

The “Son Tra Douc langur Research and Conservation Project” of Frankfurt Zoological Society

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Summary

Research activities of Frankfurt Zoological Society (FZS) on Son Tra Nature Reserve, Danang City began in 2006. This evolved into the ‘Son Tra Douc langur Research and Conservation Project’ in 2010, focusing on the conservation of red-shanked douc langurs (*Pygathrix nemaeus*). This project gathers information about douc langurs social behavior, feeding ecology, ranging and forest phenology. The project worked primarily with one group of douc langurs. Son Tra’s douc langurs live in multi-male/multi-female groups. Groups consist of multiple families with a sex ratio of adult females to adult males typically 2:1. Sixty-three different feeding plant species were identified. The douc langurs feed on a variety of plants, mainly trees but also vines and climbers. Nutritional analysis of select food items was conducted. Langurs select higher quality foods when available, suggesting dental and gut morphology is an adaptation to tough fall-back foods. During the entire study we also monitored threats to the biodiversity on Son Tra including poaching, fishing, and extraction of timber and non-timber forest products. Development of several tourist resorts and roads have serious negative impacts on biodiversity. Threats were reported regularly to Da Nang City administration.

Dự án nghiên cứu và bảo tồn loài voọc chà vá chân đỏ của Hội Động vật học Frankfurt tại bán đảo Sơn Trà

Tóm tắt

Hoạt động nghiên cứu của Hội Động vật học Frankfurt, thành phố Đà Nẵng bắt đầu từ năm 2006. Đến năm 2010, dự án nghiên cứu và bảo tồn loài voọc chà vá chân đỏ được thực hiện. Mục tiêu của dự án là thu thập số liệu về tập tính xã hội, sinh thái dinh dưỡng, tập tính di chuyển và sự phát triển của rừng. Chương trình nghiên cứu được thực hiện trên một bầy voọc chà vá chân đỏ tại bán đảo Sơn Trà. Kết quả cho thấy, loài voọc chà vá chân đỏ sống thành bầy với nhiều con đực và con cái trưởng thành. Bầy lớn được hình thành từ nhiều gia đình nhỏ với tỷ lệ giới tính ở con trưởng thành là 2 cái:1 đực. Có 63 loài thực vật là thức ăn chính của loài voọc chà vá chân đỏ đã được xác định. Thức ăn của loài đa dạng với phần lớn là cây thân gỗ, một số dây leo và cây thân thảo. Đặc điểm dinh dưỡng của thức ăn cũng được phân tích. Kết quả cho thấy loài lựa chọn những thức ăn có hàm lượng dinh dưỡng cao. Mặt khác cấu trúc răng và dạ dày của loài cũng thích nghi với việc ăn các loại thức ăn kém chất dinh dưỡng trong những thời điểm nhất định. Trong quá trình nghiên cứu những tác động đến sự tồn tại của loài cũng được ghi nhận và giám sát. Các tác động bao gồm săn bắt, đánh cá, khai thác gỗ và làm sản ngoài gỗ. Sự phát triển của các khu du lịch và đường sá cũng tác động nghiêm trọng đến đa dạng sinh học ở bán đảo Sơn Trà. Những tác động đã được báo cáo thường xuyên lên nhà chức trách của thành phố Đà Nẵng.

Introduction

One of the most colorful primates in the world, the red-shanked douc langur¹ (*Pygathrix nemaeus*) is endemic to Indochina. They inhabit a diversity of tropical forests in north and central Vietnam, east-central Laos and the northeastern tip of Cambodia (Fooden, 1996; Timmins & Duckworth, 1999; Nadler et al., 2003; Rawson & Roos, 2008). Unfortunately, an absence of basic survey data throughout their range confounds exact population estimates. Red-shanked douc langurs are listed as Endangered on the IUCN Red List of Threatened Species (IUCN, 2012) and the Red Data Book of Vietnam (Ministry of Science and Technology & Vietnamese Academy of Science and Technology, 2007). Despite legal protection in Vietnam, Laos and Cambodia populations are declining rapidly all over the distributions range mainly due to hunting for medicinal purposes. Law enforcement is lacking. Douc langurs are further threatened by habitat loss and fragmentation as result of logging, agricultural and infrastructure development.

They have dental and gut adaptations allowing them to process low quality foods, such as mature leaves (Kay, 1978; Chivers & Hladik, 1980; Davies & Oates, 1994). Although they have unique folivorous adaptations their diet is diverse, consisting of fruits, nuts, seeds, flowers, and bark in addition to young and mature leaves (Lippold, 1977; Pham Nhat, 1994).

Material and Methods

Son Tra Nature Reserve

Son Tra Nature Reserve is located on Son Tra Peninsula only 8 km from the center of Danang City. The peninsula comprises a total landmass of about 6000 ha with several peaks of which the highest is 696 m (Tordoff et al., 2004). Son Tra comprises a patchwork of different habitats including forests, plantations and shrub lands. Son Tra forest is home to a large variety of plants and animals. Surveys conducted by Danang University confirmed 985 plant species, 36 mammal species, 106 bird species, 23 reptile species, 9 amphibian species and 113 insect species (Dinh Thi Phuong Anh, 1997). Observations made during this project have confirmed even greater diversity than the numbers reported in 1997. Regardless, many of the species remaining on Son Tra are listed in the Red Data Book of Vietnam and the IUCN Red List of Threatened Species and some of them are critically endangered.

Son Tra played an important role in Danang's legends and its recent history. Initially the entire peninsula was protected under military jurisdiction. In 1977 4.439 ha of the peninsula were protected as a cultural and historical site (Tordoff et al., 2004). The protection status was upgraded to a nature reserve in 1992 and forest protection rangers were appointed to stop illegal activities. In 2008, the size of the reserve was reduced by nearly half, to 2.670 ha and many areas important for biodiversity are now being developed (Vietnam Conservation Fund, Central Region TA, 2009). The entire coastline of Son Tra is no longer protected and numerous large resorts are being built.

Many roads have been constructed crossing Son Tra and have created wide gaps in the forests, which are impossible for douc langurs and other wildlife to cross. An invasive vine which has been brought in with the road construction spreads over the peninsula, covering and destroying large areas of the forest. Nature on Son Tra is on the decline and protection measures are urgently required.

¹ There remains some scholarly debate about the common names for the *Pygathrix* species, although this does not affect systematic placement. For the purpose of consistency within the Vietnamese Journal of Primatology, douc langur is used for all *Pygathrix* species. Please refer to the article in this issue for a discussion of vernacular names [Nadler (2012): Why Sea Lions don't catch Zebras—Thoughts about common names of Indochinese primates. Vietnamese J. Primatol. 1(2), 3-5].

Son Tra reflects the threats to biodiversity in the entire country and also the problems conservation face trying to address them (Lippold & Vu Ngoc Thanh, 2008). There is rampant hunting and cutting, severe habitat loss and fragmentation, uncontrolled tourism and development, and a lack of awareness of the douc langurs and biodiversity conservation and an entire absence of law enforcement activities.

First reports of red-shanked douc langurs at Son Tra were published in 1969 and 1971, from a survey that took place from 1966-69 during the Vietnam-American War (Van Peenen, 1969; Van Peenen et al., 1971). A brief survey in 1974 estimated only 11-28 individuals (Lippold, 1977). A survey conducted in 1988 reported one group of 10 individuals remaining in the area (Pham Nhat, 1994). In 1995, the population estimate was 30-40 individuals remaining on the peninsula (Lippold, 1995). Until the beginning of 2007, it appeared the population of douc langurs at Son Tra was very small if not extirpated (Nadler et al., 2003). In 2007, a survey recorded 171 individuals, and a population estimate of 198 red-shanked douc langurs (Vu Ngoc Thanh et al., 2007), suggesting that nearly 60% of the red-shanked douc langur population in Vietnam may be located on Son Tra (Lippold & Vu Ngoc Thanh, 2008). Son Tra is therefore home to an important population of red-shanked douc langurs, probably one of the largest populations remaining in Vietnam. Here the species managed to survive relatively undisturbed due to military presence and restricted access to the peninsula.

Research component

Phenology transects

Three transects were established, measuring 8 x 300 m (2 transects), and 8 x 500 m (1 transect). Transect locations were chosen randomly using a number generator for coordinates. All trees with 10 cm diameter at breast height (DBH) or greater were marked. Measurements of DBH, tree height, crown width, percentage of young to old leaves, living to dead leaves, and proportion of fruits and flowers were recorded. Measures on the leaves, fruits and flowers were recorded twice each month for 14 months. There are 512 trees with at least 10 cm DBH along the transects. Transect trees have all been identified to at least family level.

Feeding ecology

Feeding observations used focal sampling, and rotated between adult males and adult females, but also included sub-adults, juveniles, and infants where possible. Records were made of time, weather, individual, feeding behavior, tree(s) species, tree characteristics, canopy height and distance to nearest douc langur.

Nutritional quality

Select feeding plants were collected for testing. Within 48 hours of the observed feeding bout, 300 g of wet matter were collected from the same feeding tree, and weighed on location. Plants matter was then stored in open plastic containers with silica gel in an open air room, then in an air conditioned room for drying. Samples were weighed for consecutive months until a dry weight was reached, then stored in sealed plastic containers until tested. Based on dry weight, 22 were selected for testing including 18 plants selected for by the douc langurs and 4 plants readily available but not selected as food. Tests include crude protein, neutral detergent fiber, acid detergent fiber, ash, water content, and condensed tannins. Tests were conducted at the Center for Environmental Management Laboratory of Nong Lam University, Ho Chi Minh City. Water content is based on wet

and dry matter weights. Other tests are conducted using the following methods: AOAC 987.04-1997 (crude protein), AOAC & TC 2000 (ash), AOAC & TC 2000 (tannins), AOAC 973.18 (fibers).

Behavioral observations

Behavioral observations are also based on focal sampling, rotating between adult males and adult females, and opportunistically on subadults, juveniles and infants (Fig. 1).



Fig.1. An adult male, female and young in the habituation group. Photo: Larry Ulibarri.

Preliminary results

Tree compositions and characteristics between the 3 transects are different. Transect 1 has the highest percentage of trees taller than 15 m (13%), and is the only transect which contains trees higher than 20 m. It has the highest diversity of tree families. Douc langurs were most often seen around transect 1 compared to the other transects. Transect 2 has the next highest percentage of tall trees (8% with a height 15 m or greater) and the next highest diversity of tree families. Transect 3 has the lowest diversity of tree families and the lowest percentage of trees 15 m height or greater (2%). Douc langurs were seen infrequently along Transect 2, and only observed twice along Transect 3. This pattern suggests a habitat preference towards good secondary or primary forests in which there is a greater percentage of trees 15 m height or greater.

The douc langurs were observed feeding at all canopy levels, including the ground. Young leaves comprise a majority of their diet, followed by mature leaves, fruits, flowers, seeds and bark. As observations are predominantly on one group of douc langurs, the total number of food species is likely low compared to the probable diversity of feed species on Son Tra. However, 63 different plant species were selected and have been identified, and the list is growing. Among the most important

food resources, including its young and mature leaves, its flowers and seeds, is the IUCN classified critically endangered tree – White Seraya (*Parashorea stellata* Kutz) (IUCN, 2012) (Fig. 2). This is the same tree that the douc langurs were seen in most frequently during observations, positively correlating with the frequency of douc langur observations.

Selection of fruits and flowers increases with availability. However, the douc langurs do not actively seek out fruiting or flowering trees, and were never observed to deplete a food resource on an individual tree. This implies

that the douc langurs folivorous adaptations (dentition and gut morphology) are for fall-back resources in a seasonal and fluctuating environment. Results of the nutritional analysis are still pending.

During the first year of this project the semi-habituated douc langur group consisted of 17 individuals, the following year a new infant was born into the group. This group comprises three families. Two of these families have a single adult male, the 3rd family has two adult males. The sex ratio is 2:1; adult females to adult males. The families come together to form a group, and are often seen together at all times of the year, especially during the spring (February – May) and autumn (August – October) months. During other times of the year, they frequently sleep together, then split into their respective families in the morning, travel and feed as separate families, then join again in the late afternoon. This daily fission-fusion behavior was frequently observed in several groups, not just among the habituation group. Adult males tolerate other adult males intragroup. Both friendly and aggressive intergroup interactions were observed.

Two separate groups comprising only adult and subadult males were observed. These bachelor groups appear to be seasonally formed in the spring and autumn. However, these males also roam the forest as solitary males, often shadowing douc langur groups and coming as close as 100 m before a douc langur family becomes agitated.

Douc langur groups were often observed together with a troop of rhesus macaques (*Macaca mulatta*). During all such observations, the macaques tended to stay below 15 m and the douc langurs above, although overlap in substrate use and encounters of 1 m distance between species were not uncommon. Such associations between the two species appear to be unstable chance encounters. However a few prolonged occasions of half-day feeding and traveling associations were recorded. Also, adult male red muntjacs (*Muntiacus muntjac*) were infrequently observed to travel under the douc langur group (and macaque troops) for extended periods, presumably feeding on seeds dropped by the primates. These associations also appear to be chance encounters.

Conservation component

Threats to biodiversity

Hunting and Non-timber-forest-products (NTFP) collection

Based on the number douc langurs confiscated by local authorities in 2010, we predict that about one adult per month was hunted from Son Tra during that year. No reported confiscations occurred in 2011 and 2012. Snare fences stretching 500 to 1000 m were found during the research and



Fig.2. A White Seraya tree (*Parashorea stellata* Kutz) with flowers. Flowering season is short and was only observed once in 2.5 years.
Photo: Larry Ulibarri.

numerous snares are removed from Son Tra by the rangers each month (Fig. 3). Hunting activities are not only conducted by hunters but to a large degree by construction workers living in the forest during road construction. At times there were about 1000 construction staff living in tents and sheds on Son Tra. Some of the construction workers have been living on the site for the last 7 years. Wildlife has been found in the construction camps (Fig. 4).

Bird hunting is rampant and is done by hunters but also young men and students to earn extra money during the weekends. Although most are aware that catching birds is illegal, few are concerned about repercussions. Based on records made during 2010 - 2011, it was estimated that 30 birds are hunted each day leading to a massive reduction of the bird populations of Son Tra (Fig. 5).

Trees, rattan, Cycadaceae plants and orchids are taken from Son Tra daily (Fig. 6). Tree scraping of White Seraya is also frequent and is done for the resin which is used as boat sealant.



Fig.3. Snare fences and single snares are an ongoing problem. Photo: Larry Ulibarri.



Fig.4. Wildlife of all sorts has been observed in construction camps. This adult male has been injured with a machete probably by construction workers. Photo: Larry Ulibarri.



Fig.5. On an average day at least 30 birds are estimated to be hunted on Son Tra. Photo: Ulrike Streicher.



Fig.6. The cutting of leaves from cycad species has nearly eradicated these plants on Son Tra. Photo: Larry Ulibarri.

Habitat destruction and fragmentation

A road surrounding Son Tra Peninsula was approved by Danang City in 2001 (Decision No. 113, 2001). Construction of the road was initially very slow. In July 2012, the road is still under construction. All forests below the road and along the coast not longer belong to the nature reserve and are designated for development. In some locations, the areas designated for development include several hundred ha of good secondary forest and is home to douc langur groups.

Road construction is done with little concern to the forest. In many areas forest is cleared simply for access to soil which is then used in the road construction. Steep slopes are blasted into the hill side and the nearly vertical slopes are left exposed. This results in heavy landslides during the raining season and large patches of forest slide down with the mud. The gaps in the forest created by the roads are in some places over 100 m wide (Fig. 7). Roads and the slopes are significant barriers for all arboreal species. Smaller forested areas and arboreal species are more susceptible to the negative effects of habitat fragmentation, which is a double-strike against the douc langurs on Son Tra Nature Reserve. In at least two locations, douc groups are currently separated by the roads; one family on the ‘protected’ side of the road, the other on the ‘unprotected’ side. All observation of such split groups indicate they stay close to each other and thus to the road, and are maximally exposed to hunting.



Fig.7. Roads create large gaps in the forest, which in some places are over 100 m wide. Photo: Ulrike Streicher.

Conservation activities

Raising awareness

Education activities involved the cooperation of several organizations and people including the Department of Education, Department of Science and Technology, Danang City consultant Dr. Ulrike

Streicher, Frankfurt Zoological Society, and Danang University. We have conducted and continue to work on several activities to raise public awareness about the red-shanked douc langurs, Son Tra Nature Reserve, and the threats they face (Fig. 8).



Fig.8. Several activities to raise public awareness have been conducted, including a photo exhibition in Danang City, which attracted nearly 8000 visitors.
Photo: Ulrike Streicher.

Canopy bridges

Based on these threats this project proposed a tree bridge project to link the habitat patches which are fragmented by the newly developed tourist roads. This includes planting and maintaining trees to encourage natural canopy bridges. This has been approved by the People's Committee of Danang City, but the implementation of the tree bridge project is slowed due to administrative reasons.

Continued activities

The project is on-going, although the primary activity during 2012 focused on conservation awareness activities and analysis of data obtained so far. With the relative success of habituating a red-shanked douc langur group, the ability to locate the group consistently, follow the group at close range for full days, and identify each individual within the group, plans to continue research and contact with the douc langur group are important. It is not currently possible anywhere else in Vietnam to gather data of the same quality on red-shanked douc langurs.

Outputs and conclusions

This project is expanding our knowledge on the ecology of the red-shanked douc langurs. Data

on nutrition will be immediately useful for the care of douc langurs in zoos and rescue centers, where adequate diet is often a problem (Edwards & Killmar, 2004).

This study also gathered data immediately useful for the protection of the douc langurs on Son Tra as we gather information on home ranges, important plant species, movement patterns, and threats and provide this directly to the relevant protection authorities. It has continued to raise the issue of threats to various departments of the city government and the People's Committee.

Conservation activities on Son Tra need to be intensified and must focus on law enforcement and protection of the douc langurs and the nature reserve.

Decisive measures are needed if the red-shanked douc langurs should be given the chance to survive.

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