The Orange-necked Partridge *Arborophila davidi* and five other galliforms in two protected areas in southern Vietnam

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August 1998

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Citation:

Atkins, R.A. and Tentij, M. 1998. The Orange-necked Partridge *Arborophila davidi* and five other galliforms in two protected areas in southern Vietnam. Institute of Systematics and Population Biology, University of Amsterdam. 42 p.

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SUMMARY

The Orange-necked Partridge *Arborophila davidi* was discovered in 1927 at Bu Kroai, Song Be Province in Vietnam (Delacour *et al.*, 1928). Until 1991 it was considered to be extinct, when it was reported to have been seen very briefly on a site near Dac Lua, a substation of Cat Tien National Park, Dong Nai Province (Eames *et al.*, 1992).

From February 1997 until the end of April 1997, a three-month survey of the Orange-necked Partridge was made in Cat Tien National Park and in the neighbouring Cat Loc Nature Reserve. The aim of this survey was to determine if the species was present and to gather data on its ecology and behaviour.

The site near Dac Lua was searched and line transects were used to survey other areas systematically. Five other species of galliforms were also surveyed; Germain's Peacock-pheasant *Polyplectron germaini*, Scaly-breasted Partridge *Arborophila chloropus*, Siamese Fireback *Lophura diardi*, Red Junglefowl *Gallus gallus* and Green Peafowl *Pavo muticus*.

The presence of the Orange-necked Partridge was established in an area of approximately 10 km^2 in Cat Loc (up to 26 individuals) and at two sites in Cat Tien (two and five individuals).

The Orange-necked Partridge appears to have a preference for slopes covered with bamboo and a thick litter layer. The species seems to tolerate some degree of habitat disturbance by man.

Both Cat Tien and especially Cat Loc are under threat. Large areas of Cat Loc have been cleared of forest and the central government of Vietnam is encouraging the hill tribes that live there to start commercial cashew nut plantations. Particularly Cat Loc Nature Reserve needs to be better protected to secure the continued existence of the Orange-necked Partridge.

ACKNOWLEDGEMENTS

We would like to thank the following foundations and companies for their generous financial support:
Lucie Burgers Foundation for Comparative Behaviour Research; BirdLife International Vietnam Programme; British Airways Assisting Conservation Programme; Stiftung Avifauna Protecta & Zoologische Gesellschaft für Arten- und Populationsschutz; Martina de Beukelaar Stichting; Stichting J.C. van der Hucht Fonds; Institute for Systematics and Population Biology /University of Amsterdam; World Pheasant Association; Partridge, Quail and Francolin Specialist Group; Constructiebureau Tentij B.V.; Bever Zwerfsport and RAF Personal Audio Amsterdam.

We would also like to thank and greet a number of people:
Dr. René Dekker of the National Museum of Natural History, Leiden, for all his effort and supervision; Jonathan Eames and Dr. Nguyen Cu of BirdLife Vietnam Programme, for their guidance and good company in Vietnam; Dr. Jan Wattel of the Zoological Museum, University of Amsterdam, for his share in the supervision; Tran Van Mui, Director of Cat Tien National Park; Pham Huu Khánh, from Cat Tien National Park, for helping us with our fieldwork, his excellent company and showing us the Vietnamese social niceties; Nguyen Tran Vy, from the Institute of Ecology and Biological Resources, for helping us with our fieldwork with great enthusiasm; Do Thi Xua for her extremely generous hospitality in Cat Tien; Keith Howman and Jane Clacey of the World Pheasant Association; John Caroll, Chairman of the Partridge, Quail and Francolin Specialist Group; Rod Hall from BAAC; Charlotte Vermeulen for sacrificing her holiday; Boudewijn Heuts for his statistical acumen; Tineke Prins for handling our mail; Jan-Herman van der Sloot of the Expert Center for Taxonomic Identification, Amsterdam for his sonographic artistry; Nick Brickle from BirdLife International and Jon Brommer for their "harsh" comments and corrections; Han Assink, Ben King and all the people who sent us mail in Vietnam.

PREFACE

This report presents the results of a survey of the Orange-necked Partridge *Arborophila davidi*. This survey was a part of our Master of Science degree (doctorandus) in biology at the University of Amsterdam. The fieldwork was carried out in Vietnam from February 1997 until April 1997.

Early in 1996 we received a copy of the Partridges, Quails, Francolins, Snowcocks and Guineafowl: Status survey and conservation action plan 1995-1999 (McGowan *et al.*, 1995). In this Action Plan the necessity of a survey of the recently rediscovered Orange-necked Partridge in Vietnam was indicated. More information was urgently needed in order to assess the potential threats to its survival. We became very enthusiastic about the project, particularly because we were interested in the conservation aspect. Dr. René Dekker of the National Museum of Natural History, Leiden, would be our supervisor together with Dr. Jan Wattel of the Zoological Museum, Amsterdam. Through the Birdlife Vietnam Programme in Hanoi we were able to apply for a three-month research visa.

We stayed in Cat Tien National Park for three months and were assisted by Pham Huu Khánh, a staff member of the Technology Department of Cat Tien National Park, and Nguyen Tran Vy, a post-graduate student from the Institute of Ecology and Biological Resources in Ho Chi Minh City. Our supervisors in Vietnam were Jonathan C. Eames and Dr. Nguyen Cu of the BirdLife Vietnam Programme.

We arrived in Vietnam on the 1st of February, near the beginning of Tet, the Vietnamese New Year. We bought two bicycles so that we could travel through the Park without having to rely on the services of the very expensive Jeep.

The original aim of the survey was to concentrate exclusively on the Orange-necked Partridge. Unfortunately, during the first two months of our fieldwork we did not hear or see any sign of the species. Within a few weeks though, we were able to identify more than 100 species of birds and we could recognize the vocalisations of most terrestrial birds, including all the galliforms. We decided to combine our survey of the Orange-necked Partridge with a census of five other species of galliforms. In this way we were able to search large areas of Cat Tien in a systematic manner and we hoped that, whilst censusing the other species, we would have a better chance to find the Orange-necked Partridge.

By the beginning of April, we had almost given up hope that the Orange-necked Partridge was still present in Cat Tien National Park. Together with a team from the BirdLife Vietnam Programme and of the National Museum of Natural History, Leiden, we went the neighbouring Cat Loc Nature Reserve. Three years before our visit to Cat Loc, a team from the BirdLife Vietnam Programme visited this reserve and found no evidence of the Orange-necked Partridge (Eames, J.C., pers.comm.). During our visit, the Orange-necked Partridge did turn out to be present in Cat Loc Nature Reserve.

Only during the last month of our fieldwork were we able to focus completely on the Orange-necked Partridge, because by that time we knew how and where to look. Back in Cat Tien we continued our survey on this beautiful species. So in this report, we are glad to announce that the Orange-necked Partridge still exists and we are happy to show the results of our survey.

1. INTRODUCTION

The Orange-necked Partridge *Arborophila davidi* (Delacour, 1927) (Appendix VII) is endemic to the forests of southern Vietnam and was first described from two specimens that were collected at approximately 250 m altitude in densely wooded country with rolling hills at Bu Kroai, Song Be province (Delacour, 1927) (Appendix I; map of Vietnam). "It is nearer to *A. rubrirostris* (Salvad.) [Red-billed Partridge] from Sumatra, than to any other species, but yet quite different" (Delacour *et al.*, 1928). The type locality has long since been completely cleared of forest and since there were no other records of this species for the next 64 years, it was considered to be extinct.

In June 1991 the Orange-necked Partridge was claimed to have been re-discovered in Cat Tien National Park, Dong Nai province in southern Vietnam. Near the village of Dac Lua, in the north of the park, two birds were seen on the 21st and the 22nd and a single bird on the 24th. In early 1993 two birds were possibly seen, again near Dac Lua in Cat Tien National Park. On all occasions the birds were merely glimpsed and no vocalizations were heard (Eames *et al.*, 1992; McGowan *et al.*, 1995; Eames, J.C. pers. comm., 1997). They were seen on small hills at 140-200 m altitude, covered with non-thorny bamboo forest, reaching 6-10 m in height (Eames *et al.*, 1992). The Mace-Lande status of Orange-necked Partridge is 'endangered' and the species is probably threatened by habitat loss (McGowan *et al.*, 1995). In 1995, a survey of Orange-necked Partridge was recommended in the *Partridges, Quails, Francolins, Snowcocks and Guineafowl: Status Survey and Conservation Action Plan* (McGowan *et al.*, 1995). Following this recommendation, we aimed to get a clearer view of the distribution, habitat requirements, population size, ecology, breeding biology, behaviour, possible threats and to record the call of the Orange-necked Partridge. The survey areas were Cat Tien National Park and the neighbouring Cat Loc Nature Reserve where suitable habitat for the Orange-necked Partridge was thought to exist.

Additionally, a census of the following five galliforms was carried out in Cat Tien National Park: Green Peafowl *Pavo muticus imperator* Delacour, 1949 occurs in Vietnam, Laos, China and at a single site in western Thailand (McGowan and Garson, 1995). In the past Green Peafowl was considered to be one of the commonest pheasants in its range, now it is believed to have undergone a major decline (Eames *et al.*, 1992). Its habitat consists of mixed deciduous woodland, open forest, forest edge, secondary growth and clearings, usually close to shallow streams or rivers with sandy riverbanks. It is a resident of plains and foothills and occasionally higher plateau areas, up to 900 m (King *et al.*, 1975; Nguyen Cu & Eames, 1992). Green Peafowl are wary birds, often found in groups composed of an adult male, a few females and young (Delacour, 1977). Nesting takes place on the ground in fairly open spots, during which four to eight eggs are laid (Delacour, 1977). It roosts high above the ground in trees, often calling during sunrise and sunset. No data on its population status were available from Vietnam, though there are recent reports of it being observed several times in Cat Tien National Park and Yok Don Nature Reserve (McGowan & Garson, 1995; Eames *et al.*, 1992). It is threatened by hunting for food and the bird trade, but also by habitat loss and degradation resulting from the use of chemical defoliants and clearance of land for agriculture and logging. Its Mace-Lande status is 'endangered' (McGowan & Garson, 1995). Our aims were to record every sighting of Green Peafowl in Cat Tien National Park and to interview the local people about other possible places of occurrence.

Siamese Fireback *Lophura diardi* (Bonaparte, 1856) is widely spread in Indochina except in Tonkin [northern Vietnam], and is confined to lowland (King *et al.*, 1975). Its habitat consists of dense forest, scrub and second growth. It is often seen on trails at the forest-edge (King *et al.*, 1975; Eames *et al.*, 1992). It goes in small flocks composed of one or

more males and 3-5 females. The males 'call' by whirring their wings. Siamese Fireback live on the ground, only taking to the trees (about 2-3 m above the ground) to roost or when frightened. A clutch of eggs is laid in hidden spots; there is not much of a nest (Delacour, 1977). In Vietnam and Laos the population estimate is 10,000 individuals and is thought to be declining; in Thailand it is about 5,000 individuals (McGowan & Garson, 1995). Siamese Fireback is threatened by habitat loss due to deforestation, and by hunting and snaring, for both local consumption and domestic trade (McGowan & Garson, 1995; Eames *et al.*, 1992). Its Mace-Lande status is 'vulnerable' (McGowan & Garson, 1995).

Germain's Peacock-pheasant *Polyplectron germaini* Elliot, 1866 is endemic to Cochinchina and Southern Annam and is confined to lowland and sub-montane forests up to 1,100 m (Nguyen Cu and Eames, 1992; Delacour, 1977). Its habitat consists of thick and damp evergreen, semi-evergreen or bamboo forest on flat and gently sloping ground. Germain's Peacock-pheasant seems to tolerate some habitat disturbance, because the species is also found in secondary and logged forest (Eames *et al.*, 1992). It is not very shy but keeps out of sight, calling continuously when disturbed or to make contact. It seldom flies but often runs with spread wings. The species is omnivorous, eating insects and fruit. It roosts in trees about 2-3 m above the ground. Both sexes call: a cackling sound which changes to a harsh and fast *ha ha ha ha*. During the breeding season, the male's call is the same but louder (Delacour, 1977). It seems to breed almost throughout the year, the female laying again when the young become independent (Delacour, 1977). The population is estimated to be less than 10,000 individuals, and continuing forest loss in the area suggests that it is declining. Germain's Peacock-pheasant is threatened by habitat loss due to deforestation and is hunted for food. Its Mace-Lande status is 'vulnerable' (McGowan & Garson, 1995).

Scaly-breasted Partridge *Arborophila chloropus* (Beyth, 1859) occurs in southern Vietnam (Johnsgard, 1988). The taxonomic status of the species is unclear. The subspecies present in Cat Tien National Park is *A. c. cognacqi* (Delacour & Jabouille, 1924). Its habitat consists of lowland tropical evergreen forest. It occupies moist jungles and thick evergreen forests in both flat areas as well as in steep valleys. More rarely found in drier scrub. It occurs in pairs or small groups, feeding on seeds, berries and termites. No information is available on its reproductive biology or its population status (Johnsgard, 1988). Scaly-breasted Partridge is 'safe' according to the Mace-Lande criteria, but suffers from habitat loss (McGowan *et al.*, 1995).

Red Junglefowl *Gallus gallus gallus* (L., 1758) occurs in Cochinchina, Cambodia and nearby islands, Annam except the extreme north, middle and lower Laos and eastern Thailand (Delacour, 1977). Its habitat consists of evergreen and deciduous forests, secondary growth and scrub. It is widespread throughout Vietnam in an extensive range of forest types over a wide altitudinal range (King *et al.*, 1975; Nguyen Cu & Eames, 1992). It lives in small, mixed flocks in summer, autumn and winter. In spring, the stronger males keep a territory with three to five females. Young males live isolated or with two or three other males. It nests on the ground, laying four to eight eggs (Delacour, 1977). The species is a widespread resident throughout its range (Nguyen Cu & Eames, 1992). Red Junglefowl is not threatened though populations are much reduced due to hunting. Its Mace-Lande status is 'safe' (McGowan & Garson, 1995).

The aim of the galliform census was to calculate densities in a relatively small area of Cat Tien National Park by using line transects, making a base-line measure of abundance that can be repeated in the future to investigate possible changes.

2. LOCATIONS

2.1 Cat Tien National Park (Appendix II; fig. 1)

Cat Tien National Park was created in 1978 and its boundaries enclose an area of 36,500 ha (Thai Van Trung, 1988). Cat Tien (11° 21'- 11° 34'N, 107° 11'- 107° 28'E) lies entirely within Cochinchina (Robson *et al.*, 1990). It is situated in the Dong Nai province, bordering Song Be and Lam Dong provinces.

The boundaries of the park are partly natural and partly arbitrary: the Dong Nai River makes up 56 km of the border and roads and provincial borders form the rest. Vinh An and La Nga forestry enterprises lie to the west and south (Pham Huu Khánh, pers. comm.).

The western part of the park consists of a range of hills of 150-300 m altitude, covered by semi-evergreen and deciduous forest (Robson *et al.*, 1990). In the north there are isolated hills of approx. 150-200m altitude, covered with non-thorny bamboo, as well as in the extreme east near Da Co guard station. Lowland forest covers most of the central and eastern part of the park, together with large wetland areas in the centre and agricultural land in the north and south. The vegetation consists mainly of tropical seasonal semi-deciduous forest, tropical evergreen forest and large areas of bamboo. Since Cat Tien has a tropical monsoon climate with rains from May to October, the wetlands in the centre of the park expand dramatically in this period (Troung Quang Tam, 1991).

Approximately 270 bird species have so far been recorded from Cat Tien (Robson, 1991). Cat Tien National Park also holds several species of large mammals. These include: Gaur *Bos gaurus*, Banteng *Bos javanicus*, Asian Elephant *Elephas maximus*, possibly Javan Rhino *Rhinoceros sondaicus*, three species of bear (Ursidae), possibly Tiger *Panthera tigris* and other smaller Felidae, Small-clawed Otter *Aonyx cinerea*, Black-shanked Duoc Langur *Pygathrix nigripes*, White-cheeked Gibbon *Hylobates leucogenys* and several species of deer (Cervidae) (Robson *et al.*, 1990; Eames *et al.*, 1992).

During the Vietnam war, especially the northern part of the park was sprayed with defoliants. The hills in this area used to be covered by tropical evergreen forest, but are now entirely covered by bamboo. The Orange-necked Partridge was claimed to have been seen on one of these hills in 1991 and 1993 (Pham Huu Khánh, pers.comm.).

There are two villages inside the boundaries of Cat Tien National Park: Dac Lua in the north and Ta Lai in the south. These villages, and other smaller settlements, have a large effect on the surrounding area. Ta Lai is inhabited by tribal people who used to live in the forest, but were resettled to the edge of Cat Tien in 1978 (interview Tai Lai forest ranger, 1997). This resettlement has led to the area around Ta Lai being intensively cultivated: tracts of remaining forest are cut down, burned and replanted with mixed crops like maize, tobacco and a type of cabbage. There is also much cutting for firewood. The land around the village of Dac Lua is used for rice, sugarcane and pasture land for cattle. Fishing goes on in the wetlands and streams in the area. The remaining large Dipterocarps are slowly dying from the effects of resin-tapping.

Along the borders of the park there are 13 permanently manned guard stations, equipped with field radios. The guard stations on the river have boats with outboard motors with which they can patrol the river. Two mobile ranger teams, based at the HQ, are able to patrol in jeeps or on motorcycles and are equipped with walkie-talkies. However, large areas of the park are inaccessible for any kind of vehicle, since there is only one main dirt road running through the park in roughly a north-south direction. In April 1997 a track, suitable for motorcycles, was completed into the central wetlands (Bao Sau). The next stage of this project is to build a combined guardstation / lookout tower on the edge of the lake.

Domestic tourism to the park is considerable and increasing: organized tours of 50 to

150 people visit the park at the weekend. Due to its relative inaccessibility for independent visitors, there are not many foreign tourists: on average about 2 per week.

The headquarters of the park lie along the Dong Nai River in the east. In recent years there has been extensive building, especially new guest rooms for foreign and domestic tourists, as well as a big, new building to house the administrative staff.

2.2 Cat Loc Nature Reserve (Appendix II; fig. 2)

Cat Loc Nature Reserve is situated about 20 km north-east of Cat Tien National Park in Cat Tien district, Lam Dong province, Vietnam (Appendix I; map of Vietnam). It was established on the 9th of March 1996. It covers an area of 30,026 ha. Cat Loc has only 10 forest guards compared to Cat Tien's 110 (interview Cat Loc forest ranger, 1997).

Cat Loc differs from Cat Tien in that it has more and higher hills. The south-west of the nature reserve has hills of c. 300-400 m altitude, the middle is basically between 400-500 m and the north-east has hills of c. 500-600 m altitude. Whereas Cat Tien lies in Cochinchina, Cat Loc lies in South Annam at the beginning of the Annamese Highlands.

The natural vegetation consists of dense primary evergreen forest, secondary evergreen forest, mixed bamboo/evergreen forest on the slopes, patches of scrub and dense stands of bamboo on some slopes and along streams.

Cat Loc is the only location on mainland Asia that has a population of the endangered Javan Rhino *Rhinoceros sondaicus*; although there have been reports of one or two rhinos remaining in Cat Tien National Park, no evidence has been found of them recently (Pham Huu Khánh, pers.comm.).

Indirect evidence shows that there are 6-12 rhinos remaining in Cat Loc Nature Reserve. The last time a rhino was actually seen was in 1995. Since 1960 c.17 individuals are known to have been shot by hunters in the reserve (interview Cat Loc forest ranger, 1997).

There are several villages situated in the reserve, populated by hill tribes who live off shifting agriculture, hunting and, through encouragement by the central government, cashew nut plantations. There has been extensive logging in the reserve in the past and now the biggest problem is the cutting and burning of large areas of forest which are cleared for cashew nut plantations.

Lam Dong province is poor compared to Dong Nai province, and so the resources available to the Forestry Department, and Cat Loc Nature Reserve, are slender. The area between Cat Tien National Park and Cat Loc Nature Reserve has been proposed to be turned into a corridor linking the two nature areas. There are however c. 70,000 people living in the area, including the medium-sized town of Bogor (now called Cat Tien Town). This area has been designated a New Economic Zone by the central government, which means that people from the North are encouraged to move to this area and develop it. This growing population, together with the slender financial means of Lam Dong province and the administrative problems between two provincial governments, means that the future of Cat Loc Nature Reserve looks very bleak.

3. METHODS

3.1 Survey methods

3.1.1 Orange-necked Partridge survey in Cat Tien National Park

One of the best ways to survey galliforms in dense tropical forest is to note vocalisations to establish which species, and how many individuals, are present (Gaston, 1979), for the encounter rate of seeing a bird is many times lower than the rate of hearing a bird. Partridges of the genus *Arborophila* call in a duet, and it was believed that Orange-necked Partridge would have a call similar to that of Scaly-breasted Partridge (Eames, J.C., pers.comm.). From 9 February until 4 April, the area alongside the dirt road was surveyed regularly. We taped unknown calls, which we played back immediately, hoping to lure the birds towards us so that we could identify them.

Information on the presence of Orange-necked Partridge and other species was obtained by interviewing the staff of the park and people living in the villages along the border of the park. We talked to an old man who had guided foreigners apparently looking for partridges in 1996. Forest guards that were stationed at various guard stations in the park were interviewed about the forest and the species present near their station. We showed illustrations of various species. The interviews were always conducted in such a way that the people being interviewed had no previous knowledge of the aims of the survey.

An intensive survey of Orange-necked Partridge was done from 11 until 29 April, after returning from Cat Loc Nature Reserve. We surveyed the area around Dac Lua, Nui Tuong, Ta Lai, C5-mountain and along the entire distance of the main road. A recording of the call, made in Cat Loc Nature Reserve, was used to stimulate the birds to call back or to lure them into the open. Attempts were made to photograph Orange-necked Partridge.

3.1.2 Orange-necked Partridge survey in Cat Loc Nature Reserve

From 5 until 10 April, we visited Cat Loc Nature Reserve together with a team consisting of Jonathan C. Eames and Dr. Nguyen Cu of BirdLife Vietnam Programme, Dr. René W.R.J. Dekker of the National Museum of Natural History, Leiden, Pham Huu Khánh of Cat Tien National Park and Charlotte Vermeulen. In groups of two, we surveyed the area around our base, approximately one and a half hours walk (4-5 km) into the reserve. Each team surveyed in a different direction, so that a large area could be covered in a relatively short time. Calls were recorded and played back in order to induce calling and to lure Orange-necked Partridge into the open.

After five days the permission we had to visit the reserve was suddenly withdrawn. We had to leave immediately.

3.1.3 Green Peafowl

Green Peafowl was surveyed at two sites in Cat Tien National Park, namely at Bao Sao on 26 February and on 19, 20 and 21 March, and at the area around the village Dac Lua.

Forest guards and local people were interviewed to pinpoint other areas where Green peafowl possibly exists.

3.1.4 Line transects

Germain's Peacock-pheasant, Scaly-breasted Partridge, Siamese Fireback and Red Junglefowl were censused by means of line transects.

Seven line transects were situated close to Dac Lua, another six were up to 7 km south

from headquarters and two line transects were made along the trail leading to Bao Sau (Appendix II; fig. 1). Perpendicular to the road, trails were cut 200 m into the forest along a straight line and marked with red paint and yellow string. The 200 m were measured by pacing the distance. The transects were half a metre wide in order not to disturb the forest too much. Line transects were 500-1000 m apart and successive transects on opposite sides of the road. Transects were left to resettle for a day before surveying them. All line transects except one were made in semi-deciduous forest. One line transect was an old trail in mixed scrub and bamboo at the foot of a hill covered with bamboo. Forest type and the dominant vegetation were identified by Pham Huu Khánh. A description of the line transects can be found in Appendix IV.

Transects were usually walked by two persons and teams were alternated regularly to prevent a bias by the researchers. Thirty minutes were spent at a line transect each time. We walked as slowly and as quietly as possible. Line transects were walked from sunrise until 10:00 hr and from 15:30 hr until sunset. The census was carried out from 4 until 21 March. The exact dates, times and numbers of calling birds can be found in Appendix V.

All birds that called within a limit of 50 m from the line were recorded. The species that is the object of the census must, of course, have a call loud enough to carry further than the distance between the centre and the line transect limits, in our case 50 m. The male of Siamese Fireback does not have such a call. The sound produced by its wing-whirring does not carry further than 30 m, so the individuals of this species were recorded within a limit of 30 m from the line.

3.2 Data analysis

The data obtained from the line transect counts were used to calculate the densities of Germain's Peacock-pheasant, Scaly-breasted Partridge, Siamese Fireback and Red Junglefowl.

We did not use the calculation described in Bibby *et al.* (1992), because a census based on calling birds differs from a sighting based census. A census based on sightings uses the assumption that 'the number of birds detected declines with distance from the observer'(Bibby *et al.*, 1992). We have assumed however, that in a census based on loudly calling birds, the chances of hearing a bird when calling within the line transect limits (the distance between the line of the transect and the arbitrarily chosen border of 50 m from the line) is actually 1. Thus an equation incorporating a detection curve becomes greatly simplified and the factor 'chance of detection' disappears from the equation. The maximum density per transect is calculated by taking the sum of the highest number of calls found in each line transect, divided by the number of transects. The average density per transect is calculated by taking the sum of the average number of calls of each line transect, divided by the number of transects. A transect is 200 m long and 100 m wide (for Siamese Fireback the width is 60 m) making an area of 20,000 m^2 (for Siamese Fireback 12,000 m^2). The values per hectare are the average and maximum densities per transect divided by 2 and in the case of Siamese Fireback by 1.2. The total area of habitat similar to that where the surveys were carried out is unknown and therefore it is not possible to calculate an accurate population size for the four species in Cat Tien National Park.

When trying to calculate the density of a population based on the number of calling males, birds or pairs, one should survey during the hours of the day and the time of the month when calling activity is at its maximum. Only then will the observer obtain a representative sample of the number of calling birds in a given area. Parts of the day or days of the month with lower calling activity levels should therefore be discarded. The data used to calculate the average and maximum density, have been adjusted depending on what is found in the

statistical analysis: if a significant difference is found in calling activity between different times of the day or of the month, the data with the lower values are discarded for that species.

For correct interpretation of our data it was necessary to find out:
1) whether there is a difference in calling activity during the day and
2) whether calling activity changed during the month of March in which the line-transects were carried out.
The calculations were done with a chi-square Test with a Yates' correction because of the small sample size. Very low counts were tested with a Fishers' Exact Probability Test.

A significant difference between the areas where the line-transects were situated, namely the seven transects near Dac Lua, the six near headquarters and the two near Bao Sau, could either be caused by a difference between the locations or by the fact that they were surveyed at different times of the month. A significant difference can also be caused by a biased observer. This problem was minimalized by surveying in pairs. On one occasion, a strikingly discrepant observation was removed from the data, after discussion and comparing field-notes.

4. RESULTS

4.1 Orange-necked Partridge

From 8 February until 5 April, we saw nor heard any sign of Orange-necked Partridge in Cat Tien National Park. Since the exact habitat requirements of the species were unknown, there was a good chance of finding Orange-necked Partridge anywhere during the daily survey-walks. But evidently, and despite the assurance of an old forest-guide, semi-deciduous forest dominated by *Lagerstroemia* species was not the right place to look. We had however, also surveyed the bamboo-covered hill where the Orange-necked Partridge was glimpsed in 1991. Initially we did not find any evidence of the species there either.

On 5 April the neighbouring Cat Loc Nature Reserve was visited. During a survey in Cat Loc by a team from Birdlife three years earlier, no evidence was found of the Orange-necked Partridge. On 5 April, a partridge with black-and-white flanks was seen briefly next to the trail running through the reserve. This was 4 or 5 km from the southern border of the reserve (Appendix II; fig. 2). From 6 until 10 April, the area surrounding this location was searched. One or more individuals of the Orange-necked Partridge were seen every day. In total up to 26 birds (at least 22 different individuals) were seen in six different locations. The species was present in a variety of habitats: secondary evergreen forest, mixed evergreen/ bamboo forest, scrub and bamboo forest, with a preference for slopes.

It may be that the Orange-necked Partridge tolerates a certain degree of habitat disturbance; a pair of Orange-necked Partridges was seen on a hillside (c.40 % slope) with mostly bamboo (10 m high) and some small evergreen species (Appendix VIII; fig. 3). The pair was feeding and we were able to observe these birds for ten minutes without them noticing us. About 20 m away from that site the undergrowth and litter layer had been set alight and were burning. Tree-felling could be heard about 200 m away. The distance between us and the pair was about 5 m. Whilst feeding, they continually made a soft "whit-whit, whit, whit" sound. Both birds were scraping in the 10 cm deep litter layer and stayed close together. A red eye-ring was clearly visible, which is not illustrated in King *et al.* (1975).

On 7 April, the team managed to record the call of the Orange-necked Partridge: a duet as expected, apparently similar to the Bar-backed Partridge *Arborophila brunneopectus* (Blyth, 1855)(Eames, J.C., pers.comm.). The song of one bird consists of a series of whistles gradually increasing in pitch and tempo, with the other bird punctuating this with higher single notes. A sonogram of the complete call of the Orange-necked Partridge is shown in Appendix III. The species reacts strongly to playbacked recordings.

On 13 April, in Cat Tien National Park, we heard, very briefly, an *Arborophila*-partridge calling at the western slope of Nui Tuong (Elephant Mountain). We were convinced that it was the Orange-necked Partridge and on 16 April four to five individuals were heard and one was seen around Nui Tuong. On 23 April two pairs were heard here and one was seen while roosting in Bamboo c. three m off the ground at about 18:00hr. On 24 April two pairs were heard at Nui Tuong. Nui Tuong is an elongated hill covered mainly with bamboo and mixed bamboo-semi-deciduous forest. The vegetation is similar to the hill near Dac Lua where the Orange-necked Partridge was glimpsed in 1991. Nui Tuong is 150-200 m high. A week later we were able to confirm the presence of Orange-necked Partridges at the site near Dac Lua (Appendix VIII; fig. 4), were it was claimed to have been seen in 1991: one individual was heard and seen on 20 April and two were seen on 25 April.

We found that there are at least five individuals (possibly three pairs) present at Nui Tuong and at least two individuals (possibly one pair) at the site near Dac Lua. The two sites in Cat Tien where Orange-necked Partridges were seen are c. 21 km apart with semi-

deciduous forest dominated by *Lagerstroemia* in between. In the in between area, we did not see or hear any sign of Orange-necked Partridge, in spite of the many attempts we made to find them there.

The individuals in Cat Tien National Park did not react so strongly to played-back recorded calls as in Cat Loc Nature Reserve.

Unfortunately, we were not able to photograph Orange-necked Partridge.

4.2 Green Peafowl

In Cat Tien National Park we saw or heard Green Peafowl in at least four different sites. Its call carries very far. We heard birds calling from February to late April in the morning and evening, although the species apparently undergoes a post-breeding moult between March and June at which time it does not call (Eames *et al.*, 1992).

The greatest concentration of Green Peafowl appears to be around the central wetlands called Crocodile Lake (Bao Sau). There we saw a group of eight birds, comprised of one adult male and seven juveniles on 26 February. In this same location we heard up to four males calling between 6:30hr and 7:30hr from 19 until 21 March.

Near the village of Dac Lua a male was heard calling nearly every day in the early morning from a hill covered with bamboo and deciduous trees next to a sugarcane field. On three occasions an individual was seen crossing the road inside the forest in March c. 5,5 km from Dac Lua. On 4 March two individuals where heard calling from the forest in the morning near this location. On 27 February we saw a juvenile female roosting high in a tree next to a former rice field at 18:00hr, again near the village of Dac Lua.

Elderly people say they believe that Green Peafowl are common around the village of Dac Lua, which probably means that the species used to be common many years ago. By interviewing forest rangers we learned that in parkland along the Dong Nai River, the Green Peafowl is abundant in the rainy season. We visited these locations, with suitable habitat, but only during the dry season when the species is not so obvious.

4.3 Line transect results

No significant difference in numbers of calling birds was found between the areas near Dac Lua, headquarters and Bao Sau nor between the various transects and therefore it is reasonable to assume that there is no change in the level of calling activity throughout March.

4.3.1 Siamese Fireback

Our first sightings of the Siamese Fireback were made in early March. In February we never encountered them. Very early in the morning, shortly after first light they were regularly seen crossing the road in groups of up to six individuals, e.g. two males and four females. In March they were more conspicuous than in April and the males were 'wing-whirring' more frequently, which might suggest that the reproductive season starts in March. In Cat Tien we never heard the "pee-yu, pee-yu" call that the males make. The females made soft, clucking sounds. In Cat Loc Nature Reserve Siamese Firebacks were heard several times on the slopes, wing-whirring as well as calling, though on some occasions the calls could have been made by Silver Pheasants *Lophura nycthemera* (L., 1758).

Our data on Siamese Fireback show the following:

- Siamese Firebacks have a significantly lower calling activity between 9:00hr and 10:00hr, compared to the early morning hours from 6:00hr until 9:00hr ($p < 0.05$; $N = 74$). The data from the period between 9:00hr and 10:00hr are discarded in this report.
- Transects that were carried out between 6:00hr and 9:00hr may be grouped for this species

since there are no significant differences (N = 71).
- Calling activity in the morning does not significantly differ from that in the afternoon.
Therefore, all data obtained is used to calculate the population density (N = 121)
- The average number of wing-whirring males per transect is 0.23 (table 1).
- The average number of wing-whirring males per hectare is 0.19 (table 1).

Table 1

Siamese Fireback				
Transect	n	x max	$\bar{x}$	s.d.
1	5	1	0.20	0.40
2	5	2	0.60	0.80
3	5	0	0.00	0.00
4	5	1	0.40	0.49
5	5	1	0.20	0.40
6	5	0	0.00	0.00
7	5	0	0.00	0.00
8	10	0	0.00	0.00
9	12	1	0.08	0.28
10	9	1	0.22	0.42
11	9	2	0.22	0.63
12	8	4	1.00	1.22
13	8	1	0.13	0.33
14	4	1	0.25	0.43
15	6	1	0.17	0.37
$\bar{x}$/transect		1.07	0.23	
stand.dev.		1.00	0.26	
$\bar{x}$/hectare		0.89	0.19	
stand.dev.		0.83	0.22	

n number of times a transect was walked.
x max greatest number of wing-whirring males counted on a transect at any time.
$\bar{x}$ average number of wing-whirring males counted on the transect.
s.d. standard deviation.

4.3.2 Germain's Peacock-Pheasant

Germain's Peacock-Pheasant is quite common in Cat Tien: we heard this species every day several times and saw them frequently next to or crossing the dirt road that runs through the park. Both males and females seem to call, but we never saw a pair of birds together, only solitary individuals. On 14 February we discovered a nest of Germain's Peacock-Pheasant with a female incubating the single egg (Appendix VIII; fig. 1 and 2). We were able to approach the female up to 0.5 m. The nest had been made in a shallow depression about 4 m from the dirt road and consisted of a scrape lined with downy feathers. The female was extremely difficult to spot amongst the deep litter layer, but the egg that was present was not camouflaged and of a whitish colour. Species in the genus *Polyplectron* differ from other pheasants by laying only one or two eggs per clutch (Delacour, 1977). About 18 days after the discovery of the nest, all signs of this nest had disappeared. We did not find any eggshell

fragments; whether the egg had hatched or had been predated remains unknown.

In Cat Loc Nature Reserve Germain's Peacock-pheasant was heard calling every day infrequently, which may indicate low densities. The birds appeared to be in the valleys and not on the slopes.

Our data on Germain's Peacock-pheasant show the following:
- Germain's Peacock-pheasants call significantly less between 9:00hr and 10:00hr, compared to the early morning hours from 6:00hr until 9:00hr ($p < 0.05$; $N = 74$). The data from the 9:00-10:00hr period are discarded in this report.
- Transects that were carried out between 6:00hr and 9:00hr may be grouped for this species, since there are no significant differences ($N = 71$).
- Calling activity in the morning does not significantly differ from that in the afternoon.

Therefore all the data obtained can be used to calculate the population density.
- The average number of calling birds per transect is 0.59 (table 2).
- The average number of calling birds per hectare is 0.30 (table 2).

Table 2

Germain's Peacock-pheasant				
Transect	n	x max	$\bar{x}$	s.d.
1	5	2	1.40	0.49
2	5	2	0.80	0.75
3	5	1	0.20	0.40
4	5	0	0.00	0.00
5	5	2	0.80	0.75
6	5	2	1.00	0.63
7	5	1	0.60	0.49
8	10	3	1.10	0.71
9	12	3	0.75	1.01
10	9	1	0.11	0.31
11	9	1	0.22	0.42
12	8	1	0.13	0.33
13	8	2	0.63	0.70
14	4	2	0.50	0.87
15	6	2	0.67	0.75
$\bar{x}$/transect		1.67	0.59	
stand.dev.		0.79	0.39	
$\bar{x}$/hectare		0.83	0.30	
stand.dev.		0.39	0.20	

n number of times a transect was walked.
x max greatest number of calling birds counted on a transect at any time.
$\bar{x}$ average number of calling birds counted on the transect.
s.d. standard deviation.

4.3.3 Scaly-breasted Partridge

Scaly-breasted Partridges are very shy and were usually seen in pairs, sometimes two pairs together. In April we started to hear solitary birds calling: only one part of the duet, perhaps

by juveniles or individuals that had not found a mate. Scaly-breasted Partridges were never seen on the dirt road, always in the cover of the forest.

In Cat Loc Scaly-breasted Partridges were seen and heard. On one occasion an individual was seen on a slope covered with bamboo and evergreen species, similar to Orange-necked Partridge habitat.

Our data on Scaly-breasted Partridge show the following:

- The Scaly-breasted Partridge has a significantly lower calling activity between 9:00hr and 10:00hr, compared to the early morning hours from 6:00hr until 9:00hr ($p < 0.05$: $N = 74$). The data from the period between 9:00hr and 10:00hr are discarded in this report.
- Transects that were carried out 6:00hr and 9:00hr may be grouped since there are no significant differences for the species ($N = 71$).
- Scaly-breasted Partridges call significantly more between 6:00hr and 9:00hr ($p < 0.05$; $N = 121$) than between 15:00hr and 18:00hr or even later. Only the observations done during the morning are used to estimate the population density.
- The average number of calling pairs per transect is 1.06 (table 3).
- The average number of calling pairs per hectare is 0.53 (table 3).

Table 3

Scaly-breasted Partridge				
Transect	n	x max	$\bar{x}$	s.d.
1	3	0	0.00	0.00
2	3	5	3.17	1.03
3	3	1	0.33	0.47
4	3	2	1.67	0.47
5	3	2	1.33	0.58
6	3	1	0.50	0.41
7	3	2	0.67	0.94
8	6	2	1.17	0.69
9	8	2	0.75	0.66
10	5	2	0.40	0.80
11	5	1	0.40	0.49
12	5	2	1.00	0.63
13	4	3	1.00	1.22
14	2	2	1.50	0.50
15	3	3	2.00	1.41
$\bar{x}$/transect		1.97	1.06	
stand.dev.		1.01	0.78	
$\bar{x}$/hectare		0.98	0.53	
stand.dev.		0.50	0.39	

n number of times a transect was walked (only the morning walks have been counted).
x max greatest number of calling pairs counted on a transect at any time.
$\bar{x}$ average number of calling pairs counted on the transect.
s.d. standard deviation.

4.3.4 Red Junglefowl

Red Junglefowl is common in Cat Tien National Park. Males could be heard calling throughout the park and groups of birds were seen any time of the day, especially along the road. A nest with eight eggs was found next to a clump of bamboo on 17 April. It was in an area were there was much disturbance (illegal bamboo-cutting). On 23 April, it turned out to be predated.

Our data on Red Junglefowl show the following:

- Red Junglefowl has a significantly lower calling activity between 9:00hr and 10:00hr, compared to the early morning hours from 6:00hr until 9:00hr ($p < 0.05$; $N = 74$). The data from the period 9:00-10:00hr are discarded in this report.
- Transects that were carried out in the period 6:00-9:00hr may be grouped for Red Junglefowl, since there are no significant differences ($N = 71$).
- Red Junglefowl call significantly more between 6:00-9:00hr ($p < 0.05$; $N = 121$) than between 15:00-18:00hr or even later. Only the observations done during the morning are used to estimate the population density.
- The average number of calling pairs per transect is 1.38 (table 4).
- The average number of calling pairs per hectare is 0.69 (table 4).

Table 4

Red Junglefowl				
Transect	n	x max	$\bar{x}$	s.d.
1	3	5	3.00	1.63
2	3	2	1.33	0.47
3	3	2	1.33	0.47
4	3	2	1.00	0.82
5	3	6	3.00	2.16
6	3	2	1.33	0.47
7	3	0	0.00	0.00
8	6	4	0.83	1.46
9	8	3	1.63	1.40
10	5	1	0.20	0.45
11	5	3	1.00	1.26
12	5	4	2.00	1.10
13	4	1	0.25	0.75
14	2	5	3.50	1.50
15	3	1	0.33	0.43
$\bar{x}$/transect		2.73	1.38	
stand.dev.		1.69	1.05	
$\bar{x}$/hectare		1.37	0.69	
stand.dev.		0.85	0.52	

n number of times a transect was walked (only the morning walks have been counted).
x max greatest number of calling pairs counted on a transect at any time.
$\bar{x}$ average number of calling pairs counted on the transect.
s.d. standard deviation.

5. DISCUSSION

5.1 Orange-necked Partridge

Until the beginning of April, we did not hear or see any signs of Orange-necked Partridge. This may point to a lack of experience, but we believe that, had we heard it before, we would have noticed this distinctive *Arborophila* call. The absence of calling before this time might suggest that the reproductive season starts in early April, at the onset of the rainy season.

Orange-necked Partridge appeared to be present in lower numbers in Cat Tien National Park than in Cat Loc Nature Reserve. This might indicate that Cat Tien holds sub-optimal habitat for the species. Another reason for this difference in numbers between the two areas could be that the survey in Cat Loc was done with seven people instead of the four people that surveyed in Cat Tien. On the other hand, the survey in Cat Loc lasted only six days, compared to 18 days of intensive surveying in Cat Tien in April.

In Cat Tien National Park Orange-necked Partridge has been seen in two locations. Both these locations are near to human settlements and consist of stands of bamboo. These locations are under threat from cutting. Every week we encountered people collecting bamboo at places where we had seen the Orange-necked Partridge. The location on Elephant Mountain suffers from noise throughout the day to such an extent that it is difficult to hear a bird calling. However, we do not know in what way this effects the Orange-necked Partridge in, for instance, its ability to find a mate. The two Orange-necked Partridge-sites are c. 21 km apart with seemingly no suitable habitat in between. The area in between the two sites consists of *Lagerstroemia*-dominated semi-deciduous forest on level ground. The few low hills that are present have some sparse bamboo cover, but showed no signs of the presence of Orange-necked Partridge.

It would seem that the two Orange-necked Partridge populations in Cat Tien are separated. Two small populations are generally more vulnerable than a single larger one. The western part of Cat Tien National Park may still contain suitable habitat, but some areas have apparently suffered from encroachment in the last few years.

In Cat Loc Nature Reserve Orange-necked Partridge was seen in six different locations, in an area of about 10 km^2, consisting of a variety of habitats. Most of which suffered some degree of disturbance. The species appears to tolerate some disturbance, but the question remains how long Orange-necked Partridge can survive the constant habitat degradation caused by the cutting and burning of Cat Loc Nature Reserve.

Unfortunately, we had to leave Cat Loc on 10 April, because, for unknown reasons, the permission to visit the reserve, given by the chairman of the district, was revoked by the provincial government. This was a great setback: we did not have the chance to learn more about the ecology or behaviour of the Orange-necked Partridge, nor were we able to photograph the species and so we had to continue our fieldwork in Cat Tien. We were therefore unable to even guess the population size or range of the Orange-necked Partridge in Cat Loc.

The current Mace-Lande status of the species is *endangered* (McGowan *et al.*, 1995). Our new findings may warrant a reassessment of its status.

5.2 Census

Some problems and factors influencing the results of the fieldwork are discussed below:
- The calculated densities are of limited value when interpreted in an absolute sense. This

census was done in a small area of Cat Tien National Park and should not be seen as characteristic for the various species. Comparing the species with each other is also of limited use: the species differ in their ethology, ecology, demography and life-history.

The value of the census lies in the fact that it can be repeated in the same manner in different years, thus making it possible to compare findings in successive years. In this manner, possible changes can be detected. This census should therefore be viewed as a base-line measure of abundance for future censuses of the various species in the same area, during the same time of the year.

- Access to remote, dense forest areas is often very difficult, therefore the line transects were made perpendicular to a dirt road. Birds are either scared away or attracted to open spaces like this road. As a result, the line transects cannot be considered as having been randomly chosen. Since there are only two roads in Cat Tien National Park, the total area of forest "influenced" by a road is very small, causing the censused areas not to be representative for the larger part of Cat Tien.
- Every line-transect was censused for a period of 30 minutes. This is relatively long for a distance of 200 m, but we wanted to maximize the chances for us to hear an individual in the transect area when it called. However, it also increases the chance of recording the same individual twice, especially if the bird is moving through the transect area. If this is the case, it will result in a higher density than actually exists. If we decreased the time spent at a transect, the result could be that some birds that were actually present were not recorded: the density would be lower than in reality.
- When making a line transect it is often difficult to make a perfectly straight line. In tropical rainforest this is even more so; dense vegetation or thick trees can cause a winding transect instead of a straight line. As a result, the number of square metres with which the density is calculated, is smaller in a winding line transect than in a straight line transect and therefore there is an error in the calculated density.
- In a census based on calling birds, all the non-calling birds are, of course, missed out. Foraging birds will easily be overlooked and these birds may be in the majority: it is unknown which proportion of the population is likely to call at any certain time of the day or the year. That is why we expressed the densities as number of calling males, calling pairs or calling individuals and why we have made no attempt to calculate the overall population density.
- Walking line transects in the dry season can be very noisy. In the early morning the litter layer is damp and one is able to walk silently trough the forest. Later in the morning the litter layer becomes crisp and walking in silence is more difficult. This noise may scare birds away or it may stop the birds in the vicinity from calling. The observer may have difficulties hearing calling birds if there is a lot of background noise.

5.3 Threats to Cat Tien National Park

- Until 1978 extensive logging of hardwood species took place in Cat Tien National Park (Thai Van Trung, 1988). In 1978 Cat Tien was granted a nature reserve status which made logging illegal and a national park status between 1986 and 1990 (Thai Van Trung, 1988). Illegal logging apparently still occurs on the western boundary, however not on the scale of the years between 1978 and about 1990.
- During the Vietnam War the North Vietnamese Army had a base inside the forest and large areas were sprayed with chemical defoliants by the Americans. Many of the affected areas were subsequently burnt and were colonized by species of bamboo. After the war a division of the North Vietnamese Army settled around Cat Tien, clearing large areas for agriculture and wood used for fuel and construction. These ex-soldiers and their families still live on the edges of Cat Tien National Park in the village of Dac Lua.

- The ethnic minorities that used to live inside the forest have been re-settled in the village of Ta Lai. They have changed their methods from shifting cultivation to permanently growing rice, maize and sugarcane and herding livestock. In this way large areas of prime tropical rainforest have been converted to farmland (Appendix VIII; fig. 5 and 6). An attempt was made to re-forest some land. However this was done using exotic species as *Acacia* and *Eucalyptus*.
- Even the prime forest still left in the national park suffers from the effects of humans. The central wetlands (Bao Sau), though being difficult to reach, are fished illegally. This causes much disturbance to the rare or threatened (bird-)species that make use of these wetlands. Furthermore, the fishermen and poachers regularly set fire to the surrounding grasslands to shoot or trap herbivores that are attracted by the young grass. The crocodiles *Crocodilus siamensis* which give Bao Sau (Crocodile Lake) its name used to be abundant: "...The eyes of the freshwater crocodiles used to shine at night in the surface of the water "like stars"..."(Morris, 1987). All these crocodiles have long been shot and not a single individual remains. Presumably this has also been the fate of the Javan rhinoceros in Cat Tien National Park, which also "...was once seen regularly in the surrounding marshes" (Morris, 1987).
- Near the village of Dac Lua there is a smaller swamp called Bao Beo. This is a small stream surrounded by dense thorny bamboo and dead Dipterocarps. This is ideal habitat for White-shouldered Ibis *Pseudibis davisoni* (Hume, 1875) and possibly a breeding ground for the species (Eames, J.C., pers. comm.). Because of its proximity to the village, Bao Beo suffers more from human impact. This includes: bamboo-cutting, resin-tapping, electro-fishing and, in the surrounding grassland, grass-cutting and grazing by domestic cattle. This grassland is habited by Green Peafowl.
- Most Green Peafowl-habitat is also attractive to humans. An example in Cat Tien National Park is the area of wet grassland south of Elephant Mountain (Nui Tuong). More than three-quarters of this area are being excavated for the construction of commercial fishponds. Between February and April 1997, 50 ha were near to completion. According to Vietnamese law, this is an illegal project: it is a commercial enterprise in a national park and is not intended for local use, but purely for profit. Once the fishponds are fully operational, they should attract various predators. Lesser Adjutants *Leptoptilos javanicus* (Horsfield,1821), Purple Herons *Ardea purpurea* L.,1766, Woolly-necked Storks *Ciconia episcopus* (Boddaert, 1783), Ospreys *Pandion haliaetus* (L.,1758), Grey-headed Fish-eagle *Ichthyophaga ichthyaetus* (Horsfield, 1821), Oriental Darters *Anhinga melanogaster* Pennant, 1769 and Little Cormorants *Phalacrocorax niger* (Vieillot, 1817) may benefit from this sudden bounty. The result might be that these birds will be persecuted or poisoned.
- Most of the guard stations along the Dong Nai River in the national park grow crops for personal use or for selling on the market. The size of these plots of land can be quite substantial: at one guard station two tractors were needed for two days to plough a sugarcane field. To make these fields of sugarcane, tobacco or maize, forest is destroyed by the agency meant to protect this same forest.
- One of the biggest threats to Nam Bai Cat Tien National Park, is probably the continued development of the infrastructure in the park. One of the results is that a road has been built, opening up Crocodile Lake (Bao Sau): an area that formerly could only be reached after a three hour walk through dense forest and that is very important for large mammals and Green Peafowl. A watchtower and a manned guard station are being built to protect the lake from illegal fishing. Theoretically, this is a good idea, but permanent human presence in such a remote area might seriously affect the population of species such as Banteng, Gaur, Lesser Adjutant, White-winged Duck *Cairina scutulata* (Müller, 1842) and Green Peafowl.
- Domestic tourism is growing in Cat Tien National Park. Every weekend groups of 50 to 150 people visit the park. The number of visitors is increasing and therefore the number of

facilities for these visitors is also being increased. There are plans to build a swimming-pool and a soccer pitch, as well as a larger, 'ethnic-style' canteen. Meanwhile the national park headquarters have also been greatly enlarged: the new headquarters is twice the size of the old one. More accommodation for (foreign) visitors has also been built, particularly luxury villas with air-conditioning.

5.4 Threats to Cat Loc Nature Reserve

- Cat Loc was declared a nature reserve in 1996. Before that time there was extensive logging taking place. Cat Loc is poorly protected and there are no facilities for tourists or visiting scientists. The inhabitants of Cat Loc (c. 200 families) are hill-tribes ('ethnic minorities') who used to live off shifting cultivation and hunting. The central government is encouraging these people to give up their traditional agricultural methods and to grow cashew nuts instead. For these commercial cashew plantations, large areas of forest on the tops of hills are cleared, burned and replanted with cashew nuts. Hunting and trapping is still practised, though only for the inhabitants' own use.
- Although Cat Loc has officially been designated a nature reserve, the implementation of this status is practically impossible: there are about ten forest rangers for the entire reserve with meagre resources for an area about the same size as Cat Tien National Park. A team from the BirdLifeVietnam Programme that visited Cat Loc three years ago and returned this year, reported an increase in the amount of primary forest that had been cleared.
- Cat Loc Nature Reserve still remains the only location in mainland Asia where there is evidence that the Javan Rhinoceros actually exists. Cat Loc also appears to harbour the largest population of Orange-necked Partridge. The fact that Cat Loc is officially a reserve does not actually seem to mean that it is really protected and, if no action is taken soon, we expect that there will be not much left to protect in ten years or so.

6. CONCLUSIONS

6.1 Orange-necked Partridge

- The continued existence of the Orange-necked Partridge has been proved in Cat Tien National Park, Dong Nai province and in neighbouring Cat Loc Nature Reserve, Lam Dong province. Two new locations have been found for the species. The Orange-necked Partridge appears to be present in larger numbers in Cat Loc than in Cat Tien.
- The habitat requirements of the Orange-necked Partridge are now clearer: hills of at least 150 m altitude with steep slopes, covered with tall, non-thorny bamboo or a mixed bamboo-evergreen vegetation. The presence of water nearby may also be a requirement in the dry season.
- Foraging is done in pairs. Pairs of the Orange-necked Partridge react strong to the playback of recorded calls.
- We found that Orange-necked Partridges started calling in early April. This might indicate the beginning of the breeding season.
- A reassessment of the Mace-Lande status may be needed, particularly in the light of habitat loss, though further, more intensive research is needed.

6.2 Green Peafowl

- The central wetlands, Bao Sau, appear to contain the largest concentration of Green Peafowl in Cat Tien National Park.
- It is difficult to estimate the total population size in Cat Tien, because Green Peafowl seems to be present in more areas, particularly alongside the Dong Nai River, during the rainy season. Our survey was during the dry season, when the birds are absent from these areas.
- The constant human presence at Bao Sau may have a negative effect on the species.

6.3 Siamese Fireback

- The density of Siamese Fireback in semi-deciduous forest was found to be 0.19 wing-whirring males per hectare on average, with the maximum densities up to 0.89 wing-whirring males per hectare.
- Birds were not seen or heard in February, but in March groups of males with several females became more conspicuous and the males could be heard wing-whirring. This might indicate that the breeding season begins in March.

6.4 Germain's Peacock-pheasant

- The density of Germain's Peacock-pheasant in Cat Tien National Park in semi-deciduous forest was found to be 0.30 calling birds per hectare on average, with maximum densities up to 0.83 calling birds per hectare.

6.5 Scaly-breasted Partridge

- Scaly-breasted Partridges are quite common in Cat Tien National Park, with average densities in semi-deciduous forest of 0.53 calling pairs per hectare and with maximum densities of 0.98 calling pairs per hectare.

- Pairs of Scaly-breasted Partridges call significantly more in the morning than in the afternoon ($p<0.05$, N=121).

6.6 Red Junglefowl

- Red Junglefowl are very common in Cat Tien National Park. An average density of 0.69 calling males per hectare, and a maximum density of 1.37 calling males per hectare was found in semi-deciduous forest.
- Males call significantly more in the morning than in the afternoon ($p<0.05$, N=121).

6.7 Suggestions for research and conservation

Following our fieldwork in Cat Tien National Park and Cat Loc Nature Reserve we would like to make some suggestions for further research in these two areas:
- The availability of preferred habitat should be examined in Cat Loc and Cat Tien, using satellite images, to find reasons for the difference between the size of the *A. davidi* populations in both parks and to obtain more information about its overall distribution and habitat requirements.
- Suitable areas, if present, outside Cat Tien and Cat Loc need to be examined for the presence of Orange-necked Partridge.
- The development of the commercial fishpond in Cat Tien National Park should be ended as soon as possible.
- Attempts should be made to make Cat Loc readily accessible to (foreign) researchers and to find a way to provide the Cat Loc forestry service with adequate financial means.
- Continued presence of researchers in Cat Tien and Cat Loc will make the staff and inhabitants more aware of the importance of conservation in general and the species in the area in particular.
- The personnel and inhabitants of Cat Tien National Park should be made aware of the needs for conservation in 'their' National Park. Senior staff of the Park should be given some basic form of natural history education and species-recognition.
- Cat Tien National Park needs one or more flagship species, perhaps incorporated in a park logo. This would attract more foreign tourists and, together with the sale of Park merchandising and the rental of bicycles, would generate some extra cashflow.

6.1 Orange-necked Partridge

Addendum

The conservation status of the Orange-necked Partridge, according to the Mace-Lande criteria, is 'Endangered', as given in the Partridges, Quails, Francolins, Snowcocks and Guineafowl: Status survey and conservation action plan 1995-1999 (McGowan *et al.*, 1995). This status was determined when there were little data available on the species. This report presents new data on the Orange-necked Partridge and therefore we feel that a re-evaluation of the conservation status of the species is needed, using the criteria of the new IUCN Red List Categories (IUCN, 1994).

We have calculated an extent of occurrence of ca 2,000 km^2 by measuring the area between the type locality (Bu Kroai), Cat Loc Nature Reserve and Cat Tien National Park. However, as described in the introduction, Bu Kroai has been cleared of forest so the extent of occurrence may be smaller.

As mentioned in the results, there are presently three locations known for the species: two in Cat Tien and one in Cat Loc. Presumably Cat Loc as a whole may be counted as one location, though further surveying is necessary.

We observed intensive use and destruction of these localities in Cat Tien and Cat Loc, as described in the discussion. Based on these findings, the Orange-necked Partridge should, in our opinion, be designated as **Endangered: B1+2c.**

IUCN. 1994. *IUCN Red List Categories Prepared by the IUCN Species Survival Commission As approved by the 40th Meeting of the IUCN Council.* IUCN, Gland.

Appendix VI. Bird sighting list

Erratum (C. R. Robson, in lit.)

93 Bamboo Woodpecker *Gecinulus viridis* should be removed from the list

108 Oriental Skylark *Alauda gulgula* might be Rufous-winged Bushlark *Mirafra assamica*

Addendum

22a Shikra *Accipiter badius* should be added to the list (seen on 150297)

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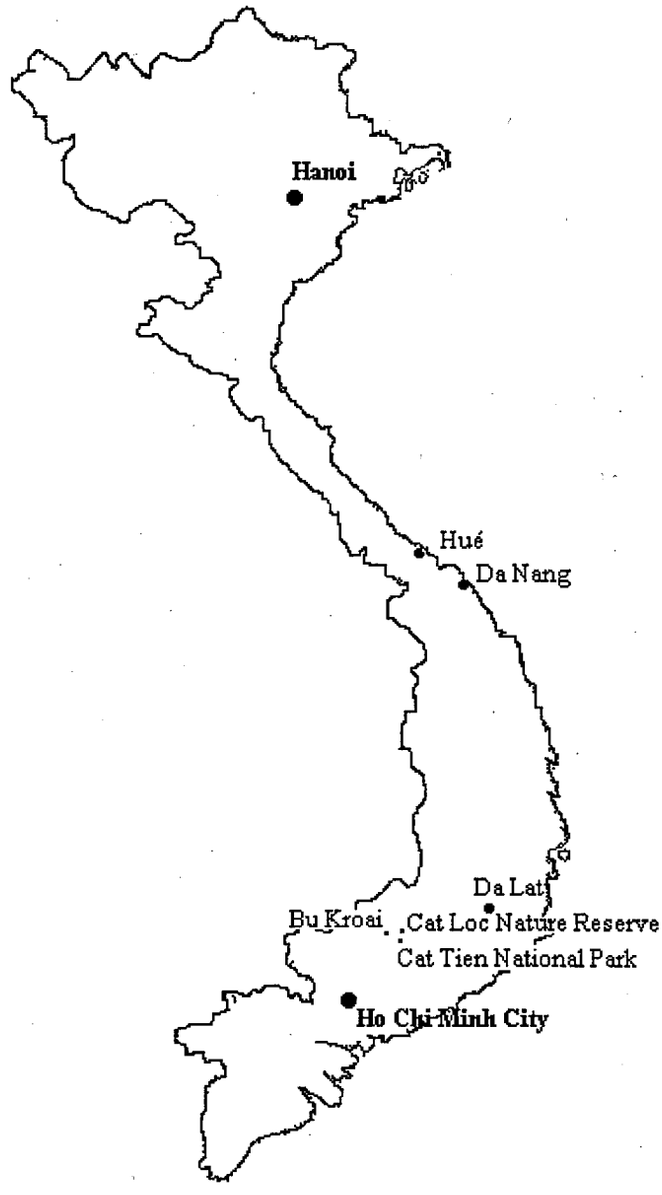
Appendix I. Map of Vietnam



Appendix II. Maps of Cat Tien National Park and Cat Loc Nature Reserve

Fig. 1 Cat Tien National Park

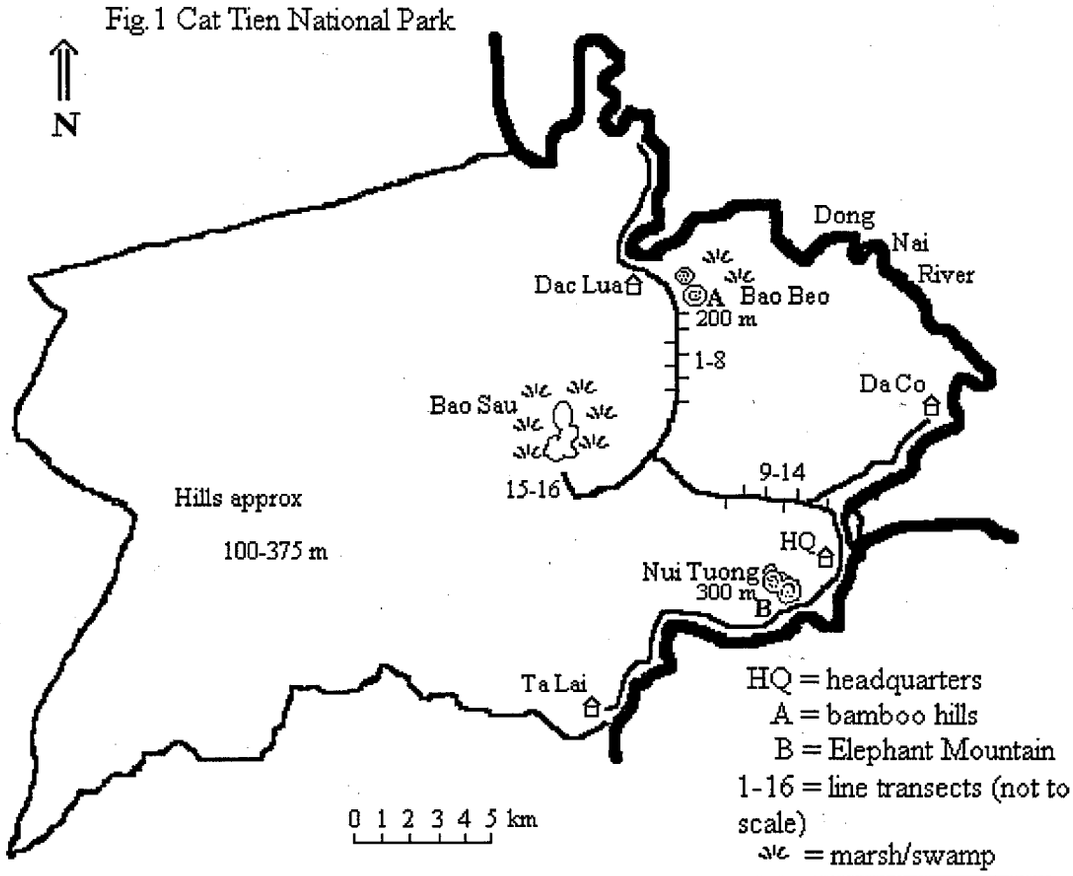
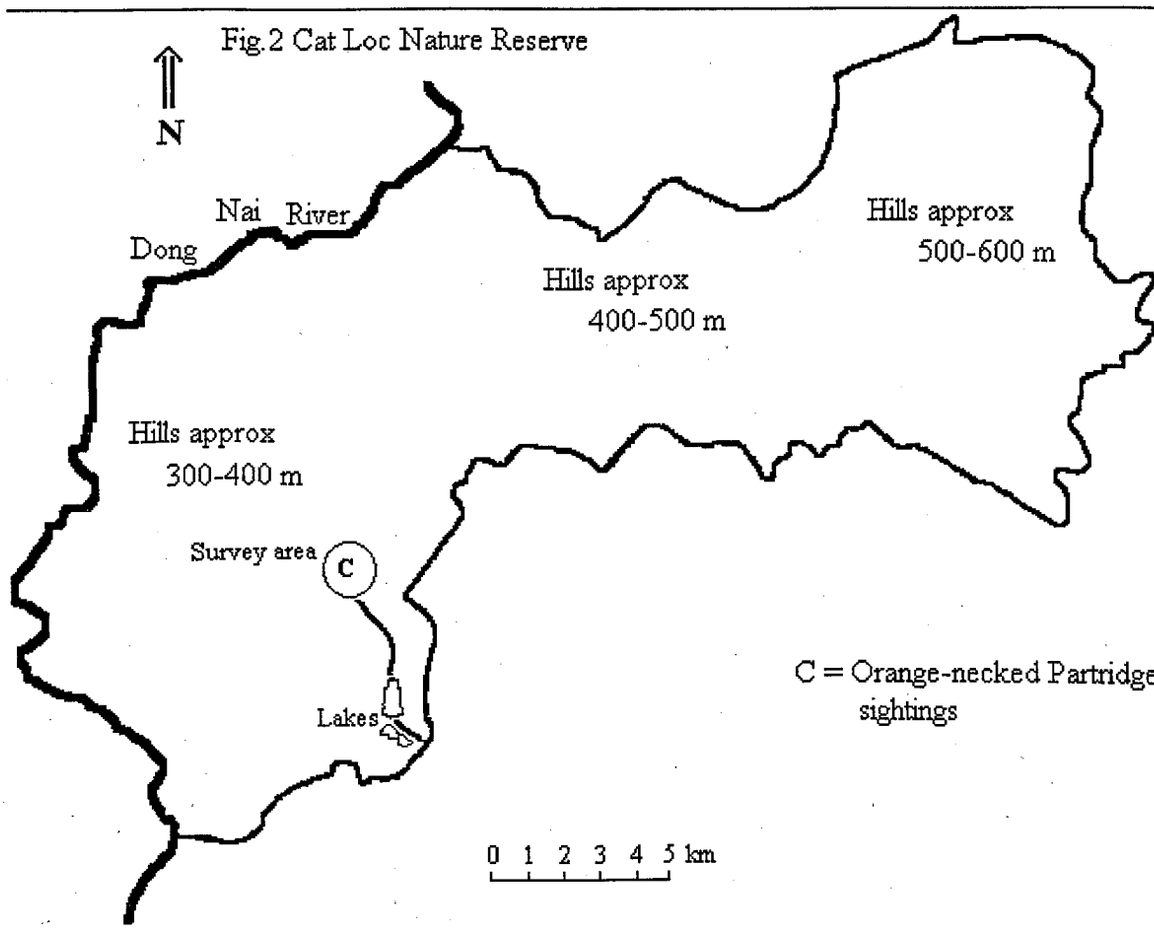
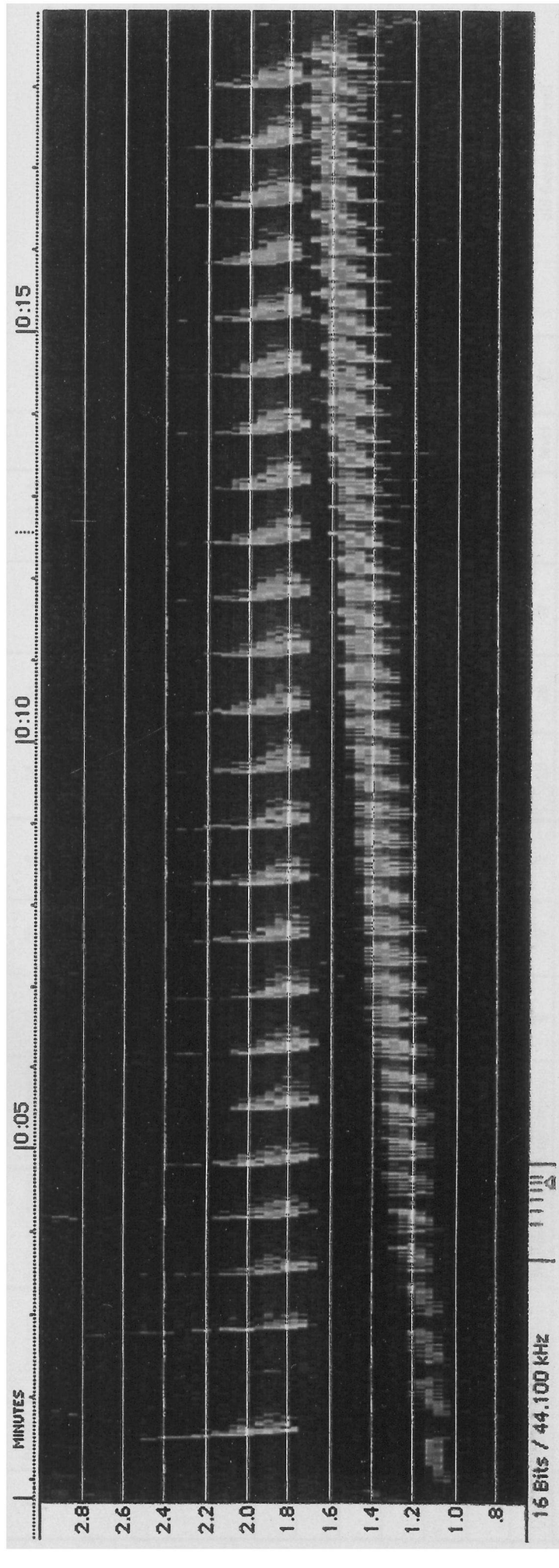


Fig. 2 Cat Loc Nature Reserve



Appendix III. Sonogram of the duet of Orange-necked Partridge



Appendix IV. Line transect description

transect	created on	location	forest type	dominant vegetation	ground cover (%)	litter layer (%)	litter layer (cm)	canopy height (m)	canopy cover (%)	understorey height (m)	understorey cover (%)	aspect	rock cover (%)	remarks
1	040397	Dac Lua	semi-deciduous	Lagerstroemia	0	60	2	30	20	3	65	level	10	
2	040397	Dac Lua	semi-deciduous	Lagerstroemia	0	40	2	20	15	3	60	level	10	
3	050397	Dac Lua	semi-deciduous	Lagerstroemia	0	90	2	20	40	3	70	level	5	
4	050397	Dac Lua	semi-deciduous	Lagerstroemia	0	80	2	20	20	3	60	level	0	C6 trail
5	050397	Dac Lua	semi-deciduous	Lagerstroemia	0	90	5	20	30	3	60	level	5	last 20m make a 180° bend
6	050397	Dac Lua	semi-deciduous	scrub	0	70	1	15	10	3	70	level	0	old forestranger trail
7	050397	Dac Lua	semi-deciduous	Lagerstroemia	0	90	3	30	50	4	30	level	1	
8	050397	Dac Lua	bamboo forest	Lagerstroemia	10	75	1	-	-	4	80	level	0	next to bamboo-hill, disturbed, dead dipterocarps
9	110397	headquarters	semi-deciduous	Lagerstroemia	0	50	1	30	20	4	60	level	0	
10	110397	headquarters	semi-deciduous	Lagerstroemia	0	80	2	30	40	4	80	level	0	
11	110397	headquarters	semi-deciduous	Lagerstroemia	0	50	1	30	20	5	60	level	0	
12	110397	headquarters	semi-deciduous	Lagerstroemia	0	80	2	30	40	4	80	level	0	ecological way
13	130397	headquarters	semi-deciduous	Lagerstroemia	0	85	1	20	40	3	30	level	1	road to Ong Dung tree
14	130397	headquarters	semi-deciduous	Lagerstroemia	0	50	2	>30	20	7	65	level	15	old forestranger trail
15	200397	Crocodile Lake	semi-deciduous	Lagerstroemia	0	60	2-3	>30	30	7	70	slope	70	road to Crocodile Lake
16	200397	Crocodile Lake	semi-deciduous	Lagerstroemia	0	60	2-3	35	30	7	60	slope	75	road to Crocodile Lake

Appendix V. Line transect schedule

line transect	date	time	Germain's Peacock-pheasant (# calling birds)	Siamese Fireback (# calling males)	Red Junglefowl (# calling males)	Scaly-breasted Partridge (# calling pairs)
1	040397	16:40-17:10 hr	2	0	2	0
	060397	5:55-6:25 hr	1	0	3	0
	070397	6:17-6:47 hr	2	0	5	0
	070397	17:55-18:20 hr	1	0	1	1
	080397	6:50-7:20 hr	1	1	1	0
2	040397	17:35-18:00 hr	2	0	1	0
	060397	6:00-6:30 hr	0	0	1	2
	070397	6:25-6:55 hr	1	2	2	3
	070397	17:25-17:50 hr	0	1	3	0
	080397	7:35-8:05 hr	1	0	1	4.5
3	050397	5:55-6:20 hr	1	0	1	0
	050397	15:55-16:15 hr	0	0	0	0
	060397	6:40-7:10 hr	0	0	2	0
	070397	6:20-6:50 hr	0	0	1	1
	070397	17:20-17:45 hr	0	0	0	0
4	050397	6:45-7:10 hr	0	0	0	2
	050397	16:00-16:30hr	0	0	0	0
	060397	6:40-7:10 hr	0	1	2	2
	070397	7:10-7:30 hr	0	1	1	1
	070397	16:35-17:00 hr	0	0	0	0
5	050397	6:50-7:20 hr	2	0	1	2
	050397	16:45-17:10 hr	1	0	0	0
	060397	7:45-8:15 hr	0	1	2	1
	070397	7:15-7:45 hr	0	0	6	1
	070397	16:40-17:10 hr	1	0	2	0
6	050397	8:15-8:45 hr	1	0	1	0
	050397	16:50-17:20 hr	0	0	0	0
	060397	7:50-8:10 hr	2	0	2	1
	070397	7:20-7:50 hr	1	0	1	0.5
	070397	16:00-16:25 hr	1	0	1	0
7	050397	8:25-8:55 hr	1	0	0	0
	050397	17:30-17:55 hr	1	0	0	3
	060397	8:30-9:00 hr	0	0	0	0
	070397	7:20-7:50 hr	1	0	0	2
	070397	16:05-16:35 hr	0	0	0	0
8	050397	17:50-18:20 hr	1	0	2	0
	060397	8:45-9:10 hr	1	0	0	0
	070397	6:10-6:40 hr	1	0	0	0
	070397	18:00-18:20 hr	1	0	0	0
9	110397	6:40-7:10 hr	1	0	0	1
	120397	7:00-7:30 hr	2	0	0	0
	120397	15:40-16:10 hr	3	0	0	0
	130397	6:00-6:30 hr	2	0	4	1
	130397	16:00-16:30 hr	0	0	0	0
	140397	6:05-6:35 hr	1	0	0	2
	140397	16:00-16:30 hr	0	0	1	0
	150397	6:00-6:30 hr	1	0	1	2
	150397	16:00-16:30 hr	1	0	0	1
	160397	6:00-6:30 hr	0	0	0	1
10	110397	6:45-7:15 hr	0	0	0	1
	120397	7:45-8:15 hr	0	0	2	0
	120397	16:00-16:30 hr	0	0	0	0
	130397	6:05-6:35 hr	0	0	0	1

Appendix V. Line transect schedule

	130397	6:37-7:07 hr	0	0	0	0
	130397	16:45-17:15 hr	0	0	1	0
	140397	6:50-7:20 hr	1	0	3	1
	140397	15:55-16:25 hr	1	0	1	0
	150397	6:00-6:30 hr	0	1	2	0
	150397	16:00-16:30 hr	2	0	0	0
	160397	6:00-6:30 hr	2	0	3	1
	170397	7:25-7:55 hr	3	0	3	1
11	120397	7:15-7:45 hr	0	1	0	0
	120397	16:00-16:30 hr	0	1	0	1
	130397	6:05-6:35 hr	0	0	1	0
	130397	17:30-17:50 hr	0	0	0	0
	140397	7:40-8:10 hr	0	0	0	0
	140397	16:45-17:15 hr	0	0	0	0
	150397	6:40-7:10 hr	0	0	0	2
	150397	16:35-17:05 hr	0	0	0	0
	160397	6:00-6:30 hr	1	0	0	0
12	110397	6:45-7:15 hr	0	0	0	0
	120397	7:50-8:20 hr	0	0	0	0
	120397	16:30-17:00 hr	1	0	0	0
	130397	15:45-16:15 hr	0	0	0	0
	140397	7:45-8:30 hr	0	2	2	1
	140397	16:30-17:00 hr	1	0	0	0
	150397	7:05-7:35 hr	0	0	0	0
	150397	16:50-17:20 hr	0	0	0	0
	170397	6:45-7:15 hr	0	0	3	0
13	130397	7:10-7:40 hr	1	1	2	2
	130397	15:55-16:25 hr	0	0	0	0
	140397	6:50-7:20 hr	0	1	1	1
	140397	17:30-18:00 hr	0	1	2	1
	150397	7:45-8:15 hr	0	0	2	0
	150397	16:05-16:35 hr	0	0	1	0.5
	160397	6:50-7:20 hr	0	1	4	1
	170397	6:02-6:32 hr	0	4	0	0
14	130397	7:05-7:35 hr	2	0	0	1
	130397	16:55-17:25 hr	0	0	0	0
	140397	6:00-6:30 hr	1	0	1	0
	140397	17:20-17:50 hr	1	0	0	0
	150397	8:00-8:30 hr	0	0	0	3
	150397	17:45-18:10 hr	0	0	0	0
	160397	7:10-7:35 hr	1	0	0	0
	170397	16:00-16:30hr	0	1	0	1
15	200397	6:25-6:55 hr	2	1	2	2
	200397	16:00-16:30 hr	0	0	1	0
	200397	17:00-17:30 hr	1	0	0	0
	210397	6:30-7:00 hr	1	0	5	1
	210397	8:55-9:25 hr	0	0	1	1
16	190397	16:45-17:15 hr	0	0	0	0
	200397	6:30-7:00 hr	2	0	0	3
	200397	8:15-8:45 hr	1	0	0	3
	200397	16:00-16:30 hr	0	1	0	0
	200397	16:40-17:10 hr	0	0	0	0
	210397	6:40-7:10 hr	1	0	1	0
	210397	9:00-9:30 hr	0	0	0	2

Appendix VI. Bird sighting list

Robert Atkins and Manon Tentij

February 8th 1997 - April 28th 1997, Cat Tien National Park, Vietnam

		(first) seen on:
1 Grey Heron	*Ardea cinerea*	
2 Purple Heron	*Ardea purpurea*	
3 Little Heron	*Butorides striatus*	030497
4 Little Egret	*Egretta garzetta*	
5 Great Egret	*Egretta alba*	
6 Cattle Egret	*Bubulcus ibis*	
7 Chinese Pond-Heron	*Ardeola bacchus*	
8 Cinnamon Bittern	*Ixobrychus cinnamomeus*	
9 Woolly-necked Stork	*Ciconia episcopus*	170297
10 Lesser Adjutant	*Leptoptilos javanicus*	260297
11 White-shouldered Ibis	*Pseudibis davisoni*	200297
12 Lesser Treeduck	*Dendrocygna javanica*	190397
13 Cotton Pygmy Goose	*Nettapus coromandelianus*	260297
14 Osprey	*Pandion haliaetus*	
15 Black Baza	*Aviceda leuphotes*	170297
16 Oriental Honey-buzzard	*Pernis apivorus ptilorhynchus*	200297
17 Black Kite	*Milvus migrans*	
18 Brahminy Kite	*Haliastur indus*	210297
19 Grey-headed Fish-eagle	*Icthyophaga icthyaetus*	210297
20 Crested Serpent-eagle	*Spilornis cheela*	200297
21 Pied Harrier	*Circus melanoleucos*	200297
22 Chinese Goshawk	*Accipiter soloensis*	150297
23 Grey-faced Buzzard	*Butastur indicus*	280297
24 Black Eagle	*Ictinaetus malayensis*	150297
25 Rufous-bellied Eagle	*Hieraaetus kienerii*	280297
26 Mountain Hawk-eagle	*Spizaetus nipalensis*	260297
27 Collared Falconet	*Microhierax caerulescens*	220297
28 Oriental Hobby	*Falco severus*	260297
29 Blue-breasted Quail	*Coturnix chinensis*	260497
30 Orange-necked Partridge	*Arborophila davidi*	160497
31 Scaly-breasted Partridge	*Arborophila chloropus*	040397
32 Siamese Fireback	*Lophura diardi*	020397
33 Red Junglefowl	*Gallus gallus*	
34 Germain's Peacock-pheasant	*Polyplectron germaini*	220297
35 Green Peafowl	*Pavo muticus*	250297
36 Barred Buttonquail	*Turnix suscitator*	130497
37 Red-legged Crake	*Rallina fasciata*	130497
38 White-breasted Waterhen	*Amaurornis phoenicurus*	170297
39 Watercock	*Gallicrex cinerea*	260297
40 Purple Swamphen	*Porphyrio porphyrio*	190397
41 Bronze-winged Jacana	*Metopidius indicus*	260297
42 Red-wattled Lapwing	*Vanellus indicus*	280297
43 Little ringed Plover	*Charadrius dubius*	280297
44 Wood Sandpiper	*Tringa glareola*	200297
45 Common Sandpiper	*Actitis hypoleucos*	310397
46 Thick-billed Pigeon	*Treron curvirosta*	
47 Pompadour Pigeon	*Treron pompadora*	120497
48 Green Imperial Pigeon	*Ducula aenea*	
49 Barred Cuckoo-dove	*Macropygia unchall*	

Appendix VI. Bird sighting list

50 Oriental Turtle-dove	*Streptopelia orientalis*	
51 Red Turtle-dove	*Streptopelia tranquebarica*	280297
52 Spotted Dove	*Streptopelia chinensis*	140297
53 Green-winged Pigeon	*Chalcophaps indica*	280297
54 Red-breasted Parakeet	*Psittacula alexandri*	080297
55 Vernal Hanging Parrot	*Loriculus vernalis*	080297
56 Plaintive Cuckoo	*Cacomantis merulinus*	200497
57 Banded Bay Cuckoo	*Cacomantis sonneratii*	240297
58 Violet Cuckoo	*Chrysococcyx xanthorhynchus*	090397
59 Drongo Cuckoo	*Surniculus lugubris*	100397
60 Common Koel	*Eudynamys scolopacea*	280297
61 Green-billed Malkoha	*Phaenicophaeus tristis*	
62 Greater Coucal	*Centropus sinensis*	080297
63 Lesser Coucal	*Centropus bengalensis*	210297
64 Asian Barred Owlet	*Glaucidium cuculoides*	090297
65 Great Eared Nightjar	*Eurostopodus macrotis*	080297
66 Large-tailed Nightjar	*Caprimulgus macrurus*	160297
67 Brown Needletail	*Hirundapus giganteus*	310397
68 Asian Palm-swift	*Cypsiurus batasiensis*	260297
69 Orange-breasted Trogon	*Harpactes oreskios*	020397
70 Pied Kingfisher	*Ceryle rudis*	190297
71 Common Kingfisher	*Alcedo atthis*	280297
72 Stork-billed Kingfisher	*Pelargopsis capensis*	210297
73 Banded Kingfisher	*Lacedo pulchella*	200297
74 White-throated Kingfisher	*Halcyon smyrnensis*	
75 Black-capped Kingfisher	*Halcyon pileata*	200297
76 Chestnut-headed Bee-eater	*Merops leschenaulti*	
77 Blue-throated Bee-eater	*Merops viridis*	250497
78 Blue-bearded Bee-eater	*Nyctyornis athertoni*	
79 Indian Roller	*Coracias benghalensis*	
80 Dollarbird	*Eurystomus orientalis*	170297
81 Wreathed Hornbill	*Rhyticeros undulatus*	090297
82 Indian Pied Hornbill	*Anthracoceros albirostris*	
83 Great Hornbill	*Buceros bicornis*	030397
84 Red-vented Barbet	*Megalaima lagrandieri*	100397
85 Lineated Barbet	*Megalaima lineata*	200297
86 Blue-eared Barbet	*Megalaima australis*	090397
87 Green-eared Barbet	*Megalaima faiostricta*	200297
88 Coppersmith Barbet	*Megalaima haemacephala*	200297
89 White-browed Piculet	*Sasia ochracea*	270497
90 Rufous Woodpecker	*Micropternus brachyurus*	110497
91 Laced Woodpecker	*Picus vittatus*	220297
92 Grey-headed Woodpecker	*Picus canus*	160297
93 Bamboo Woodpecker	*Gecinulus viridis*	
94 Greater Yellownape	*Picus flavinucha*	020397
95 Lesser Yellownape	*Picus chloropholus*	200297
96 Common Goldenback	*Dinopium javanense*	280297
97 Black-and-buff Woodpecker	*Meiglyptes jugularis*	210297
98 Great slaty Woodpecker	*Mulleripicus pulverulentus*	160297
99 White-bellied Woodpecker	*Dryocopus javensis*	210297
100 Heart-spotted Woodpecker	*Hemicircus canente*	100397
101 Greater Goldenback	*Chrysocolaptes lucidus*	140297
102 Dusky Broadbill	*Corydon sumatranus*	280297
103 Black-and-red Broadbill	*Cymbirhynchus macrorhynchus*	020397
104 Banded Broadbill	*Eurylaimus javanicus*	260297

Appendix VI. Bird sighting list

105 Long-tailed Broadbill	*Psarisomus dalhousiae*	110497
106 Blue-winged Pitta	*Pitta moluccensis*	170497
107 Bar-bellied Pitta	*Pitta ellioti*	210297
108 Oriental Skylark	*Alauda gulgula*	260497
109 Sand Martin	*Riparia riparia*	030497
110 Barn Swallow	*Hirundo rustica*	280297
111 Striated Swallow	*Hirundo striolata*	280297
112 Common House-martin	*Delichon urbica*	300397
113 Bar-winged Flycatcher-shrike	*Hemipus picatus*	180497
114 Indochinese Cuckoo-shrike	*Coracina polioptera*	210297
115 Large Wood-shrike	*Tephrodornis virgatus*	220297
116 Pied Triller	*Lalage nigra*	210297
117 Scarlet Minivet	*Pericrocotus flammeus*	200297
118 Common Iora	*Aegithinia tiphia*	190497
119 Great Iora	*Aegithinia lafresnayei*	220297
120 Golden-fronted Leafbird	*Chloropsis aurifrons*	250497
121 Blue-winged Leafbird	*Chloropsis cochinchinensis*	
122 Black-headed Bulbul	*Pycnonotus atriceps*	
123 Black-crested Bulbul	*Pycnonotus melanicterus*	
124 Red-whiskered Bulbul	*Pycnonotus jocosus*	020397
125 Stripe-throated Bulbul	*Pycnonotus finlaysoni*	180297
126 Streak-eared Bulbul	*Pycnonotus blanfordi*	280297
127 Ochraceous Bulbul	*Criniger ochraceus*	200297
128 Black Drongo	*Dicrurus macrocercus*	
129 Ashy Drongo	*Dicrurus leucophaeus*	010397
130 Crow-billed Drongo	*Dicrurus annectans*	180297
131 Bronzed Drongo	*Dicrurus aeneus*	210297
132 Lesser racket-tailed Drongo	*Dicrurus remifer*	160297
133 Spangled Drongo	*Dicrurus hottentottus*	200297
134 Greater racket-tailed Drongo	*Dicrurus paradiseus*	
135 Black-naped Oriole	*Oriolus chinensis*	230297
136 Black-hooded Oriole	*Oriolus xanthornus*	
137 Asian Fairy-bluebird	*Irena puella*	220297
138 Collared Crow	*Corvus torquatus*	030497
139 Large-billed Crow	*Corvus macrorhynchos*	130497
140 Yellow-breasted Magpie	*Cissa hypoleuca*	020497
141 Racket-tailed Treepie	*Crypsirina temia*	
142 Velvet-fronted Nuthatch	*Sitta frontalis*	
143 Striped Tit-babbler	*Macronous gularis*	190497
144 Grey-faced Tit-babbler	*Macronous kelleyi*	280497
145 Chestnut-capped Babbler	*Timalia pileata*	190497
146 Puff-throated Babbler	*Pellorneum ruficeps*	200297
147 White-crested Laughing-thrush	*Garrulax leucolophus*	
148 Siberian Blue Robin	*Erithacus cyane*	290397
149 Magpie Robin	*Copsychus saularis*	250297
150 White-rumped Shama	*Copsyschus malabaricus*	
151 Stonechat	*Saxicola torquata*	140297
152 Pied Bushchat	*Saxicola caprata*	260497
153 Chestnut-bellied Rockthrush	*Monticola rufiventris*	290397
154 Inornate Warbler	*Phylloscopus inornatus*	090397
155 Sulfur-breasted Warbler	*Phylloscopus ricketti*	120497
156 Yellow-bellied Warbler	*Abroscopus superciliaris*	
157 Black-browed Reed-warbler	*Acrocephalus bistrigiceps*	280297
158 Common Tailorbird	*Orthotomus sutorius*	100397
159 Dark-necked Tailorbird	*Orthotomus atrogularis*	

Appendix VI. Bird sighting list

160 Rufescent Prinia	*Prinia rufescens*	090397
161 Yellow-bellied Prinia	*Prinia flaviventris*	190497
162 Tawny-flanked Prinia	*Prinia subflava*	210297
163 Grey-breasted Prinia	*Prinia hodgsonii*	280297
164 Bright-capped Cisticola	*Cisticola exilis*	280297
165 Dark-sided Flycatcher	*Muscicapa sibirica*	090397
166 Asian brown Flycatcher	*Muscicapa latirostris*	090397
167 Red-throated Flycatcher	*Ficedula parva*	180497
168 Tickell's blue Flycatcher	*Cyornis tickelliae*	280297
169 Black-naped Monarch	*Hypothymis azurea*	160497
170 Asian Paradise-flycatcher	*Terpsiphone paradisi*	090397
171 Yellow Wagtail	*Motacilla flava*	310397
172 Richard's Pipit	*Anthus novaseelandiae*	210297
173 Ashy Wood-swallow	*Artamus fuscus*	220297
174 Brown Shrike	*Lanius cristatus*	280297
175 Black-collared Starling	*Sturnus nigricollis*	030497
176 Vinous-breasted Starling	*Sturnus burmannicus*	
177 Golden-crested Myna	*Ampeliceps coronatus*	
178 Hill Myna	*Gracula religiosa*	
179 Brown-throated Sunbird	*Anthreptes malacensis*	
180 Ruby-cheeked Sunbird	*Anthreptes singalensis*	180497
181 Olive-backed Sunbird	*Nectarinia jugularis*	090397
182 Crimson Sunbird	*Aethopyga siparaja*	220297
183 Purple-naped Sunbird	*Hypogramma hypogrammicum*	190397
184 Little Spiderhunter	*Arachnothera longirostra*	180497
185 Steaked Spiderhunter	*Arachnothera magna*	090397
186 Scarlet-backed Flowerpecker	*Dicaeum cruentatum*	090397
187 Plain-backed Sparrow	*Passer flaveolus*	260497
188 Baya Weaver	*Ploceus philippinus*	250497
189 White-rumped Munia	*Lonchura striata*	150397
190 Scaly-breasted Munia	*Lonchura punctulata*	280297
191 Yellow-breasted Bunting	*Emberiza aureola*	270297

Species heard, not sighted:		heard on:
192 White-winged Duck	*Cairina scutulata*	200397
193 Spot-bellied Eagle-owl	*Bubo nipalensis*	230397
194 Javan Frogmouth	*Batrachostomus javensis*	230397
195 Red-headed Trogon	*Harpactes erythrocephalus*	

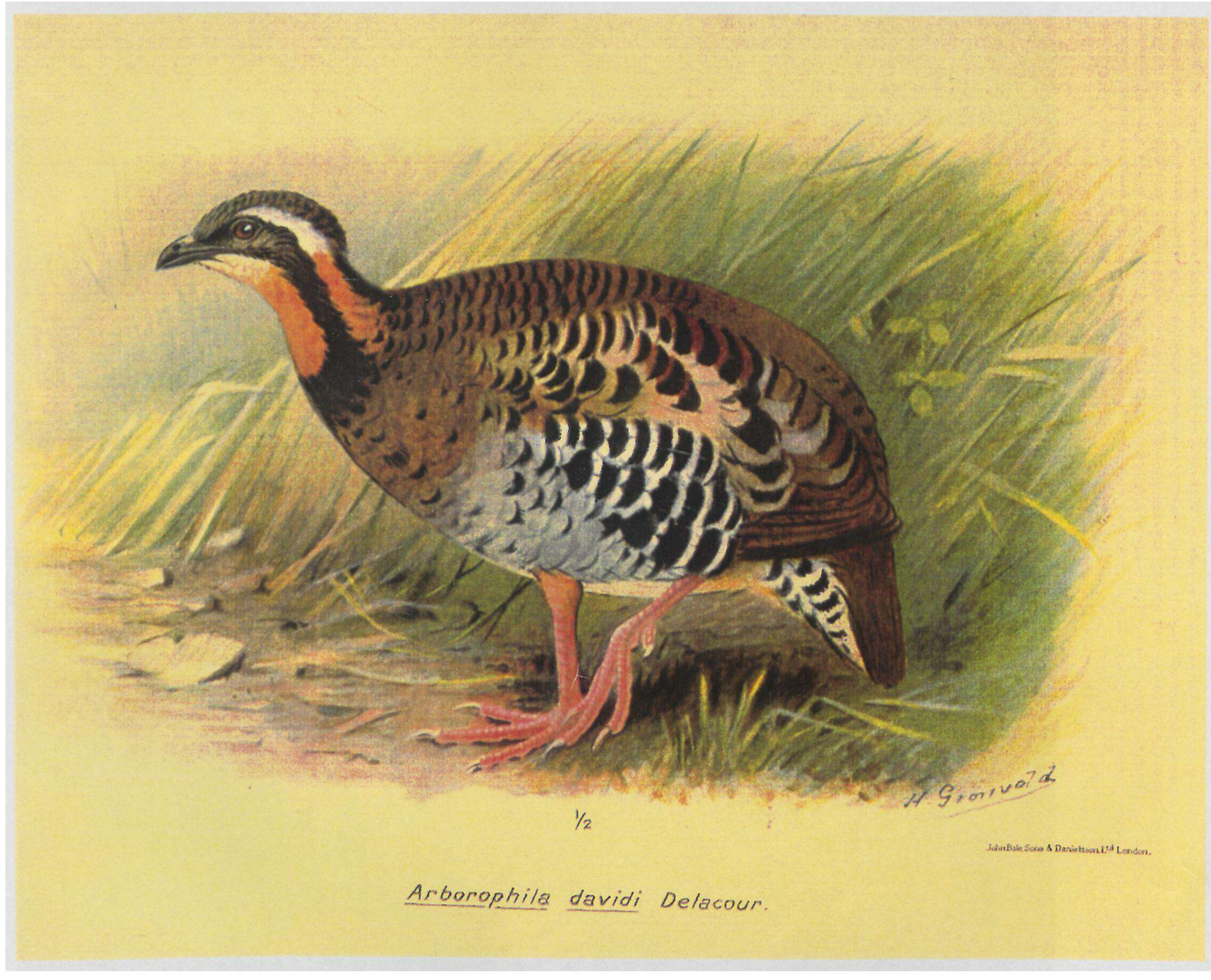
Additional species sighted in Cat Loc Nature Reserve, April 5th-April 10th 1997:

196 Little Grebe	*Podiceps ruficollis*
197 Yellow Bittern	*Ixobrychus sinensis*
198 Black-shouldered Kite	*Elanus caeruleus*
199 Greater Paintedsnipe	*Rostratula benghalensis*
200 Black-backed Kingfisher	*Ceyx erithacus*
201 Buff-breasted Babbler	*Trichastoma tickelli*
202 Mountain Fulvetta	*Alcippe peracensis*
203 Blue Rock-thrush	*Monticola solitarius*
204 Eurasian Tree-sparrow	*Passer montanus*
205 Asian Golden Weaver	*Ploceus hypoxanthus*

Species heard, not sighted:

206 Silver Pheasant	*Lophura nycthemera*

Appendix VII. The Orange-necked Partridge



from: Delacour, J. and Jabouille, P., 1931

Appendix VIII. Photographs

Fig. 1. Female Germain's Peacock-pheasant on nest. (Photograph by Manon Tentij)

Fig. 2. The egg and nest of Germain's Peacock-pheasant. (Photograph by Manon Tentij)

Appendix VIII. Photographs

Fig. 3. A site in Cat Loc Nature Reserve where Orange-necked Partridges were seen. Note the burnt areas. (Photograph by Manon Tentij)

Fig. 4. Manon Tentij and Pham Huu Khánh in front of the bamboo hill in Cat Tien National Park near Dac Lua where Orange-necked Partridges were seen. (Photograph by Robert Atkins)

Appendix VIII. Photographs

Fig. 5 and fig. 6.
Habitat destruction in Cat Tien National Park near Ta Lai.
(Photographs by Manon Tentij)

Appendix IX. Itinerary

January	29	Amsterdam - London - Kuala Lumpur.
	31	Kuala Lumpur - HCM-city.
February	1	bought equipment in market.
	2	HCM-city - Nam Bai Cat Tien National Park walked along the road north-east from headquarters.
	3	as 3, and walked along the road to Da Ko, went back to HCM-city.
	4	HCM-city.
	5	as 4.
	6	as 5.
	7	as 6.
	8	arrival Nam Bai Cat Tien National Park.
	9	went along road to Dac Lua (by car).
	10	walked south-west, up to Nui Tuong (Elephant-mountain).
	11	walked north-east , up to rapids, and south-west to Nui Tuong.
	12	walked down the ecological way, 3 km from headquarters, and to Nui Tuong, and wet grassland next to it.
	13	walked north-east (5:00 AM), went to Phung Lam-market (bought bicycles), and walked south-east (Nui Tuong).
	14	went north-west to Dac Lua, talked to old guide, and surveyed Bao Beo.
	15	went down the road to Da Ko.
	16	went north-east up to 7 km from headquarters, and south-east (Nui Tuong).
	17	went north-east up to 7 km from headquarters.
	18	went south-east (Nui Tuong).
	19	stayed home to do paper-work.
	20	headquarters - Dac Lua, walked in forest and on road near Dac Lua, and went to Bao Beo.
	21	went to Bao Beo and old rice-fields next it, to look for White-Shouldered Ibis and Green Peafowl.
	22	went along road near Dac Lua, Dac Lua - headquarters, went south-east (Nui Tuong).
	23	went north-east up to 7 km from headquarters, headquarters - Dac Lua.
	24	went to second bamboo mountain, and along the road.
	25	went to hill next to sugarcane field and along the road, and to old ricefield next to Bao Beo.
	26	went to Bao Sau (Crocodile-lake) .
	27	visited Cat Loc Nature Reserve, to arrange our stay, and went to old ricefield next to Bao Beo.
	28	Dac Lua - headquarters, and went up to 7 km north-west from headquarters.
March	1	went to Phoung Lam-market, and went up to 7 km north-west from headquarters.
	2	headquarters - Dac Lua, and went south-east along the road.
	3	went to Bogor-market, and made line-transects 1 and 2.
	4	made line-transects 3,4,5,6,7 and 8.
	5	surveyed along road, and allowed the new line-transects to settle.
	6	surveyed the 8 line-transects, drank with the forest-rangers and did nothing in the afternoon because of it.
	7	surveyed the 8 line-transects twice except for # 2, which we surveyed only once.

	8	surveyed line-transect 2, and Dac Lua - headquarters.
	9	surveyed north-east along road, and went south-west to look for a suitable place to make a line-transect.
	10	made line-transects 9,10,11 and 12.
	11	surveyed line-transects 9,10,11 and 12 made and surveyed line-transect 14a.
	12	surveyed line-transects 9 and 12 twice and 10 and 11 once, and made line-transects 13 and 14.
	13	surveyed line-transects 9,10,11,12,13 and 14 twice.
	14	as 13.
	15	as 14.
	16	as 15.
	17	surveyed line-transects 10,12,13 and 14, and discussed our methodology with Vy and Khanh.
	18	did nothing because we were suffering from severe diarrhoea.
	19	surveyed road to Bao Sau and line-transect 16.
	20	surveyed pointcount 1 and line-transects 15 and 16 twice, and pointcount 2 once.
	21	surveyed line-transects 15 and 16 twice, and pointcount 1 once, and surveyed road to Bao Sau, Bao Sau - headquarters.
	22	Nam Bai Cat Tien National Park - HCM-city.
	23	HCM-city.
	24	as 23.
	25	HCM-city - Nam Bai Cat Tien National Park.
	26	stayed at headquarters.
	27	headquarters - Dac Lua, and surveyed the first bamboo-mountain, and line-transects 1 and 2.
	28	surveyed line-transects 1 and 2 and bamboo-mountain.
	29	surveyed line-transect 2, Dac Lua - headquarters.
	30	surveyed north-east from headquarters.
	31	stayed at headquarters to prepare for Da Ko.
April	1	headquarters - Da Ko, surveyed pointcount 3.
	2	surveyed pointcount 4 and 5 twice and pointcount 6 once.
	3	went along the Dong Nai-river by boat, and visited Da My, Da Lak and Da Rong (sub-stations), Da Ko - headquarters.
	4	stayed at headquarters.
	5	Nam Bai Cat Tien National Park - Cat Loc Nature Reserve, surveyed along road to village # 4, but made camp at minority people's house, after about 4-5 km walk.
	6	surveyed area around the camp in groups of two.
	7	as 6.
	8	as7, and surveyed line-transect A.
	9	surveyed line-transect A,B and C, and the area around the camp.
	10	surveyed along the road during our walk back, Cat Loc Nature Reserve - Cat Tien National Park.
	11	went to the chairman of the police of Tan Phu-district in Tan Phu-town, and surveyed north-west of headquarters.
	12	surveyed north-west of headquarters up to the road to Bao Sau.
	13	surveyed Nui Tuong and wet grassland next to it.
	14	Nam Bai Cat Tien National Park - Bien Hoa - HCM-city (night in hotel).
	15	HCM-city - Nam Bai Cat Tien National Park, made a trail to the top of Nui Tuong.
	16	surveyed south-east to Nui Tuong and on the trail.
	17	as 16.

	18	as 17
	19	as 18, but surveyed north-west also.
	20	surveyed along the road to Dac Lua, especially the mountain next to the road to Bao Sau, surveyed the first and second bamboo-mountain near Dac Lua and surveyed along the road in the direction of headquarters.
	21	surveyed along the road to headquarters and the trail to the bamboo-mountain next to the sugarcane-field (leechland), surveyed old rice-field next to Bao Beo.
	22	surveyed the mountain next to the road to Bao Sau and the road to headquarters, Dac Lua - headquarters, celebrated Manon's birthday and had a big party and a two layer birthday-cake.
	23	surveyed south-east up to Nui Tuong.
	24	as 23.
	25	surveyed C5-mountain (gibbon-mountain), and the road to Dac Lua (twice).
	26	surveyed road to Ta Lai and a bit further up to the mixed bamboo-mountain in between the plantations of the people of Ta Lai.
	27	surveyed south-east up to Nui Tuong (twice), and north-west from headquarters.
	28	prepared for the presentation of our work in the park, and presented this to the director of Nam Bai Cat Tien National Park and the other senior staff.
	29	Nam Bai Cat Tien National Park -Da Lat.
April 30 - May	14	went on holiday.
	15	HCM-city: visited the animal-market, and flew HCM-city - Kuala Lumpur - Heathrow.
	16	flew Heathrow - Schiphol.