Meetings

Golden Lion Marmoset Conference

The Wild Animal Propagation Trust (WAPT) sponsored a meeting to develop a plan that would ensure the survival of the golden lion marmoset, *Leontopithecus rosalia*, both in its native Brazilian habitat and in captivity. A conference of 28 biologists, representatives of zoos and research institutes throughout the United States and Brazil, was hosted by the National Zoological Park, Washington, D.C., on 15 to 17 February 1972.

At the opening of the conference, a survey was presented by the conference chairman, D. D. Bridgwater (Minnesota Zoological Board), on the status of captive and wild populations of *L. rosalia*. The golden lion marmoset was originally distributed along a strip of montane rain forest, approximately 500 by 100 km, within the states of Rio de Janeiro and Espírito Santo in Brazil. Deforestation for plantations, urbanization, and animal trade have had a severe impact on the population of the golden lion marmoset. At present, it is found only in a small 900-km^2 area in the state of Rio de Janeiro. It is estimated that about 500 of these animals remain.

Only limited success has been obtained with breeding the golden lion marmoset in captivity. There are about 130 in captivity, with 70 of these in the United States. These 70 animals are housed in 13 institutions, 11 of which have breeding potential. However, evidence suggests that reproduction will occur only when one or both parents were wild-caught. True breeding in second-generation-captive marmosets has never occurred. Because the last wild marmosets were imported in 1968, and they have a life-span of approximately 10 years, the wild-caught stock now in captivity will become negligible within the next 3 to 5 years. Unless consistent second-generation breeding is achieved soon, the future of this species in captivity is bleak.

The present status of *Leontopithecus* in Brazil was discussed by A. F. Coimbra-Filho (Instituto de Conservação da Naturesa, Guanabara, Brazil) and A. Magnanini (Departmento de Pesquisa e Conservação da Naturesa, Guanabara, Brazil). Although legislation has eliminated the capture and export of this species, their numbers are still rapidly declining due to clearance of the land for agricultural purposes. The species is now completely extinct in the state of Espírito Santo.

Two major efforts are being made by Brazilian biologists to ensure the survival of *Leontopithecus*. First, it has been proposed that a Federal Biological Reserve be established for the golden lion marmoset in the Poco das Antas area where a few *L. rosalia* live in the remnants of a forest. It was hoped that the official decree establishing this biological reserve would be obtained soon. However, because of the urgency of the problem an additional golden lion marmoset breeding facility is being established in the Tijuca National Park on the outsirts of Rio de Janeiro, an area once part of the range of the golden lion marmoset. The Tijuca "Bank" of golden lion marmosets will consist of 30 large breeding cages, and will provide a place to keep marmosets that are translocated from areas where their habitat is being destroyed. It is hoped that the Tijuca breeding center would also supply animals for restocking the Tijuca National Park and the Poco das Antas Biological Reserve.

The status of the two additional species of *Leontopithecus*, never seen outside of Brazil, was described. The golden-rumped marmoset, *L. chrysopygus*, was considered extinct until 1970 when two killed specimens caused the rediscovery of the species. It is estimated that about 100 specimens are living in a state park in western São Paulo. However, there have been many severe fires there which may have destroyed some habitat areas. The golden-headed marmoset, *L. chrysomelas*, is in even greater danger of extinction. This species lives only in a limited area in the state of Bahia. The small remaining habitat is the private property of wealthy families, and is being heavily used as timber- and farmland. The conference recommended that these two species become part of the WAPT golden lion marmoset program.

Several types of conservation efforts were discussed by R. A. Mittermeier (Harvard University). The Tijuca "Bank" of golden lion marmosets has received a grant from the World Wildlife Fund, but additional funds are urgently needed. A "Save the Lion Marmoset Campaign" has been started by Mittermeier in the hope of not only raising funds, but also increasing awareness in the United States and in Brazil of the plight of the golden lion marmoset. In an article (May 1971) in *Oryx*, J. Perry (National Zoological Park), secretary of WAPT, described his visit to Brazil to determine the conservation efforts that would be most effective.

As a member of the family Callithricidae, *Leontopithecus*, like other marmosets and tamarins, displays many social patterns that are distinct from other primates. A pair-bond is the major social unit (J. F. Eisenberg and D. Kleiman, National Zoological Park); there is strong evidence that, no matter how large the group, only one adult pair is sexually active (G. Epple, University of Pennsylvania). Field studies of wild populations of *Saguinus oedipus geoffroyi* at Barro Colorado Island, Panama, have shown that most groups consist of four or fewer individuals (N. Muckenhirn, National Zoological Park). Thus, caging the animals in small family groups is highly recommended.

A golden marmoset breeding facility has recently been constructed at the Monkey Jungle, Miami, Florida (F. V. DuMond). This facility is an attempt to simulate a seminatural environment, with large outdoor cages containing natural plantings. The social and developmental behavior of the golden lion marmosets in this facility is being studied (D. K. Candland, P. Snyder) through a cooperative program with Bucknell University.

Data on the management of other marmoset species in captivity could be usefully extrapolated to provide information on the golden lion marmoset. A

small colony of *Callimico goeldii*, another endangered marmoset species, is being maintained at the Delta Regional Primate Research Center, Covington, Louisiana (R. Lorenz); a detailed studbook of this species is being compiled. A large colony of *Saguinus fuscicollis* and *S. nigricollis* has been maintained at the Lincoln Park Zoo, Chicago, Illinois (S. Kitchener). This colony of about 135 pairs has, since 1964, produced 1264 live offspring, most of which have been used for experimental purposes at Presbyterian–St. Luke's Hospital, Chicago. At the University of Texas Dental Science Institute at Houston, another large breeding colony of about 100 pairs of marmosets has produced about 1000 live young in a laboratory environment (S. H. Hampton). True second-generation breeding was reported in some species. There was tentative evidence that animals born in captivity have successfully bred and cared for their young only when they had remained with their parents as juveniles and had assisted in the rearing of their next-born siblings.

There was extended discussion of the advantages and disadvantages of a seminatural caging and feeding system, as opposed to the more regimented laboratory environment; both systems have produced some success in maintenance and breeding. Diets for the animals range from extensive feeding of live foods, fruits, and vegetables to complete maintenance for many years with only a commercial diet.

J. Wallach (Brookfield Zoological Park) stressed the need for more complete physiological and nutritional data about *Leontopithecus*, as well as about other marmosets and tamarins. Although the need for large amounts of vitamin D_3 in animals caged indoors is well known, other nutritional factors, especially the amount of protein intake, are often ignored. Not only is adequate medical care important in the maintenance of *Leontopithecus*, but detailed postmortem examinations are also essential.

The major recommendations of the conference include:

1) Although a studbook of the golden lion marmoset is currently being maintained, it was recommended that a much more detailed and extensive history of all captive *Leontopithecus* be compiled. A questionnaire that would provide this information was drafted; this would provide the most adequate basis to effect animal exchanges for increased breeding potential. It is hoped that all owners of golden lion marmosets in the United States, and perhaps in the world, will cooperate with efforts to compile a complete studbook of the golden lion marmoset. Computer facilities for processing, storage, and maintenance of this data have been obtained through U. S. Seal (Veterans Administration Hospital, Minneapolis, Minnesota).

2) Detailed standards for a model system for keeping *Leontopithecus* in captivity were drafted. The standards set by this model system should be followed by those institutions wishing to be designated as Golden Marmoset Breeding Centers approved by the Golden Marmoset Committee of WAPT. This system includes minimum and optimum standards of animal identification, record keeping and observations, medical care, nutrition, housing, social environment, maintenance and personnel, interinstitutional cooperation, and specifications for transport of animals between centers.

3) The conference sent a letter to the President of Brazil requesting favorable action in the creation of the Poco das Antas Biological Reserve. Because the survival of the golden lion marmoset in the wild seems to depend upon the immediate establishment of major habitat reserves, conference letters were also sent to the director general of the International Union for the Conservation of Nature requesting support for both the Tijuca Field Station and the establishment of the Poco das Antas Reserve. A similar appeal was forwarded to the president of the World Wildlife Fund.

4) A letter was drafted to be sent to all owners of golden lion marmosets describing the conference and its recommendations. It is essential that as many golden lion marmosets as possible be made available in a cooperative long-range breeding program. Some existing groups must be rearranged, new pairs formed, and further pairings made in the future.

It was the hope of the conference that its recommendations would result in positive actions to save the golden lion marmoset in the wild and in captivity. But there was also a greater hope—that this meeting would serve as an example of what could be done for other species facing extinction. The golden lion marmoset, because of its striking appearance, appeals to man; but there are many other species which, unfortunately, lack a golden coat but, nevertheless, are on the brink of extinction and would benefit from a like concern.

SUZANNE H. HAMPTON
University of Texas Dental Science Institute at Houston, Houston 77004

Penrose Conference on Fracture Mechanics and Earthquake Source Mechanisms

Effective stress, stable sliding, stick-slip, stress drop, rupture velocity: these phrases are part of a new vocabulary in rock mechanics and seismology. How do they relate to earthquakes? Are there parameters whose measurement or observation might permit earthquake prediction? Where is the action today in understanding earthquake source mechanisms?

A Geological Society of America Penrose Conference, which convened at the Mountain Chalet, Snowmass-at-Aspen, Colorado, from 26 to 30 September 1971, fostered communication among rock mechanics experimentalists, dislocation theorists, earthquake engineers, and seismologists. Eighty-four experts heard 40 short papers in informal sessions on friction, pore pressure, microearthquakes, source mechanisms, and crustal deformation.

A major goal of the experimentalist is to apply to the earth what he finds in the laboratory; to make the results in hours and centimeters meaningful in terms of years and kilometers. In the laboratory, stable sliding or stick-slip (sudden rapid displacement) characterize movement in a friction experiment. By analogy, in the crust stable sliding accompanies a creeping fault without great seismic activity. On the other hand, stick-slip may describe behavior along seismogenic faults. High temperature, low effective pressure, high porosity, and thick gouge all enhance stable sliding in the laboratory