animals such as monkeys in the major urban centers, where other protein sources exist.
- Substitute alternative sources of proteins in rural areas (IVITA is already involved in this problem).
- Exert more control over the hunting activities of companies involved in the exploitation of the Amazon, especially the petroleum and lumber companies.
- Limit hunting by means of the price of shells.

3.1.3. Exportation

Limits should be set on exportable numbers of the more endangered species (see sections 2.2.1. and 3.3.1.). The health conditions in the exporters' pens should be controlled. Advice on both such procedures could be obtained from a study group similar to that proposed in section 3.2.

Another possibility is to develop breeding farms for some of the species: this would combine the advantages of conservation of wild populations, assurance of a steady, quality supply, and, ultimately, profit. The development of an economically feasible program is, of course, a long-term procedure. The group mentioned above could again be useful in either carrying out the development or in an advisatory capacity.

3.1.4. Education in conservation

There is a tremendous need for conservation education at all levels. This should come both through the presentation of information and ideals and through more dramatic measures. In this sense (and as a tourist attraction) it would be very useful for Iquitos to have its own zoo featuring fauna of the region. A model could be the famous "Desert Museum" near Tucson, Arizona, U.S.A., a small zoo which features exhibits of selected local fauna in quassi-natural settings.

3.1.5. Continuation of a modified form of this project

A rational exploitation of the Amazonian forest requires a considerable body of knowledge not currently in existence. The usefulness to government ministries of a research body which could provide them with advice is clear, and a reasonable approach would be to continue the work of the present research group but on an expanded scale. In section 3.2. this projected extension is outlined in greater detail.

3.2. Continuation of the project

Peru desperately needs a study group in the tropical forest region to continue gathering basic ecological data and to assist in the development of rational management techniques. An economical way to obtain such a group is to continue the present project, utilizing the experience of its members but expanding the scale of its investigations to a broader range of animals and commencing applications of the knowledge to management problems. The expanded project would also be increasingly able to respond with technical advice to the needs of enquiring agencies.

In May in Iquitos in an informal session with IVITA and the Eighth Agricultural Region, PAHO functionaries and project members explored the idea of such an investigatory group. The following ideas are going into the project's proposal, the formal version of which will be presented by Curtis Freese and Rogerio Castro.

3.2.1. Possible administrative and financial structure

The expanded project would be administered and funded by an agency of the state interested in natural resources as for example, the Ministry of Agriculture.

A provisional biannual budget exceeds S/.4,000,000, most of which is accounted for by salaries. The details of this budget are left for the formal proposal. The uniqeness and necessity of such a project are such that foreign financial support could almost undoubtedly be attracted.

We suggest that the project's direction be assigned to someone with considerable experience and interest in this type of work, as, for example, Rogerio Castro, who has had the most field and administrative experience within the present project, and that some current project members can form a nucleus for its scientific and worker staff. We ask that the basic group be formed by 5 investigators (including the director) and 3 permanent assistants; these numbers are very modest considering the scope of the work. The principal seat of the project would continue to be Iquitos. Cooperating institutions could be IVITA and the UNMSM itself, the UNAP, and any other organizations interested in such investigations.

3.2.2. Continuation of the field station "Callicebus"

Our field station combines the features of accessibility from Iquitos, a system of marked and measured trails, and a backlog of gathered data, with a varied flora and a fauna which is still relatively abundant, and it contains in addition to many species of monkeys a number of other economically important forest species, e.g., both species of peccaries ("sajno". Tayassu tajacu, and "huangana", T. pecari), while other interesting species have been shot close to the hamlet of Mishana (e.g., the tapir or "sachavaca", Tapirus terrestris).

The continuation of the field camp is therefore very desirable, both as a location for basic ecological and behavioral studies and as a possible training area for advanced students (see section 3.2.6.). In addition, some husbandry and breeding experiments could be carried out in the area (see section 3.5.).

3.2.3. The project launch "Maquisapa"

The launch is necessary if the project is to continue working in areas more than a day distant from Iquitos, We would like to continue investigating new areas, as there is considerable habitat variation from one river basin to another and as the questions posed by exploitation and development of Loreto continue to increase. We would also like to repeat some previously investigated areas on a systematic schedule in order to detect the effects of different seasons and changing exploitation. Planned repeat locations, for example, would be along the Nanay and Samiria Rivers, especially the peninsula at Lake Maldonado on the Samiria, in which we have prepared a system of marked and surveyed trails. The Samiria R. is particularly interesting as an example of a protected area which preserves a rich and varied fauna but in which considerable exploration for petroleum has taken place.

An immediate and practical use for the launch would be as a base for investigations into the establishment and development of a national park in Loreto (see section 3.1.1.); this is another example of the kind of aid which an extended and expended project could perform.

3.2.4. Expeditions to more distant areas

We wish to continue the present project's interest in areas beyond the reach of the launch, which, because of its slowness, becomes impractical upstream of Iquitos at about the level of the juncture of the Nuallaga and Maranon rivers and of the village Dos de Mayo on the Ucayali R. Of special interest is the Pucallpa area, where we could coordinate with the IVITA scientists at that station. Madre de Dios with its National Park of Manu, and the northern Andean foothills. The experience of the project members, nearer Iquitos would supply a very useful comparative basis to such studies and makes the current project scientists natural choices for the investigations which Peru must make for a rational utilization of these areas.

3.2.5. Breeding and management experiments

Continued or expanded utilization of many species (including most monkeys) will be impossible on a basis of uncontrolled harvesting from the forests: this procedure leads to overcropping with resulting population densities being so low that either continued harvesting is economically impossible or the populations cannot maintain themselves and the species becomes locally extinct.

Some Peruvian primates are of major importance in biomedical research, and their supply should be regular. Use of wild species as food on a systematic basis has also proved economically feasible in other countries, e.g., the use of capybaras ("ronsocos", Hydrochoerus hydrochaeris) in Venezuela. The IVITA group in Pucallpa has initiated studies concerning management of some species, and these activities could be coordinated with our group based in Iquitos. In some cases management of wild populations may be the answer to increase and regularize supply, while in other cases actual breeding colonies should be established. Our proposed budget allows for such experiments on a small scale. Added financing for such work could probably be obtained from drug companies or foreign universities; we have already had two offers of assistance.

3.2.6. Training advanced students

Peru must continue to train biologists and veterinarians for work in the Amazon, and a portion of the training should come in the field. The current project has served to form a nucleus, but much more is needed. Continued training of those who continue in the project should be addressed both through the visits of consultants and through the possibility of fellowships for further study (both points would require financing by some other agency).

The project could aid in the training of advanced students by providing the opportunity for such a student to investigate a particular problem, e.g., a thesis study, for several months. The aid could consist variously in usage of project facilities such as the tent and trail system at "Callicebus", advice from project members concerning the problems of the student's investigation, and perhaps food supplies while in the field. Expenses beyond that level should be financed through outside means. It should be emphasized that only advanced students could be incorporated into the structure.

3.2.7. Cooperation with other agencies and investigators

The project could also increase its value by offering its facilities to visiting funded investigators, provided that such investigators would exchange data and relevant reports with the group. This would in effect increase the staff of the project at little or not cost, as well as offering project members the opportunity of association with investigators with other skills and knowledge. Such investigators could be foreign or national. An explicit example is the possibility of exchange of investigators between IVITA's Pucallpa and the projected Iquitos stations.

The existence of an operating institution in the jungle is of tremendous potential aid to other state agencies, who would be able to shortcut many of the problems of initiating an investigation by making use of the institution's facilities and accumulated knowledge. Thus, for example, the Ministry of Health could more rapidly mount a study of a particular zoonosis by sending its investigators on the project's expeditions and to its field station.

4. ACKNOWLEGEMENTS

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A CENSUS OF NON-HUMAN PRIMATES IN PERU

by Curtis Freese

INTRODUCTION

This report presents information on the population status of Peruvian non-human primates. Data were collected from April to December, 1974, while I was a short-term consultant for the Pan American Health Organization project AMR-0719. The background and structure of the project were outlined by my predecessor, Dr. Melvin Neville (1974). The information presented herein was collected by several Peruvian scientists, my wife, Marge, and myself. The Peruvian scientists were: Rogerio Castro, Napoleon Castro, Juan Revilla, Andres Marmol, and Marleni Ramirez.

A high demand for non-human primates for biomedical research and a reduction in the primate supply have prompted some recent field studies to determine the status of wild primate the populations (Southwick and Siddiqi 1966, Southwick and Cadigan 1972, Wilson and Wilson 1973, and another Pan American Health Organization monkey censusing project in Colombia in 1974). Prior to this project, the only attempt to comprehensively assess the status of Peruvian monkey populations was made by Crimwood (1969) whose comments were very general. Besides being used for biomedical research, the monkey species of Peru are sold as pets. More significant the monkeys are an important protein source for Amazonia's rural population (Pierret and Dourojeanni 1966, Neville 1974).

The results of our research are considered from two major approaches: 1) each area surveyed is analysed and compared with other areas, and 2) the status of each species is briefly discussed. Our methodology is thoroughly described with the hope that future research projects concerned with the population densities of New World primates will employ similar techniques so that data from various research endeavors can be compared.

I will refer to any data collected during Neville's term and not included in his final report by citing his name only.

The taxonomy follows Hershkovitz (1972). Ecological and behavioral data compiled during our research will be presented in future reports.

STUDY AREAS

Seven geographical areas were surveyed. The location and a brief description of each area is given below.

(1) Nanay River-Iquitos area: Censuses were conducted in 3 areas along the Nanay River, a tributary of the Amazon which, near its south, roughly forms the northern and western limits of Iquitos. and between the Itaya and Amazon rivers from 2 to 4 km south of Iquitos. The 3 sub areas along the Nanay were: 1) behind Nina Rumi, a hamlet on the south side of the Nanay about 30 km by river above Iquitos; 2) Campamento Callicebus, the project's biological station, located about 60 km by river above Iquitos on the south (right) side of the river near the hamlet of Mishana; and 3) the upper Nanay River, from ap-

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proximately 190 km to nearly 400 km by river above Iquitos, including about 16 km along each of the headwater rivers, Aguas Negras and Aguas Blancas.

The area between the Itaya and Amazon has been subjected to more human pressure than any other area censused. The forest has received heavy selective and clear cutting although primary growth may still dominate. Several families live in the area. The entire area, inundated during the survey, is inundated annually, primarily by the Amazon.

The forest that we censused behind the tiny hamlet of Nina Rumi has received selective cutting and is non-inundatable.

Campamento Callicebus, established in 1973, is the only area along the Nanay that is at least partially protected from hunting. The non-inundatable forest of Campamento Callicebus has received no, to very little, selective cutting.

The Nanay is a black-water river. Most forests along the upper and lower Nanay are inundated annually and were inundated during our survey. Only in a few locations is high, non-inundatable ground right along the river; otherwise, forests on both sides are inundatable, sometimes the inundation extending 3 km or more inland along the lower Nanay. Only 4 permanently inhabited hamlets were encountered along the upper Nanay, ranging in size from 1 to 9 families, with the last one at the 307 km mark. However, several more camps used intermittently by hunters and loggers exist along the entire course of the river. Hamlets are only along the river or its ox-bow lakes, never inland.

Selective cutting in the inundatable forests has occurred all the way up the Nanay although the amount of cutting diminishes as one gets further from Iquitos. Non-inundatable forests suffer very little, or no, cutting, except in the immediate areas around villages where slash-and-burn agriculture is practiced. This trend in forest cutting is the same along the Orosa and Ampiyacu rivers.

(2) Ampiyacu River basin: The Ampiyacu River is a northern tributary of the Amazon discharging its waters 170 km downstream (east) from Iquitos. The Ampiyacu basin, in many aspects, is a miniature version of the Nanay basin, but some notable differences do exist. During the survey, the river's water was fairly turbid and, from appearance alone, seemed to fit somewhere between a white-water and black-water river. The inundatable forests occur almost exclusively along the lower section (roughly the lower 50 km) of the river. The water level was low during the survey.

Almost the entire human population of the river lives within 35 km of its mouth; above 35 km, where almost all censusing was done, there are only 2 or 3 lone habitations.

(3) Orosa River basin: The Orosa River enters the Amazon from the south side approximately 120 km downstream from Iquitos. The Orosa is very similar to the nearby Ampiyacu, including its appearance as an almost white-water river and the distribution of its human population. The only significant difference we noticed was that relatively more forest near the headwaters is inundatable compared to the Ampiyacu.

(4) Samiria River basin: The Samiria River lies in the fork between the Maranon and Ucayali rivers and empties into the Maranon near the confluence of the two great rivers. The features of the Samiria basin are quite distinct from those of the previous river systems. Foot and canoe work, aerial photographs and flyovers, and accounts of local people all indicate that almost the entire Samiria basin, as well as the basin of its sister river, the Pacaya, and

ill forest between the two, is seasonally or permanently inundated. Palm-dominated forests are extensive with broadleaf-dominated forests restricted to the islands of high ground along river sides and ox-bow lakes. The topography is flat.

The Samiria is a black-water river although during our survey, it carried considerable quantities of suspended matter. Because substantial overflow from the silt-loaded Huallaga River may pass through the Samiria basin during high water, nutrient input, and hence, productivity in the area may be higher than a cursory look would suggest. Large floating islands of aquatic, vascular plants in the tributary streams and ox-bow lakes, accompanied by an abundant bird life, essentially absent and uncommon, respectively, in the Nanay, Ampiyacu and Orosa systems, testify to a relatively productive system.

A final important distinction between the Samiria and previously discussed rivers is that the Samiria basin lies in the Empresa Publica de Servicios Pesqueros (EPSEP) fishing reserve in which commercial hunting and lumbering have been prohibited since 1944. Several guard stations are located along the river, and, consequently, violations are probably infrequent even though subsistence hunting and logging are allowed. The human population in the reserve has dwindled to a very low number in recent years, but recent ingress and exploration by hundreds of petroleum workers, who are permitted to hunt for food, must be detrimental to the fauna of the area.

(5) *Pucallpa area: One censused area near Pucallpa, called Panguana*, is a biological field station located along the Llullapichis River, which is a very small affluent of the Pachitea River and enters it from the east. Panguana is approximately 140 km south-southeast of Pucallpa near 9.6 degrees S latitude and 74.9 degrees W longitude. The other two localities censused are 59 and 90 km west-southwest of Pucallpa near the Lima-Pucallpa road. One survey site was near the Instituto Veterinario de Investigaciones Tropicales y de Altura (IVITA) and the other in the Von Humboldt National Forest. The IVITA site is around 8.7 degrees S latitude and 75.0 degrees W longitude, and the Von Humboldt at roughly 8.8 degrees S latitude and 75.2 degrees W longitude. The biological station of Panguana, established in 1968, encloses an area of 2 square kilometers and officially has been declared a reserve since 1972. There are no permanent guards, but little hunting probably has occurred within the reserve during the last 5 years. Little, to no, cutting has occurred.

The IVITA and Von Humboldt areas both have been subjected recently to human pressure: in the IVITA forest, which has received almost no cutting, we worked along a petroleum exploration trail cut a few months earlier, and the Von Humboldt forest area was subjected to large-scale selective logging about 3 years ago.

The forests of the Pucallpa area are taller than the forests in the previously described areas, averaging 25 to 30 m tall. No extensive inundatable forests exist. Human settlements are common near each of the 3 localities.

(6) Cocha Cashu Biological Station, Manu National Park. The Cocha Cashu Biological Station is located on the northeast side of Manu River in Manu National Park at about 11.8 degrees S latitude and 71.4 degrees W longitude. Manu National Park lies mostly in the department of Madre de Dios, the most sparsely populated department in Peru. The 15,800-sq-km area was declared a national park in 1969 and since then has received rigorous protection. Before 1969, however, the inaccessability of the park area made human disturbance a very limited factor. The only human inhabitants of the park are the park guards and

a few isolated Indians. Oil exploration occurred recently in the park, but the petroleum companies were not permitted to hunt.

The Cocha Cashu trail system, enclosing approximately 1.2 sq km, is situated between the northeast bank of the white-water Manu River and an ox-bow lake, Cocha Cashu. The terrain is flat, but not inundatable (or rarely so), and the mature forest averages 25 to 30 m tall, resembling forests near Pucallpa more than forests near Iquitos.

(7) Moyobamba area: A short investigation was made in the highland (approximately 1000 m) forest along the upper Mayo River 80 km northwest of Moyobamba around 5.7 degrees S latitude and 5.5 degrees W longitude. The highland forest near Moyobamba covers mostly very rugged, mountainous terrain. The rivers are torrential and forest cutting is limited to near the few roads in the area. The forest averages approximately 20 m tall. The area that we censused along the upper Mayo River lies within the Upper Mayo Forest Reserve, established in 1963; nevertheless, a new road presently is being constructed through the area, and human settlement has been encouraged.

A description of the study areas would not be complete without an additional note on the human factor. In Amazonian Peru, wildlife, including monkeys, is an important source of meat. Human inhabitants of the Samiria (including the guards), Nanu (the park guards hunt outside the park for only those species permitted by law), Nanay, Ampiyacu, and Orosa rivers acquire almost all of their meat from the forest, and in the latter 3 areas, commercial hunting also has been intense. Low-income people in the Pucallpa and Moyobamba areas, where more beef is available, also often depend on wild meat. In addition, large-scale projects in the forests, such as petroleum exploration and logging operations, often employ hunters to supply fresh meat for the workers. Finally, Peruvian hunters are skilled at their task and at home in the forest, the professional often going inland 3 to 4 days from a river to hunt.

METHODS

Monkey censusing and analysis of data basically followed the methods of Southwick and Cadigan (1972) because they provide a fast estimate of monkey densities, and enabled us to survey several areas of Peru within a few months. In this method the observers move in a line through the forest, measuring the distance they cover and recording all monkey groups encountered. For each species, the observer estimates the average maximum distance from his path at which he is able to detect that species; this distance is called the auditory visual field. With estimates of the length and width of path covered, one can calculate the area (in square kilometers in this study), and with the number of groups or monkeys observed within that area determine a theoretical density.

Censuses were conducted via three types of transportation — by foot, by canoe, and from motor boat, usually our expedition boat, the Maquisapa. Usually 2 or 3 persons participated in a census; in some areas we hired a forest guide who was familiar with the area.

During censuses on foot we attempted to walk quietly and slowly (average speed 0.95 km/hr), stopping for several seconds every 20 to 40 m to listen and look more intensely for monkeys. We moved in a single file and usually stayed within 25 m of each other. We conducted most foot censuses along a forest trail although considerable distance was covered without trails. Extra noise and

difficulty of passage through undergrowth often made censusing off trails undesirable; however, trailless areas of the forest have, in most cases, received less hunting pressure and thus may harbor higher monkey densities. To estimate distances covered while censusing, we ascertained the number of steps required to cover 20 m and then used a hand counter to tabulate the number of 20 m segments walked.

Because travel by canoe was so quiet and because at least 2 or 3 of the observers (there were almost always three in the canoe) could constantly watch and listen for monkeys, the canoe was not stopped regularly, and we averaged 1.8 km /hr. Forest streams, flooded forest trails, and the edges of ox-bow lakes were the primary census paths. Distances covered by canoe were estimated by eye, usually in 201m segments, and recorded on a hand counter also. We practiced both the pacing and eyeing techniques of measuring distances along measured forest trails and feel that our estimates had less than a 20 percent error.

I called censuses by foot and canoe "transect censuses" and divided them into three main types. Censuses conducted through a forest, whether by trail, no trail, or narrow stream, I called "regular" censuses. In these censuses the visibility conditions on both sides of the census path were relatively optimum for any particular forest. During such censuses, the auditory/visual field for each species was multiplied by the census distance to calculate the area covered. But often, when censuses were conducted along the edge of an ox-bow lake or river, we used a special type of census and analysis of data. When a lake or river was wider than approximately 25 m, we would keep the canoe near one bank and look for monkeys in the forest of the near bank. We called this a "one-half regular" census. If the other shore was less than approximately 75 m away, it was also watched for monkeys and was termed a "one-half shoreline" census. The denseness of shoreline vegetation affected visibility and adjusted these distances. For density calculations, the areas covered on the "one-half regular" censuses were determined by halving auditory/visual fields of the species, i.e., the radius of the auditory/visual field, and multiplying this by the distance canoed. In "one-half shoreline" censuses, observation conditions were worse for the far shore, and the auditory/visual field radius for each species was halved to calculate the area censused. Because of the extremely meanderous nature of some of the small streams that we censused along the Ampiyacu River (one ends up looking at the same area from different sides), I used two-thirds of the actual distance covered along these streams to calculate the area.

Repeat censuses also were made, primarily at the three biological stations. The same method of looking for monkeys was employed during a repeat census (casually walking along a trail a second time was not considered a repeat), and almost always, there was a day or more between repeats. For any section of trail censused more than once, the average number of monkey troops observed along that section was calculated, and this number was used in the density estimates. For example, if a 300-m section of trail was covered twice, and one troop was seen the first time and two the second, we considered that 1.5 troops had been seen along 300 m of trail.

A total of 302,685 m, during 262 hours of censusing, were covered by transect censuses; 112,440 m were by canoe and 190,245 m by foot. Table 1 gives the breakdown of distances for each area. Many more hours and kilometers of non-census field work were also performed.

While travelling up the Nanay, Ampiyacu, Crosa and Samiria rivers in the expedition boat, the Maquisapa, and during another trip up the Ampiyacu and its tributaries in a different motorboat, we censused the shorelines of the rivers by two observers watching for monkeys from atop the boat. In more than 98 hours of motorboat censusing, we covered 617.14 km. Upstream speed of the Maquisapa varied from an estimated 4 to 8.5 km hr during censuses and allowed ample time to search the trees of both shorelines for monkeys that had not fled from the noise of the boat. We did not attempt to calculate the area covered by motorboat surveys but compared data on groups seen per distance of river censused and perhour of observation. The lower Nanay River is more than 150 m wide, and we censused only one shoreline at a time. These data are made comparable to results from censusing both shorelines of other rivers by halving the distances covered.

Transect censuses and motorboat censuses were conducted during all hours of daylight. Censuses were never conducted in the rain or heavy sprinkle. During transect censuses we tried to avoid areas of human settlement although this was not always practiced or possible. All areas surveyed, however, were quite susceptible to human pressure (unless protected) because all censuses were done within 12 km of the nearest navigable river or road.

During a census, we investigated any sound or movement that indicated the presence of monkeys. When we detected monkeys, we tried to move closer to identify the species and to count individuals. We considered the observation of a single monkey as a troop sighting. Besides noting habitat and behavior, we also approximated the distance the monkeys were from us when we first detected their presence; these data aided us in selecting the auditory/visual field for each species.

To estimate an auditory/visual field for each species, 3 overlapping factors were considered: 1) the average distance at which we first detected groups of that species; 2) the group size and dispersal of members in the group; and 3) the most subjected one, how consistently, or what percent of the time, does the behavior of that species make it conspicuous to the human observer, e.g., does it spend 10 percent or 60 percent of the day resting. Due primarily to their secretive or sedentary habits, the auditory/visual fields for Callicebus spp., A. semiculus, and to a lesser degree, P. Monachus were difficult to estimate. In most cases, depending on differences in behavior, due possibly to hunting, the densities calculated for these species from the auditory/visual fields given below are probably much too low. The auditory/visual fields of the other species should result in theoretical densities consistently closer to the true densities, and the more predictable, conspicuous behavior of these species increases the reliability of comparing relative population densities between areas. Better estimates of auditory/visual fields will be possible when transect censuses are tested in areas of known population densities. The estimated auditory/visual fields for each genus are as follows: Saguinus, 60 m; Saimiri, 100 m; Callicebus, 40 m; Alouatta, 40 m; Pithecia, 50 m; Cebus, 70 m in areas where they were usually not seen with Saimiri and 80 m in areas where they usually associated with Saimiri; Lagothrix, 90 m; Ateles, 90 m.

Valuable information was also collected during surveys by listening for morning vocalizations of such species as A. soniculus and Callicebus spp. and by questioning local people who usually replied with much useful, reliable data.

Intensive field studies on C. pygmaea and C. torquatus have been performed by project members to obtain more precise data on the ecology and

abundance of these 2 species. Only a few of the findings of these studies are presented.

RESULTS AND DISCUSSION

During transect and motorboat censuses a total of at least 185 sightings of monkey groups were made, and more than 33 additional group observations were made during non-census field work. Vocalizations, especially of A. ceniculus and Callicebus spp., often provided additional data on monkey abundance and distribution. Table 2 gives the number of sightings of each species in each of the study areas.

The results of group size counts is discussed first because the average group size for each species is later used to estimate monkey densities. This is followed by sections discussing the monkey densities in each area, the results of the motorboat censuses, the status of each species, and the rate of monkey sighting during the day.

Group size

It is extremely difficult to obtain a complete group-size count of any of the species while censusing, and without several hours, or days, of observation one can never be sure of a complete count. We often felt, at times after only a minute of observation, that we had seen and counted all members of a troop, if the troop was cohesive instead of fragmented, something which only prolonged observation could answer. Also, the absence of distinct, sexual dimorphism in New World monkeys makes the determination of sex ratios of groups even more difficult.

Areas with different hunting pressures and different selective pressures may not have similar group sizes. The counts in one area, therefore, may not apply to another area. Because the number of reliable group-size counts in any one area was too small to ascertain any group-size for each species, over all areas censused, is used to calculate densities of individuals. Large groups of A. paniscus, and probably L. lagotricha, frequently separate into smaller subgroups, and the average group size refers to the average size of all groups and sub-groups encountered during the censuses. The estimated average group size used for each species is as follows: Saguinus fusciollis, 6; Saguinus nigricollis, 6; Saguinus imperator, 3; Saimiri sciureus, 40; Callicebus moloch, 3; Callicebus torquatus, 3.5; Alouatta seniculus, 5; Pithecia monachus, 5; Cebus apella, 10 Cebus albifrons, 10; Lagothrix lagotricha, 10; Ateles paniscus, 7. We lack sufficient group-size data for several species; consequently, some of the above estimates are quite tentative and may be conservative.

Below is a brief summary of the group-size counts for each species and some findings of other investigators.

S. fuscicollis: Possibly complete counts of S. fuscicollis groups ranged from 2 to 9, but nearly all counts registered 4 to 8 individuals. Rogerio Castro counted 24 at Campamento Callicebus and Hernandez-Camacho and Cooper (1972) report that S. fuscicollis groups in Colombia have 5-20 members. The small group sizes that we encountered during our censuses are similar to those reported by Moynihan (1970) for S. geoffroyi and by Thorington (1968) for S. midas.

S. nigricollis: The few observations of this species, seen only along the Ampiyacu River, suggest that its troop sizes are similar to S. fuscicollis. Our best count registered 6 individuals. Hernandez-Camacho and Cooper (1972) believed the average troop size for this species to be from 5 to 10 in Colombia.

S. imperator: S. imperator was observed only 4 times at Cocha Cashu Biological Station, but we felt confident that we obtained complete, or nearly complete, counts each time. The 4 counts yielded 1, 3, 3, and 3 individuals.

S. sciureus: The large groups of squirrel monkeys never afforded us a chance to make what we thought might be complete counts. Our best looks at S. sciureus troops almost always indicated that there were at least 30 to 40 individuals, but in some cases, I believe that there were more than 50. Hernandez-Camacho and Cooper (1972) likewise were unaware of reliable counts of more than 40 or 50 individuals. However, Rogerio Castro observed a group with more than 100 individuals at Campamento Callicebus, and Baldwin and Baldwin (1971) report seeing groups with at least 120 to perhaps 300 individuals in northern Amazonian Peru.

C. moloch: Group counts of this species usually registered 2 to 3 individuals, usually 3 when visibility was good; and never more than 3. Groups of 3 primarily appeared as family units, i.e., 2 adults and 1 juvenile. Mason (1968) also found 3 the average group size for C. moloch in the Colombian llanos.

C. torquatus: In the six counts of different C. torquatus groups, 3 individuals were registered 2 times and 4 individuals 4 times. One count of 3 is complete because this troop is currently under study; the other counts were probably either complete, or nearly complete. Troops of 2 to 5 are reported by Hernandez-Camacho and Cooper (1972) in Colombia.

A. seniculus: The most reliable, and highest, counts of this species were made along the Samiria River where we saw from 2 to 7 monkeys per group with the mean approximately 5. Counts by Neville also indicated that A. seniculus groups average 5 in the Samiria area. Observations of A. seniculus at Cocha Cashu suggest that troops are similarly small there. Neville (1972) found an average group size of 8.6 for A. seniculus at his study area in Venezuela.

P. monachus: We recorded 3 animals in each of our 3 best counts of P. monachus along the Samiria River and never saw more than 3 in any group. Neville, however, observed groups with at least 7 or 8 along the Samiria, and we counted from 5 to around 8 individuals per group along the Nanay.

C. apella: Several counts of this species, all probably incomplete, produced minimums of 5 to 10 monkeys per group. Sometimes we believed there were more than 10. Durham (1972) reported group sizes of 18 to 34 for Cebus spp. (group sizes were not broken down for each species) in the lowland forest of southeastern Peru. Kuhlborn (1936) observed groups of 8 to 18 in the southern Matto Grosso of Brazil. Thorington reports an average of 6 for 2 troops from the llanos of Colombia, and Klein and Klein (1972) observed troops with 1 to 12 independently moving monkeys at their study site at La Macareua, Colombia.

C. albifrons: Because C. albifrons disperse while foraging, are extremely wary of humans in the study areas, and are difficult to see when travelling with S. sciureus groups, we never obtained good group-size counts. Our highest counts showed minimums of 5 individuals, but there were almost certainly more in each case. Durham's (1972) observations of Cebus spp. suggest that, at least

in southeastern Peru, average group size may be larger than 10 for C. albifrons. Hernandez-Camacho and Cooper (1972) estimate that groups of this species in Colombia average 15-20 individuals or, at times, up to 30.

L. lagotricha: The 2 observations of this species in the Samiria basin produced minimum numbers of 5 and 6, but in both cases there may have been several more. During expeditions by Neville to the area, counts indicated 3 to 8 individuals per troop, except for one group of more than 30. Durham (1972) reports group sizes varying from 6 in highland areas to 14 in lowland areas in southeastern Peru, and Hernandez-Camacho and Cooper (1972) estimate an average group size of 4 to 6 for L. lagotricha in Colombia.

A. paniscus: The well-known variability in group size of Ateles spp. in any one area (Durham 1972, Klein and Klein 1972, Carpenter 1964, Freese 1972) was again documented during our observations of A. paniscus at Cocha Cashu. The number of individuals in a group or subgroup of A. paniscus was usually distinct due to the apparent cohesiveness of the few individuals within that group and the conspicuousness of the animal. We were often confident that our counts were complete, or nearly complete, and in 12 encounters, group-size counts ranged from 1 to 24 individuals and averaged ca. 6. (I arrived at an average of 7 for density calculations by assuming 1 individual went uncounted in each troop.) This average is significantly lower than the mean group size of 18.5 reported by Durham (1971) in a nearby lowland forest in Manu National Park, but because his figure probably refers only to entire groups, instead of groups and sub-groups, our averages are not comparable.

Monkey abundances in the study areas

Table 3 presents the densities of each species in each area (except around Moyobamba where no monkeys were seen) as estimated from the transect census method.

Nanay River-Iquitos area: According to the estimated densities from transect censusing, C. moloch, 3.2 groups per sq km; S. fuscicollis, 2.6 groups per sq km; and P. monachus, 1.7 groups per sq km have distinctly higher group densities than the other species in the Nanay-Iquitos area. However, because S. sciureus groups tended to frequent shoreline vegetation during our survey along the upper Nanay River—13 of the 14 groups seen during that survey were observed from the Maquisapa (see Table 5)—S. sciureus is undoubtedly underrepresented since transect censuses typically were made away from shorelines. The only S. sciureus group seen during transect censuses along the upper Nanay was from a canoe in the shoreline forest of an ox-bow lake. S. sciureus certainly has the highest individual density in the area followed by S. fuscicollis. Only one groups each was observed of C. torquatus, C. apella, and C. albifrons.

Long-term observations at Campamento Callicebus show that C. torquatus density, at least in that locality, is definitely higher than indicated by transect censuses. During an expedition inland from Campamento Callicebus, morning vocalizations of at least 2, and probably 3, different, nearby groups of C. torquatus were heard from our camp. More precise data from recent studies by Warren Kinzey (personal communication) and Rogerio Castro at Campamento Callicebus have revealed that C. torquatus group densities there may be at least 4 per sq km in suitable forest. Along the Nanay River, C. torquatus inhabits

apparently only non-inundatable forest although C. moloch is found in both inundatable and non-inundatable forests.

The possibly unique ability of S. fuscicollis and S. sciureus to thrive in highly disturbed, mixed primary and secondary forest is illustrated by census results from the inundated forest between the Itaya and Amazon within 4 kilometers of Iquitos. In the 13,670 m censused, only S. fuscicollis and S. sciureus were observed, with estimated group densities of 4.97 and 1.49 per sq km. Omitting these census data from the calculations for the entire Nanay area in Table 3 does not significantly alter the general trend in monkey densities.

The inconspicuous C. pygmaea and Aotus trivirgatus inhabit the Nanay basin and may be moderately common. A. seniculus, heard during the survey, and L. lagotricha were reported uncommon by locals along the Nanay. A. paniscus is extinct along the middle and lower Nanay, and possibly along the upper Nanay and its headwaters. A boatman who has carried hunters up and down the Nanay for 20 years has seen A. paniscus only twice, both shot by hunters in the headwaters several years ago.

Ampiyacu River basin: Probably only 3 species were observed during transect censuses in this basin—S. nigricollis, C. torquatus, and Cebus (probably apella, although the genus is even questionable). There is a very slight possibility that 2 of the 6 groups identified as S. nigricollis were S. fuscicollis, and that 1 of the 4 groups identified as C. torquatus was C. moloch. C. torquatus and S. nigricollis had comparatively high estimated densities with 3.8 and 3.2 groups per sq km. Possibly due to the absence or rarity of C. moloch in the basin, C. torquatus inhabits both inundatable and non-inundatable forests along the Ampiyacu. The scarcity of S. sciureus, seen only once during the entire survey, was substantiated by local people who claimed that the species was not common in the area.

Marks and observations of C. pygmaea on feeding trees and reports of locals indicate that C. pygmaea is common along at least parts of the Ampiyacu. A. seniculus was heard but is uncommon. A. trivirgatus, P. monachus, both Cebus species, and L. lagotricha were reported present by locals, but all, except possibly A. trivirgatus, are uncommon. Although there was some disagreement in reports, it seems C. moloch is not found in the basin. Cacajao calvus, A. paniscus, and, owing to claims that only one Saguinus sp. inhabits the basin, S. fuscicollis were reported as naturally absent in the basin.

Orosa River basin: With the exception of a high C. apella density of 1.7 groups per square kilometer, estimated densities of the 5 species seen along the Orosa River generally follow the trends found for the Nanay area. C. moloch again has the highest group density with 4.5 groups per sq km, followed by C. apella, and S. fuscicollis. The individual density of S. sciureus was found to be at least twice as great as that of any other species.

A. trivirgatus and A. seniculus were heard in the basin and hunter-killed L. lagotricha were seen. C. pygmaea, C. calvus, and A. paniscus were also reported present.

Samiria River basin: The Samiria River basin offers a distinct change from the pattern of primate abundance along the 3 previously discussed rivers. The census data indicate that A. seniculus has, by far, the highest group density, 5.9 groups per sq km, and 4 other species, S. fuscicollis, S. sciureus, P. monachus, and C. apella are relatively abundant with approximately 2 groups per sq km. In the estimated individual density, S. sciureus is more than twice as numerous as the next 2 most common species, A. seniculus and C. appella.

L. lagotricha and C. albifrons (identification at specific level for the latter is questionable) were recorded at low numbers in the area.

The possibility of extremely high monkey densities in some localities of the Samiria basin was revealed during censuses on the peninsula in the ox-bow lake of Maldonado. In two 3,500-m censuses of the peninsula (one was a repeat), we saw 20 primate groups, a theoretical density of more than 260 monkeys per square kilometer. Neville also investigated this area and found high numbers of monkeys on the peninsula.

Reserve guards claimed that C. pygmaea and A. trivirgatus inhabit the surveyed area, but that C. moloch is found only along the headwaters of the Samiria. A. paniscus is rare in the area; a single individual was seen during Neville's expeditions.

Pucallpa area: The Pucallpa localities censused have clearly the lowest overall group density of any major survey area. S. fuscicollis has the highest estimated group density and S. sciureus has the highest, although low in absolute numbers, individual density. S. sciureus and C. albifrons were observed only at Panguana biological station where they are relatively common. According to local people, they are present, but not as common, in the IVITA and Von Humboldt forests.

Not recorded during censuses, but reported present at, or near, the study areas were: A. trivirgatus; A. seniculus, also seen and heard; C. apella, at IVITA and Von Humboldt only; L. lagotricha and A. paniscus, both uncommon, or rare, at the IVITA and Von Humboldt sites and extirpated for several kilometers inland from Panguana.

Cocha Cashu Biological Station: Seven of the 8 species observed during censuses at Cocha Cashu have estimated group densities higher than 1.8 per sq km; A. seniculus has the highest group density, 4.8 per sq km. Vocalizations indicated that C. moloch is more common than revealed by transect censusing, although by no means abundant. As usual, S. sciureus has the greatest individual density, more than twice that of the next most numerous species, C. apella. Total group and individual densities at Cocha Cashu are the highest of any area studied. John Terborgh (personal communication) similarly notes that monkey numbers in Manu National Park greatly exceed anything he has seen elsewhere during his extensive travelling in Amasonian Peru. In addition to the species we observed, he notes that C. pygmaea and P. monachus are at the biological station. L. lagotricha is found in the park but not at the biological station.

Differences in the biological productivity of the study areas complicate interpretation of the census results. For example, because of sedimentation, annually inundated forests might be expected to support greater numbers of animals, including monkeys. Local differences in the distribution of some monkey species also may confuse interpretations. I might have sited hunting as the probable reason for the absence of C. apella at Panguana if I had not been informed that C. appella does not naturally inhabit forests on the east bank of the Pachitea River. Another obvious variation in the local distribution of a species occurs in Manu National Park where L. lagotricha is found in good numbers in some areas of the park, but is absent at the Cocha Cashu Biological Station. Hernandez-Camacho and Cooper (1972) mention that in Colombia, L. lagotricha and A. paniscus groups may tend not to inhabit the same areas. If so, the absence or rarity of one species may be attributable to natural causes when the other is common. But in all the study areas, except Cocha Cashu and maybe the Samiria basin, both species are rare.

or extinct, and the cause is probably hunting. In fact, the pattern of our results vividly demonstrates that human pressure has a devastating effect on monkey abundance while differences in productivity or local distributions explain only a few local or minor variations. The two areas with a history of little hunting, the Samiria reserve and Cocha Cashu, have an average density more than 3.5 times greater than the average density of all the other, more intensely hunted areas.

Habitat destruction is not as serious as hunting. Forest cutting in the Amazonian lowlands is significant only in the inundatable forests and in forests along streams and rivers because timber extraction is easy at high water, and the inundatable land along the major rivers is highly suitable for agriculture. Especially in heavily-populated areas, the result has been reduced tree-species diversity and degradated forests which must adversely affect monkey populations in these areas.

The significance to monkey numbers of such destruction is probably proportionately greater than the small percent of all forests affected because our census results from the Nanay-Iquitos, Orosa, and Ampiyacu areas showed that 2.5 times more monkeys inhabit inundatable forests that non-inundatable forests. Forest destruction in the highland forest, around Moyobamba for example, is more significant because the land is more favorable for agriculture than the non-inundatable forests of the lowlands, and land clearing for farming is expanding into new areas.

Motorboat Censuses

Tables 4 and 5 present two different sets of data obtained frommotorboat censuses. The 4 sets of data from the Samiria River (Table 4), 3 of which were obtained during expeditions by Neville, illustrate clearly the large variability in sightings which may occur between 2 censuses. Though local people usually claim that more monkeys are found in the riverside forest during highwater, the data are insufficient to ascertain if such a trend truly exists.

Table 5 shows that in each of the 5 motorboat censuses, the highest rate of monkey sightings were obtained along the upper one-half of the river travelled. The overall rate was 4.5 times higher along the upper one-halves of the rivers censused than along the lower one-halves. Because the lower stretches of rivers are typically closer to and/or inhabitated by more people, the scarcity of monkeys along the lower parts of rivers was expected.

It appears that motorboat censuses are probably on unreliable method for comparing relative monkey abundances between river systems: for example, although the Samiria basin had the second highest primate density of any area surveyed, the rate of monkey sightings from the motorboat was one of the lowest.

Status of each species

In this section our findings concerning the population status of every Peruvian primate species and the most important factors currently affecting the status of each is discussed. For some species, or subspecies, e.g., L. flavicauda and S. mystax, we have very little information; this may simply reflect the location of our survey sites or indicate that that species is indeed very rare.

C. pygmaea: Because this species occupies the unique position among Peruvian monkeys of being too small to be hunted for food, threats to its survival are reduced considerably. Trapping it for export or as pets and habitat destruction are its greatest enemies. C. pygmaea was reported along all of the tributary rivers of the Amazon (does not include Pachitea) and Maranon which we surveyed. In addition, our guide at Moyobamba stated that C. pygmaea, which he accurately described, inhabits forests near Moyobamba, and John Terborgh (personal communication) reports sightings of this species at Cocha Cashu. These 2 latter locations are far to the west and south of the known distribution of this species in Peru. Because of its extremely small size and inconspicuousness, only intensive study in an area could yield reliable data on the population density and its determinants in this species. A study of 2 C. pygmaea groups near the hamlet of Mishana along the Nanay River demonstrated that the distribution and density of the 2 or 3 tree species that are most important as resin or sap sources may largely determine the density of C. pygmaea. Thus, in a well-surveyed forest along approximately 1.5 km of a small tributary stream of the Nanay only 2 C. pygmaea groups live, and these 2 groups are located in the only two sites where the resin-source trees occur in distinctly higher densities. One of these troops had 9, and later, 8 individuals. In the Nanay basin our extensive fieldwork and local reports show that C. pygmaea inhabits almost strictly stream-side, inundatable forest, but along the Ampiyacu we found C. pygmaea inhabiting non-inundatable forest and utilizing some different tree species for resin. This species' specialized feeding habit and its apparent dependence on a limited number of tree species in any one forest or area probably means that numbers of this monkey may be locally abundant but that overall it is not abundant.

S. fuscicollis: S. fuscicollis exists in good numbers in all areas surveyed, except along the Ampiyacu basin where an apparent gap in its distribution is filled by S. nigricollis. This species survives similarly well in virgin forest away from human population centers and in heavily disturbed, largely secondary forest near large population centers such as Iquitos. No important differences in densities of this species were observed between protected and non-protected areas although this species was heavily exported in recent years and is sometimes killed for food. The population status of this species is probably in good shape over most of its distribution in Peru.

S. nigricollis: The Ampiyacu River basin is probably the only area surveyed which lies within this species' distribution although the Nanay basin might fall within the fringe of its range (Soini 1972). This species also survives well under heavy human pressure.

S. imperator: The range of this species in Peru is limited to the southern departments of Madre de Dios and possibly Cuzco where it probably occurs at natural population levels throughout because this region of Amazonian Peru has received very little human exploitation.

S. mystax: Two areas surveyed within this species' distribution, as described by Hershkovitz (1968), the Orosa and Samiria river basins, yielded no direct evidence of the occurrence of S. mystax. A guard and long-time resident of the Samiria fishing reserve reported that 2 kinds of Saguinus inhabit the basin, but his description of the one other than S. fuscicollis was insufficient for us to be sure that it was S. mystax. Earlier expeditions by Neville also failed to observe this species. However, we know S. mystax apparently occurs

in substantial numbers in some areas of Loreto because several hundred were captured in just 2-3 months for export from Iquitos in 1974.

C. goeldii: Our surveys added almost nothing new to the paucity of information on the distribution or status of this species. A live C. goeldii accompanied us on most Maquisapa expeditions, but, with few exceptions, the monkey was completely unrecognized by local people. Along the Nanay River, a couple of locals, out of the many questioned, claimed that the species occurred there, and at the hamlet of Mishana, Pekka Soini (personal communication 1974) has recently seen C. goeldii. The only other place where we found any report indicating the possible occurrence of C. goeldii was Madre de Dios where a Manu National Park guard described an all black Saguinus-size monkey which he claimed lives near the mouth of the Manu River. The species is certainly rare in nearly all of Amazonian Peru although it could occur in good numbers in some largely unexplored, isolated areas.

S. sciureus: S. sciureus was observed in all of the lowland areas surveyed and is the most abundant monkey in Peru. Like Saguinus spp., S. sciureus can tolerate heavy human disturbance such as hunting and selective cutting, but the census data indicate that such human pressures definitely have a depressing effect on S. sciureus populations which were at least 2 to 3 times higher in the Samiria and Cocha Cashu areas than the other areas surveyed.

A. trivirgatus: This widespread species was reported by locals as being at least fairly common in all areas surveyed although we questionably heard or observed it only a few times. Although it, too, has been hunted for both export and food, its nocturnal habits seem to permit its survival in even heavily hunted areas.

C. moloch: This species also appears to survive in substantial numbers in areas of high human populations. Though very few were exported in recent years (Soini 1972), this small monkey is frequently hunted for food; however, it continues to survive in highly exploited areas due primarily to its small troop size and extremely wary conduct. Although Hershkovitz's (1963) distribution map puts C. moloch in the Ampiyacu and Samiria river basins, we failed to detect it in either area and Neville also did not find it along the Samiria. Knowledgeable locals usually reported that C. moloch is not found in either area, except that it was stated to occur near the headwaters of the Samiria. At best, it is, for unknown reasons, very rare in both areas.

C. torquatus: C. torquatus also survives in fair numbers near human populations and its status Peru is probably good.

A. seniculus: The large size of A. seniculus makes it a highly desired quarry for the Amazonian hunter, and the consequences were clearly illustrated during our surveys. Only along the Samiria River and at Cocha Cashu were A. seniculus observed during censusing, and indeed, they were found in high numbers in these protected areas. In all other lowland areas surveyed, vocalizations verified the presence of this species, but in low numbers. They are certainly wiped out in some extensive local areas where they formerly existed; for example, we have never heard or seen A. seniculus at or around Campamento Callicebus although one group of A. seniculus was seen recently by Pekka Soini (personal communication) along this lower section of the Nanay.

P. monachus: P. monachus appears to survive human hunting pressures fairly well, in spite of the fact that it is larger and a more desired food animal than the previously discussed species. It is apparently found in all major areas

surveyed except Moyobamba, but always at low individual densities. Its tree-top living habits, quietness and shyness make it a hard animal to hunt. P. monachus probably does not inhabit areas with extensive secondary forest.

C. calvus (subsp. rubicundus): The Orosa River basin was probably the only area surveyed that is within the range of C. calvus; everyone questioned insisted that this species does not inhabit the forests of the Ampiyacu River, an area within the limits of this monkey's range as described by Soini (1972). We know C. calvus still occurs near the Orosa River because during the expedition to the area, some Yague Indian hunters told of a group of this species that they had been searching for near their riverside camp. We have no information about its population status within its range.

C. apella: The depressing effect of human exploitation on the populations of this species are clearly shown by the census data. The Samiria and Cocha Cashu areas have densities of this species several times greater than other areas surveyed that recently have been, or are, vulnerable to high hunting pressure. This species was reported at the Von Humboldt site; however, reliable sources noted that this species occurs only on the west side of the Pachitea River in the area of Panguana. In the past, C. apella also has been a favorite animal for export from Iquitos (Soini 1972). It probably tends to disappear from an area before the previously discussed species do as human exploitation increases. Thus, within several kilometers of Iquitos, the species has been extirpated or is very rare; indeed, nearly two years of work at the Biological Station "Campamento Callicebus" have yielded only one questionable sighting of this species. Our work indicates that the species probably should not be called abundant over most of its range in Peru as Grimwood (1968) asserts.

C. albifrons: Field work and the comments of locals usually showed C. albifrons to be the rarer of the 2 Cebus species. The only exceptions were at Panguana along the Pachitea River where C. apella is probably absent and possibly along the Ampiyacu where locals reported C. albifrons to be the most common of the two. This general difference in abundance is in agreement with Grimwood's (1968) notes. Its low population level in areas could make it very susceptible to local extinction with a small increase in hunting pressure.

L. lagotricha: L. lagotricha and A. paniscus are, for their meat, the two most highly esteemed monkey species in Amazonia, and the populations of both species have suffered tremendously because of this ominous distinction. L. lagotricha's distribution encompasses all of the surveyed areas, except around Moyobamba, where it is replaced by L. flavicauda, and locals always reported them as present at least in the general area of each survey. In all lowland areas surveyed locals stated that L. lagotricha was the rarest or second rarest, behind A. paniscus, monkey in their area, and often noted that they could be found only by going may kilometers inland away from human disturbance. The species is certainly extinct over extensive areas along the rivers of the Department of Loreto, and is probably rare in most of the Peruvian Amazon. Apparently good numbers of this species inhabit the Samiria and Pacaya river fishing reserves as indicated by Neville's field work. Our work, observations by John Terborgh and his co-workers (personal communication), and the guard's reports show that L. lagotricha does not inhabit the immediate area around Cocha Cashu; however, the park guards and other reliable sources claimed that it is common in the higher ground forest away from the Manu River, particularly on the southwest side. Durham (1972) considered them

"moderately abundant" at his study sites in the Departments of Madre de Dios, Cuzco and Puno.

L. flavicauda: Questioning of local people around Moyobamba indicate that this species may still be found in the area, but at dangerously low numbers and far from human activity. Two days were spent near the headwaters of the Mayo River, in the area which is the first definite locality for the species (Fooden, 1963). Our guide, who had been walking the forest around Moyobamba for 40 years, claimed to have seen L. flavicauda (his description fit fairly well) only 2 to 3 times in his life. Other people knew of the species and could roughly describe it, but many more people were not at all familiar with any kind of woolly monkey in the region. However, we found the people of the Moyobamba region far less knowledgeable about their wildlife than people of other areas. The recent discovery of fresh skins and a live captive specimen of L. flavicauda near Chachapoyas by Russell Mittermeier (personal communication) and his co-workers confirms the existence of this species in the area. L. flavicauda could still occur in substantial numbers in some of the isolated forests of this rugged region, but accelerated human encroachment and forest destruction, at rates probably higher than in lowland areas, provide an additional threat to this species.

A. paniscus: This is usually the first primate species to disappear from an area subjected to human encroachment, and its absence, or rarity, in the vicinities of all areas censused, except the most remote, Cocha Cashu, is testimony to its intolerance to hunting pressure. It seems likely that no A. paniscus (subsp. belzebuth) exist anymore in the entire Nanay River basin, but their occurrence even along the lower Nanay 40 years ago is reported by older residents of the area. Nor does A. paniscus appear to inhabit the Ampiyacu River basin, but in this case their absence may be due to a natural gap in their distribution. In the rest of the survey areas, except Cocha Cashu, A. paniscus survives in probably small numbers, usually separated by many kilometers from waterways and roads. The sighting of a single A. paniscus (subsp. paniscus) in the Samiria basin is reported by Neville, the only sighting of this species made in their four expeditions to the Samiria and Pacaya fishing reserve area.

The A. paniscus paniscus populations in the more pristine, southern forests of Peru are in distinctly better shape than those of A. paniscus belzebuth in the northern forests, as shown by the high density at Cocha Cashu and the very similar density of 24 per sq km reported by Durham (1972) for his nearby lowland study area. The situation for the subspecies A. paniscus belzebuth could be critical in northern Peru.

The low reproductive rate of Cebids and the proficiency, of the Amazonian hunter has resulted in large-scale decimation of most of the monkey species in Peru. It appears that for species such as A. paniscus and L. lagotricha only light, to moderate, hunting is needed to completely extirpate them from large areas. For these two species, still intensively hunted for food, any moderate increase in hunting, whether to feed a growing population, or to meet a heavy export demand could quickly eliminate the low numbers that currently persist in many areas and greatly expand the areas where they are extinct. Oil exploration in Amazonian Peru is creating new population centers in areas that were previously sparsely populated. Some of these newly-populated areas have undoubtedly been important refugia for sizeable populations of some primate

species, but these areas will be lost as they become heavily hunted. The prospect of increased human pressure in Amazonian Peru leads to the inevitable conclusion that the situation for all primate species can only worsen, that some definite protective measures will have to be implemented to insure the survival of sizeable populations of all species in several distinct areas of Peru.

Rate of monkey sightings per hour of day

A definite change in the visibility of monkeys during the day deserves discussion since this could affect the density estimates obtained for an area. Figure 1 shows the rate of monkey sightings per hour of the day during all transect censuses. The rate of sightings peaked between 07:00 and 08:00 at 0.89 sightings per hour and then declined until 13:00 to 14:00 to only 0.30 sightings per hour. The rate rapidly rises again later in the afternoon but never regains the high rate recorded before 11:00. The high figure for the last hour, 17:00 to 18:00, is probably much too high and not representative because the sample size for this period is very small. Thus, the monkey densities obtained for an area by transect censusing could be strongly influenced by the time of day the census was performed. If we take two areas with equal monkey densities and consistently census one early in the morning and the other around midday, the results may show the former area to have almost twice as many monkeys.

The change in the rate of sightings undoubtedly reflects the daily activity patterns of monkeys, the low midday rate resulting from the monkeys' inactivity and consequent inconspicuousness. If monkey groups become so much more invisible by simply resting, one wonders how effectively monkey species in some areas can avoid human detection when they actively attempt to hide themselves from the human observer. I suggest that when censusing all the species of an area that not only the midday hours be avoided, but also, depending on the species present, the hours before 07:00 and after 16:00 because some Saguinus spp. may not leave their sleeping holes until three quarters of an hour after full light (Moynihan 1971) and C. torquatus frequently move to the tops of their sleeping trees by 16:00.

RECOMMENDATIONS

Primate breeding centers and exportation

A primate breeding center should be developed in Iquitos to establish a continuous primate supply for research institutions and to lessen or eliminate the exploitation of wild primate populations.

In addition to a breeding center in Iquitos, and possibly another in Pucallpa later, research institutions who have a need for monkeys should be encouraged to begin breeding programs. Then, a transition phase will be needed whereby over an approximate 10-year timetable, the exact duration depending on the easiness of breeding a species and demand, the export and research use of wild-caught monkeys would diminish at a set rate while the production and use of monkeys from the Iquitos and institutional breeding centers increased. At the end of that period all, or nearly all, research-bound monkeys would be breeding-center produced.

Only institutions engaged in the establishment of a breeding center or donating significantly in some way to a breeding center would be eligible to obtain monkeys, whether wild-caught or breedings-center produced, during the transition period. For this purpose a priority system must be established for the most important research programs.

I recommend that an export tax be charged on each monkey, whether wild-caught or breeding-center produced, leaving the country. This tax money should be put back into monkey research, primarily for the breeding center.

The capture of L. flavicauda should be prohibited, except for a few individuals to be used in a breeding program. Such a breeding attempt probably should not be initiated until more experience is gained with the breeding of L. lagotricha. Exportation of wild-caught C. pygmaea, S. imperator, C. goeldii, C. calvus, L. lagotricha, and A. paniscus should be very restricted, perhaps less than an average of 50 to 100 per year over the next 10 years, and limited to institutions concerned primarily with breeding them. Export restrictions could be looser, to varying degrees, for the other species. The highest export quotas of wild-caught monkeys could be allowed for S. fuscicollis and S. sciureus, with 10-year averages of approximately 1,000 per year and 3,000 per year.

An advisory team of Peruvian scientists engaged in monkey research and international experts should be established to oversee the authorization of requests to export monkeys and to establish export quotas. The international experts would also assist, when information were needed, the bodies authorizing monkey exportation in other countries.

Research

The present team of field researchers in Iquitos and their equipment should be maintained and expanded. Research responsibilities of this project should eventually expand to include other fauna besided primates and more botanical studies.

Research is needed badly on the status of populations of C. goeldii, C. calvus, L. flavicauda, and A. paniscus (particularly A. p. belzebuth). These are most urgent, but much more data is needed on the other species also.

Censuses should be continued in order to better define and understand the status of primate populations in various areas of Peru. More comparative population data in conjunction with good descriptions of areas censused will more clearly reveal the relative importance to primate abundance of such factors as hunting pressure, productivity of a river system (e.g., black-water versus white-water rivers), and forest type (e.g., inundated versus non-inundated forests). More census data is needed for all areas, but major areas where data are especially lacking are the area south of the Amazon River and east of the Ucayali River, in the highland (foothill) forests (most importantly around Moyobamba and Chachapoyas), and near the coast in the department of Tumbes.

Because all censuses during this project were done within a days walk of navigable rivers or roads, the relative population sizes in forests two or more days inland are unknown. Censuses should be conducted far inland from rivers such as the Nanay and Orosa to ascertain how far inland the effects of hunting penetrate.

During the above surveys data can be opportunistically collected on other animals.

The types and extent of forest destruction should be determined in various areas. These kind of data are needed most urgently for inundatable lowland forests and Andean foothill forests.

Study areas should be scrutinized for their potential as wildlife reserves or national parks. Currently, no Peruvian reserve or park offers protection for large populations of S. nigricollis, most subspecies of S. fuscicollis, S. mystax, C. goeldii, C. torquatus, L. flavicauda, A. paniscus belzebuth, and possibly C. pygmaea. Such reserves should be established soon; most urgently one is needed for L. flavicauda.

The training of more Peruvian scientists for biological field work should continue through the project's assistance. Each year at least 2 students should have an opportunity to perform biological field studies in the Amazonian forest, probably at an area like Campamento Callicebus where equipment and facilities should be provided.

Peruvian and foreign scientists should be encouraged to conduct research at the project's biological station(s). This will not only advance our knowledge of Amazonian flora and fauna, but also, will provide a continuous and stimulating interflow of ideas between foreign and Peruvian scientists. Such an exchange can, in part, give the project the range of expertize it will need.

Supreme decree no. 934-73-AG

Supreme Decree No. 934-73-AG, which prohibits the killing of monkeys, should be enforced in areas where it is feasible. Such areas include the markets of Iquitos and other major population centers, and oil exploration and drilling camps.

TABLE 1. Months when the study areas were censused and a breakdown of distances censused. The numbers in parentheses show the distance that was repeat.

Area	Distance Month	Distance by foot (m)	Distance by canoe (m)	Total (m)
Nanay	Apr-May	56,090 (6,195)	42,720 (250)	98,810 (6,445
Orosa	Jun-Jul	2,350	20,120	22,470
Ampiyacu	Oct-Nov	19,270	9,730	29,000
Samiria	Oct	16,360 (3,500)	39,870	56,230 (3,500
Pucallpa	Jun-Jul	60,440 (18,340)	0	60,440 (18,340
Cocha Cashu	Aug-Sept	30,235 (19,005)	0	30,235 (19,005
Moyomamba	Nov	5,500	0	5,500
Total		190,245 (47,040)	112,440 (250)	302,685 (47,290

TABLE 2. Total number of monkey groups of each species observed during field work in each of the study areas. The numbers in parentheses represent the number seen during transect and motor boat censuses. Numerous additional observations at Campamento Callicebus are indicated by a plus sign.

	Nanay-Iquitos	Ampiyacu	Orosa	Samiria	Pucallpa	Cocha Cashu	All areas
C. pygmaea	2(0)	1(0)					
S. fuscicollis	15+(15)		4(3)	6(6)	6(5)	4(3)	
S. nigricollis		6(5)[b]				4(3)	
S. sciureus	16(16)	11(1)	5(4)	9(9)	7(5)	9(6)	
A. trivirgatus						1(0)[a]	
C. moloch	14(13)[b]		4(4)		4(2)	1(1)	
C. torquatus	2+(1)	4(4)[a]					
A. seniculus				13(11)	1(0)	6(6)	
P. monachus	7(7)		2(1)	7(7)	1(1)		
C. apella	2(1)	1(1)[c]	3(3)	10(9)		12(8)	
C. albifrons	1(1)			1(1)[a]	4(4)[a]	4(4)	
L. lagotricha				2(2)			
A. paniscus						12(9)	
Unidentified	3(3)					1(1)	
All species	62(57)	13(11)	18(15)	48(45)	23(17)	218(186)	

a = Identification of 1 group not positive, but probable.
b = Identification of 2 groups not positive, but probable.
c = Identification of genus and species not positive, but probable.

TABLE 3. Group and individual densities estimated by transect censuses.

	Study Areas a,b											
	Nanay-Iquitos		Ampiyacu		Orosa		Samiria		Pucallpa		Cocha Cashu	
	Gr /km	Ind /km	Gr /km	Ind /km	Gr /km	Ind /km	Gr /km	Iud /km	Gr /km	Ind /km	Gr /km	Ind /km
S. fuscicollis	2.6	15.6			1.5	9.0	2.5	15.0	1.4	8.4	1.8	10.8
S. nigricollis			3.2[c]	19.2								
S. imperator											1.9	5.4
S. sciureus	.4	16.0			.9	36.0	1.8	72.0	.4	16.0	2.1	84.0
C. moloch	3.2[d]	9.6			4.5	13.5			.9	2.7	.7	2.1
C. torquatus	.2	.7	3.8[c]	13.3								
A. seniculus							5.9	29.5			4.8	24.0
P. monachus	1.7	8.5			.9	4.5	1.8	9.0	.5	2.5		
C. apella	.2	2.0	.6[e]	6.0	1.7	17.0	2.4	24.0			3.6	36.0
C. albifrons	.2	2.0					.2[c]	2.0	.4[c]	4.0	2.4	24.0
L. lagotricha							.7	7.0				
A. paniscus											3.2	22.4
Unidentified	.4- .6										.5	
All species	8.9-9.1	54.4	7.6	38.5	9.5	80.0	15.3	158.5	3.6	33.6	20,9	208.7

a - Gr /km^2 = Groups /km^2
b - Ind /km^2 = Individuals /km^2
c - Identification of 1 group not positive, but probable.
d - Identification of 2 groups not positive, but probable.
e - Identification of genus and species not positive, but probable.

TABLE 4. Rate of monkey sightings during motorboat censuses, including Neville's expeditions, on the Samiria River.

Expedition	Date	Monkey sightings							Census hours	Groups/100 census hrs
		Alouatta	Lagothrix	Pithecia	Cebus apella	Saimiri	Sag. fusc.	unID	Total	
Samiria I[a]	Feb/Mar 73	4	0	1[b]	0 0	0	0	0	5	31:58	16
Samiria II[a]	Oct/Nov 73	0	0	0	0	1[b]	0	1	2	43:03	4.6
Samiria III[a]	March 74	3	1	0	1	6	3	1	15	62:42	27
Samiria IV	Oct 74	2	0	3	0	0	0	0	6	28:48	17.5

a = From Neville's expeditions
b = Identification not positive but probable

TABLE 5. Monkey sightings during motorboat censuses.

Expedition	Census dates	Total km ascended	km censused	Monkey sightings						#observations / 100 km censused		
				Sag-fusc.	Sai-miri	Cal-mol.	Alou-atta	Pith-ecia	Total	Lower river	Upper river	TOTAL
Nanay	7-14 May	399.0	200.2	1	13	1	0	0	15	1.2	11.6	7.4
Orosa	26-28 June	94.6	62.5	1	12	0	0	0	3	0.0	17.2	4.8
Samiria	6-12 Oct	179.1	195.0	0	0	0	2	3	5	1.2	3.4	2.6
Ampiyacu I	4 Aug.	50.5	50.5	5	1	0	0	0	6	8.0	15.8	11.9
Ampiyacu II	30 Oct. 3 Nov	122.2	112.2	0	1	0	0	0	1	0.0	1.8	0.9
TOTAL		845.4	620.4	7	17	1	2	3	30	1.6	7.2	4.8

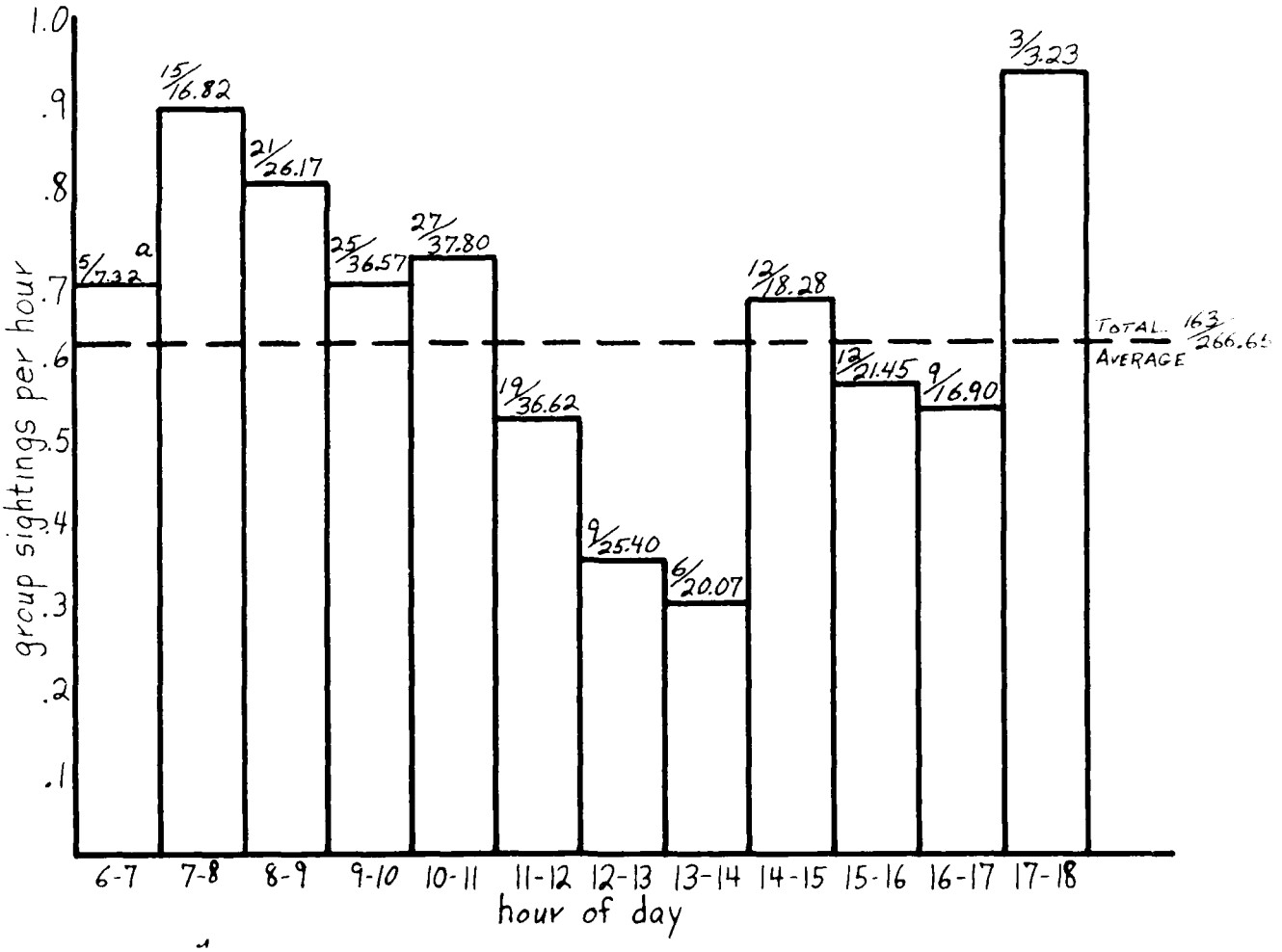

FIGURE 1.. Rate of monkey group sightings for each hour of the day.

A SURVEY OF PRIMATES AND THEIR HABITATS IN NORTHERN COLOMBIA

May-August 1974

by Thomas T. Struhsaker, Kenneth Glander, Hernando Chirivi, and Norman J. Scott

INTRODUCTION

This report covers a survey of forests and wild primates carried out in northern Colombia during May, July and August, 1974. The work was supported by a grant (74/PG/AMR/0719) from the Pan American Health Organization (PAHO) and funds from the Instituto de Desarrollo de los Recursos Naturales Renovables (INDERENA) of the Colombian government. There are two previous field reports on this project: Bernstein, Balcaen, Dresdale, Gouzoules, Kavanagh, Patterson and Warner A. Population Survey of the Monkeys of Northern Colombia covering the 1973 field work, and Scott Northern Colombia Monkey Survey covering the May, 1974 aerial reconnaissance. The latter information is included in the present report.

Personnel making the survey were Hernando Chirivi, biologist, INDERENA, Bogato; Dr. Thomas Struhsaker, primatologist, New York Zoological Society; Kenneth Glander, primatologist, Loyola University, Chicago; Dr. Norman J. Scott, Jr., biologist, U.S. National Fish and Wildlife Laboratories, Albuquerque, New Mexico; and Jorge Fuentes, field assistant, INDERENA, Bogota.

The objectives of the survey were to inventory in as great a detail as possible the status of forests and primates in Colombia north of about 7 N latitude and between approximately 73 and 77 W longitude.

ACKNOWLEDGMENTS

Many people contributed to our part of the project. Overall project planning, financial logistics and international travel were handled by PAHO: Drs. Pedro Acha, Harold Hubbard, Eduardo Sarue, Mr. Nelson Marchand and their staffs. Dr. Richard Thorington, Smithsonian Institution, provided advice and maps of the study area.

Dr. Jorge Hernandez-Camacho, INDERENA, provided the most important biological input towards project-planning. Ernesto Barriga-Bonilla and Elena de Echeverry, Peace Corps, provided invaluable logistical support. Patricia Warner, also Peace Corps, went out of her way to consult with us at length.

We received invaluable specific locality information from the many inspectors and other INDERENA employees that we met in the field. We are also indebted to the several finca owners and administrators that unquestioningly allowed us to use their shelter and to survey their lands. Finally, we gained much valuable information from local people, campesinos, Indians and finca workers that greatly increased our efficiency.

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Mitzi Smartt competently and efficiently typed the various drafts of this report.

We would like to thank all of these people for their efforts on our behalf.

METHODS

Aerial survey

During 21-23 May 1974, N. Scott and E. Barriga made a forest survey of much of northern Colombia during 16.3 hours of flying time in a four-place Piper. The route followed and forests observed are outlined in Figure 1 of the appendix. The departments of Bolivar, Cordoba and northern Antioquia were well covered in the flight, as was the coast between Turbo and Barranquilla. Observations in Cesar, coastal Magdalena and Guajira were fragmentary because of cloud cover, and interior Magdalena and Sucre were not flown.

Ground survey

Based on the results of the aerial survey and on the personal knowledge of Dr. Jorge Hernandez-Camacho of INDERENA, a plan of field work was drawn up in Bogota. Several criteria guided the development of the field plan. Areas with extensive forest were especially important because they held more promise for the future of the primates in northern Colombia and because they are potential national parks. Areas threatened by imminent colonization were also given high priority. The present national parks, Tayrona and Isla de Salamanca, were also given special attention with the thought of developing a system of regular primate inventories to monitor population fluctuations.

From 1 July-31 August, a team composed of N. Scott, T. Struhsaker, K. Glander contracted by PAHO and Hernando Chirivi and Jorge Fuentes of INDERENA made a land survey of the area. This route and the survey camps are shown in Figure 2 and the itinerary is given in Table 1. Approximately 4,000 km were covered in two jeeps and another 200 km by boat. At each camp the actual monkey surveys were done on foot.

A vegetation description is given for each site. These are by necessity brief, vague and general, partly because of the limitations of time, partly because of the botanical limitations of the investigators. The forests were classified into the following types. The rainfall figures are very approximate and are based almost entirely upon our subjective opinions combining interview information, appearance of the vegetation, the presence of certain plant species and our past experience. Several of the areas, especially in the Parque Nacional Tayrona, receive considerable amounts of moisture in the form of fog and dew.

Forest Type	Approximate Rainfall
very dry	less than 1,000 mm
dry	1,000 - 2,000 mm
moist	2,000 - 3,000 mm
wet	more than 3,000 mm

Systematic censuses

The exact location, distances covered and time spent on the ground surveys are included in Table 2. The general technique was as follows. Preliminary plans were made to choose the approximate routes to be followed by the investigators. The routes were chosen to take advantage of existing trails and good habitat and to eliminate as far as possible overlap between investigators.

The investigator moved along the predetermined route modifying the travel direction as needed to maintain a good rate of survey (approximately 1 km/hr). All mammals (except squirrels) seen were recorded, and approximate primate group compositions were noted. Time, distance and direction of travel and contact times were also recorded.

The distance censused is the total of the approximate amount of trail covered by all four investigators. Any particular section of trail was included only once in the distance tabulation no matter how many times it was traversed and no matter how many of the investigators censused it. Thus, the distance censused, as presented in this table, represents the total of unique distance traversed and not the total of all our travel distance. For example, backtracking on the same trail was not included in this tally, nor was that section of trail tallied again if another observer traversed the same trail at a subsequent time.

Search time represents the total time spent in the field looking for primates minus the total time spent observing primates (contact time) or other animals. When two or more investigators censused together, the time and distance involved was tallied only once and not once for each observer.

In tallying the numbers of social groups of the various primate species we have attempted to eliminate from the tabulation re-sightings of the same groups by the various observers. The number of groups, then, represents not the actual number of sightings, but rather what we think is the actual number of distinct groups seen by all of the observers. Redundancy was eliminated by comparing the field notes on location, the counts of these groups, and the time and date of the sightings.

The nocturnal censuses were tabulated independently of the diurnal censuses. The trails used in the nocturnal censuses were usually the same trails as used for the diurnal censuses. This then is the only exception to the previous statement regarding the tabulation of "unique distance traversed", i.e. trails used in both diurnal and nocturnal censuses were tallied twice; once in the diurnal column and once in the nocturnal column. The nocturnal censuses were of much shorter duration and distance than the diurnal censuses. In addition, visibility was more restricted, and rate of movement along the trail by the investigator was slower at night than in the day. These variables are most important when comparing the relative abundance of Aotus (seen only at night and the only primate seen at night) with the other primates. Our Aotus census results may not reflect true densities, but without more detailed study a definitive statement is inappropriate.

An independent estimate of the number of howler groups was made by counting the troops participating in howling choruses at dawn. Usually the observer listened for an hour after dawn from a vantage point and counted the number of troops heard, their direction and the approximate distance from the

observation point. The different observers then combined their data and arrived at a figure for the probable number of troops heard.

RESULTS OF THE AERIAL SURVEY

Forest in Northern Colombia remains in several discrete blocks (see Figure 1):

Serrania de San Lucas, Bolivar and Antioquia: still forested from the Rio Ite in the south to the level of La Raya in the north. The deforested valleys of the Rio Nechi and the Rio Magdalena form the western and eastern boundaries of this forest block. The best penetration into this zone should be up the larger rivers: the Tigui, the Tamara and the San Marcos.

Cerros de Santa Barbara, Antioquia: forested still on the upper elevations, especially in the southern portions, but being cut rapidly. Access is difficult.

Serranias de Ayapel and San Jeronimo, Cordoba and Antioquia: forested north of Cerro Paramillo, west of the Rio Taraza at least to the Rio Verde del Sinu. Northern boundary of the forest is the lowlands and river valleys south of Monte Libano and Tierra Alta. Access looks good up the Rios San Jorge and San Pedro and possibly the Rio Esmeralda.

Area East and Northeast of Turbo, Cordoba and Antioquia: many forest patches left, but being rapidly cut in all parts. Monkeys are probably abnormally concentrated in remaining patches. There is one forest patch west of Nuevo Paraiso that is accessible by highway and looks to be part of a ranch unaffected by logging.

Serrania de San Jacinto, Sucre: a few large forest patches on slopes of southern end of the Serrania plus the forest patch west of the mountains currently being worked by Pat Warner. These patches appear to be stable and relatively accessible by land.

Sierra Nevada de Santa Marta, Magdalena and Cesar: forested on the northern slopes above the lowlands. Forest accessible by a few roads and trails, especially in the Parque Nacional Tayrona. Clouds prevented survey of northeastern slopes of the Sierra, but there are forest patches accessible by road on the Sierra Nevada and the valley between the Sierra Nevada and the Venezuelan border south of San Juan del Cesar.

SITE RESULTS

1. Parque Nacional Tayrona

Interview results

Sources: INDERENA personnel.

Cebus: present throughout. Rare at western edge of park.
Alouatta: same as Cebus.
Ateles: not known.
Aotus: not definitely known.
Saguinus: not known.

Long-term prospects

Long-term prospects

Prospects for primates within the national park appear to be about as good as anywhere in the survey area. Hunting appears to be fairly effectively controlled. The major threats to the stated objectives of the park are colonists clearing the forest, logging and livestock grazing. The latter seems to be most prevalent. Although the effects of grazing within the forest are not immediately impingent on the primate populations, the long-term effect on forest regeneration could easily reduce the forest's capacity to support monkeys.

Ia. El Cedro, Parque Nacional Tayrona—dry to moist forest

Topography and vegetation

The camp was at about 300 m near a large quebrada several kilometers from the sea in the western part of the park. The terrain was mountainous with a ridge near the camp going to a 700 m peak.

Vegetation in the larger quebradas was well developed: some trees were 35 m tall. Large trees include Sterculia, Hura, Cedrela, Bursera, Spondias, Anacardium and Ficus. Some large trees and palms (to 30 m) were on the slopes, but the ridges, upper slopes and smaller quebradas were largely covered with a dense thorny vegetation of shrubs, small trees and vines. Some ridges had a strip of 1-1 /2 m bunch grass. Ridges at higher elevations (600 m+) had wind-formed trees and a tendency towards typical low "elfin" cloud forest. Epiphytes (Tillandsia, Usnea and tank bromeliads) were fairly common, especially higher up. On some ridges the soil was wet and the vegetation damp, in contrast to the forest lower down.

The vegetation is probably largely influenced by the diurnal pattern of fog movements across it. Fog became apparent in the late afternoon and largely obscured the sun until about 0930 the next morning. The ground was dry and cracked but the trees were all in leaf.

Some of the area that we worked was recent second growth grazed by cattle but the quebradas and the upper slopes and ridges appear to be relatively undisturbed.

Survey results

We found good numbers of Alouatta and one troop of Cebus albifrons at this site (Table 2).

Ib. Pueblito, Parque Nacional Tayrona—dry to moist forest

Topography and Vegetation

The camp was at about 250 m at an archaeological site in about the center of the park. The terrain was mountainous.

The vegetation was well developed in undisturbed areas with most of the same species of trees as at El Cedro. Rainfall is probably quite a bit more; the ground was not so dry and the fog is not as apparent here as at El Cedro. Most of the undisturbed slopes and ridges are covered with open forest.

The area is largely a mosaic of different ages of second growth with most of the large trees in the quebradas. Much of the second growth around Pueblito is rather old (about 25 years) with avocado, orange and mango trees being common.

Survey results

We heard several Alouatta troops here and contacted one troop of Cebus albifrons (Table 2).

Ic. Gayraca and Cinto, Parque Nacional Tayrona—very dry to dry forest

Topography and Vegetation

The camp was on the beach at the dry western end of the park. The terrain surrounding the camp was hilly but not especially steep. Our survey work was concentrated in the lower slopes and the river valleys at Cinto and the next valley to the west.

The vegetation around Gayraca was predominantly leafless when we got there but became greener while we worked. The thorn forest was mostly Bursera spp. with Pseudobombax, Pereskia, Stenocereus, Subpilocereus and Cochlospermum. Vegetation in the river valleys where we surveyed was better developed and green. The large trees were the same as those at El Cedro, plus Pseudobombax, Enterolobium, Ceiba, Calycophyllum and several large unknown mimosaceous legumes. There were large areas of Guazuma woodland in the floodplain. Epiphytes were not common.

Most of the area that we worked was apparently undisturbed except by cattle and possibly fire.

Survey results

We saw no primates at Gayraca. Near Cinto we contacted one group of Alouatta and heard several others (Table 2).

II. Parque Nacional Isla de Salamanca—mangrove and swamp forest

Topography and Vegetation

The camp was at park headquarters Los Cocos on the edge of the mangroves, 10 km E of the Rio Magdalena.

The vegetation of much of the park was almost all subject to periodic or permanent flooding. The salt-water mangrove sequence was typical Rhizophora to Avicennia. The freshwater forest that we saw was approximately 90% Erythrina. The eastern half of the island is covered by thorn forest.

There was some clearing on higher ground. The forests were disturbed unevenly by timber extraction.

Interview results

Sources: INDERENA personnel, local residents.

Cebus: present in freshwater woods.

Alouatta: present throughout in woods, sometimes even in saltwater mangroves.

Aotus: not known except for released animals

Survey results

We heard several Aloutatta troops here (Table 2).

Long-term prospects

The land within the national park appears to be well-protected from degradation except for illicit small scale lumbering and poaching. The latter is probably the more important factor; we found the skinned carcasses of seven Caiman. The swamp forest containing most of the monkeys is very difficult to enter at most times of the year which should further protect the monkeys.

III. Sierra Nevada de Santa Marta

Long-term prospects

The long-term prospects for primates in Sierra Nevada appear to be poor, especially on the lower slopes below 1,500 m. Extensive high-elevation forest remains, especially in the northwest, but most primate species either drop out or become rare above the level of coffee plantations. Even these high-elevation forests are seriously threatened by colonization. Many of the plant and animal populations of this region are endemic at the specific level. Because of these considerations and because this is one of only three major forest blocks in northern Colombia, we recommend an immediate intensive biological reconnaissance coupled with effective legal protection of the remaining forests on the Santa Marta massif.

IIIa. Northwestern Slopes: Minca Road, Sierra Nevada de Santa Marta, Minca (500 m) to San Lorenzo (2,200 m)—moist forest

Topography and Vegetation

Our camp was located at INDERENA's San Lorenzo experiment station in mountainous terrain.

The natural vegetation on the slopes was almost entirely replaced by coffee with Inga shade between 700 and 1,500 m. Above this, the forest is fairly well developed in places, but steep. It was fairly wet on the upper slopes with a good number of epiphytes. The following plants are found around and above San Lorenzo: Ocotea and other Lauraceae, Bocconia, Gunneara, Chusquea, Podocarpus and Ceroxylon. There is a large block of undisturbed forest to the northeast of San Lorenzo at about 1,500-1,900 m which was not surveyed.

Interview results

Sources: residents of Minca, El Campano and fincas: INDERENA personnel at San Lorenzo.

Cebus: up to 1,700 m but scarce throughout.
Alouatta: up to 2,000 m. Scarce in coffee zone (700-1,500 m).
Ateles: not known.
Aotus: known at Minca.
Saguinus: one report of a troop of small dark monkeys near Minca.

Survey results

We heard three troops of Alouatta and saw one animal when we were travelling (Table 2).

IIIb. Northeastern Slopes: La Tigrera (about 50 m), Sierra Nevada de Santa Marta.
Interview results

Sources: residents of La Tigrera.

Cebus: present in hills and arroyos.
Alouatta: same as Cebus.
Ateles: not known here.

IIIc. Northeastern Slopes: Tomarrazon 20 km west to Las Casitas, Sierra Nevada de Santa Marta—dry to moist forest.
Topography and Vegetation

Vegetation here at the base of the foothills was more xeric than what we worked with in Tayrona. The road followed the foothills (at 100 m) which rise rather abruptly. Forest remnants in the foothills appear to have rather tall trees probably indicative of greater moisture. The slopes to the first ridge were generally cut over. There was some forest in the quebradas which cross the road. Near Las Casitas much of the cleared land still had isolated Scheelea and Curatella as indicators of a dry, fire savannah.

Interview Results

Sources: residents of Tomarrozon and Las Casitas.

Cebus: present in arroyos near towns and on slopes.
Alouatta: same as Cebus.
Ateles: residents of both villages said that "marimonda" were present in the foothills. This is far outside of the known distribution.
Aotus: not definitely known.
Saguinus: not present.

IV. Hacienda Andorra—dry forest.
Topography and Vegetation

The camp was at the finca seashore. A small, flat riparian forest patch of 8-12 ha remains. The trees were up to 35 m tall. The ground was

dry with no significant rain for four months. There were no other forests nearby. The forest patch included some mangroves, Ceiba, Spondias, Sterculia, Bursera and Scheelea.

Interview results

Source: finca administrator.
Cebus: present.
Alouatta: present.

Survey results

We heard at least one troop of Alouatta and contacted a troop of Cebus albifrons (Table 2).

Long-term prospects

The forest patch is so small that it is of little regional importance, but the current finca administrator says that the current owners wish to protect it from further encroachment. They do seem to be extracting a few lumber and fencepost trees.

V. Hacienda Las Ilusiones—dry forest

Topography and Vegetation

The camp was at the finca at about 100 m. The terrain was a flat, alluvial plain. The forest remnants were riparian or upland intermixed with various stages of second growth, some rather old. The practice here is to leave trees when clearing for pastures, so much of the second growth contained large trees. Conspicuous trees were Samanea, Hura, Spondias, Anacardium, Sterculia, Ceiba and Ficus.

Interview results

Sources: finca foreman Lorenzo Cantillo and other finca workers
Cebus: present.
Alouatta: present.
Ateles: not on finca but present in hills to the east.
Aotus: not definitely known.
Saguinus: described to us as present but rare. This is more than 100 km from the known distribution.

Survey results

We contacted three troops of Alouatta and one of Cebus albifrons. We heard no Alouatta vocalizations during our stay (Table 2).

Long-term prospects

The entire finca appears to have been cut over at one time or another, but the practice here of leaving large trees when clearing land seems to accelerate the process of revegetation. It also appears to increase the value of the second growth for monkeys. The finca forests appear to be fairly stable and, unless the management policy changes, long-term primate prospects at present levels seem to be good.

VI. Hacienda El Diamante—dry forest

Topography and Vegetation

The camp was at the finca headquarters at about 100 m. Two distinct forest types found here are a tall riparian forest up to 100 m in width and averaging 30 m wide along each side of the Rio Ariguani and a flat upland forest on alluvium subject to occasional flooding and fire.

The riparian forest was up to 35 m tall. Spondias, Pseudobombax, Ceiba, Anacardium, Samanea and other large legumes were the prominent species. The understory was open.

The upland forest was mostly degraded by cutting. It was quite variable from very thorny 10 m tall woods with much cactus and Bromelia to less thorny places where trees grow to 25 m tall. All the upland forests are drier than riparian woods. There is extensive cattle grazing and browsing in most parts.

Interview results

Sources: finca owner, Eduardo Varges: finca workers.

Cebus: present.
Alouatta: present.
Ateles: not present.
Aotus: not present.
Saguinus: present. Here again marmosets are reported far from their known range.

Survey results

We contacted ten Alouatta troops, two troops of Cebus albifrons and two families of Aotus (Table 2).

Long-term prospects

Monkey prospects on this finca are probably good. They have survived the original clearing and the remaining forest patches are apparently maintained for fence posts and cattle shade. Unless the management of the finca changes and more land is cleared, the present situation seems to be stable.

VII. Hacienda Estanzuela—dry forest.

Topography and Vegetation

The camp was on the finca at about 30 m. The hacienda is on flat, deep, rich alluvium.

The main forest is more than 600 ha in extent. The tallest trees are up to 50 m tall, perhaps more. The composition and appearance is much like Barro Colorado Island, Panama, except there are not so many Ficus. The dominant and conspicuous trees were: Cavanillesia, Spondias, Ficus, Samanea, Lecithys, Bursera, Ceiba, a few Bombacopsis, Sterculia, Pseudobombax, Hura, Luehea and Gustavia with much Tabebuia in areas of regeneration. The forest is largely undisturbed by cattle or cutting although logging roads penetrate in some parts. The understory was open with much Heliconia. Logging was conspicuous in a few small areas.

The riparian forest was 10-100 m wide along the quebradas and it was very similar to the main forest in structure and composition.

Survey results

Here we found four primate species: nine troops of Alouatta, three or four troops of Cebus capucinus, five to seven troops of Saguinus oedipus and one family of Aotus (Table 2).

Long-term prospects

The riparian and upland forest that we surveyed is completely contained in two fincas owned by the Navas brothers. We talked with Miguel Navas in Cartagena about the future prospects for the main forest block. He would like to save it, but governmental pressure is forcing him to "use" it, so he has put in logging roads and is taking out lumber. In order for him to adequately protect the forest, Navas indicated that he needs help in several areas: a release from the pressure to "develop" the land; INDERENA cooperation in protection of the forest against poachers; and a practical forest management plan that is more than "just plant teak (Tectona) or Eucalyptus".

VIII. Hacienda Pispiche, southern Serrania de San Jacinto—dry forest.

Topography and Vegetation

The camp was at the finca headquarters, at about 100 m. The forest was in patches on slopes and ridges of limestone mountains, the Serrania de San Jacinto. Some patches were quite extensive. The trees were up to 35 m tall with open understory. There was much second growth in many stages, especially on the eastern slope overlooking Coloso.

Interview results

Sources: finca workers; Cito Manuel Barrio.

Cebus: present. Two-year captive seen.

Alouatta: present.

Ateles: present. Perhaps only one group in vicinity. Not hunted here.
Aotus: present.
Saguinus: almost all trapped four years ago. Saw one pair two years ago. One-month captive seen.

Survey results

Here we found a troop each of Alouatta and Cebus capucinus, and we heard several other Alouatta groups (Table 2).

Long-term prospects

The area of the southern Serrania de San Jacinto is fairly stable with long established fincas and a minimum of forest clearing. Many of the forests are on steep, rocky limestone slopes unfit for anything except the extraction of forest products.

The people in the area do not generally hunt monkeys according to our interview sources.

These factors have led us to develop a model primate management plan for this area. If implemented, it would guarantee a steady supply of primates from this area, and it would assure the survival of the remaining forests.

Without protection or management we predict a slow degradation of the forests and decimation of the monkey populations. It will not happen as fast here as in areas of recent colonization, but human population pressure will eventually produce the conditions that signal the local extinction of the primates.

IX. Finca El Nevado, Serrania de San Jeronimo—wet forest

Topography and Vegetation

The camp was at the finca on a sharp ridge (about 600 m) overlooking Tierra Alta. The forest composition here was very different from previous sites. There was much second growth and a few remaining large trees in the quebradas and in a few remaining large trees in the quebradas and in a few small patches of forest. Prominent forest tree genera were Pentaclethra, Socratea, Apeiba, Lecythis and second growth was Ochroma and Cordia alliodora. There was a good epiphyte load on the ridge and fog at night.

Interview results

Sources: finca residents.
Cebus: present.
Alouatta: present.
Ateles: rare
Aotus: not known.
Saguinus: probably not present up here.

Survey results

The only survey taken was nocturnal and negative for primates. We heard one or two Alouatta troops on the slopes below the finca.

Long-term prospects

Most of the forests on and around Finca El Nevado have been recently cut. The area is one of active colonization and the region is not expected to have any significant monkey habitat in the near future.

X. Upper Rio Sinu and Rio Esmeralda
Long-term prospects

The forests along the upper Sinu and the Esmeralda were largely old second growth indicating that settlers had been in these areas many years ago. It is not entirely clear why they left, but the most important reason was the onset of guerrilla activity in the late forties and fifties. These areas are still not entirely secure and the only inhabitants are Indians. Several Indians stated that the army had taken away their weapons, and they do not hunt very much now. The Indians clear the alluvial forests for pasture, corn and platanos, but they do not farm the slopes as extensively as the Spanish colonists do. This region is one of the few large forest blocks remaining in northern Colombia, but, with the suppression of guerrilla activity, it appears to be headed for the same agricultural fate as most of the rest of the country that we surveyed.

Xa. Margarita's Tambo, Rio Esmeralda—wet forest.
Topography and Vegetation.

The camp was on a river bank (at about 200 m). The canyon was fairly steep in most places.

The vegetation here was a mosaic of young to old second growth, with much of it fairly tall and open. The prominent genera were Pentaclethra, Socratea, Apeiba, Ficus, Pithecolobium longifolium, Luehea, Inga and Castilla. Second growth was Heliconia, Cedrela, Ochroma, Cecropia (two spp.) and Schizolobium. There were no very large trees.

Interview results

Sources: resident Indians.

Cebus: present.
Alouatta: present.
Ateles: present, hunted for food.
Lagothrix: not known here.
Aotus: indefinite.
Saginus: known, indefinite location.

Survey results

We contacted one group of Cebus capucinus.

Xb. Juan de Jesus' Tambo, Rio Sinu—moist forest.
Topography and Vegetation

The morning's work was in the mountainous forest near the Rio Sinu. Much of the forest is apparently mature with large Cavanillesia, Ficus, Spondias and Lecythiadaceae. It is very similar to Barro Colorado Island, Panama, in forest composition, structure and terrain.

Interview results

Source; Juan de Jesus.
Cebus: present.
Alouatta: present.
Ateles: present, hunted for food.
Aotus: present.
Saguinus: not present locally but can be found on the upper Sinu (Rio manso) and at Socorro which is between the upper Sinu and the upper Esmeralda.

Survey results

We contacted one troop of Cebus capucinus.

Xc. Maicito's Tambo, Rio Esmeralda—moist forest.
Topography and Vegetation

The camp was at the finca on the bank of the river. The area worked consisted of old second growth (40 years +) on a dry steep ridge. There were no large trees but the understory was open.

Interview results

Source: Maicito. He confirmed what we had learned from Juan de Jesus in all particulars.

Survey results

No primates seen or heard in a one-hour search.

Barranquilla: Interview with Simon Daza, animal dealer.
Cebus: no trouble getting enough for demand.
Alouatta: very little demand.
Ateles: some difficulty in getting them, probably because they are hunted for food.
Lagothrix: not many come through Barranquilla. Best source Serrania de San Lucas.

Aotus: no trouble in filling demand. Almost all come from Magangue and Isla de Mompos on the Rio Magdalena. They are taken in *secondary vegetation.*

Saguinus oedipus: most come from northern Antioquia on upper Rio Sinu, Rio San Jorge and Arboletes. Many years ago, many were sent from Valledupar.

Saguinus leucopus: more difficult to secure than oedipus. Best source is Serrania de San Lucas.

RESULTS OF THE SYSTEMATIC CENSUSES

We found five species of primates in our systematic censuses. There were no unexpected species, but we did not see one, the spider monkey, Ateles paniscus *(Lacepede),* which was almost certainly present. The species that we observed were:

Red Howler	Alouatta seniculus (Linnaeus)
Black White-Faced Capuchin	Cebus capucinus (Linnaeus)
Brown White-Faced Capuchin	Cebus albifrons (Humboldt)
Night Monkey	Aotus trivirgatus (Humboldt)
Cottontop Marmoset	Saguinus oedipus (Linnaeus)

Table 2 shows the times spent on the survey, the unique distances covered and the primate groups seen or heard.

It is evident that the sample size (distance and time) was extremely variable from place to place. Although we cannot say with certainty what the ideal sample size is for this kind of survey, it is apparent that some areas were inadequately sampled in terms of evaluating the relative abundance of primates, e.g. Salamanca, Andorra and Maicito's Tambo on the Rio Esmeralda. In fact, any sample comprised of less than 20 hr and 5 km is probably inadequate. Consequently, the results of such small samples should not be given too much emphasis in evaluating the relative abundance or presence or absence of the various primate species.

Table 3 summarizes the results of the systematic censuses in terms of ratios: the number of groups per hour of search time and the number of groups per kilometer of unique census route. These ratios permit direct comparison of the results between areas. The number of groups per km of unique census route appears to be the best of the two as an index of relative abundance, because the ratio of number of groups per hour of search time will underestimate densities if the same section of trail is covered repeatedly and the same groups are seen.

In the majority of localities the red howler was the most common monkey present. Our census results are probably representative of Alouatta abundance in most localities. However, the locality Pueblito is certainly exceptional in that no Alouatta were seen in spite of the fact that at least six different sources (groups) were heard. At a similarly sampled site, El Cedro, seven different sources of Alouatta were heard; but, in contrast to Pueblito, six different groups were seen. In other localities where Alouatta were heard but not seen we can attribute the

absence of sightings to the correspondingly small sample size. However, Pueblito was sampled extensively and yet we still failed to see Alouatta. There is no apparent explanation of this. Perhaps the Alouatta were missed because we did not survey the ridges as extensively as we did at El Cedro.

Alouatta appears to be at similar densities in the following localities: El Cedro, Las Ilusiones, El Diamante, and La Estanzuela. On the basis of the number of groups heard at Pueblito similar densities may be attained there as well. Gayraca and Cinto appear to have lower numbers of Alouatta than the preceding places. The localities on the Rio Sinu and Rio Esmeralda were not sampled sufficiently to make a definite statement on Alouatta abundance, but the fact that none were heard indicates that they are probably low in number. Although only one group of Alouatta was seen at Pispiche, six or seven different sources of Alouatta were heard which indicates a higher density than do the results of our censuses. This too may in part be a function of the small sample.

Cebus albifrons and C. capucinus were the second most common monkeys seen. In three localities they were two to five times less abundant than Alouatta. In four other places where, according to our censuses, they were either of equivalent or greater abundance than the Alouatta, our samples were small, and inconclusive, albeit suggestive. It is quite possible that in the wetter forest of the Rio Sinu and Rio Esmeralda Cebus are more numerous than Alouatta.

Saguinus oedipus were observed only at La Estanzuela. Group density appeared to be greater than that of Cebus capucinus, but somewhat less than that of Alouatta. However, the smaller size of their groups may place Saguinus in numerical equivalence with Cebus.

Aotus trivirgatus were seen in only two places: El Diamante and La Estanzuela. Their absence from some localities may be a function of the small sample size. However, in many other cases we believe their apparent absence is real, or at least an indication of very low densities. This conclusion is supported by the examples of El Cedro and Pueblito, areas that were sampled near nearly as intensely as El Diamante and La Estanzuela but where Aotus were not seen. We frequently saw other and more secretive nocturnal mammals even in areas that were censused very little at night. It was clear to all of us that Aotus were the easiest of all nocutrnal mammals to detect primarily because of the noise created by their leaping about in the trees.

Table 4 shows the differences between primate densities in different types of habitat. This analysis was restricted to El Diamante and La Estanzuela because at these two localities we had both large samples and the proximity of two different habitat types. The major differences between these habitat types are described in the vegetation section. These data indicate that Alouatta is more abundant in riparian forest even when similar forest exists in large blocks nearby (e.g. La Estanzuela). Both Alouatta and Cebus albifrons do better in wet gallery forest than they do in nearby dry forest (El Diamante). Cebus capucinus, Saguinus oedipus, and Aotus trivirgatus all seem to be doing better in the large block of wet forest than in gallery forest comprised of similar vegetation (La Estanzuela).

Table 5 summarizes the total number of sightings of nocturnal, non-primate mammals.

Tables 2-6 show that the majority of active nocturnal mammals are not primates and that the majority of diurnal mammals are primates. These data also support our conclusion that the more conspicuous Aotus were either absent

from or extremely rare in most of the localities, because in these other localities much more secretive and difficult to observe nocturnal mammals were seen, such as Didelphis, Potos, Coendou and the sloths.

Differences in the nocturnal mammal fauna between localities are probably best explained by either gross differences in sample size, e.g. Salamanca, San Lorenzo, Andorra and Pispiche, all four of which were sampled very little at night, or by gross differences in habitat. For example, the nocturnal census routes at Gavraca included some of the driest habitat in our entire survey and thus accounts for the sighting of a Dusicyon, which is generally considered a non-forest mammal. Salamanca is predominantly a mangrove swamp and thus accounts for the high incidence of Procyon. Sylvilagus floridanus, another non-forest mammal, were sighted at or near the interface of forest and grassland or scrub brush.

Table 6 shows the paucity of diurnal, non-primate mammals which may be a reflection of intense hunting pressure by man. It was surprising that no peccaries were seen or heard during the entire survey. Eira and Tamandua were the most consistently observed non-primate diurnal mammals and this may be because of their low priority among human hunters.

Unfortunately, red squirrels (Sciureus granatensis) were not systematically tallied during our censuses. In most areas, however, they were very common. For example, on three days at La Estanzuela, Struhsaker systematically scored five sightings of this squirrel during 564 minutes of searching along a 4 km route. This is more than twice the number of sightings of all other non-primate diurnal mammals seen by all observers on four days at the same locality. Sciureus may have been unusually conspicuous at this time. They were in breeding condition as evidenced by enlarged scrota.

HOWLER GROUP SEX AND AGE COMPOSITION

During this survey an attempt was made to determine the age sex structure of Alouatta groups (Table 7). Each group appears only once in the table even though more than one observer may have counted that group or one observer counted the same group on successive days. We minimized repeating counts in the table by comparing notes on age sex composition, position of the group on the trail, and the time of the sighting for all groups.

Four age categories based on size were distinguished. A subadult male was an animal with descended testicles but lacking adult size. Any male smaller than an adult male was placed in the subadult category if it had descended testicles. There was considerable size range in this category. The juvenile class was not sexed because of the difficulty in distinguishing between a juvenile female and a juvenile male with undescended testicles. Subadult females were placed in the juvenile class because they could not be distinguished with certainty. Any animal carried by an adult was categorized as an infant.

Many of the counts are partial counts as females with infants and adult males were often extremely wary and varying amounts of time were spent with a group. In addition, red howler groups tend to be more widely dispersed than mantled howlers [(Alouatta palliata (Gray)]. Complete counts were probably more often obtained in the riparian habitat than in the upland forest since the gallery forest somewhat restricted monkey dispersal and movement.

The adult sex ratio (M:F0 for the 23 groups was 1.13:1. Solitary individuals were not included in the table. The presence of more adult males than adult females is a rare condition in free-ranging primates. Only five of the 23 groups contained more adult females than adult males. All other groups had equal numbers of both sexes or more adult males. The sex ratio more nearly approaches a 1:1 ratio if all of the unsexed adults are assumed to be females. With the addition of these animals to the female class the sex ratio is (M:F) 1:03:1.

On seven occasions a solitary animal was sighted. Four of the seven were adult males, two were adult females and one individual was unsexed. These animals may have simply become temporarily separated from their group, or they may be truly solitary.

Thus the distinct difference in group sex-ratios between Alouatta palliata and A. seniculus first reported by Neville (1972) is further documented. Neville found a sex ratio (M:F) ranging from 1:1.58 to 1:1.04, the latter obtained only by adding the subadult males with the adult males and grouping the subadult females with the juveniles. The lowest sex ratio for the A. palliata was 1:1.18 (Chivers, 1969). This is within Neville's range but quite different from even our lowest ratio of 1:03:1.

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SUMMARY OF INTERVIEW INFORMATION

Generally the information gathered from interviews was compatible between different sources and with our field checks. Two important observations were consistent in the interviews but not field checked. One is the presence of Ateles on the northeastern slopes of the Sierra Nevada de Santa Marta near Tomarrazon, and the other is the widespread reporting of Saguinus in northern Cesar south and southwest of Valledupar.

Ateles is known from the level of about San Juan de Cesar (map of Hernandez and Cooper), and the interview results extend this distribution some 50 km to the north.

The Saguinus reports are much more important, both for understanding the former distributions of the species and for conservation efforts directed towards specific species. According to present formal knowledge (Hernandez and Cooper), Saguinus oedipus formerly ranged throughout the departments of Cordoba, Sucre and Atlantico, always west of the Magdalena and Cauca Rivers. S. leucopus ranged from southern Magdalena, through Bolivar and south along the Magdalena River into Tolima, always east of the Rio Cauca and west of the Rio Magdalena. Thus the large rivers in northern Colombia appear to be important zoogeographic barriers to marmoset dispersal.

Our information from northern Cesar, if true, would place a different interpretation on the marmoset ranges. Marmosets were reported from two sites—Las Ilusiones and El Diamante, which are 50 and 200 km northeast of the presently known distribution of S. leucopus. They are even further from the range of S. oedipus. In all of our interviews concerned with Saguinus in Cesar (except that with Simon Daza), we did not distinguish species of Saguinus. Daza claims to have received many S. oedipus from Valledupar in past years.

If it is true that Saguinus oedipus is or was present in northern Cesar, then the zoogeographic interpretations of the ranges must be changed. The apparent control of distributions by major rivers may be only an artifact of agricultural patterns that obscure the true former distributions. Saguinus oedipus may be characteristic of the drier forests of all of northernmost Colombia while S. leucopus appears in the wetter southern forests.

RECOMMENDATIONS FOR FUTURE RESEARCH ON PRIMATES AND PRIMATE HABITATS IN NORTHERN COLOMBIA

Species studies

Detailed ecological and distributional information is urgently needed for four species of primates in northern Colombia: Aotus trivirgatus, Saguinus oedipus, Saguinus leucopus, and Lagothrix lagotricha. The Aotus and Saguinus species are of considerable importance to medical research. In addition, both Saguinus species as well as Lagothrix appear to be rare and probably endangered species in northern Colombia. Our preliminary survey revealed very few Aotus (present in 2 of 13 localities) and no Saguinus leucopus or Lagothrix. As a consequence of these preliminary findings, we recommend that detailed studies be made of these four species in northern Colombia. Emphasis of the studies should be on distribution, habitat preference, population densities, food habits and other ecological requirements. In view of the great demand for Aotus and the large numbers of this species which are exported from the region each year, it is imperative to determine precisely where these animals are being trapped, the methods employed, and the effect on the local population of Aotus. For example, we would like to know if the populations of Aotus which are being trapped for commercial exportation are being exploited on a sustained yield basis or whether the population in a specific area is completely trapped out in a single intensive trapping effort. We would also like to know something of the status of the habitat from which these Aotus are being trapped. Is it stable or is it in a rapid state of decline? Answers to these questions can only be obtained from detailed studies of relatively long duration. We would, therefore, recommend that four experienced field biologists undertake detailed ecological and distributional studies of these primate species in northern Colombia. It is anticipated that each of these studies would require a minimum of 18 to 24 months. Each of these scientists would also require liberal funding to cover the costly logistic expenses. Once these basic data are available it would then be feasible for INDERENA or other appropriate personnel to make annual evaluations of the population status of these species and to implement management and conservation programs.

Studies of specific areas

One of the major findings of our survey was the extreme paucity of forest. This was initially established through extensive aerial reconnaissance and confirmed with ground checks. Most of the remaining forest in northern Colombia consists of small remnant patches or narrow strips of gallery forest.

In contrast to the general situation in the area, we found three large blocks of relatively mature forest. One of these was located on the north slopes of the Sierra Nevada de Santa Marta north and northeast of the television towers near Las Vegas, Figure 1a, another in the upper reaches of the Rios Sinu and Esmeralda in the vicinity of the Serrania de San Jerommo and the Serrania de Abibe, Figure 1b, and the third block was in the vicinity of the Serrania de San Lucas, Figure 1c. All three of these forests are of difficult access, but would seem to have great potential as protected biological reserves or national parks. We therefore recommend, therefore, that these three forests be the subject of detailed biological surveys with particular emphasis on their primate faunas as a step toward the possible establishment of national parks or faunal reserves in these areas. It is suggested that each of these forests be surveyed by a team of three or four biologists, including a plant ecologist and a primate-forest-mammalogist. Each survey would require eight to 12 months and would have as its goals an inventory of the major plants and animals and their relative abundance, an evaluation of present and future conflicting human interests in these forests, the extent and nature of present human exploitation, and a study of possible boundaries for the establishment of protected areas.

Some funding for all of the recommended studies might be available from international agencies, such as the Pan American Health Organization and the World Wildlife Fund.

ANNUAL INVENTORY OF FOREST CHANGE

The key to primate management is the forests in which they live, and an annual inventory of changes in the present forest blocks should be an integral part of INDERENA's program. After the preliminary studies identify the forests that are important to monkeys, an annual aerial monitoring of these forests is indispensable to the maintenance of reliable knowledge of the status of these primate habitats.

In the region covered by our survey, three major forest blocks remain as important primate centers. One is the Sierra Nevada de Santa Marta and the associated Parque Nacional Tayrona, an area of about 6,000 km^2. This region could be intensively surveyed by air in a few days or an afternoon. Care must be taken to not confuse cafetales with forest.

The second region is that centered [illegible] de San Lucas about 6,000 km^2, and the third is the [illegible] Sinu, Esmeralda and San Jorge about 10,000 km^2. These [illegible] be easily mapped in a single four-hour flight.

The maps and photographs developed [illegible] should be carefully compared with those of previous years [illegible] loss or degradation of these important forest blocks [illegible] prime importance in the annual management pro[illegible]

THE FUTURE OF COMMERCIAL EXPLOITATION OF PRIMATES

Currently, primate supplies for commercial purposes in northern Colombia are threatened primarily by forest destruction, but evidence exists that some species also have been greatly reduced or eliminated from given areas by excessive hunting and trapping. The demand for primates is much greater than the supply and prices are rising rapidly. Within this bio-economic framework there appears to be an excellent opportunity to profitably manage primates for the market. Two systems are being considered by diverse government agencies, businessmen and biologists. One is the production of monkeys from a caged breeding colony similar to that employed for many other domestic animals. The other system is the management of free-living populations in largely natural forests.

Breeding colony

The major advantage of animals from breeding colonies is that they are animals of known pedigree and health. Control of these two variables is of great importance to the experimental laboratory scientist.

The success of the caged breeding colony depends less on biologists or ecologists than it does on skilled animal husbandry. The economics of monkey raising would seem to favor dry lowland tropical areas because of the favorable climate and the presence of cheap food and labor. Under this system, any species, even exotics, could be considered. Transportation should not be a great problem. Monkeys shipped cheaply by air from Barranquilla arrive at the holding farm in Tampa, Florida the same day.

In our opinion, current efforts to establish breeding colonies in northern latitudes near the points of consumption should be redirected towards establishing primate production centers in tropical countries. The probability of developing psychologically well-adjusted colonies is probably much greater in large outdoor enclosures than it is in cramped indoor quarters.

The funding for captive breeding programs can be either governmental or private. There are companies interested in primate production in the tropics that could be encouraged to establish colonies.

Management of free-living populations

The management of free-living wild animal populations for harvest is well-established in Europe and North America. Much has been written concerning the possibilities of managing African game, but no large-scale projects are operating.

Two ways of approaching wild primate management seem to be feasible in Colombia. The first is to convince landowners with forests on their land that primate production is profitable, so that they will protect the forests and the monkeys from uncontrolled exploitation. The second is the purchase or control of forest lands expressly for the purpose of primate production.

Under either of these systems the technical assistance of INDERENA biologists would be necessary. There would have to be a firm commitment of personnel and support for several years to each large project. These commitments could be paid for by a tax on all legally-exported primates which, by this time, will be almost entirely products of breeding colonies or management areas.

By way of illustration, let us consider a hypothetical management plan for a real area, the Serrania de San Jacinto. There are fair amounts of accessible forest in the southern Serrania which lies east of Macajan and north of Tolu Viejo in Sucre. The fincas for the most part are old and stable and forests are not being cut as rapidly as in areas of colonization. Primate species currently present are Cebus capucinus, Alouatta seniculus and Ateles paniscus. Aotus trivirgatus may be present. Saguinus oedipus may also still be present in some parts, but most were trapped out according to local residents.

The first step in a mangement plan should be to establish an INDERENA inspector in Macajan. His prime mission should be to conserve and protect the remaining monkeys and forests from illegal exploitation. Another very important part of his effort, however, would be to establish good working relations with the landowners. The effectiveness of this part of his mission will largely determine the success of the total project.

As a second step, INDERENA biologists should carry out a primate and forest inventory with the aim of determining primate numbers and forest quality. In the forest inventory special attention should be paid to preferred food trees such as Ficus, Spondias, Anacardium, Cecropia and members of the Sapotaceae.

With the inventory information at hand, the biologists could present the landowners with a primate-forest management package. The first stages of the program would permit conservative harvest of the monkey species that appear to be able to sustain it, plus a modification of lumbering patterns to encourage the tree species useful to monkeys. In the first few years, every attempt should be made to raise the population levels of the primates present to the carrying capacity of the forest. At present this must be a subjective hit-or-miss procedure but as data accumulate this process can be more exact.

Later stages of the program (implemented 4-5 years after the project starts) would include more intensive controlled cropping in order to determine the most productive population levels, and planting of desirable tree species, and the reintroduction of Saguinus and Ateles if necessary to repopulate forest patches where they have been exterminated. At no point in a program in this area should the introduction of exotic species not formerly present be considered. Only in the case of isolated forests without native primates should this be a part of a program.

The success of the program depends on the ability of the INDERENA personnel to convince the landowners of the merit of the project. This could be done on a purely economic basis, since each monkey, except Alouatta, should in the near future return between $1,250 pesos and $2,000 pesos to the landowner. On top of this INDERENA should add a tax of about 10% in order to partially pay for the program.

A wild guess, based on little evidence, for the maximum annual primate production in the area would be as follows:

	Number	Value Each (pesos)	Total Value (pesos)
juv. Ateles	20	$2,000	$ 40,000
adult Aotus	10	1,250	12,500
juv. Cebus	35	1,500	52,500
adult Saguinus	40	1,500	60,000
TOTAL	105		$165,000

In addition INDERENA would add a slight export tax to the price charged the animal dealer. One aspect of this program is that several middlemen are eliminated and the landowner receives a larger share of the final market price. The Colombian animal dealer's profit, shipping costs and the U.S. animal dealer's profits could double the animal's price and they would still find a ready market.

As an integral part of this specific plan the same INDERENA personnel could continue the basic research that is now being carried out on the finca La Estanzuela. The owner, Miguel Navas, expressed interest in a forest research and management plan in conversation with us. He has on the finca a forest of more than 500 ha. that contain some of the last populations of Saguinus oedipus in this region. These Saguinus are currently under study by Miss Patricia Warner of the Peace Corps and INDERENA. Her data and those from subsequent years could provide the basic control data on reproduction, food habits, carrying capacity, and population dynamics, which would be necessary for scientific management and exploitation of these monkeys in other areas.

There are many administrative, technical and political problems which have to be overcome. First the image of INDERENA as a purely regulatory agency would have to be changed internally and externally. The INDERENA personnel in this project would be functioning like biological consultants. Current government taxes and threats of expropriation designed to encourage forest clearing would have to be waived for the forests included in this project. Better capture mechanisms for catching young Cebus and Ateles would have to be designed because the current method is to shoot the mother and capture the infant. All of these problems can probably be solved and they should not endanger the project.

The important aspect of this plan is the cooperation of INDERENA personnel and the landowner. An INDERENA biologist must be on the site full-time the first year and at least several months during successive years. A single biologist could probably manage about three established projects as a full-time load. The protection by the inspector and monitoring of the biologist must be permanent commitments by INDERENA.

INDERENA already has the legal mechanism to establish their own primate management areas where both research and production could be carried out. Their projected Faunal Territories (Territorios Faunísticos) provide for intensive research followed by experimentation, manipulation and management. Under this structure a primate management area similar to that outlined above could be set up and run as a model for all of Latin America. The Serrania de San Lucas appears to have all of the necessary requirements for an excellent Faunal Territory of this sort. It has forest and six primate species. The area would have to be quite large in order to successfully manage such wide-ranging species as Ateles and Lagothrix—at least several hundred square-kilometers.

The funding necessary to establish a primate management program is not available in the operational budget of INDERENA. The initial phases of the project will be costly and non-remunerative, and funding will have to be sought from either foreign or international sources. Probably the best source for the former type of funds would be the potential consumer, mainly in the United States and various European countries. Their concern for an assured primate supply should make them willing contributors to the project. International sources might be the World Wildlife Fund or other conservation agencies.

SUMMARY AND CONCLUSIONS

The major result of the project so far is probably the documentation of how little first-class primate habitat remains in northern Colombia. Aside from three major forest blocks and a few minor patches, northern Colombian monkeys are restricted to those that can stand the habitat restrictions and human harassment implicit in riparian forest strips and young second growth. If non-human primates are to continue to exist in northern Colombia, effective measures must be instituted very soon.

We recommend a multi-leveled approach towards the conservation and management of northern Colombia's monkeys. First and foremost, the forests now under government control must be effectively protected from logging, grazing, burning, clearing and poaching. The amount of forest under protection must be increased. Research into the population dynamics of all of the primate species is urgently needed, but especially critical are Ateles, Aotus and Saguinus; the former because it is widely sought for human food and the latter two genera because they appear to be very susceptible to trapping and they are in great demand for biomedical research. Immediate research into the biological composition of the three remaining large forest blocks, the Sierra Nevada de Santa Marta, the Serrania de San Jeronimo and the Serrania de San Lucas, is also urgently needed.

Another recommendation of some urgency is that captive breeding programs be established, either as government or private ventures. Sufficient production of a uniform, quality product could take much of the pressure off of wild stocks. Monkeys are the only widely-used laboratory animals that are almost entirely caught in the wild.

Our last recommendation is that a system of management of primates for commercial exploitation be developed. Both private fincas and lands controlled by INDERENA could be sites for management programs designed for primate production. We recommend this for several reasons—in order to manage the species a great deal of basic biological research will be necessary, legal production will take some of the illegal pressure off of natural populations and managed production may be the only hope for some species such as Saguinus oedipus or S. leucopus that have very limited ranges.

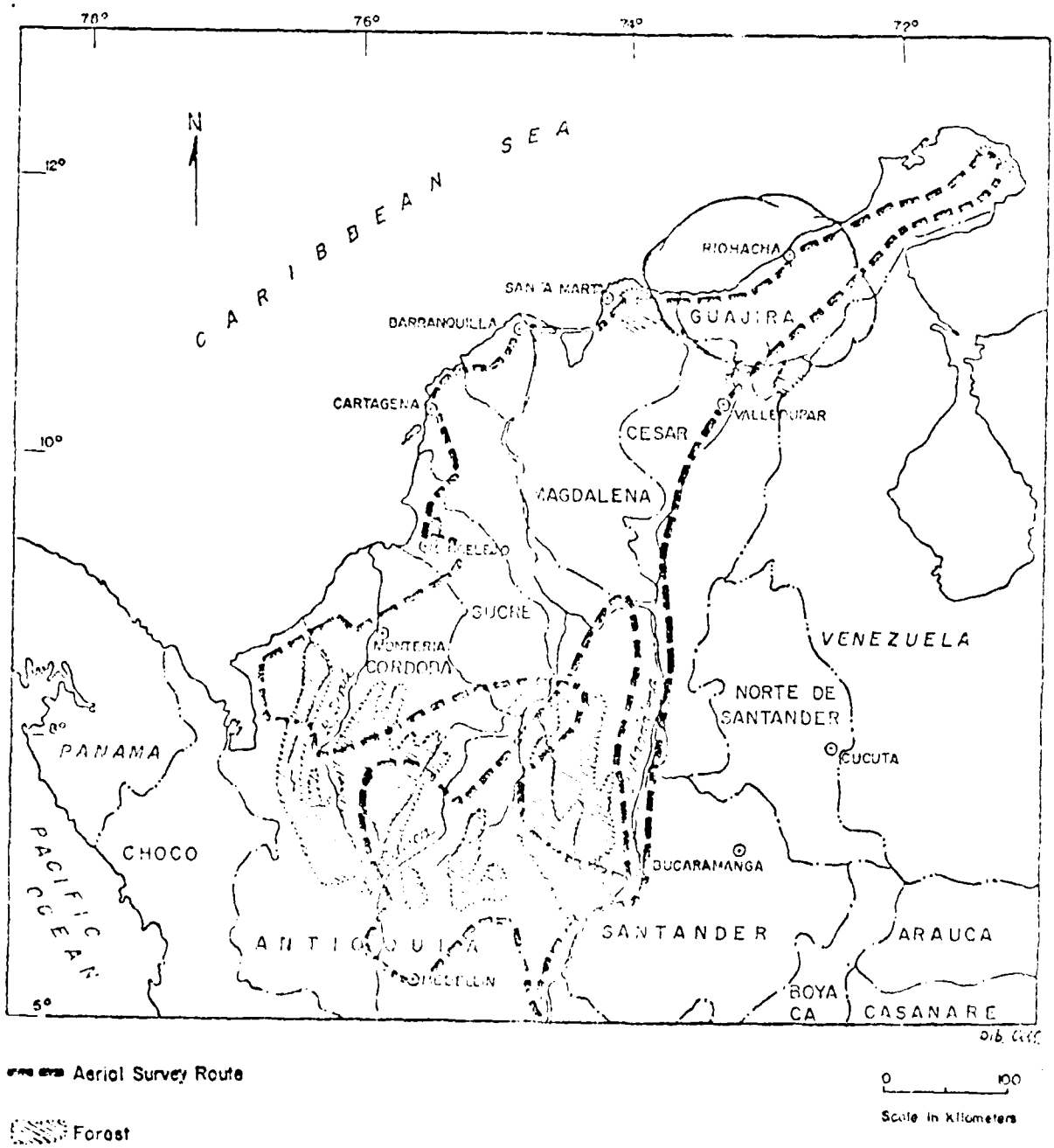

FIGURE 1.—Map of aerial survey route and remaining forest patches in northern Colombia, May 1974. The area surveyed was roughly 100 km wide except where clouds were present east of Santa Maria.

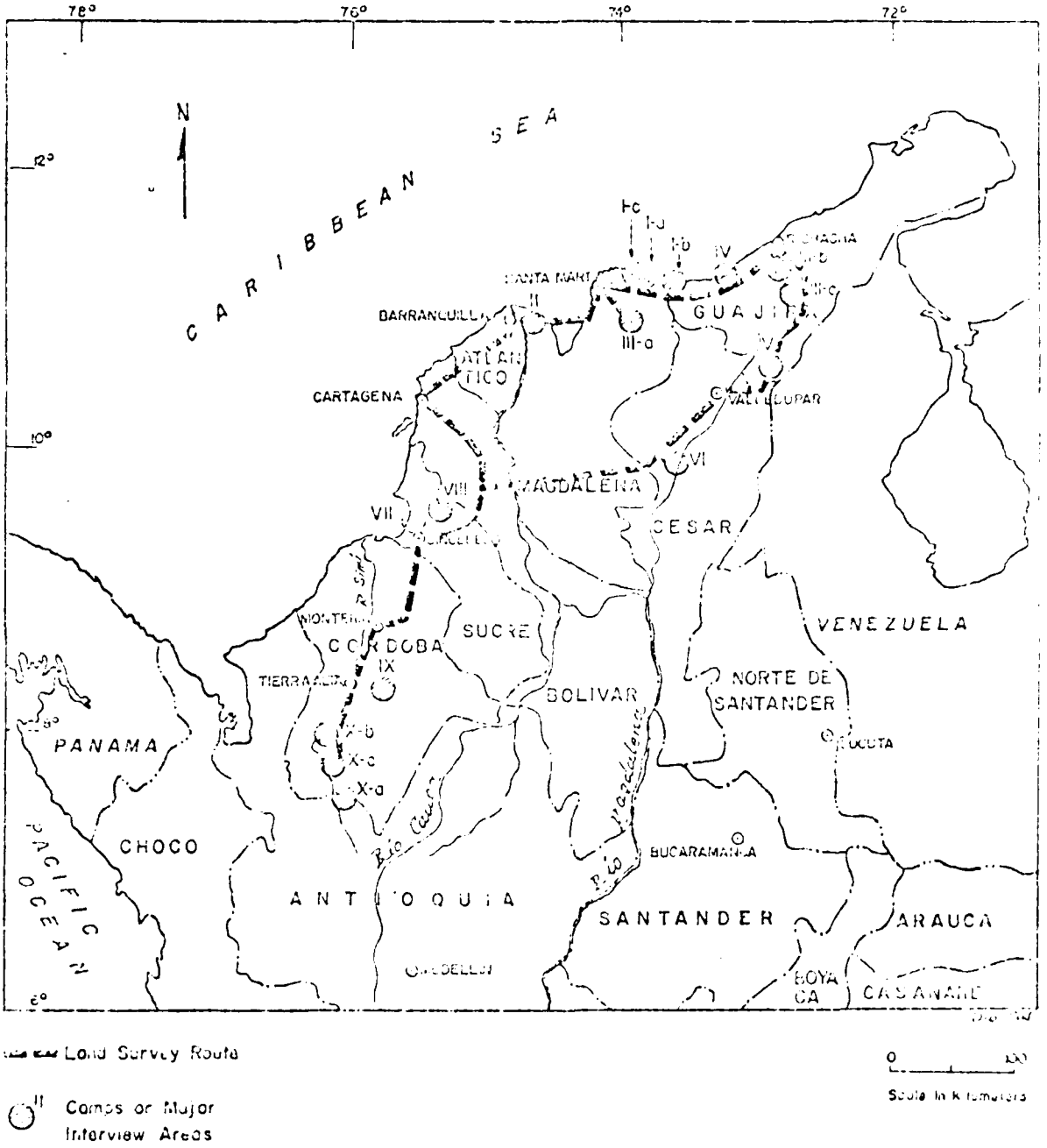

FIGURE 2.—Map of land survey route. The numbered spots locate camps or major interview areas.

TABLE 1. Itinerary. A detailed location is given for the place underlined. See also Figure 2.

Date 1974	Activity	Location
7-1	Arrived Bogota.	
7-2--3	Acquired supplies and equipment. Talked with PAHO, INDERENA and Peace Corps personnel.	
7-4	Flew from Bogota to Barranquilla. Acquired supplies and equipment.	
7-5	Arranged for rental vehicles and supplies.	
7-6	Traveled by bus from Barranquilla to Santa Marta.	
	Departamento de Magdalena	
7-7	Drove from Santa Marta to Parque Nacional Tayrona (Cahaveral) and then to El Campano on the Sierra Nevada de Santa Marta and back to Santa Marta.	11°19'N 73°56'W
7-8	Drove from Santa Marta to San Lorenzo on the Sierra Nevada de Santa Marta and back.	11°04'N
7-9	Traveled by bus from Santa Marta to Barranquilla.	
7-10	Drove from Barranquilla to Santa Marta. Drove from Santa Marta to Parque Nacional Tayrona (Canaveral and Gayraca) and back.	11°19'N 74°03'W
7-11	Drove from Santa Marta to Parque Nacional Tayrona and packed into El Cedro (Ia, Figure 2).	11°19'N 74°01'W
7-12--14	Surveyed El Cedro.	
7-15	Packed out of El Cedro. Drove from Parque Nacional Tayrona to Barranquilla and Parque Nacional Isla de Salamanca (II, Figure 2). Surveyed Salamanca and then drove from Salamanca to Canaveral in Parque Nacional Tayrona.	10 km east of Barranquilla

Table 1 (continued)

Date 1974	Activity	Location
7-16	Packed into Pueblito (Ib, Figure 2) from Canaveral, Parque Nacional Tayrona.	11°19'N 73°59'W
7-17--18	Surveyed Pueblito.	
7-19	Packed out of Pueblito and drove to Gayraca in Parque Nacional Tayrona.	
7-20	Surveyed Gayraca and Cinto areas (Ic, Figure 2)	11°20'N 74°04'W
7-21	Rest day and night census.	
7-22	Surveyed Gayraca and drove to Parque Nacional Isla de Salamanca, 10 km E of Rio Magdalena (II, Figure 2).	
7-23	Surveyed Salamanca including a boat survey to Cienaga Grande de Santa Marta and back.	10°59'N 74°30'W
7-24	Drove from Parque Nacional Isla de Salamanca to San Lorenzo on Sierra Nevada de Santa Marta (IIIa, Figure 2).	
7-25	Surveyed San Lorenzo area.	
	Departamento de la Guajira	
7-26	Drove from San Lorenzo to Hacienda Andorra 2 km E of Palomino (IV, Figure 2).	11°15'N
7-27	Surveyed Hda. Andorra and drove to Riohacha, then to La Tigrera (IIIb, Figure 2). Interviewed residents of La Tigrera.	45 km west of Riohacha
7-28	Drove from Riohacha to Tomarrazon and Las Casitas	50 km south
7-28	Drove from Riohacha to Tomarrazon and Las Casitas (IIIc, Figure 2). Surveyed Tomarrazon and Las Casitas area. Drove from Las Casitas to Fonseca.	50 km south of Riohacha
7-29	Drove from Fonseca to Hacienda Las Ilusiones (V, Figure 2). Surveyed Las Ilusiones.	10 km west of El Molino

Table 1 (continued)

Date 1974	Activity	Location
7-30	Surveyed Las Ilusiones and then drove to Valledupar for the night.	
	Departamento del Cesar	
7-31	Drove from Valledupar to Hacienda El Diamante 10 km SSE of Bosconia (VI, Figure 2).	9°53'N 73°55'W
8-1--3	Surveyed El Diamante.	
8-4	Drove from El Diamante to Sincelejo.	
	Departamento de Sucre	
8-5	Drove from Sincelejo to Hacienda Estanzuela 4 km E of Tolu (VII, Figure 2).	9°32'N 75°32'W
8-6--9	Surveyed Hda. Estanzuela.	
8-10	Drove from Hda. Estanzuela to Hacienda Pispiche near Tolu Viejo and Macajan (VIII, Figure 2).	9°29'N 75°26'W
8-11	Surveyed Serrania de San Jacinto near Coloso, Pispiche, and La Piche.	9°30'N 75°21'W
8-12	Drove from Hda. Pispiche to Sincelejo.	
8-13	Drove from Sincelejo to Monteria.	
	Departamento de Cordoba	
8-14	Drove from Monteria to Tierra Alta and walked into El Nevado, about 7 km SE of Tierra Alta (IX, Figure 2).	70°km SW of Monteria
8-15	Walked out from El Nevado and began boat trip up Rio Sinu from Tierra Alta to Puerto Nuevo near Tucura.	4 hours up Rio Sinu

Table 1 (continued)

Date 1974	Activity	Location
8-16	Continued boat trip up the Rio Sinu and the Rio Esmeralda, another four hours and 42 minutes. Began the return trip downriver. Camped 15 minutes down river at Margarita's Tambo (Xa, Figure 2).	8-1 2 hours up Rio Sinu and Rio Esmeralda (about 80 km SSW of Tierra Alta)
8-17	Surveyed forest at Margarita's Tambo. Continued downriver. Camped at Maicito's Tambo (Xc, Figure 2).	4 km above junction of Rios Sinu and Esmeralda
8-18	Surveyed forest around Juan de Jesus' Tambo (Xb, Figure 2) in a. m. Surveyed forest around Maicito's Tambo in p. m.	about 2 km below junction Rios Sinu and Esmeralda
8-19	Continued downriver to Tierra Alta. Drove from *Tierra Alta to Sincelejo.*	
8-20	Drove from Sincelejo to Cartagena.	
8-21	Cartagena. Spoke with Miguel Navas and Patricia Warner.	
8-22	Drove from Cartagena to Barranquilla. Spoke with Simon Daza.	
8-23	Flew from Barranquilla to Bogota.	
8-24--31	Bogota. Conferred with INDERENA and Peace Corps personnel. Prepared our report.	

Table 2. Results of Systematic Primate Censuses in Northern Columbia, July-August 1974.

Location	# Groups Seen: Alouatta seniculus	Cebus albifrons	Cebus capucinus	Saguinus oedipus	Aotus trivirgatus	# Alouatta groups heard	Distance* Censused (km): Diurnal	Nocturnal	Diurnal** Search Time (min)	Diurnal Contact Time (min)	Nocturnal Search Time (min)	Nocturnal Contact Time (min)
El Cedro	6	1	-	-	0	7	20.0	4.25	2,606	218	490	0
Pueblito	0	1	-	-	0	6	9.8	4.50	1,481	0	414	0
Gayraca & Cinto	1	0	-	-	0	3	14.3	3.90	925	14	190	0
Salamanca	0	0	-	-	0	5-6	1.5	1.45	106	0	135	0
San Lorenzo	0	0	-	-	-	3	18.8	1.50	1,262	0	65	0
Andorra	0	1	-	-	0	1	1.4	0.25	120	118	18	0
Las Ilusiones	3	1	-	-	0	0	7.0	1.55	893	352	175	0
El Diamante	10	2	-	-	2	10	22.6	5.00	2,132	485	782	44
La Estanzuela	9 (plus 2 solit.)		3-4	5-7	1	8	16.0	4.10	2,039	268	513	29
Pispiche	1	-	1	0	0	6-7	7.0	1.65	764	26	112	0
Rio Esmeralda-Margarita's	0	-	1	0	0	0	5.8	2.00	518	7	255	0
Rio Sinu-Juan de Jesus	0	-	1	0	0	0	6.5	0	493	24	-	-
Rio Esmeralda-Maicito's	0	-	0	0	0	0	1.0	2.00	60	0	180	0

* All distances are rough estimations. Any particular section of trail was included only once no matter how many times it was traversed, except if it was traversed again at night when it was then also tallied in the nocturnal column.

** Search plus contact time equals total time spent in potential primate habitat. When two or more observers worked together the time and distance involved was tallied only once and not once for each of the observers.

TABLE 3. Summary of relative abundances of Primates seen in Northern Colombia, July-August 1974.

Location	Alouatta seniculus		Cebus albifrons		Cebus capucinus		Aotus trivirgatus		Saguinus oedipus	
	#Groups Search hr	#Groups Search km	#Groups Search hr	#Groups Search km	#Groups Search hr	#Groups Search km	#Groups Search hr	#Groups Search km	#Groups Search hr	#Groups Search km
El Cedro	0.138	0.300	0.023	0.050	-	-	0 0	0 0	-	-
Pueblito	0	0	0.041	0.102	-	-	0	0	-	-
Gavraca & Cinto	0.065	0.069	0	0	-	-	0	0	-	-
Salamanca	0	0	0	0	-	-	0	0	-	-
San Lorenzo	0	0	0	0	-	-	-	-	-	-
Andorra	0	0	0.500	0.714	-	-	0	0	-	-
Las Ilusiones	0.202	0.429	0.067	0.143	-	-	0	0	-	-
El Diamante	0.281	0.440	0.056	0.089	-	-	0.154	0.400	-	-
La Estanzuela	0.264	0.563	-	-	0.088-0.118	0.188-0.250	0.117	0.244	0.147-0.206	0.313-0.438
Prspiche	0.079	0.143	-	-	0.079	0.143	0	0	0	0
Rio Esmeralda-Margarita's	0	0	-	-	0.116	0.172	0	0	0	0
Rio Sucio-[illegible]	0	0	-	-	0.122	0.172	0	0	0	0
[illegible]	0	0	-	-	0	0	0	0	0	0

TABLE 4. Abundances or Primates in Different Habitats in Northern Colombia, July-August 1974.

	NUMBER OF GROUPS KM OF CENSUS ROUTE	
EL DIAMANTE	Riparian	Dry Upland
	Diurnal Sample 7.75 km, 1,064	Diurnal Sample 17 km, 1,070 min
Alouatta seniculus	1.217	0.176
Cebus albifrons	0.174	0.059
	Nocturnal Sample 3 km, 702 min	Nocturnal Sample 2.55 km, 184 min
Aotus trivirgatus	0.666	0
LA ESTANZUELA	Riparian	Dry Upland
	Diurnal Sample 7.75 km, 1,064	Diurnal Sample 17 km, 1,070 min
Alouatta senicules	0.830	0.400
Cebus capucinus	0.166	0.20-0.30
Saguinus oedipus	0.166	0.40-0.60
	Nocturnal Sample 2.28 km, 159 min	Nocturnal Sample 1.3 km, 411 min
Aotus trivirgatus	0	0

TABLE 3. Nocturnal mammals (excluding primates) seen during systematic primate censuses, northern Colombia, [illegible] August 1974.

Location	Didelphis	Caluromys	Metachirops	Metachirus	Marmosa	Coendou	Agouti	Dasyprocta	Prochimys	Mouse & Rat Supp.	Dasypus	Tamandua	Potos	Procyon	Conepatus	Bradypus	Choloepus	Sylvilagus	Duisicyon	TOTAL
El Cedro	3		1				1			2	1	1	2							9
Pueblito						1		1		5					1					7
Gayraca & Cinto														1	1				1	3
Salamanca														4						4
San Lorenzo																				0
Andorra													1							1
Las Ilusiones						2														2
El Diamante	5			1	1	1			3		7		1					3		22
La Estanzuela		1				1							2			1	2	4		11
Pispiche													1							1
El Nevado									1	1	1					1				4
Rio Esmeralda-Margarita's																				
Rio Esmeralda-Maicito's		1			3				3											7
TOTALS	8	2	1	1	4	5	1	1	7	15	2	1	5	5	2	2	2	7	1	71

TABLE 6. Non-primate diurnal mammals (excluding squirrels) seen during systematic primate censuses, northern Colombia, July-August 1974.

	Dasyprocta	Tamandua	Mazama	Eira	Sylvilagus	TOTAL
El Cedro						0
El Pueblito						0
Gayraca & Cinto				1		1
Salamanca						0
San Lorenzo						0
Andorra						0
Las Ilusiones					2	2
El Diamante	1	2		2		5
La Estanzuela		1	1			2
Pispiche						0
Rio Esmeralda-Margarita's						0
Rio Sinu-Juan de Jesus'			2	1		3
Rio Esmeralda-Maicito's						0
TOTALS	1	3	3	4	2	13

TABLE 7. Age/sex composition of howling monkey groups in Northern Colombia, July-August 1974.

Location	Habitat	Adults M	Adults F	Sub-Adult Male	Juv	Inf	Un-Sexed Adults	Group Size*	Observer
Las Ilusiones	U	4	2	2	-	-	-	8	KG
Las Ilusiones	U	2	1	2	-	-	-	5	TS
Las Ilusiones	R	2	1	2	-	-	-	5	TS
El Diamante	R	3	3	-	-	1	-	7	KG
El Diamante	R	6	5	-	3	2	-	16	KG
El Diamante	R	2	3	1	1	1	-	8	KG
El Diamante	R	1	4	2	2	2	-	11	KG
El Diamante	R	8	10	2	2	4	-	26	KG
El Diamante #	R	6	1	1	1	1	1	11	TS
El Diamante	R	5	4	2	1	2	-	14	TS
El Diamante	U	4	3	2	-	1	-	10	TS
El Diamante #	R	4	4	1	-	3	-	12	TS
El Diamante	R	1	1	-	-	-	-	2	TS
El Diamante	R	1	1	-	-	-	-	?	NS
El Diamante	U	4	2	2	1	-	-	9	NS
El Diamante	U	3	3	-	-	1	1	8	NS
El Diamante	U	2	4	-	-	2	2	10	NS
Hda. Estanzuela ♂♀	U	2	1	-	-	-	-	3	TS
Hda. Estanzuela ♂♀	U	1	1	2	-	-	-	4	TS
Hda. Estanzuela	R	-	1	-	1	-	-	2	NS
Hda. Estanzuela	R	2	1	-	1	1	1	6	NS
Hda. Estanzuela	R	3	4	2	1	-	-	10	KG
Hda. Pispiche	U	3	1	-	1	-	1	6	NS
TOTALS		69	61	23	15	21	6		

U - remnant non-riparian forest
R - riparian forest
- may be partial counts of the same group
♂♀ - may be partial counts of the same group
* - many of these counts may be only partial counts of the total group

MISSION OF P. A. H. O. TO EVALUATE

THE PROJECT AMRO-0719

February 1975

INTRODUCTION

The Mission visited Lima and Iquitos, Peru from 3 to 8 February and reviewed the proposed letter of agreement between PAHO and Peru and found its aims and objectives to be worthwhile and encourages their implementation (Annex 1). The following recommendations are offered as those most important for the initial implementation of the Programs.

1. Ecologic Studies

1.1. The ecologic studies initiated during the initial phase of the project have been important in establishing methodology as well as an administrative base which should be continued and expanded both in scientific and geographic scope.

1.1.1. Since the resources currently available are limited the Mission concluded that they could be most effectively used by concentrating studies at camp Callicebus with particular reference to the ecology and population densities of Saguinus, Saimiri and Aotus. It is impossible, however, that it be fully understood that ecologic studies involve the understanding of the interrelationships of all species, and therefore the efforts of this program cannot and should not be limited to the above three taxa.

1.1.2. In relation to scientific expansion, expertise in Botany should be the first added in order to describe forest types and associate them with particular species.

1.1.3. Censusing techniques already developed show much promise for application to Saguinus and Saimiris but not for the nocturnal Aotus. Further attention needs to be given to developing techniques useful for nocturnal species.

1.1.4. The Mission concluded that as soon as possible the Staff should be expanded to broaden the geographic scope of these studies. This should be initiated by conducting a further series of pilot expeditions to determine species distribution and population densities. Emphasis should be given to including areas from which there has been little previous primate trapping and a variety of ecologic zones.

1.1.5. The Mission members believe international scientific collaboration can contribute significantly to the development of this program. There is a high probability that the information to be gained can contribute in several important ways to the body of scientific knowledge. This should be particularly important to Peru, but will also be of benefit to all mankind. It is recommended that the PAHO promote and facilitate in any appropriate way the collaboration of scientists and institutions from other countries, and serve to coordinate such international collaboration.

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2. Primate Production

2.1. The Mission determined that Peruvian officials responsible for wildlife conservation recognize that there are important needs through a program of primate production. The following conclusions were reached during discussions between Peruvian authorities and the Mission:

2.1.1. International assistance (funding and expertise) will be required for planning and developing such a program, and PAHO is the appropriate agency for providing the assistance.

2.1.2. The primate production program, while closely related to the on going ecologic (Sensus) studies, should be developed and operated independently of those studies. The two activities must have close working relations and continuing exchange of information, but their objectives will be different and the needs in terms of technical expertise differ considerably.

2.1.3. The primate production program can be developed through the establishment of primate breeding facilities wherein selected animals are kept within restricted space (cages or pens) especially constructed for the purpose, or through application of wildlife management techniques applied to primate population in their natural habitats under free-ranging conditions over extensive areas. Each of these production methods should provide an excess of animals that can be made available to meet bona fide research needs.

2.2. Further to the development of the Primate Production Program, the Mission presents the following comments:

2.2.1. Even though the ongoing ecologic studies program and the reproduction program are to be carried out as separate entities, they will be mutually supportive and in that sense pilot studies on wildlife population dynamics could be initiated immediately in connection with the work already in progress, This would provide valuable information for rational and sustained natural resource management.

2.2.2. The Mission recommends that a limited pilot study be initiated immediately on a suitable species at camp Callicebus. This study should include the trapping of the species in one sector and comparing the effects within a similar control sector in which there is no trapping.

2.2.3. To achieve the aforementioned objectives in primate production the Mission recommends that funds be sought for the assignment of Peruvian and international counterpart staff. For this purpose,

persons with expertise in wildlife management and in primate breeding centers should be recruited.

3. Conditioning and Breeding Station

3.1. The Mission recommends that a conditioning and breeding station be established as a basic support facility for the field management procedures.

3.1.1. Animals cropped from selected areas should be brought to the station for conditioning and selection for introduction into the breeding compounds. Cropped animals not selected for the former purposes should be made available for biomedical research.

3.1.2. Some of the criteria that should be considered in siting the conditioning and breeding station include the accessibility to a city with certain resources, degree of contact with urban populations, possibilities for expansion and resident staff.

3.1.2.1. The station should be located within reasonable commuting distance by an all weather road to a city that offers housing facilities both for staff members and long and short term consultants. Further it would be advantageous for the city to have an international airport. Administrative support from dependencies of those agencies concerned with the program should also be available.

3.1.2.2. While the station should be near an urban area it would be best for it to be sufficiently remote and isolated to discourage unnecessary contact with persons not involved with the program.

3.1.2.3. Sufficient acreage should be provided for the station to enable further expansion of breeding areas and support facilities. The area must contain parts for construction cites that have good drainage throughout the year.

3.1.2.4. The station should have facilities that provide for permanent resident staff to allow for observation of the facilities and animals at all times.

3.1.2.5. From information made available to it the Mission concluded that a site near Iquitos might best fit the above criteria.

3.2. The Mission recommends that basic laboratory support facilities be made available for clinical microbiology and parasitology and the preparation of specimens for shipment to other laboratories providing more extensive support. If a site is chosen near Iquitos, the Ministry of Agriculture Zone VIII Veterinary Laboratory

could be suitable for this purpose if provided additional staff and equipment.

4. Additional Recommendations

4.1. A small library with subscriptions to basic journals and containing appropriate books should be established immediately. This is a basic prerequisite for the activities of this program.

4.2. Adequate facilities should be provided to stimulate the participation of guest workers.

4.3. A long range goal of the project should be the development of sufficient technical expertise among Peruvian staff members to reduce the dependency on outside consultants. Towards this end fellowships should be provided for advanced studies for Peruvian participants in the project.

1. INTRODUCTION

The Mission visited Bogota, Colombia from 9 through 15 February 1975 for the purpose of evaluating the primate census activities carried out under Project AMRO-0719 and to consider plan for future activities. Upon arrival in Bogota a schedule for the week's activities was developed. (See Annex 2).

2. OBSERVATIONS

2.1. In 1974, the Government of Colombia banned the export of all non-human primates with a proviso that only animals destined for biomedical research would be permitted to be exported in the future. Since then, INDERENA has received requests from numerous institutions over the world for permits to obtain primates from Colombia. An indication of the magnitude of interest is evident in that INDERENA received some 64 such requests during the first 15 days of 1975, asking for a total of 8,263 animals, of which the major part (6,654 animals) specified three species Saguinus, Aotus and Saimiri.

2.1.1. The official Colombian reaction to these requests has been to retain the ban on export until adequate arrangements are made to protect primates as a natural resource in Colombia so that animals authorized for export will result from measures to encourage their production (breeding colonies or wildlife management) and will not cause serious effects upon primate populations in the country.

2.1.2. INDERENA is convinced that funds needed for primate conservation and reproduction work in Colombia will have to come from sources other than the national budget. Accordingly the Institute has prepared the broad outlines of a plan for financing the work by creating a

special fund to be made up from contributions from interested institutions throughout the world. The incentive for contribution would be that certain quantities of primates would be made available for export to the participating institutions. (A copy of the INDERENA plans is attached as Annex 3)

2.1.3. INDERENA recognizes that the proposed international collaboration will require a special organizational arrangement, and looks to the Pan American Health Organization for assistance in developing such arrangements.

2.2. During the course of the activities carried out under Project AMRO-0719 much important data was developed related to the nonhuman primate population characteristics in Colombia. These data along with other information indicate that certain Colombian non-human primate populations are threatened with extinction. There is an urgent need to initiate programs which could lead to the conservation of these populations.

2.2.1. The primary problem is deforestation throughout the country resulting from lumbering and agricultural development, much of which is uncontrolled colonization. Its effects have been particularly extensive in northern Colombia and The Cauca and Magdalena Valley. Reforestation sometimes is carried out with exotic plants which may not support the indigenous primate.

2.2.2. Of secondary importance is hunting. Its impact varies according to species and geographic areas. The animals are hunted either for meat, for control as agricultural pests, or for capturing for trade.

2.2.3. Other factors mentioned as affecting population levels are epizootics and the use of pesticides.

2.3. All taxa in areas undergoing deforestation are affected. Two of the most seriously affected species Saguinus oedipus and Aotus trivirgatus, have been important in biomedical research.

2.3.1. Saguinus oedipus is described by INDERENA as the primate species most urgently needing protection.

2.3.2. Aotus trivirgatus in northern Colombia are genetically different from members of the species in the Amazon. Those from northern Colombia are more susceptible to human malarias and have been in greater demand for biomedical research. The northern Aotus are now endangered.

3. CONCLUSIONS AND RECOMMENDATIONS

3.1. The Mission regards the problem of preservation of habitats for non-human primate species in Colombia to be of primary and urgent importance.

3.1.1. The Mission is in general agreement with the INDERENA proposal for multilateral funding of certain activities which would ensure the preservation of those species important to biomedical research.

3.1.2. The Mission was not provided with technical details of the implementation of those operations that would be supported through the above plan and therefore cannot comment thereon.

3.1.3. The Mission recommends that PAHO respond positively to a Colombian request for assistance in the development of such a program.

3.2. The Mission regards the population studies carried out within Project AMRO-0719 as valuable and recommends they be continued and expanded in scientific and geographic scope.

3.2.1. The Mission recognizes that various agencies and institutions, both from Colombia and from abroad, are interested in the objectives of this program, and recommends that they be encouraged to take part in it.

3.3. A coordinated program should be developed to insure the continued supply of Colombian primates of importance in biomedical research.

3.3.1. In the development of this program consideration should be given to both wildlife management systems and the breeding of restricted populations.

3.3.2. Colombia offers particularly good prospects of carrying out an effective program in that there are already several organizations, resources and activities which with coordination could contribute in a positive manner.

3.4. Until programs are developed to insure their preservation all efforts should be taken to use substitute species for those threatened with extinction.

3.5. A number of suggestions was presented by the Mission to the Colombian authorities during the closing meeting to be considered in planning their primate program.

ANNEX 1

ASUNTO: Conversaciones con la Mision de la Organizacion Panamericana de la Salud para Proyecto Primates.

Entre los dias 3 a 7 de febrero de 1974, se llevaron a cabo en las ciudades de Lima e Iquitos las reuniones entre representantes del Ministerio de Agricultura, Ministerio de Salud y del instituto Veterinario de investigaciones Tropicales y de Altura del Peru y representantes de la Organizacion Panamericana de la Salud.

PARTICIPANTES DEL PERU
En Lima:

Ministerio de Agricultura

Direccion General Forestal y de Fauna

- *Dr. Marc Dourojeanni R., Director General*
- Ing. Carlos Ponce, Director de Fauna Silvestre
- Dr. Antonio Brack Sub-Director de Conservacion de Fauna
- Dra. Perla Rendon, Asesora Legal

Ministerio de Salud

- Dr. Eduardo Guillen, Director de la Oficina de intercambios internacionales
- Mayor EP. Ramon Pizarro, Asesor Supervisor de Control de Zoonosis de la Direccion de Normas Tecnicas.

IVITA

- Blgo. Rogerio Castro Encargado Proyecto Primates.

PARTICIPANTES DE LA OFICINA SANITARIA PANAMERICANA

- Dr. Benjamin D. Blood, Coordinador de Programas de investigacion de Alimentos y Drogas.
- Dr. Luis V. Melendez, Asesor Regional on Medicina Veterinaria del Departamento de salud Humana y Animal.
- Dr. Benjamin Lucas Moran, Consultor en Salud Publica Veterinaria, Zona IV.
- Dr. Joe R. Held, Director de la Division de Servicios de investigacion del INS-Estados Unidos.
- Dr. Melvin Neville, Primatologo, Universidad de California.

En Iquitos

Ministerio de Agricultura

- Ing. Juan del Aguila Sabell, Director Zona Agraria
- Ing. Ramon Ruiz Hidalgo, Sub-Director de Recursos Naturales
- Ing. Javier Peixoto, Jefe de la Oficina de Planificacion.

Ministerio de Salud

- Dr. Moises Reyna Rodriquez, Jefe de la Region Salud Oriente.
- Dr. Manuel Coronado, Medico Veterinario.

Universidad Nacional de la Amazonia Peruana

- Dr. Manuel Acosta Jurado

IVITA

- Dr. Jaime Moro, Jefe de la Sub-Estacion de Iquitos.

Invitados por la Zona Agraria:

- Sr. Pekka Soini, Especialista en Fauna

OBJECTIVOS

a. Evaluacion de los resultados y beneficios del estudio sobre el Censo de Primates no humanos en la Amazonia Peruana durante el Bienio 1973-1974.
b. Discusion de la factilidad de continuar el Proyecto.
c. Discusion de la necesidad del establecifiniento de programas para la conservacion, mejoramiento y centros de reproduccion de primates.

ACTIVIDADES:

03 FEB. 75 En Lima.

- Exposicion de les objectivos de la Mision por los delegados de O.S.P.
- Exposicion del Blgo. Rogerio Castro de los resultados del Proyecto obtenidos en el bienio 1973-1974.

04 FEB. 75 En Lima.

- Discusion de la carta convenio para el Desorrolla de un Proyecto de investigaciones Biologicas sobre Primates no humanos en el Peru (AMRO 3170 Peru).
- Exposicion de la Problematica de la Conservacion de la Flora y Fauna on el Peru por el Dr. Marc Dourojeanni R.

05 FEB. 75 En Iquitos.

- Discusion y Programacion en Iquitos con el Director de la Zona Agraria VIII.
- Visita a una trocha para examinar las condiciones en que se efectua la determinacion de la densidad de poblacion.
- Visita a la Sub-estacion Experimental de IVITA para examinar las condiciones de explotacion de fauna exotica y nativa.
- Examen de los laboratorios de diagnosticos del Ministerio de Agricultura.

06 FEB. 75 En Iquitos

- Reunion plenaria
- Participacion de las instituciones universitarias en el Proyecto.
- Determinacion del lugar mas adecuada para comenzar los estudios biologicos sobre primates.
- Factibilidad del establecimiento de una estacion experimental para para estudio de manejo de flora y fauna.

07 FEB. 75 En Lima.

- Conversacion sobre lineamientos para el establecimiento de centros de reproduccion
- Discusion de los resultados finales de la reunion.

CONCLUSIONES:

- El gurpo de trabajo estima que los estudios ecologicos realizados en especies de Primates han sido fructiferos, al haber permitido el establecimiento de una metodologia y base administrativa para la continuacion y la ampliacion de estas investigaciones.

- El grupo de trabajo considera necesaria la continuacion del proyecto de Primates debiendo ponerse especial enfasis en los estudios de las especies de los generos Saguinus, Saimiri y Aotus.

- El grupo de trabajo ha constatado que los recursos economicos del Proyecto son escasos, por lo que se considero necesaria la colaboracion tanto nacional como internacional a fin de lograr un mejor desarrollo de las investigaciones y de esta manera, extenderlas a otras regiones del pais

- El grupo de trabajo se informo del contenido de la Carta Convenio AMRO 3170 Peru y lo considera como un factor esencial para lograr una eficaz continuacion del Proyecto.

- El grupo de trabajo estima que para organizar los centros de reproduccion, la Direccion General Forestal y de Fauna consulte con la Organizacion Panamericana de la Salud.

Lima, 07 FEB. 75

ANNEX 2

PROGRAMA

MISION PARA LA EVALUACION DEL PROYECTO AMRO-3170

9 a 14 de Febrero

Drs. J. R. Held, B. D. Blood, M. Neville y L. V. Melendez

LUNES 10 DE FEBRERO	ENTREVISTAS
A. M. Saludo a las Autoriadades Nacionales y de la OPS-OMS	Dr. Eduardo Sarue Perez Representante OPS-OMS en Colombia
Ministerio de Salud Publica	Dr. Mario Gaitan Yanguas Viceministro de Salud Publica
	Dr. Abel Duenas Padron Secretario General de Salud Publica
	Dr. Ricardo Galan Director de investigaciones Ministerio de Salud Publica
	Dr. Carlos Ferro Vargas Malaria Director de Campanas Directas
P. M. Calle 16 N. 9-64 Piso 2	Dr. Efrain Otero Ruiz Director de COLCIENCIAS
MARTES 11 DE FEBRERO	
9 a 12 A. M.	Dr. Julio Carrizosa Umania Hernando Chirivi, Jorge Hernandes Alfredo Franky Gerente INDERENA
	Dr. Manuel Quevedo Director General de Conservacion del Medio Ambiente, INDERENA
2:30 a 5:00 P. M.	Dr. Hernando Groot Director del INPES
	Dr. Luis J. Villamizar Herrera Laboratorio Nal. de Salud, INPES

MIERCOLES 12 DE FEBRERO	
9:00 a 12:00 A.M.	Dr. Jaime Estupiñan Subgerente Produccion Pecuaria, ICA
MIERCOLES 12 DE FEBRERO	Dr. Alfonso Ruiz Jefe Sanidad Animal, ICA
	Dr. Ricardo Ochoa, Jefe del Laboratorio de Investigaciones Medico-Veterinarias, ICA
JUEVES 13 DE FEBRERO	Estarian libres para discutir con la Comision nuevas entrevis- tas o visitas de interes.
VIERNES 14 DE FEBRERO	
10 A.M. Inderena—Revision del projecto	Libre
3:00 a 5:00 P.M. Ministerio de Salud 9 Piso	Mesa redonda sobre la investigacion presidida por el Dr. Mario Gaitan Yanguas, Viceministro de Salud Publica, con la participacion de Representantes de los Organismos visitados.

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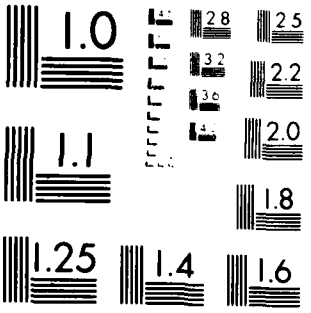

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ANNEX 3

PUNTOS FUNDAMENTALES PARA LA CREACION DEL PROGRAMA NACIONAL COLOMBIANO DE PRIMATOLOGIA (PNCP)

Como resultado de las reuniones adelantadas en la Direccion General de Conservacion del Medio Ambiente del INDERENA, con motivo de la visita a Colombia de la Mision de Expertos en Primates de la Oficina Sanitaria Panamericana (OPS), acerca de la factibilidad de programar una accion comun para el estudio e investigacion de especies, en lo que respecta a su: patologia, ecologia, manejo y reproduccion, se concretaron los siguientes puntos basicos para una solucion.

A. Proceder a la creacion del Programa Nacional Colombiano de Primatologia (PNCP).

B. El objecto de este programa es el de dar en Colombia un manejo adecuado a las poblaciones de primates no humans.

C. Las metas propuestas para el PNCP son las siguientes:

1- Reservaciones y proteccion de areas de vida silvestre adecuadas para garantizar la utilizacion y la perpetuidad de especies de primates no humanos.

2- Realizar investigaciones de campo para determinar: el estado actual, la ecologia, la distribucion, la taxonomia y la dinamica de poblaciones de especies colombianas de primates no humanos, particularmente utilizados y utilizables en investigaciones biomedicas.

3- Obtener informacion, tanto basica como aplicada, para diseñar y poner en ejecucion: a) modelos de manejo de poblaciones naturales, b) tecnicas de cria y fomento de especies en cautividad y semicautividad.

D. Para lo constitucion del PNCP, inicialmente se han identificado los siguientes puntos fundamentales:

1- Conformar un Pull economico de gobiernos, entidades publicas y privadas, nacionales y mundiales, interesadas tanto en el manejo adecuado y preservacion, como en la utilizacion de primates no humanos para fines de investigacion, el cual tendra a su cargo: a) el soporte financiero del programa, b) la distribucion entre sus miembros de las cuotas anuales de primates disponibles que el INDERENA Fije.

2- La Oficina Sanitaria Panamerican (OPS) seria la institucion, que por su capacidad cientifica, administrativa y politica, estaria en las mejores condiciones para promover la formacion del Pull financiero del programa.

3- Por parte de Colombia se suscribiria, dentro de los convenios generales actuales, con la OPS, un proyecto de cooperacion para la organizacion y funcionamiento en Colombia del Programa Nacional Colombiano de Primatologia, el cual tendra como entidad ejecutora al Instituto de Desarrollo de los Recursos Naturales Renovables (INDERENA). Esta entidad como ejecutora del programa y participante de el, colaborara con personal tecnico, apoyos logisticos y aporte presupuestal.

4- Desde el instante en que se constituya, financie y comience a a operar el programa, INDERENA asignara la primera cuota de primates a la cual sera distribuido, como ya se dijo, por el Pull entre sus miembros.

Bogota, D. E., febrero 11 de 1975.

ANNEX 4.

MISSION OF THE PAN AMERICAN HEALTH ORGANIZATION ON EVALUATION OF REGIONAL PROJECT AMRO-0719 (now 3170) ON NON-HUMAN PRIMATES CONSERVATION AND DEVELOPMENT IN PERU PERU AND COLOMBIA

February 2- 8 - Lima and Iquitos, Peru
February 9-15 - Bogota, Colombia

PARTICIPANTS:

PERU:

Lima:

Ministerio de Agricultura

Direccion General de Forestal y Fauna
Dr. Marc Dourojeanni R., Director General
Ing. Carlos Ponce, Director de Fauna Silvestre
Dr. Antonio Brack, Sub-Director de Conservacion de Fauna
Dra. Perla Rendon, Asesora Legal

Ministerio de Salud

Dr. Eduardo Guillen, Director de la Oficina de Intercambios Internacionales
Mayor EP. Ramon Pizarro, Asesor Supervisor de Control de la Direccion de Normas Tecnicas

IVITA

Biologo Rogerio Castro, Encargado de Proyecto Primates

Iquitos:

Ministerio de Agricultura

Ing. Juan del Aguila Sabell, Director de Zona Agraria
Ing. Ramon Ruiz Hidalgo, Sub-Director de Recursos Naturales
Ing. Javier Peixoto, Jefe de la Oficina de Planificacion

Ministerio de Salud

Dr. Moises Reyna Rodriguez, Jefe de la Region Salud Oriente
Dr. Manuel Coronado, Medico Veterinario

Universidad Nacional de la Amazonia Peruana

Dr. Manuel Acosta Jurado

IVITA

Dr. Jaime Moro. Jefe Subestacion Iquitos

Invitado por Zona Agraria

Sr. Pekka Soini, Especialista en Fauna

COLOMBIA:

Ministerio de Salud

Dr. Mario Gaitan Yanguas, Viceministro de Salud Publica
Dr. Abel Duenas Padron, Secretario Secretaria General de Salud Publica
Dr. Carlos Ferro Vargas, Director de Campanas Directas
Dr. Elmer Escobar, Director Control de Zoonosis

Ministerio de Educacion—Colciencias

Dr. Efrain Otero Ruiz, Director
Dr. Emilio Yunis, Genetista

Instituto Nacional de Recursos Naturales (INDERENA)

Dr. Manuel Quevedo, Director General de Conservacion del Medio Ambiente
Dr. Jorge Hernandes Camacho, Asesor Cientifico
Dr. Alfred Franky

Instituto Nacional de Programas Especiales de Salud (INPES)

Dr. Hernando Groot, Director
Dr. Luis J. Villamizar, Director de Laboratorios

Instituto Colombiano Agropecuario

Dr. Jaime Estupinan, Subgerente Produccion Pecuaria
Dr. Alfonso Ruiz, Jefe Sanidad Animal
Dr. Ricardo Ochoa, Jefe del Laboratorio de Investigaciones Medico Veterinarias

Organizacion Panamericana de la Salud

Peru:

Dr. Victor Moya
Dr. Benjamin Moran

Colombia:

Dr. Hamlet E. Sarue
Dr. Aldo Gaggero

Miembros de la Mision

Dr. Benjamin Blood, H.E.W.
Dr. Joe R. Held, N.I.H.
Dr. Melvin Neville, University of California, Davis
Dr. Luis V. Melendez, PAHO, Jefe de la Mision

ANNEX 5

CONCLUSIONS OF THE PRIMATE SURVEYS IN COLOMBIA AND PERU

by Dr. Richard W. Thorington

INTRODUCTION

During the 1960s and early 1970s, several species of South American primates became important as experimental animals in medical research. The vast majority of these came from two countries: Colombia and Peru. Thus, as concern arose for both the conservation and the continued availability of these species, it was natural to focus attention on these two countries. Because of this concern and that involving primate populations throughout the world, a Committee for the Conservation of Nonhuman Primates was formed within the Institute of Laboratory Animal Resources, NAS-NRC. Receiving funds from the National Institutes of Health and the Department of Defense, the committee was charged with assessing the status of various primate species in South America. It was hoped that the Committee could similarly consider primate species of Africa and Asia in subsequent studies. The reports which follow form the final report on the field work in South America conducted under the auspices of the committee up to the end of 1974. They should be considered only as progress reports. There is too much work yet to be done for us to adopt any other attitude. Yet they constitute a series of status reports which show a vast increase in our knowledge of South American primates.

1. Colombia: a summary statement

The surveys in Colombia demonstrate clearly that the northern part of the country is greatly deforested and severely depleted of primates. Only three major forest blocks remain. (See Figure 1.) The small patches of forest that are left between them are of transitory importance for most primate populations because many of them will soon be destroyed.

Of the primates from northern Colombia used in medical research, the cotton-topped tamarin (Saguinus oedipus) is the species which is in the most difficulty. Apparently it still occurs in only a few of the small residual forests in northern Colombia. Even in some areas where the habitat is still suitable, the animal has apparently been eliminated or reduced to extremely low densities by trapping pressures in the past.

The conservation problem of the cotton-topped tamarin is confused by a taxonomic problem. Some persons consider this tamarin of northern Colombia to be conspecific with the rufous-naped tamarin (Saguinus geoffroyi) of eastern Panama. This taxonomic issue is irrelevant to the medical users, however, because only the Colombian animals have been used in medical research in the United States and only they are available for use in the future due to the legal restrictions in Panama.

The night monkey (Aotus trivirgatus) has been similarly affected by the reduction of forested areas in northern Colombia. At present most of the animals used

in medical research are coming from one large forest block, which still remains in the Serrania de San Lucas. This area is rapidly being deforested, and it is probable that most of the Aotus are coming from the regions in which the forest is being destroyed. The future supply of Aotus from this region is, therefore, endangered for two reasons: first, because of the destruction of the forests in this area and, second, because of the increasing concern of the Colombians to save what fauna still exists in northern Colombia. The latter concern has and will probably continue to cause the Colombians to reduce the number of Aotus exported whether or not they can protect the populations by any other means.

Other species of primates of potential or actual use in medical research are not found in sufficient numbers in northern Colombia to warrant their being considered in the assessment of future supplies. These include two species of Cebus monkeys, the howler monkey, the spider monkey, and the woolly monkey. A small number of these will continue to be exported from northern Colombia, but we doubt that these species will present anything but conservation problems in the future.

Our conclusion is, therefore, that there is great need for breeding programs and conservation programs associated with the primates of northern Colombia. It is critical that breeding programs be established as soon as possible for cotton-topped marmosets (Saguinus oedipus) and the night monkeys (Aotus trivirgatus) from the San Lucas region. These animals are needed in biomedical research, and their supply from the wild is not assured for the future. Our assessment is that the situation is critical for both these species. Unless breeding programs are established and funded in the very near future, both of these species will soon become unavailable for medical research in the United States.

The promotion of conservation programs in northern Colombia is similarly of great importance. Ways must be found to promote the establishment and protection of forest reserves whether public or private. The primate populations maintained in such reserves are potential sources of animals for future breeding programs. These are the genetic stocks of the future, and it is essential that their existence be guaranteed whether or not arrangements have presently been made for their use in future breeding programs. If the animals exist in reserves, there is always the possibility that they can be used for establishing future breeding colonies. If they do not exist in reserves, then the loss of breeding colonies in the United States or elsewhere because of disease or mismanagement becomes an unmitigated disaster. Therefore, the promotion of conservation programs should be viewed in the same light as other programs involving the conservation of genetic stocks. A good conservation program can be the most efficient and least expensive way of maintaining such stocks.

2. Peru: a summary statement.

The situation in Peru is quite different from that in northern Colombia. The forests have not been extensively destroyed in Peru, but the primate populations are generally to be found at low densities. Many of the species are found at densities which are probably far below the carrying capacity of the habitat due to hunting and trapping pressures. There is public record of the large numbers of primates which have been exported from Iquitos in the past several decades. Through Dr. Neville's work, it has become evident that the meat market in primates is even greater than

the export market was. Monkey meat has been readily available in Iquitos, and we must presume that it is also available in other areas of the Amazon region of Peru. A more recent factor has been the introduction of survey teams and drilling teams from various oil companies. It has been common practice for the oil companies to assign hunters to their work crews. The hunters provide meat for the men conducting the surveys, and monkeys are a favorite source of food. A second aspect of the survey work is that the oil companies have been opening up an extensive network of overland trails, which make large areas of the Peruvian Amazon accessible to other hunters.

A recent law prohibits the hunting or sale of monkeys and most other wildlife without government authorization. The export of monkeys will be permitted only for scientific purposes, but the number of such authorizations will probably be very limited. While this law has thus far stopped the export of monkeys, it has had little effect on the hunting of monkeys for local consumption. Don Felipe Benavides very recently has brought the issue to national consciousness through the press, but governmental pressure can probably reduce the sale of monkey meat only in Iquitos and a few other large population centers. Observance of this law by oil companies also might be enforceable. However, a large majority of all monkeys killed are consumed in rural Amazonian Peru where enforcement is not possible. In view of this and a growing human population in Amazonian Peru, we do not anticipate any future improvement in the overall status of its monkey populations.

The future availability of Peruvian primates for medical research will be dependent on the development of two different types of programs. First, breeding programs will need to be established, probably in Peru. It is doubtful that Peru will export any primates unless they are made collaborators in an international biomedical project. One of the best ways we see of effecting this is to enroll Peruvian biologists and medical doctors in breeding and research programs presumably through an international agency such as the Pan American Health Organization. Second, because breeding programs can supply only a limited number of quality animals for research, it will be essential to establish a careful program of wildlife management in Peru. The field work conducted by Neville and Freese has laid the basis for such a program of wildlife management. The primate project is continuing in Peruvian hands, and with international assistance, they can develop proper management techniques including a sensible program of monitoring and cropping wild populations.

One last caveat must be mentioned. The letter and the spirit of the laws of the exporting countries must be recognized and observed. Any government or private efforts to ignore or avoid the regulations of the exporting countries will work to the long-term detriment of the biomedical community. There have recently been several attempts to obtain primates for research through somewhat dubious channels. These have aroused the concern and nationalistic ire of the countries involved. The medical community must make special efforts not to arouse the suspicions of the exporting countries by any overt or inadvertent acts contrary to the laws of these countries.

APPENDIX B

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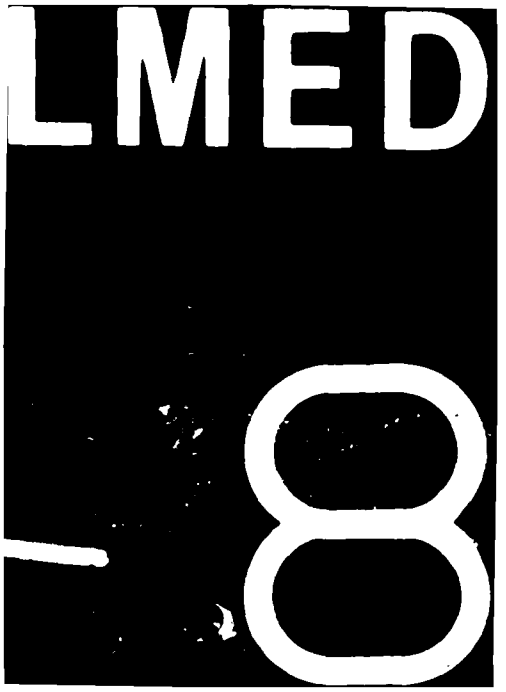
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