A wildlife and habitat survey of Dong Hua Sao National Biodiversity Conservation Area, Champassak Province, Lao PDR in 1996

Authors: T.D. Evans, A.J. Stones, H.C. Towll and R.C.M. Thewlis

Conducted during January-March 1996

A report to the IUCN Biodiversity Conservation Project of the Provincial Agriculture and Forestry Office, Pakse, Champassak Province, Laos.

Contact addresses:

IUCN Biodiversity Conservation Project
c/o Forestry Division
PO Box 19
Pakse
Champassak Province
Lao PDR

T.D. EVANS
11 Yeoman Lane
Bearsted
Maidstone
Kent
ME14 4BX
UK

A.J. STONES
32 Hill Street
Norwich
NR2 2DT
UK

CONTENTS

FIGURES

TABLES

ABBREVIATIONS

DHS Dong Hua Sao NBCA
IUCN The World Conservation Union
MDF Mixed deciduous forest
NBCA National Biodiversity Conservation Area
PDR Peoples' Democratic Republic
SEF Semi-evergreen forest

ACKNOWLEDGEMENTS

The survey was conducted under contract to the Biodiversity Conservation Project, funded by the Dutch government and implemented by the Lao Forestry Department with technical assistance from The World Conservation Union (IUCN). The authors are particularly grateful to Mr. Somnuk, field director at Dong Hua Sao and his staff, Mr. Chantavi, Mr. Padith and Mr. Khamhou, who are warmly thanked for their assistance and companionship. We highly appreciated assistance in survey planning and logistics from Messrs. Boonsay, Vilavong and Berkmüller. William Duckworth and Rob Timmins provided useful information. Joost Foppes povided advice, company and very timely help with computers and printers. Last but not least we thank the many local residents who shared their knowledge and acted as guides.

.

EXECUTIVE SUMMARY

A rapid assessment of habitats, threatened wildlife species ('Key species') and human use was conducted in Dong Hua Sao National Biodiversity Conservation Area (NBCA) during 31 January - 1 March 1996. A survey using the same methods was conducted in 1993. In 1996 some parts of the reserve were resurveyed and some new areas were visited. All coverage in 1996 was of the lowlands and lower hill slopes.

Main Findings

Sectors numbers follow Figure 1.

Habitats

Small changes were necessary to the map of habitats produced during the 1993 survey (Timmins *et al.* 1993) but conclusions about the extent and location of various habitat types remain essentially unchanged.

The most important terrestrial habitats identified for wildlife were the unlogged forests on the steep escarpment slopes and in the Houay Bangliang gorge. The plateau forests in areas which have yet to be encroached by coffee plantations are also of high importance. One extensive complex of salt-licks was found near Houay Bong. The large area of mixed deciduous forest in the south-east has fewer Key species but one, Green Peafowl, is of very great importance.

The commonest habitat is logged semi-evergreen forest of the flat lowlands, but this is currently of lower importance for Key terrestrial species, mainly because of heavy hunting pressure now and in the recent past. It is an important habitat for species not sensitive to hunting or logging, and would become more important if allowed to regenerate.

At least 140 pools occur in the logged lowlands, with five more on the plateau. These are a critical habitat for several large birds and represent a habitat now scarce in South-East Asia. Hunting and distrubance are high and growing. The two least heavily-hunted groups of pools are probably in Sector 5 (Nong Ngu and two others around Houay Pong) and Sector 14 (Nong Hou and five others south of Houay Touay-Gnai).

Four major streams cross the lowlands of the reserve and support several specialised Key species. The most important sections of stream are thought to be a) the upper lowland parts of Houay Namphak and the nearby Houay Nyat and b) the reaches of Houay Touay-Gnai upsream of Ban Houay Phoung. The middle reaches of Houay Namphak, Touay-Gnai and Touay-Noy are good habitat without permanent settlements and could also be important.

Human uses

There are five large enclave villages, one seasonal enclave of nine huts and at least ten other isolated sites where single huts are seasonally occupied for wet rice farming. Seasonal road access is good in most of the flat lowlands and allows heavy use of remote areas including opportunistic hunting with guns, snaring, fishing, logging and collection of several non-timber forest products (e.g. malva nuts, rattans, yang oil, large bamboos). Use is less intensive on the steeper slopes, but the lower altitudes still experience moderate use. Hunting, is by far the most significant use relating to Key wildlife species - it may be the main purpose for visiting the forest or a subsidiary activity during visits for other reasons.

Human use is also high in two broad belts of the plateau forests where clearance for coffee plantations combines with increased hunting to have high impacts on Key species. Use in the rapidly shrinking unencroached areas has not been studied but is thought to be lower.

The highest human impacts on significant populations of Key species were thought to be occurring in four lowland sectors (Sector 5, Houay Bong; Sector 8 Middle Houay Namphak;

Sector 14 Nong Hou and surroundings; and Sector 17E Quan Mou). Human use is moderate or high and rising in these areas, impacting on vulnerable populations of lowland species which do not have secure populations on the hill slopes. Human use is higher in sectors closest to the western boundary but surviving populations of Key species are thought to be much smaller there. High impacts are also expected to be occurring in Sectors 19, 23 and 26.

Birds of conservation interest (degree of threat in brackets)

Eleven species occur in populations which might be considered of moderate global significance. Four of these, Lesser Adjutant (Globally threatened), Green Peafowl (Globally threatened), Blyth's Kingfisher (Globally threatened) and Eastern Green Magpie (Globally near-threatened) are thought to be present in very small numbers (the peafowl may be extinct). Siamese Fireback (Globally threatened), Wreathed Hornbill (Regionally at risk), Red-collared Woodpecker (Globally threatened), Green Cochoa (Globally near-threatened), Red-tailed Laughingthrush (Globally near-threatened), Bar-bellied Pitta (Globally near-threatened) and probably Blue-rumped Pitta (Globally near-threatened) are thought to occur in somewhat larger populations. Grey-faced Tit-Babbler (Globally near-threatened) is very numerous and occurs in a population of high global significance. The population of Black-and-Red Broadbill (Regionally at risk) is of high national significance. White-winged Ducks (Globally threatened) were reported and, if this were confirmed, even a tiny population would be of national importance.

Lesser Adjutant, Green Peafowl, Siamese Fireback, Wreathed Hornbill and the pittas are principally threatened in DHS by hunting or snaring, depending on the species. Blyth's Kingfisher is not immediately threatened but remains vulnerable to habitat loss or deterioration in water quality. Eastern Green Magpie and Red-collared Woodpecker are suspected to be sensitive to logging (Thewlis *et al.* in prep.), but since most suitable habitat on the flat lowlands has already been logged this is not a major current threat, except locally. Green Cochoa and Red-tailed Laughingthrush are at risk from clearance of the plateau forests for coffee. The babbler and broadbill are not thought to be under serious threat in DHS. Four Key species (Woolly-necked Stork, Lesser Fish Eagle, Green Imperial-Pigeon and Great Hornbill) which were not shown to occur in significant populations are probably at risk of extinction in the reserve, principally due to opportunistic hunting.

Fourteen other Key species of lower conservation significance (one of which was provisionally identified) were recorded.

Mammals of conservation interest (degree of threat in brackets)

The gibbon population of DHS is of high global importance, particularly whilst it remains linked to the larger population in Xe Pian NBCA. The populations of Douc Langur, Sun Bear and Dhole may also be of moderate global significance, but there are few records from which to draw this conclusion and their DHS populations may prove to be rather small. The large healthy populations of Finlayson's Squirrel and Cambodian Striped Tree Squirrel are moderately significant in view of the relatively restricted ranges of these species. The small populations of Tiger and wild cattle (probably Gaur) and the somewhat larger population of Black Giant Squirrel are probably of high national significance.

Hunting is by far the most significant threat to Key mammal species in the reserve. Three localised areas for concern are the Houay Bong salt-licks (which might be expected to attract high hunting of ungulates and associated predators); the Houay Bangliang valley (where a Tiger trap was found) and Ban Nonglouang, (where a cattle-killing Tiger is reported and may be at risk of being killed as a result).

Other species are likely to be affected in a less localised fashion, since opportunistic hunting occurs very widely in the reserve, especially in the logged lowlands where the trail and road network is best. The only areas of lower hunting are thought to be the steep hill slopes and possibly the remotest parts of the plateau. Species affected, in addition to those above, include gibbon (although these are localised in the logged lowlands), macaques, Silvered Langur

(presence unconfirmed), Sun Bear, Dhole and Black Giant Squirrel , all of which are found in reduced densities. The heavy hunting of the smaller squirrels is not thought to be an important threat.

Recommendations

The most urgent general aims are

a) reduction of human uses in order to enhance habitat value for wildlife and
b) reducing direct pressure by hunting.

The manner in which such changes can be brought about must be determined by the protected area staff together with local residents and authorities and they will be the ones to judge what is acceptable and politically feasible.

Five main approaches are recommended. Further description of the options is available in the recent status Report (Berkmuller *et al*. 1995). Most of the recommendations are addressed to and amenable to a solution by local residents and protected area staff. Others require support and involvement by political authorities at district and provincial levels.

- Reduce destructive methods of any extractive use throughout the reserve.
- Establish effective use controls in selected core zones with participation of local communities. Such use controls should emerge from participatory planning with local communities.
- Associated rural development should serve to encourage abandonment or size reduction of villages within the reserve boundaries. In-migration should be discouraged.
- Introduce restrictions on vehicle access and restrict access to local residents.

Table 1 provides a summary of where selected types of action are most urgent.

Table 1 Summary of protective action required

Action	**Location (sectors)**
Stop road construction, logging and large scale clearance on the platreau	24, 25, 26, possibly 23
Stop road construction and logging	17E, 18, 19, 20
Encourage the abandonment of huts and cultivation at pools.	5, 8, 9
Prevent settlement at the most important remaining pools	5, 14
Stabilise existing cultivation and numbers of residents in enclave villages. Reduce if possible.	Ban Nongkhe, Ban Houay Phoung, Ban Houayton, Ban Nonphu, Ban Non Ek, Ban Thong and Quan Mou.
Prevent the hunting of Key species.	Throughout but particularly in proposed core areas (below).
Reduce/prevent fishing and over-night camps.	High value stretches of rivers and pools in sectors 5,6,11 and 14.
Prohibit the carrying of modern firearms.	Throughout.
Prohibit the use of destructive fishing methods: explosives / poisons	Throughout but particularly in core areas.

Discourage barrage traps / scooping / pumping out pools	Throughout but particularly in core areas.
Prohibit vehicle entry without permit.	All motorable roads into the protected area.

Three potential core areas were identified:

Core Area A: Escarpment slopes, Houay Bangliang gorge, Phou Pong and Phou Tabeng
Sectors 4, 22, 5 (upland part), 6, 11, 27, 21.

Core Area B: Houay Pong lowlands
Sector 5 (flatland part)

Core Area C: Nong Hou, Houay Touay-Gnai and surroundings
Sector 14

Additional information

Additional information is desirable on the certain aspects of human use and the status of Key wildlife species, as detailed in the text.

Links with other protected areas.

It is important for the long-term viability of DHS that protected habitat links be established with the large forested areas to the east and south, including Xe Pian NBCA. The best solution for wildlife would be the declaration of Xe Khampho Proposed Protected area as an NBCA, as proposed by Berkmüller *et al.* (1995). Detailed comments on habitat links were presented by Timmins *et al.* (1993).

PART 1: SITE DESCRIPTION

1.1 Site Description

Dong Hua Sao NBCA (DHS) lies in the province of Champassak at 14°50' - 15°11'N, 105°55' - 106°17'E. The area covers about 910 km^2 of the southern Bolovens plateau, the intervening slope and adjacent lowlands. Most of the area (70%) lies below 250m, but the sheer escarpment and plateau rise to over 1000m; the highest point, Phou Tabeng, is 1280m. A full site description can be found in Timmins *et al*. (1993).

There have been significant changes in the surveyed areas since 1993 resulting from rapidly intensifying human use.

DHS came under active management in February 1996.

The reserve has been divided into recording sectors for the purposes of gathering information for management (Figure 1).

1.2 Access

Figure 2 shows vehicle access routes and place names within the reserve. It is based on Figure 3 of Timmins *et al*. (1993), taking account of newly visited routes and access routes upgraded since 1993. Almost all parts of the flat lowlands are criss-crossed with abandoned logging roads, some of which are still frequently used.

Road access in the dry season is now possible by four-wheel drive vehicle to the following areas:

- Ban Nongkhe and a hamlet 3 km beyond
- several sections of Houay Namphak
- at least one point on Houay Bangliang, about 7 km north of Ban Houay Namphak
- the Houay Touay-Gnai at two points (the mouth of Houay Phoung and, via Ban Hoauy Phoung to a point near Nong Hou)
- Quan Mou. The Quan Mou road was noted to be an 'old, overgrown road, rarely used, even on foot' in 1993 (Timmins *et al*. 1993), but is now a busy trail which has been cleared to allow logging trucks and bicycles to pass.
- Ban Houayton (not accessible by road in 1993); precise route not certain.
- Ban Nongphu, Ban Nongek and a nearby section of the Xe Khampho
- all villages along the southern edge of the reserve.

Paths provide easy access to almost every pool in the lowlands, within two hours from the nearest vehicular access. All sections of major stream visited had trails alongside them unless the course was rocky and could be easily walked.

One major footpath of particular significance was found leading down from the Bolovens Plateau to the lowlands. It was walked uphill from Houay Nyat (a tributary of the Houay Namphak) to a major junction. People met at the junction stated that it was a four hour walk from there to Ban Nonglouang on the plateau, and a one hour walk down to the Houay Touay-Gnai. Since our guides and several other people from Ban Nongkhe were unaware of this trail, and the section near Houay Nyat was relatively poorly marked, it is probably used mainly by people from Ban Nonglouang.

PART 2. SURVEY DESCRIPTION

2.1 Aims

A wildlife survey of DHS, then a proposed protected area, was conducted in mid-1993 (Timmins *et al.* 1993), shortly before the area was formally gazetted as a National Biodiversity Conservation Area. This report covers a second wildlife survey conducted during February-March 1996.

To assess the condition of the major habitats and the presence of Key wildlife species in and around the protected area with a view to making recommendations for management, the following objectives were set:

2.1.1 Habitat specific

a) A description of habitat types occurring in the protected area.
b) An assessment of overall habitat conditions with particular reference to settled parts of the study area and the detrimental effects of human use.
c) The identification of critical habitats within the study area and an evaluation of the relative importance of habitats to selected wildlife species.
d) A description of changes since the 1993 survey.

2.1.2 Wildlife specific

a) The determination of the status and distribution of species of conservation interest.
b) A list of bird and mammal species confirmed to occur in each habitat, with assessment of status.
c) The collection of incidental data on hunting practices, with levels and localities.
d) The training of local staff in species recognition and survey techniques was a subsidiary objective.

2.2 Participants

Four survey specialists (Tom Evans, Anthony Stones, Richard Thewlis and Howard Towll) participated, with two (TE and HT) present for the full period of the survey. All four conducted opportunistic diurnal observations of mammals and birds; TE also undertook interviews with local hunters. Four members of the DHS reserve staff (Chantavi, Khamhou, Padith and Somnuk) participated as counterparts, with Chantavi present for the whole survey. The counterparts gathered diurnal observations in the company of the survey specialists and made some additional observations whilst working alone. They were also invaluable in assisting with interviews, assessments of human use and logistics.

2.3 Survey method

The methodology followed that of previous wildlife and habitat surveys of protected areas in Laos (for example Duckworth *et al.* 1993, Timmins *et al.* 1993, Timmins and Bleisch 1995, Evans *et al.* 1996). The survey aimed to cover all habitats within the protected area, concentrating in particular on areas not covered on the previous survey, and areas where Key species (those of elevated conservation concern) were reported to occur.

Details of methods used, limitations and the selection of Key species are included in Annexes 2 and 3.

2.4 Survey dates and sites

The locations covered in 1993 and 1996 are shown on Figure 3. Six areas of the lowlands were visited in 1996. Field dates and number of person-days devoted to wildlife surveys, are given in Table 2. Time spent in transit when no field observations could be made are not included. One or more observers moving together for a full day count as a single person-day.

Table 2 Study areas and coverage in DHS in 1996

Area	Sectors (Figure 1)	Dates	Observer-days
Houay Takit campsite	2, 5	31 January - 6 February	14
Ban Houay Phoung	9, 10, 14	7-11 February	8
Middle Houay Namphak			
Ban Nongkhe*	6, 8	13-15 February	6
Houay Nyat mouth campsite	6	16-19 February	8
Houay Bangliang Valley	4, 4E	17 February; 21-24 February	12
Ban Somsup			
areas north of village*	17W	26-27 February; 29 February-1 March	2
Quan Mou (called Quan Moor by Timmins *et al*. 1993)*	17E	27-29 February	4
Houay Touay Noy/Gnai confluence			
Nong Khouang campsite	13, 16	27 February - 1 March	7
Ban Nabon*	16	26 February	1

* Area also surveyed in 1993

PART 3: FINDINGS WITH RESPECT TO HABITATS AND HUMAN USE

3.1 Habitats

3.1.1 Terrestrial habitats

Terrestrial habitats were classified according to landform, vegetation cover degradation and use intensity. The habitat map in Timmins *et al*. (1993) accurately classified the habitats over most of the areas visited for the first time in 1996. The following minor discrepancies were noted, and are incorporated in the revised habitat map in this report (Figure 4):

1) The extent of 'scrub and other degraded habitats in a mosaic with cultivation and settlements' was mapped too extensively west of Ban Houayton by Timmins *et al*. (1993). South of Ban Houay Phoung such habitat only extended to the Houay Touay-Gnai; south of this river degraded semi-evergreen forest was found, an area of habitat which may extend south to Ban Houaysot (Ban Hang). The westerly extent of the Ban Houayton enclave is not known.

2) The semi-evergreen forest mapped by Timmins *et al*. (1993) in various directions to the north of Ban Somsup actually forms a mosaic with patches of mixed deciduous forest as far as 3 km from the village, both along the main access road and along foot trails northwards.

3) Forest towards the head of the Houay Bangliang gorge was mapped as plateau forest by Timmins *et al*. (1993) but is perhaps better considered as slope forest, since it lies below 800 m.

It should also be noted that the past extent of logging in the Houay Touay-Gnai headwaters, thought to be one of the richest lowland areas of the reserve, remains uncertain, as does the extent of unlogged forest in the Houay Bangliang valley.

Table 3 summarises the distribution of the major habitat types and their associated Key species communities. Annex 4 contains more detailed notes on the habitats of the various sectors visited.

The most important terrestrial habitats for Key species were the unlogged slope forests, the unencroached plateau forests and the salt-licks found at Houay Bong. Mixed deciduous forest is also of high significance as the principal habitat of Green Peafowl *Pavo muticus* in DHS.

The few remaining areas of unlogged flatland semi-evergreen forest would be of very high value but are too limited in extent to be important priorities for management. Logged semi-evergreen forest on the flat lowlands is important for many of Key bird species whose populations in DHS are of moderate rather than high national significance (e.g. Hill Myna *Gracula religiosa* and Javan Frogmouth *Batrachostomus javensis* [provisionally identified]).

Table 3 Habitats of DHS - their distribution and relative importance for Key species.

Habitat	Flat lowlands	Slopes	Plateau (1993 data)
Semi-evergreen/evergreen forest: old growth	Very scarce, small remnant patches amongst logged forest, or at foot of slopes *Red-collared Woodpecker plus other birds and mammals as logged lowland forest* HIGH VALUE, but scarce and patchy	Extensive single unit, including Houay Bangliang valley, main escarpment and foothills around Houay Namphak/Houay Touay-Gnai headwaters..Interspersed with significant areas of very steep slopes with much bamboo. Montane and lowland species present, but some not throughout. *Centre for large mammal and bird populations: gibbon, Douc Langur macaques, Tiger, Gaur, bears and Black Giant Squirrel, Wreathed and Great Hornbills, Grey Peacock-Pheasant, Silver Pheasant, Siamese Fireback, Red-collared Woodpecker, Bar-bellied Pitta.* HIGHEST VALUE	Two units: west (Phou Pong, Sayphou Dan, gentle slopes) and south (Phou Tabeng, Phou Pongkham, steeper slopes). Not yet surveyed. *Probably important for gibbons, Douc Langur,macaques, Tiger, Gaur, Black Giant Squirrel, Silver Pheasant, Grey Peacock-Pheasant, Bar-backed Partridge, Green Cochoa and Red-tailed Laughingthrush* Probably HIGH VALUE
Semi-evergreen/evergreen forest: lightly logged	Patches amongst more heavily logged forest. Significant areas include Ban Nongkhe to Ban Houay Phoung, upper Houay Huaxang to Houay Bangliang and riverine forest near Quan Mou. Many wetlands (see Table 4). *Mammal densities low and patchy. Small numbers of gibbons, macaques and probably Silvered Langurs. Bears present. Wild cattle in Houay Takit area. Wreathed Hornbills present at lowered densities. Good densities of Bar-bellied Pitta and Grey-faced Tit-Babbler. Siamese Fireback, Blue-rumped Pitta, Eastern Green Magpie and Green Imperial-Pigeon present.* MODERATE VALUE, especially where close to hill slopes. High value if allowed to recover.	None observed.	Strips amongst coffee plantations especially east of Houay Namphak and north of Phou Pongkham. *Poor for large mammals. Densities of pheasants, partridges and hornbills not thought to be high. Green Cochoa and Red-tailed Laughingthrush common.* LOW VALUE
Semi-evergreen /evergreen forest: heavily logged	Dominant habitat. Large areas, e.g. Sectors 5, 8, 16 Many wetlands (see Table 4). Few mammal records: probably low densities of bears, Dhole, macaques. Also occasional gibbons and possibly Silvered Langurs. Good numbers of Grey-faced Tit-Babbler and Bar-bellied Pitta, Siamese Fireback also probably present. LOW VALUE	None observed.	Little observed, often fragmented, at margins of cultivation. *Green Cochoa present in some areas.* VERY LOW VALUE
Pine forest and rocky flats with grass	None observed.	None observed.	Present on many flat hilltops, especially on Sayphou Dan (west arm of plateau) and north of Phouy Pongkham (south arm), where heavily grazed by domestic stock. Little survey effort. *May be important for grazing animals (Gaur and others) and associated predators (e.g. Tiger). No Key bird species expected.* MODERATE VALUE. Western areas within an unlogged forest area of high importance.

Table 3 continued

Habitat	Flat lowlands	Slopes	Plateau (1993 data)
Mixed deciduous forest	Extensive block in south-east, with patches around Ban Somsup. Strong gradient of increasing degradation close to Somsup and probably other villages. *Few large mammals recorded or reported. Unsuitable habitat for primates. Bears present, Dholes expected, occasional visits by big cats and wild cattle suggested by villagers.* *Remnant Green Peafowl population. Also Green Imperial-Pigeon and White-bellied Woodpecker.* MODERATE VALUE, lowered if peafowl extinct.	None observed.	None observed.
Cliffs	None present.	Extensive, mainly above 600 m. *Serow reported.* MODERATE value. Included within slope areas of high value, above.	None observed.
Salt-licks	Present in Houay Pong area. Extensive complex, including open grassy fields and smaller licks under trees. Much of area with unusual stunted evergreen forest. Conflict with seasonal human settlement. *Key area for ungulates, mainly commoner species but also probably Gaur. Associated predators such as Tiger and Dhole might occur.* HIGH value, compromised by human presence.	None located or reported. May occur.	None located or reported. May occur.
Coffee, cultivation and scrub around settlements.	Extensive around Ban Nongkhe, Ban Houay Phoung and Ban Houayton. Also expanding at Quan Mou. *Probably visited by larger mammals from surrounding forests, which may find good feeding amongst crops or early successional growth (e.g. commoner ungulates, associated predators and bears). Value restricted by hunting pressure. Few Key bird species.* LOW value given high hunting levels, probably moderate otherwise.	None observed.	Extensive around villages on plateau, extending well inside reserve boundaries in both southern and western arms. Continuous near villages, patchy within reserve. *Probably visited by larger mammals from surrounding forests, which may find good feeding amongst crops or early successional growth (e.g. commoner ungulates, associated predators and bears). Value restricted by hunting pressure. Few Key bird species.* LOW value given high hunting levels, probably moderate otherwise.

3.1.2 Pools

Over 140 pools occur in the flat lowlands of DHS, almost all in logged forest. Five pools are known to occur in the plateau forest. Table 10 (Annex 4) details all pools visited in 1996. Figure 5 places the pools in defined groups thought to differ in importance for wildlife and degree of human use. These are summarised and ranked according to value for Key species in Table 4. In general numbers of Key species using the wetlands are very low, but the habitat remains in good to excellent condition. Few reserves in South-East Asia contain such a great number or extent of wetlands in lowland semi-evergreen forest. The main reason for the low numbers of Key species is thought to be excessive hunting. Some wetlands are now occupied for cultivation. This drastically reduces their value for conservation. These sites are highlighted on Figure 7.

Two groups of wetlands are suggested to be most promising for the conservation of wetland birds: those in the Houay Takit sector (Sector 5) and those around Nong Hou to the south of Ban Houay Phoung (Sector 14). These are highlighted on Figure 5. These two areas still support a few storks, White-winged Ducks *Cairina scutulata* are reported from one and the habitat is in good condition. These two groups of pools are also thought to be less heavily used by people than those in other sectors, although use is still at levels threatening the survival of the few remaining large water birds. These two sectors contain a total of nine pools, a small proportion of the DHS total.

Four other areas, namely Nong Thamdin (Sector 2), the Ban Nongek region (Sector 20), the Ban Somsup region (Sector 17W) and the pools around the lower Houay Phoung (Sector 9), seem to offer moderate prospects for conservation of wetland birds. They contain numerous wetlands of high habitat quality and are probably not as intensively used as the remaining sectors. The wetlands around the middle Houay Namphak (Sector 8) were identified as being important in 1993 (Timmins *et al*. 1993), but by 1996 increased human use had reduced their value and other sectors are now ranked higher.

Many wetlands, especially those around Ban Houay Namphak (Groups 1, 7 and 12) remain to be visited.

Table 4 Management priorities amongst groups of pools in DHS

Sect.	Pools in sector			Relative importance of pools in sector	Key birds recorded	Human activity (refers to hunting and fishing unless stated)
	Total	Visited in 1996	Not on map (*)			
1 (**)	9	0	3	*Unknown, probably low.*	Not visited.	*Probably very high.*
2 (**)	6	4	2	*Probably moderate*	None. Brief visits.	*Probably moderate*
5	3	3	1	*High*	Woolly-necked Stork	*Moderate.* No cultivation or huts.
7	17	4	1	*Unknown, probably low*	None. Brief visits	*Very high*
8	13	9	0	*Moderate, declining*	Woolly-necked Stork and Oriental Darter (1993), none on brief visit in 1996	*High, increasing*. Houses and fields at four pools, two pumped dry by soldiers for fish. Boat at Nong Hia.
9	4	4	1	*Probably moderate*	None. Brief visits.	*Moderate to high*. One pool now under 'claimed' ownership.
12	10	0	1	*Unknown, probably low.*	Not visited.	*Probably very high.*
13	11	9	5	*Low*	None, despite good coverage.	*Very high*. Cultivation at one pool.
14	6	3	0	*High*	Lesser Adjutant. White-winged Duck reported.	*Moderate to low*. Remote from roads.
16	22	13	4	*Low*	Grey-headed Lapwing.	*Very high*
17W	10	6	0	*Probably moderate*	None, quite brief coverage.	*Moderate to high.*
18	3	0	0	*Unknown*	Not visited	*Probably moderate to high.*
19	11	0	0	*High if peafowl present, probably moderate otherwise*	Not visited in 1996. Peafowl reported.	*Probably moderate.*
20	9	0	0	*Unknown, probably moderate.*	Not visited in 1996.	*Probably moderate to high.*
23	1	0	0	*Low*	None. Visited in 1993.	*Probably low.*
26	4	0	0	*Unknown*	Not visited.	*Unknown.*

Sectors are those shown in Figure 1

(*) Some pools not on 1:100 000 topographic maps can be seen on 1988 SPOT satellite images held at National Office for Forest Inventory and Planning, (NOFIP) Vientiane.

(**) Excludes wetlands west of Houay Bangliang.

3.1.3 Streams

Four major streams dominate the drainage of DHS (Figures 3 and 5). Their lower, middle and upper reaches are assessed with respect to Key species, human use, location and overall value for wildlife conservation (Table 5, Figure 6). Since almost none of the streams can be surveyed by boat, long parts of each stretch remain unvisited, and this should be seen as a first, tentative assessment of quality. The lowland stretches are thought to be more important for Key species than the smaller, faster-flowing streams on the plateau. However, land-use changes on the plateau threaten to affect the water quality and flow regime of these more important stretches.

The most important stretches are tentatively identified as the lowland part of Houay Touay-Gnai upstream of Ban Houay Phoung and the Houay Namphak upstream of Ban Nongkhe (including Houay Nyat). These stretches are highlighted on Figure 6.

Stretches thought to be of moderate value, with the potential to be of high value if human use is reduced, are the middle reaches of Houay Namphak from Ban Nongkhe to Houay Takit, the middle reaches of Houay Touay-Gnai around Ban Houay Phoung and the former site of Ban Nongkhou and the middle reaches of Houay Touay-Noy around Ban Somsup. The middle reaches of Houay Bangliang are probably also in this class. All other reaches are suspected to be too close to areas of human habitation to offer good prospects for the conservation of Key species.

Table 5 Management priorities amongst stretches of major streams in DHS

Stream	Terrain and stream type	Probable/potential importance for Key species	Key species recorded (1), suitability for riverine Key species	Human use (of the stream and its banks and floodplain)
Houay Bangliang				
A Upper reaches	Steep-sided valley (almost sheer sides in east), fast flowing river over boulders.	*Mid to low*. Excellent habitat but heavily used.	None	*High*. Many fishing parties from villages to the north. Banana plantation. Logging reported at Houay Koy, downstream end.
B Middle reaches	Not visited. Valley sides still steep, course less steep but still probably many rapids and boulders.	*Possibly mid*, depending on human use. Not visited.	Possibly suitable for LFE and otters.	*Unknown*. Villages more distant than in Sector A. Logging reported at Houay Koy, upstream end.
C Lower reaches	Briefly visited. Valley sides not steep. Descent moderate.	*Probably low*. Brief visit.	None	*Probably high*. Teak plantation. Vegetable gardens on banks.
Houay Namphak				
A Plateau reaches	Large rocky stream, slow-flowing in places on gentle slopes.	*Probably low to moderate*, since small and high elevation.	None. BK and otters possible.	*Moderate, growing*, Remote from villages but coffee plantations expanding rapidly, already on banks by 1993.
B Slopes reaches	Large stream flowing amongst very large boulders, very steep descent.	*Probably low to moderate*, since slopes very steep.	May be important for otters.	*Probably low*.
C. Middle reaches above Ban Nongkhe, including Houay Nyat	Two large streams joining to form small river, moderate descent with rocky stretches and pools.	*Moderate*.	BK, otter. Suitable for LFE.	*Moderate.* Fishing and hunting increase when Ban Nongkhe villagers complete renovation of coffee fields.
D Middle reaches at Ban Nongkhe	Small river, moderate descent with rocky stretches and pools.	*Low*	None	*High*. Borders village and coffee fields, although banks still mostly forested. Coffee within 20 m of southern bank.

continued, with key, overleaf;

Table 5 continued

Stream	Terrain and stream type	Probable/potential importance for Key species	Key species recorded (1), suitability for riverine Key species	Human use (of the stream and its banks and floodplain)
Houay Namphak				
E Middle reaches downstream of Ban Nongkhe to Houay Takit	Small river, gentle descent with some rocky stretches and long pools.	*High (if crocodile confirmed).* Potentially high even without presence of crocodile.	Crocodile reported. LFE, otter and other species possible	*Moderate, locally high*. Remote from villages, but some huts near Nong Hia and easy access down several side roads from Nongkhe road. Water diversion to Houay Namsai for irrigation.
F Lowest reaches	Increasingly wide. Gentle descent, but several attractive rapids and small waterfalls.	*Probably low*. Not visited.	None	*High*. Close to large village.
Houay Touay-Gnai				
A Slopes reaches	Large stream flowing amongst very large boulders, very steep descent.	*Probably low to moderate*, since slopes very steep.	May be important for otters.	*Probably low*.
B Upper reaches	Hilly, quite steep descent, probably many rapids and boulders.	*Probably moderate to high*. Not visited.	Probably suitable for BK, LFE, otters.	*Probably low to moderate*. Remote from villages. Not used by Ban Nongkhe, reportedly seldom used by Ban Houay Phoung. Access from Ban Nonglouang.
C Middle reaches near Ban Houay Phoung	Steep valley sides Steep descent near Nong Hou, gentle below.	*Probably moderate.* Potentially high. Brief coverage.	LFE. Probably suitable for otters and other birds.	*Probably moderate to high*, may increase if people in Ban Houay Phoung reduce effort on coffee. Also users from outside reserve.
D Middle reaches near former site of Ban Nongkhou	Steep valley sides. Gentle descent.	*Possibly moderate.* Potentially high. Brief coverage.	Probably suitable for LFE and otters and other birds.	*Probably moderate to high*, since easy road access. No nearby villages. Paddle boat present, suggesting easy boat access and regular use.
E. Lower reaches	Steep valley sides. Gentle descent.	*Probably low*. Not visited.	Probably good habitat but very heavily used.	*Probably high to very high*. Several large villages nearby.
Houay Touay-Noy				
A Upper reaches	Small to medium stream. Moderate descent. Mostly fringed by scrub.	*Probably low* Not visited.	Possibly BK	*Probably high*. Close to Ban Houayton.
B Quan Mou reaches	Medium stream Gentle descent with some rocky stretches.	*Probably low to moderate, declining*. Brief coverage	Possibly BK, LFE	*Probably moderate, increasing*. New settlement.
C Ban Somsup reaches	Medium stream, Moderate to gentle descent.	*Possibly moderate* Not visited	Possibly LFE	*Possibly moderate*.
D Ban Nabon reaches	Medium stream, Moderate to gentle descent.	*Low*	None	*High to very high*. Several large villages nearby.

(*) BK = Blyth's Kingfisher; LFE= Lesser Fish-Eagle. 'Other possible species' include Oriental Darter (Globally near-threatened). White-winged Duck (Globally threatened), Masked Finfoot (Globally threatened) and Tawny Fish-Owl (Globally near-threatened), which are known from similar habitat (especially slow-flowing reaches of streams and rivers) elsewhere in southern Laos.

3.2 Human use

3.2.1 Human uses of DHS

Levels of human use were high over large areas of the reserve. The following notes should be read in conjunction with the findings of Timmins *et al*. (1993). Since surveys concentrated on searches for wildlife, records of human use were patchy and opportunistic. They doubtless omit many inconspicuous, localised or seasonal uses. However, together with observations of the densities of vulnerable wildlife species, these notes give some indication of human pressures on the various sectors of the reserve.

Observation concentrated on the interior and data on cultivation and settlements is incomplete for most peripheral areas. Table 11 (see Annex 4.2) highlights the main uses for each sector, and indicates their likely impact on Key wildlife species. Figure 7 shows some of the more localised uses. A few general comments on the categories in Table 11 are given below.

- Agricultural expansion was felt to be a less significant threat than coffee cultivation within the reserve. It was noted in two extensive localities (Ban Houay Phoung and Ban Houayton), one less extensive area (in the Houay Takit sector) and locally at a number of pools in the Middle Houay Namphak sector. Encroachment around the boundaries of the reserve was not investigated.

- Coffee cultivation, noted to be a critical threat in 1993 (Timmins *et al*. 1993), had expanded in at least one area (around Ban Houay Phoung), intensified (around Ban Nongkhe) and become established in at least one new location (Quan Mou) since the 1993 survey. In 1996 observations of Sector 25 were made (Table 11) suggesting that this threat continues to impact on the plateau forests.

- No large-scale logging operations were observed, although a road reportedly built for logging in an unsurveyed area was seen near Houay Bangliang. Small scale logging was widespread and large, felled trees with sections removed for planks or pillars were seen around every village.

- Incidents of hunting were seldom observed, though gunshots were heard in most sectors. Trap remains, prey remains and the shyness and low density of quarry species showed that hunting pressure was medium to high even in most of the remoter sectors visited and high to very high closer to permanent settlement. Plucked feathers from shot birds and fur from shot mammals were common, invariably at stream crossings, poolsides, sandbars or rocky flats by rivers where people had camped. Feathers of Oriental Pied Hornbills *Anthracoceros albirostris* and Green-billed Malkohas *Phaenicophaeus tristis* predominated but many other medium-sized species were involved, for example woodpeckers, Cinnamon Bittern *Ixobrychus cinnamomeus*, unidentified eagles, Orange-breasted Trogon *Harpactes oreskios*, Greater Coucal *Centropus sinensis*, Large Cuckoo-Shrike *Coracina macei*, Blue Whistling Thrush *Myiophoneus caeruleus* and Finlayson's Squirrel *Callosciurus finlaysoni*. Remains of both species of porcupine were also found. Almost every suitable site visited had signs of camping, except in two areas, the upper reaches of Houay Nyat and along the trail from Houay Sout towards Houay Takit. In both these areas old camps were more scarce, suggesting somewhat lower levels of hunting.

- Piles of plucked feathers of snared birds (e.g. Red Junglefowl *Gallus gallus*, Siamese Fireback *Lophura diardi*, Grey Peacock-Pheasant *Polyplectron bicalcaratum*, partridges and pittas) were found in the above areas and in all other sectors (except around the Houay Nyat-Houay Namphak confluence), suggesting that snaring occurs almost throughout the lowlands and lower hill slopes of the reserve. Long snare lines were mainly found close to human habitation, but could have been overloooked elsewhere since the paths leading to them can be difficult to detect.

- Most sand and gravel areas on riverbanks showed signs of repeated searches for the eggs of the large agamid lizard known as 'katang'. Two adults were seen captured along the

Houay Bangliang and a local guide caught one for examination and release with great ease by diving after it in a pool along Houay Nyat.

- Judging from the ubiquity of evidence in surveyed areas, fishing is presumed to occur at high levels in almost all watercourses and pools in the lowlands of the reserve, except for streams on the steepest slopes. Road access probably greatly increases fishing levels in several sectors of the reserve. Several fishing parties met with carried one or more guns and some also set snares near their campsites. Since fishing is so common it is believed to contribute greatly to the overall level of opportunistic hunting.

- Tapping of dipterocarp trees for yang oil was noted at low levels in all sectors, with up to five active ovens seen per sector.

- Many people encountered on roads or paths in the reserve were carrying small bundles of small-diameter rattans, presumably for domestic use. These may well be gathered in the course of other activities in the forest.

- 'Mak chong' (Malva nuts) were reportedly widely gathered in the reserve during 1995, when the crop was particularly large. A few felled ‘mak chong’ trees were encountered. Many more could have been overlooked. The nuts can be collected when they fall to the ground, but some trees are felled to allow a higher proportion of the nuts to be gathered. The crop is erratic, with large ‘mast’ crops sometimes occurring as seldom as one year in seven (J. Foppes IUCN Non-Timber Forest Products Project, pers. comm. 1996).

3.2.2 Critical threats

In 1993, habitat loss was considered to be the most serious problem on the plateau, but associated increases in hunting were also significant.

As sections 4.3 and 5.3 conclude, the principal pressure on the great majority of Key mammal and bird species of the lowlands and hill slopes is thought to be hunting, of a variety of forms including opportunistic shooting, targeted shooting, trapping and snaring.

Suitable habitat for most of the Key species remains abundant and localised loss was not, in itself, considered to be a major current problem except in some locations as follows:

- serious in plateau sectors 24, 25 and 26, where large areas of old growth forest are cleared (no first hand information acquired in 1996, but already observed during the 1993 survey).

- in lowland enclaves, notably Ban Nongkhe, Ban Houay Phoung, Ban Houayton, Ban Nongphu and Ban Nongek there is a limited threat, because these villages are not encroaching on prime forest and the latter three are not increasing in size at a rapid rate. However, both Ban Houay Phoung and Ban Nongkhe are located in the geographical centre of DHS and close to the areas with high conservation value. They pose a latent if not critical threat.

- temporary or permanent occupation of wetlands as indicated by the presence of huts and small clearings. These are considered to pose a critical threat where they are located inside an area with high There are at least ten locations where this occurs (Figure 7).conservation value.

Logging does not seem to pose an acute and critical threat except in the plateau sectors 24, 25 and 26.

Important forms of targeted hunting are listed in Table 11. Also listed are other human activities for which increased hunting levels are the principal negative impact on wildlife. Hunting in areas with few remaining key species has been considered a low or moderate impact, but it prevents recolonisation of extensive areas of suitable habitat.

Table 6 outlines the likely broad levels of threat to Key species populations in the sectors of the reserve. Direct evidence is sufficient for a coarse classification in 16 of the sectors (first row). An even more approximate assessment is attempted for the remaining sectors (second row), to indicate areas where clarification of threats is most urgently required.

Table 6 Summary of overall impact levels for each sector of DHS

Impact level (fromTable 11)	**x (low)**	**xx (moderate)**	**xxx (high)**
Sectors where direct evidence sufficient to assess	13, 16	2, 4, 6, 9, 10, 15, 17W, 20, 24, 25	5, 8, 14, 17E
Sectors where position, habitat and access data allow tentative prediction	1, 7, 12 (low value, high use) 11 21, 22, 27 (high value, low use)	3, 18	19, 23, 26

For Sector numbers, see Figure 1.

In the lowlands a pattern is visible, whereby the most westerly sectors close to areas of high human population (certainly Sectors 13 and 16, probably also 1, 7, 12) are experiencing the highest levels of human use. Since they are thought to be largely depleted of vulnerable Key species, continuing impacts are probably relatively low.

The least-accessible areas (Sectors 4, 6, 11, 21, 22 and 27) are likely to be experiencing moderate or low impacts, mainly hunting by visiting groups, and as a consequence they also probably support the most important populations of most Key species other than large waterbirds. Growing human populations, improving access and declines in quarry populations in over-hunted sectors will probably soon lead to increased impacts in these sectors.

Around the least accessible areas is a belt of more accessible areas which still retain important Key species populations but are under varying types of pressure leading to moderate or high impact. The principal pressures detected in these sectors are listed below; other uses can be found in Table 11:

Sector 5 (high impact): hunting and disturbance around seasonal settlement at salt-licks, combined with hunting of large waterbirds and, potentially, of crocodiles

Sectors 9 (moderate impact), 14 (high impact) 17W (moderate impact): hunting of large waterbirds at pools and along rivers.

Sector 8 (high impact): hunting of large waterbirds, together with disturbance and habitat damage stemming from settlement and pumping of pools for fish. Rapidly growing enclave village.

Sector 17E (high impact): hunting of peafowl and isolated gibbon *Hylobates* sp. population. Newly established settlement.

Sector 19 (possibly high impact): hunting of peafowl if reported population confirmed

Sectors 23 (probably high impact), 24 (moderate impact), 25 (moderate impact), 26 (probably high impact): clearance of old growth plateau forest for extensive coffee plantation with heavy hunting in remaining forest strips. New settlements associated. Sector 26 experiences further high impacts because a new road has been built and old-growth forest is being logged.

Sector 10 (moderate impact), 15 (moderate impact): enclave villages where hunting of gibbons and clearance of moderately good quality forest with populations of commoner Key species probably occurring

The most severe impacts on Key species were thus found to be occurring in Sectors 5, 8, 14, 17E (Figure 1). They are also suspected to be high in Sectors 19, 23 and 26.

PART 4 .FINDINGS WITH RESPECT TO BIRDS

4.1 Completeness of coverage

About 60 species were added to the list for DHS, bringing the total to about 300 (including a few provisionally identified, or not identified to species). Unlike the 1993 survey, work in 1996 coincided with the presence of many Palearctic migrants, which contributed a high proportion of the additions.

Almost no new coverage was attempted above 600 m. The remotest and presumably richest areas of plateau forest remain unstudied and may well support important populations of game-birds and hornbills as well as a rich small bird fauna. Many additional migrants can also be expected to occur at these altitudes.

Below 600 m, the flat lowlands have been better covered than the slopes in both 1993 and 1996. It is clear from the fact that eight Key bird species were recorded for the first time on this survey that the list of species is still incomplete at these altitudes. Those which remain to be found are probably present in very small numbers, occur erratically or are particularly secretive. Likely candidates include White-winged Duck, other large waterbirds and Tawny Fish-Owl *Ketupa flavipes*, and further surveys in the flat lowlands should thus be focussed on the remoter pools and stretches of river suitable for these species. Searches of the hill slopes may produce more records of such species as Great Hornbill *Buceros bicornis* and Grey Peacock-Pheasant, as well as, possibly, Coral-billed Ground-Cuckoo *Carpococcyx renauldi*.

Coverage of the deciduous forests in the south has been localised and relatively brief. Two likely Key species have yet to be found there (Annex 4.4), and the true status of Green Peafowl has not been determined.

4.2 Status of Key bird species

Twenty-nine Key bird species are now confirmed or provisionally recorded from DHS (Table 7). This is a relatively large number compared with several other reserves surveyed recently in Laos (e.g. Phou Xang He [Duckworth *et al*. 1993], Xe Bang Nouan [Timmins and Bleisch 1995], Phou Xiang Thong [Evans *et al*. 1996]). Key factors are the wide altitudinal range, the large extent of lowland forest and the high level of ornithological coverage (approximately five person-months to date). The relatively small populations of the more important species mean that few can be considered of high global significance, and the overall species assemblage is probably of high, rather than very high, significance. However, this richness of species suggests that, given reduced human activity, the reserve could become more significant in the future. Key species present are discussed below in a number of ecological groups. Detailed accounts for each species can be found in Annex 5, and locations of selcted records are shown on Figure 8.

Green Peafowl (Globally threatened) are still believed to survive in small numbers in the southernmost part of DHS (there were reports in 1996 from Quan Mou and near Nong Bouaton, Figure 8), but this could not be confirmed during the survey. Numbers are likely to have declined at Quan Mou since 1993 (when presence was confirmed there, Timmins *et al*. 1993) due to the establishment of a new settlement there. The species is at a high risk of extinction in DHS.

Small numbers of large waterbirds were found in both 1993 and 1996 associated with the numerous pools in semi-evergreen forest of the lowlands (Figure 8). Woolly-necked Stork *Ciconia episcopus* (Regionally at risk) and Lesser Adjutant *Leptoptilos javanicus* (Globally significant) were the most significant found in 1996. Oriental Darter *Anhinga melanogaster* (Globally near-threatened) was not confirmed in 1996. Reports suggested small numbers of White-winged Ducks (Globally threatened) may occur, at least sporadically, in the same area as the Lesser Adjutants. These species, once considered abundant throughout lowland Laos, are acutely vulnerable to hunting, which has reduced them to their current extreme rarity (Thewlis *et al*. in prep.). A party of Grey-headed Lapwings *Vanellus cinereus* (Globally near-

threatened) was observed just outside the reserve on an extensive area of dry paddies - this species is less hunting-sensitive.

Two species, Lesser Fish-Eagle *Ichthyophaga humilis* (Globally near-threatened) and Blyth's Kingfisher *Alcedo hercules* (Globally threatened), are closely associated with the larger streams in the lowlands (confirmed records shown on Figure 8, see also Table 5). They occur naturally at low densities and the reserve probably supports only a handful of individuals of each species.

The extensive forests of the lowlands and lower slopes support large, healthy populations of Bar-bellied Pitta *Pitta ellioti* (Globally near-threatened), Grey-faced Tit-Babbler *Macronous kelleyi* (Globally near-threatened) and Hill Myna (Regionally at risk), moderate numbers of Wreathed Hornbills *Rhyticeros undulatus* (Regionally at risk) and a few Great Hornbills (Regionally at risk). The hill slopes are thought to be a key refuge for hornbills, which are vulnerable to the high hunting in flatland areas, and find few suitable nesting trees in logged forest (see Figure 8 and Table 13). There are also a number of less vocal or more elusive species such as Siamese Fireback (Globally threatened), Javan Frogmouth (Regionally at risk, provisionally identified), Blue-rumped Pitta *Pitta soror* (Globally near-threatened) and Golden-crested Myna *Ampeliceps coronatus* (Regionally at risk) which are probably also present in moderate numbers. Red-collared Woodpecker *Picus rabieri* (Globally threatened) appears to occur at very low densities in the flat lowlands (this may be a result of logging) but there are higher densities on the lower hill slopes.

Four species are probably more or less restricted to forest of the level lowlands: Malayan Night Heron *Gorsachius melanolophus* (Globally near-threatened), Green Imperial Pigeon *Ducula aenea* (Regionally at risk,see Figure 8), Black-and-red Broadbill *Cymbirhynchus macrorhynchos* (Regionally at risk) and Eastern Green Magpie *Cissa hypoleuca* (Globally near-threatened). The magpie seems particularly scarce, possibly due to logging.

Relatively good numbers of wintering Brown-rumped (Rosy) Minivets *Pericrocotus* (*roseus*) *cantonensis* (Globally near-threatened) were found in semi-evergreen forest in 1996. The habitat preferences of this species seem varied and little is known about threats to it.

Three Regionally at risk species, Silver Pheasant *Lophura nycthemera*, Grey Peacock-Pheasant and Bar-backed Partridge *Arborophila brunneopectus*, probably occur widely across the hill slopes and plateau forests, but since they are all quite elusive there are few records from which to assess population size.

Only one Key species typical of deciduous forests has been found, the White-bellied Woodpecker *Dryocopus javensis* (Regionally at risk), and there is only one record of this species.

Two smaller Key species, Red-tailed Laughingthrush *Garrulax milnei* (Globally near-threatened) and Green Cochoa *Cochoa viridis* (Globally near-threatened) are probably strictly montane in DHS. They were common above 1000 m in 1993 survey (Timmins *et al*. 1993). No new information was gathered about them in 1996.

Five other species listed as Key species by Timmins *et al*. (1993) are no longer treated as such, namely Red-vented Barbet *Megalaima lagrandieri*, Pale-headed Woodpecker *Gecinulus grantia*, Black-throated Tit *Aegithalos concinnus*, White-cheeked Laughingthrush *Garrulax vassali* and Mountain Fulvetta *Alcippe peracensis* (Thewlis *et al.* in prep.).

Table 7 Status of Key bird species in DHS

Species	93	96	Imp. Glo.	Nat.	Threat Hun.	Hab.	Location, numbers and notes
Oriental Darter	+	-	Low	Mid	High	Local	Pools (Nong Hia in 1993). Very few.
Purple Heron	+	+	Low	Low	High	Low	Pools. Few.
Malayan Night Heron	+	-	Low	Mid	Low	Low	Streams and pools in lowlands. Common, at least locally. Elusive, seasonal caller.
Woolly-necked Stork	+	+	Low	Mid	High	Local	Less-disturbed pools, (Figure 8). Possibly single pair.
Lesser Adjutant	-	+	Mid	Mid	High	Local	Less-disturbed pools, (Figure 8). Possibly only two.
[White-winged Duck]	-	-	?	?	High	Local	Reports from Nong Hou. May not breed, may be extinct.
Lesser Fish-Eagle	-	+	Low	Mid	High	Low	Less disturbed large lowland streams. One record, may no longer breed.
Silver Pheasant	+	+	Low	Mid	Mid	Mid/ low	Plateau and slopes down to 450 m. Numbers unknown, suspected to be good.
Siamese Fireback	[+]	+	Mid	Mid	Mid/ High	Low	Logged and unlogged lowlandsup to 500 m (possibly higher). Numbers unknown, possibly moderate.
Grey Peacock-Pheasant	-	+	Low	Mid	Mid	Mid/ low	Slopes, probably also plateau forest. Elusive seasonal caller - numbers probably moderate.
Green Peafowl	+	-	Mid?	High	High	Local	Reports from Nong Boua-ton. Possibly now extinct Quan Mou. Numbers very low, possibly extinct.
Bar-backed Partridge	+	-	Low	Mid	Mid	Mid/ low	Plateau, probably also slope forest. Elusive seasonal callers - numbers probably moderate.
Grey-headed Lapwing	-	+	Low	Low	Mid?	Low	Extensive pools along southern edge. Numbers probably low (limited habitat), but more outside reserve.
Green Imperial Pigeon	+	+	Low	Mid	High	Low	Patchy presence around pools and streams in flat lowlands, especially middle H. Touay-Gnai and southwards. Numbers probably lowered by hunting.
Great Hornbill	-	+	Low	Mid	High	Low	Present on slopes. Numbers uncertain, but low.
Wreathed Hornbill	+	+	Mid	Mid	High	Low	Fairly common on slopes, less so in logged lowlands and encroached plateau forest, very rare in south-west.
White-bellied Woodpecker	-	+	Low	Mid	Low	Mid/ low	One record from semi-evergreen/mixed deciduous interface. Numbers possibly moderate.
Red-collared Woodpecker	+	+	Mid	Mid	Low	Mid/ High	Present on lower slopes, scarce and patchy in flat lowlands (preferred habitat) probably due to logging
[Javan Frogmouth]	[+]	[+]	Low	Mid	Low	Low	Present in lowlands. tolerates logged forest, numbers unknown.
Blyth's Kingfisher	-	+	Mid	High	Low	Mid	One pair found along Houay Nyat. Suitable habitst scarce, probably <5 pairs in DHS.
Bar-bellied Pitta	+	+	Mid	Mid	Mid?	Low	Abundant in logged lowlands, also on lower slopes.
Blue-rumped Pitta	+	[+]	Mid	Mid	Mid?	Low?	Present in logged lowlands.
Black-and-red Broadbill	+	+	Low	High	Low	Low/ mid	Widespread in logged lowlands, where associated with pools and, probably, streams.
Eastern Green Magpie	+	+	Mid	Mid	Low	Mid?	Apparently very scarce in logged lowlands, possibly due to logging.
Brown-rumped Minivet	-	+	Mid	Mid	Low	Low	Present in several areas. Abundance unknown.

continued, with key, overleaf

Table 7 continued

Species	93	96	Imp. Glo.	Nat.	Threat Hun.	Hab.	Location, numbers and notes
Red-tailed Laughingthrush	+	-	Mid?	High	Low	Mid	Common in encroached and probably continuous plateau forests.
Grey-faced Tit-Babbler	+	+	High	High	Low	Low	Abundant in logged lowlands, also on lower slopes.
Green Cochoa	+	-	Mid	High	Low	Mid	Common in encroached and probably continuous plateau forests.
Golden-crested Myna	+	+	Low	Mid	Low/ mid	Low	Present in logged lowlands, probably also lower slopes. Secretive, numbers unclear.
Hill Myna	+	+	Low	Mid	Low/ mid	Low	Common in lowlands.

Key
Species in square brackets provisionally identified or based on unconfirmed reports.
93: recorded by Timmins *et al*. (1993) 96: recorded on current survey
Glo.: Global significance Nat.: National significance
Low: species low in importance, or small population in DHS if species more important
Mid: medium priority species with the DHS population globally or nationally significant
High: high priority species or major population of medium priority species
Very high: critically threatened species with significant population.
Hun.: Threat from hunting
Hab : Threat from habitat loss or degradation, including logging and water pollution (a few species may be at risk if a little habitat is cleared at the small number of pools they still use. They are marked 'Local'.)
Threats assessed on an intuitive scale.

4.3 Threats to birds

Table 7 indicates that many species are threatened principally by hunting. Of these, one group is the large waterbirds with their conspicuous habits and very restricted, easily hunted habitat. They require a sufficiently wide choice of non-hunted wetlands that they can roam between them as water levels change through the year. They are also vulnerable to quite localised habitat loss - for example cultivation on the edges of a few critical pools - since even in the absence of hunting, they are now very shy.

Another group are less conspicuous birds of semi-evergreen forest which are shot on an opportunistic basis - species such as hornbills, Green Imperial Pigeon and Lesser Fish-Eagle. This activity is not localised, although the latter two species are themselves quite localised (Figure 8).

The third group is the pheasants, partridges and pittas which experience fairly high levels of snaring. Populations of Bar-bellied Pitta appeared to be quite buoyant, but snaring levels are of moderate concern for Siamese Fireback and possibly the other pheasants. This use is not really localised, although the highest levels occur around enclave villages, seasonal or permanent, where people can invest time in long snare lines which need daily checking.

Green Peafowl is very vulnerable, because it is localised (Figure 8), conspicuous, provides a great deal of meat and during January-April offers feathers valuable for sale.

Red-collared Woodpecker is thought to be sensitive to logging, so that the progressive removal of the last tall trees from the flat lowlands may be affecting the remnant population there quite seriously. There may be a reservoir of birds in unlogged forest on the lower hill slopes. Logging in deciduous forest may also be affecting White-bellied Woodpecker, but this is of less concern.

Lesser Fish-eagle and Blyth's Kingfisher may be at some risk from water pollution (along Houay Namphak, Houay Nyat, Houay Touay-Gnai and possibly others) in the future, since both are riverine predators, vulnerable both to declines in fish or water quality and liable to accumulate dangerous loads of pesticides from their prey.

Hill Myna and Golden-crested Myna are often held to be at risk from trapping for the cage-bird trade, but there is no indication of the scale of the problem in DHS.

On the plateau, reduction of the extent of forest is a serious threat for both large and small birds. The three larger species (Silver Pheasant, Grey-Peacock Pheasant and Bar-backed Partridge) may be able to maintain populations on the hill slopes, but their numbers will be severely depleted by loss of the main plateau forests and by increased access for hunters to the slopes. The two montane passerines, Green Cochoa and Red-tailed Laughingthrush, are probably rare or absent on the slopes.

PART 5 FINDINGS WITH RESPECT TO MAMMALS

5.1 Completeness of coverage

Coverage was limited to areas below 600 m in 1996. Little new information concerning the communities of commoner diurnal species was collected over and above that collected in 1993. No nocturnal work was attempted, and this aspect of the mammal fauna remains very poorly known. Small mammals, including rodents, shrews and bats, remain wholly unstudied. Gibbons were among the most fully-recorded mammals in 1993 and 1996.

The least accessible areas of slope forest have yet to be well surveyed and offer limited opportunities for detecting footprints or other signs, but are nonetheless suspected to be the most important area for mammals. Distributions may differ markedly in the rainy season, when cattle, big cats and others are reported to roam more widely, but the relevant sectors (e.g. Houay Takit, Houay Bangliang, Ban Houay Phoung) were not all visited in the 1993 wet season.

The remoter areas of plateau forest, identified as priorities for survey by Timmins *et al*. (1993), have yet to be visited.

Annex 6 includes information on records of each species recorded for each sector.

5.2 Status of Key mammal species

Detailed accounts of Key species records are found in Annex 6.2. Selected records are shown on Figures 9 and 10.

Almost all of the larger mammal species are now very scarce or absent away from the unlogged slope forests, but some are still thought to retain moderate populations on the slopes themselves, and possibly in remoter parts of the plateau forest.

Gibbons occur in a globally important population. The majority is restricted to the hill slopes, including important numbers in the hills around the Houay Nyat and probably Houay Touay-Gnai headwaters (Figure 9). They are also reported to occur on the remoter parts of the plateau forest. In the flatter lowlands the population has been dramatically reduced in the past, presumably during the commercial logging phase, and only scattered groups occur. In the absence of further hunting and disturbance they could probably recolonise much of the flat lowlands.

Populations of other, less vocal primates were less well studied. They seem to reflect the distribution of gibbons, although macaques are somewhat commoner and one or two species may still occur widely, if very sparsely, in the logged lowlands. Only two forms have been confirmed, but it is possible that 4-5 species occur. Douc Langurs *Pygathrix nemaeus* remain extremely elusive and it must be feared that the population is small and highly threatened. There has only been one confirmed record (Figure 10) in the course of both wildlife surveys, although reports continue to be received of their presence on the upper slopes of the escarpment.

Evidence was found of a small number of wild cattle, probably Gaur *Bos gaurus*, in two areas of the hill slopes (Figure 10). Prints were also found on the southern arm of the Plateau in 1993 (Timmins *et al*. 1993). The total numbers are low. No fresh prints were found in 1996, and the seasonal movements of these animals may prove to be quite wide. Only one salt-lick area was found. Human activity there seriously reduces its value for wild cattle.

The only direct evidence of the presence of big cats was a single Tiger *Panthera tigris* footprint along Houay Nyat (Figure 10). Indirect evidence indicates that they also occur at times in several other sectors, but the total number must be very low (almost certainly five or less).

Scattered signs of bears (species unknown) were found in several sectors. Most signs were claw-marks on trees which are persistent and may exaggerate the apparent size of the population. One Sun Bear *Ursus malayanus* was seen in 1993 and another was reportedly seen by guides during fieldwork in 1996, both in the Middle Houay Namphak sector, also the only place where fresh footprints were seen in 1996.

There were no additional records of Dhole *Cuon alpinus* in 1996, and the population is still believed to be very sparse.

Elephants *Elephas maximus* no longer occur regularly in DHS, despite the extent of suitable habitat. There are reports of occasional wandering animals.

The great importance of the habitat link to the south-east of DHS should be restated. This was discussed in detail by Timmins *et al*. (1993). The area between DHS and Xe Pian NBCA is now a proposed protected area, Xe Khampho (Berkmüller *et al.* 1995), which in addition to its own high value would serve as a valuable bridge to link the two NBCAs. In this way seasonally roaming large mammals can reach optimal habitats, sparsely distributed species occur in larger effective population sizes (which are more likely to avoid chance extinction) and species severely depleted or extinct in DHS have the opportunity to recolonize from refuges in the other two areas. Logging is already heavy in Xe Khampho proposed protected area (Berkmüller *et al.* 1995). This, and the pace of expansion of the Lao road network, indicate that the habitat link is far from secure. If it is destroyed, DHS will be markedly impoverished.

Table 8 Status of Key mammal species in DHS

Species	93	96	Imp. Glo.	Nat.	Threat Hunt	Hab	Location, numbers and notes
[Slow Loris]	[+]	-	?	?	Low?	Unknown	One record on plateau. Little survey effort.
Pig-tailed Macaque	+	-	Low?	Mid?	High	Low	Mainly hill slopes.
Assamese/Rhesus Macaque	+	+	Low?	Mid?	High	Low	Mainly (wholly?) hill slopes
Unidentified macaques (1)	+	+	-	-	High	Low	Mainly hill slopes and nearby logged forest. Total number of species uncertain.
Douc Langur	+	[+]	Mid?	Mid?	High	Low	Remotest parts of hill slopes. Numbers may be low.
[Silvered Langur]	-	[+]	Unknown	Unknown	High	Low or mid	If present, flatland forest of lowlands. Response to logging not known.
Gibbon	+	+	High	High	High	Mid	Slopes, remote parts of plateau, scattered locations in logged lowlands.
Sun Bear	+	[+]	Mid	Mid	High	Low	Mainly hill slopes but also logged lowlands. Numbers unknown. Asiatic Black Bear may also be present.
Dhole	+	-	Low/ mid	Mid	High	Low	Lowlands and hill slopes, possibly throuhgout. Very low density.
[Small cats]	[+]	[+]	Low	Mid	Unknown	Unknown	Widepread, apparently in moderate numbers
Tiger	-	+	Low	Mid	High	Low	Wide-ranging, but few individuals. Hill slopes and nearby areras.
Otter sp.	-	+	Unknown	Unknown	Unknown	Unknown	Larger streams. Probably low numbers, but possibly overlooked due to survey methods.
Wild Cattle (2)	+	+	Low	Mid	High	Low	Remoter areas, especially slopes and plateau forest. Note plateau grasslands. Few individuals, moving seasonally.
Black Giant Squirrel	+	+	Low	Mid	High	Low	Mainly hill slopes and plateau forests
Finlayson's Squirrel	+	+	Mid	Mid	Low	Low	Common in lowland semi-evergreen forest and lower slopes. Replaced by another species higher up.
Cambodian Striped Tree Squirrel	+	+	Mid	Mid	Low	Low	Common in semi-evergreen habitats.

(1) may include the two forms identified (2) probably Gaur

Key
93: recorded by Timmins *et al*. (1993) 96: recorded on current survey
Glo.: Global significance Nat.: National significance
Hunt : Threat from hunting Hab : Threat from habitat loss or degradation, including logging and pollution.
Species in square brackets provisionally identified or based on unconfirmed reports.
Low: species low in importance, or small population in DHS if species more important
Mid: medium priority species with the DHS population globally or nationally significant
High: high priority species or major population of medium priority species
Very high: critically threatened species with significant population.
Threats assessed on an inuitive scale.

5.3 Threats to mammals

Hunting is by far the most significant threat to Key mammal species in the reserve. Three localised areas for concern (Figure 10) are:

Houay Bong salt-licks might be expected to attract high hunting of ungulates, both by the farmers based there and others, although there was no direct evidence

A Tiger trap was found in the Houay Bangliang valley

A cattle-killing Tiger is reported from Ban Nonglouang and may well be at increased risk of being killed for this reason

Other species are likely to be affected in a less localised fashion, since opportunistic hunting occurs very widely in the reserve, especially in the logged lowlands where the trail and road network is best. The only areas of lower hunting are thought to be the steep hill slopes and possibly the remotest parts of the plateau. Species affected, in addition to those above, include gibbon, macaques, Silvered Langur *Semnopithecus cristatus* (presence unconfirmed), bears, Black Giant Squirrel *Ratufa bicolor* and larger non-Key species, such as Sambar *Cervus unicolor*, all of which are found in reduced densities. Other squirrels and treeshrews were not thought to be at risk from hunting at present, although they are probably the commonest targets.

Silvered Langur, if present, is expected to be the large mammal species most restricted to the flat lowlands, based on recent records elsewhere in Laos (Duckworth *et al.*1994, WCS 1995). It is thus unlikely to be successfully protected by the prevention of hunting on the hill slopes. It is also likely to be quite vulnerable to progressive further logging of riverside forest. As it is of low global priority this is not a major priority for management.

The scattered groups of gibbons remaining in the lowlands (Figure 9) are at risk from hunting and logging within their territories.

PART 6: PROPOSED ACTION FOCUS

6.1 Conclusions concerning important species, habitats and threats

The most important terrestrial habitats for Key species are believed to be the unlogged slopes forests, the unencroached plateau forests (both shown on Figure 4) and the salt-licks at Houay Bong (Figures 4 and 10). Mixed deciduous forest (Figure 4) is also of high significance as the only habitat in the reserve of Green Peafowl. The few remaining areas of unlogged flatland semi-evergreen forest would be of very high value but are too limited in extent and too widely scattered to be important priorities for management. The existence of continuous habitat links with the larger and richer Xe Pian NBCA is important for several reasons.

Two groups of wetlands are suggested to be most promising for the conservation of wetland birds (Figure 5): those in the Houay Takit sector (Sector 5) and those around Nong Hou to the south of Ban Houay Phoung (Sector 14). Many other wetlands are of comparable habitat quality, but these two groups are thought to experience relatively low human use and thus remnant populations of large waterbirds sensitive to hunting. Some other areas with the potential to be equally valuable (given reduced hunting) are listed in Section 3.1.2 above.

The most important stretches of major stream (see Figure 6) are believed to be the lowland part of Houay Touay-Gnai upstream of Ban Houay Phoung (Stretch B) and the Houay Namphak upstream of Ban Nongkhe, including Houay Nyat (Stretch C). Other stretches thought to be of moderate value, with the potential to be of high value if human use is reduced, are the middle reaches of Houay Namphak from Ban Nongkhe to Houay Takit, the middle reaches of Houay Touay-Gnai around Ban Houay Phoung and the former site of Ban Nongkhou and the middle reaches of Houay Touay-Noy around Ban Somsup (Figure 6). The middle reaches of Houay Bangliang are possibly also in this class. All other reaches are suspected to be too close to areas of human habitation to offer good prospects for conservation of Key species.

Of the 29 Key bird species confirmed or provisionally recorded, eleven occur in populations which might be considered of moderate global significance. Four of these, Lesser Adjutant, Green Peafowl, Blyth's Kingfisher and Eastern Green Magpie are thought to be present in very small numbers (the peafowl may be extinct). Siamese Fireback, Wreathed Hornbill, Red-collared Woodpecker, Green Cochoa, Red-tailed Laughingthrush, Bar-bellied Pitta and probably Blue-rumped Pitta are thought to occur in somewhat larger populations. Grey-faced Tit-Babbler is very numerous and occurs in a population of high global significance. The population of Black-and-Red Broadbill is of high national significance. White-winged Ducks were reported and, if this were confirmed, even a tiny population would be of national importance.

Lesser Adjutant, Green Peafowl, Siamese Fireback, Wreathed Hornbill and the pittas are principally threatened in DHS by hunting or snaring, depending on the species. Blyth's Kingfisher is not immediately threatened but remains vulnerable to habitat loss or deterioration in water quality. Eastern Green Magpie and Red-collared Woodpecker are suspected to be sensitive to logging (Thewlis *et al.* in prep.), but since most suitable habitat on the flat lowlands has already been logged this is not a major current threat, except locally. Green Cochoa and Red-tailed Laughingthrush are at risk from clearance of the plateau forests for coffee. The babbler and broadbill are not thought to be under serious threat in DHS. Four Key species (Woolly-necked Stork, Lesser Fish Eagle, Green Imperial Pigeon and Great Hornbill) which were not shown to occur in significant populations are probably at risk of extinction in the reserve, principally due to opportunistic hunting.

The gibbon population of DHS is of high global importance, particularly whilst it remains linked to the larger population in Xe Pian NBCA (Timmins *et al.* 1993, Duckworth *et al.* 1995). The populations of Douc Langur, Sun Bear and Dhole may also be of moderate global significance, but there are few records from which to draw this conclusion and their DHS populations may prove to be rather small. The large healthy populations of Finlayson's Squirrel and Cambodian Striped Tree Squirrel *Tamiops rudolphi* are moderately significant in view of the relatively restricted ranges of these species (Corbett and Hill 1992). The small

populations of Tiger and wild cattle (probably Gaur) and the somewhat larger population of Black Giant Squirrel are probably of national significance.

Hunting is by far the most significant threat to Key mammal species in the reserve. Three localised areas for concern (Figure 10) are the Houay Bong salt-licks which might be expected to attract high hunting of ungulates and associated predators; the Houay Bangliang valley where a Tiger trap was found and Ban Nonglouang, where a cattle-killing Tiger is reported and may be at risk of being killed as a result.

Other species are likely to be affected in a less localised fashion, since opportunistic hunting occurs very widely in the reserve, especially in the logged lowlands where the trail and road network is best. The only areas of lower hunting are thought to be the steep hill slopes and possibly the remotest parts of the plateau. Species affected, in addition to those above, include gibbon (although these are localised in the logged lowlands), macaques, Silvered Langur (presence unconfirmed), Sun Bear, Dhole and Black Giant Squirrel , all of which are found in reduced densities. The heavy hunting of the smaller squirrels is not thought to be an important threat.

Impacts due to various human uses were assessed individually for each sector and an overall estimate then made of the level of impact on Key species in each sector. The most severe impacts are known to be occurring in Sectors 5, 8, 14, 17E, and they are probably also severe in Sectors 23, 25 and 26, areas which were not surveyed in 1996.

- In Sector 5 the chief threat stems from hunting and disturbance around the seasonal settlement (which may be expanding) at Houay Bong salt-licks, combined with hunting of large waterbirds at pools in the sector and, potentially, of crocodiles in Houay Namphak.
- In Sector 14 the chief threat is the hunting of large waterbirds at pools and along the Houay Touay-Gnai. The nearby enclave village of Ban Houay Phoung is probably growing.
- In Sector 17E the chief threat is the hunting of Green Peafowl and an isolated gibbon population. A settlement has been newly established at Quan Mou and human use will expand rapidly.
- In Sector 26 the principal threat is new road construction, for the purpose of logging old-growth forest and associated hunting
- in Sectors 23, 25, the main threat is expansion of coffe plantations into unencroached platteau forest, with associated hunting. It is exacerbated by road construction in Sector 25.

Severe impacts possibly also occur in Sector 19 (the hunting of peafowl, which are reported but not yet confirmed to occur).

Moderate levels of impact are believed to be occurring in 8-9 other lowland sectors (Table 6). Shooting or snaring of a number of Key species are the principal problems in the lowlands, exacerbated by the expansion of at least four enclave settlements. There is a high level of human presence in these sectors, not just for hunting but for fishing (especially at pools) and collection of forest products such as timber, small diameter rattans, bamboo, Malva nuts, Yang oil and others. Access to these sectors is easy due to the network of logging trails, many of which are still driveable.

6.2 Key areas for protection of Key wildlife species within DHS

Key areas, which can be considered as potential core areas to develop during future management of the reserve, were identified on the basis of

- confirmed presence of Key wildlife species, especially those of global or national significance, in combination with reliable reports from interviews with hunters
- presence of areas of habitat in good condition with relatively low levels of human use

They are shown on Figure 11 and listed below. The list does not exclude other areas where no information was gathered, nor is it certain that core areas can be established in all of them,

since considerations other than value for wildlife are also relevant. The rationale for the selection of each proposed core area is given below. The number of confirmed records of high priority Key species in these areas is not high, and further fieldwork may be required to gather sufficient evidence to support restrictions on human activity in these areas.

In addition to the three areas below, further surveys are urgently required to locate any remaining peafowl in Sectors 17E, 18, 19 and 20. Their area of occupation should then be included in a core area of appropriate size (it is unlikely to extend to fill an entire sector, and may straddle two).

The aim of management of the core areas should be to:

a) create sanctuaries around critical habitats where human use is minimized or eliminated

b) prevent the expansion of cultivation, road construction and any form of logging.

Core Area A Escarpment slopes, Houay Bangliang gorge, Phou Pong and Phou Tabeng
Sectors 4, 22, 5 (upland part), 6, 11, 27, 21.
This extensive area is thought to support the main DHS populations of many hunting-sensitive Key species, including: gibbon, Pig-tailed Macaque *Macaca nemestrina*, Assamese/Rhesus Macaque *Macaca assamensis/M. mulatta*, Douc Langur, Tiger, wild cattle (probably Gaur), Wreathed and Great Hornbills, Grey Peacock-Pheasant, Silver Pheasant, Bar-backed Partridge, and perhaps Sun Bear. Unlogged forest on the lower slopes is important for Red-collared Woodpecker. Houay Nyat and possibly other streams in this area support Blyth's Kingfisher.

There are three subdivisions. The northern one is Phou Pong, Sayphou Dan and the surrounding valleys of Houay Sout, Houay Bangliang, Houay Takit and Houay Pong. The plateau includes many patches of open pine forest, presumably with extensive grassy areas used by ungulates. Douc Langurs are reported and gibbon and hornbill numbers are quite healthy, at least in some parts. The Houay Bangliang is heavily used by villages to the north and it may be appropriate to allow fishing to continue but restrict access south of the river.

The central subdivision is the headwaters of the Houay Namphak, Houay Nyat and Houay Touay-Gnai where they descend from the plateau. There is an extensive area of hilly forest, much of it unlogged, below 500 m. Gibbons and hornbills occur widely and Tiger, Sun Bear and Blyth's Kingfisher have been confirmed. There may be no clear, natural boundary towards the southwest. Ban Nongkhe is close by and may have an increasing impact on this sector as it continues to expand.

The southern subdivision includes Phou Pongkham and Phou Tabeng, which are not as flat as Phou Pong. Some grassy flats again occur on the plateau. Douc Langur, Dhole and Gaur and good numbers of gibbons have been confirmed. Sector 21 is the major area where DHS is in contact with extensive forested lowland habitats to the east. Three villages exist along the feet of the escarpment and people from all are likely to hunt extensively on the lower slopes. Encroachment is occurring on the plateau due to coffee expansion.

Core Area B Houay Pong lowlands
Sector 5 (flatland part)
This smaller area has a concentration of important features. The only major salt-lick known in DHS occurs near Houay Pong. Gaur probably visit. Pools supported the only Woolly-necked Storks known to occur in DHS and appear suitable for other waterbirds. A long stretch of Houay Namphak without habitation could be included within the sector - it reportedly supports Siamese Crocodile *Crocodylus siamensis* and is probably also suitable for Lesser Fish-Eagle and otters. The forest is flatland semi-evergreen, has been heavily logged and hunted and is currently of limited importance, but once it regenerates the slopes will act as a nearby source for recolonisation.

Management is urgent here, since the presence of a seasonal settlement at such a strategic site is expected to result in high hunting pressure on vulnerable species.

Core Area C: Nong Hou, Houay Touay-Gnai and surroundings

Sector 14

This sector is significant for its large waterbirds. Lesser Adjutant and Lesser Fish-Eagle were confirmed, White-winged Duck was reported and, other species may find the wetlands suitable. This is the only one of the three core areas where Green Imperial Pigeon was confirmed. The Houay Touay-Gnai should be included within the core area, not used as a boundary, since it is also important habitat for some species. The semi-evergreen forest observed had all been heavily logged and some may have been regrowth from cultivation.

In comparison with other lowland sectors, hunting and disturbance may at present be somewhat lower here. However, management is urgent because the important Key species occur in such small numbers. The chief priority is to reduce or prevent human access to the pools and stretches of the main river. The nearby Ban Houay Phoung is thought to be growing, so threats (which are already having high impact) may increase.

PART 7 RECOMMENDATIONS

The most urgent general aims are

a) reduction of human uses in order to enhance habitat value for wildlife and
b) reducing direct pressure by hunting.

The manner in which such changes can be brought about must be determined by the protected area staff together with local residents and authorities and they will be the ones to judge what is acceptable and politically feasible.

Four main approaches are recommended. Further description of the options is available in the recent status report (Berkmuller *et al*. 1995). Most of the recommendations are addressed to and amenable to a solution by local residents and protected area staff. Others require support and involvement by political authorities at district and provincial levels.

- Reduce destructive methods of any extractive use throughout the reserve.

- Establish effective use controls in selected core zones with participation of local communities. Such use controls should emerge from participatory planning with local communities.

- Associated rural development should serve to encourage stabilisation of the size of villages within the reserve boundaries with size reduction or abandonment as a long-term objective. In-migration should be discouraged.

- Introduce restrictions on vehicle access and restrict access to local residents.

Table 1 (see Executive Summary) provides a list of Sectors where selected types of action are most urgent.

Additional information

Additional information is desirable on the following aspects of human use, which are common but were not confirmed to be serious threats to the wildlife species studied. Data gathering exercises will necessitate active villager involvement:

Pastures used by domestic cattle need to be identified and mapped on the plateau.

The owners of rights to yang oil extraction in the proposed core areas need to be identified, since their income would be affected by restrictions on access.

A study is required to indicate whether high levels of fishing in the reserve are likely to be sustainable. This requires the services of a fisheries specialist.

Boundaries and links with other reserves

It is important for the long-term viability of DHS that protected habitat links be established with the large forested areas to the east and south, including Xe Pian NBCA. The best solution for wildlife would be the declaration of Xe Khampho Proposed Protected area as an NBCA, as proposed by Berkmüller *et al.* (1995). Detailed comments on habitat links were presented by Timmins *et al*. (1993).

Priorities for future wildlife surveys

More detailed information on the numbers and distribution of the following species should be gathered during future surveys, to allow monitoring of the success of protective measures and to identify other potential measures: wild cattle, big cats, Douc Langur, gibbon, large

waterbirds (herons, storks, Oriental Darter, White-winged Duck and possibly others), Lesser Fish-Eagle, Blyth's Kingfisher and Green Peafowl.

Routine recording of large mammal and bird species is already included in the duties of patrolling staff. Gibbons, peafowl and large waterbirds lend themselves most to detection by non-specialists, and should be given particular attention. Visits to areas reported to support peafowl should be made periodically year-round, but the most important time is January-March when repeated counts of calling males (ideally involving at least 2-3 nights spent at each locality each calling season) should provide a reliable index of population size.

Accurate monitoring of cattle and big cats may require the employment of external specialists, but careful recording of the locations and measurements of any fresh signs found by field staff would be valuable.

Reports indicate presence of crocodiles at a site near the mouth of Houay Takit. This site needs to be located and visited to confirm presence or absence of crocodiles.

PART 8: TRAINING

A subsidiary aim of the survey was to provide the counterparts with training in techniques which will be useful to them in their work patrolling the reserve. One of their responsibilities will be to record important wildlife species in the course of patrols. Some may also be assigned to more specialised wildlife survey work in due course, for example active monitoring of particular species.

Although all of the counterparts showed some basic knowledge of wildlife, i.e. recognition of mammal/bird families, only one of the four showed particular interest in actively observing wildlife in the field. Time constraints, the lack of a fluent Lao-English translator and the low levels of bird and mammal activity further reduced the opportunities for gaining direct experience of the species of interest. However staff were encouraged to use the available field guides to birds and were assisted in this respect where possible. The following aspects were discussed and where possible, demonstrated:

- Map use. Use and interpretation of the 1:100 000 topographic maps and locating the trails walked. Distinction between the grid numbers and the numbers indicating latitude and longitude. Use of the latter in interpreting GPS (Global Positioning System) data gathered during the survey.
- Note-taking. Staff were encouraged to take written notes of trail details, mammal evidence and bird species encountered (using the species numbers from Lekagul and Round (1991)). The necessity for detailed wildlife descriptions for accurate identification was stressed.
- Key species. Field staff were introduced to the idea of rare and threatened species which are sought during surveys. A list in English of the likely Key mammal and bird species in PXT was given to each counterpart and they were helped to add the Lao or Thai names, and to cross-reference the bird list to the species numbers in Lekagul and Round (1991). At intervals the records of Key species accumulated during the survey were discussed.
- Caution in identification. The need for caution in identification of sightings or reports from villagers was repeatedly stressed, due to the great number of similar species, and the uncertainties involved in interpreting bird and animal signs.
- Binocular use. The basics of using and caring for binoculars were mentioned whenever we noticed a problem.
- Field guides. The basics of using a field guide (*The birds of Thailand* Lekagul and Round 1991) were shown by demonstrating, including the species numbers and the pictorial key to families. The text was of limited value because the reserve staff do not read English, but some important points were translated and discussed where possible. Identification of small birds in open habitats was easiest to discuss, but this was not pursued at the expense of other fieldwork because such species are almost entirely of low conservation interest and are of secondary importance both during the survey and for the patrolling staff in the future. Identification of wetland birds can also be a fruitful form of training, but there were relatively few encounters with waterbirds.
- Gibbon surveys. It had been hoped to discuss the recording of gibbons in some detail, and to impress on the counterparts the value of keeping daily note of where gibbons were and were not heard and the time and length of calling periods. This was attempted wherever gibbons were heard, but further focussed work would be necessary to develop counterparts' ability to use this as a survey technique.

8.1 Summary of overall staff performance

The overall performance of staff throughout the survey period is summarised (below) in terms of the major survey activities undertaken by staff during the survey, and the level of achievement attained. Chantavi was present for the longest period, the remainder of the counterparts for no more than 6 days.

Map reading

All staff were competent in most respects in the use of 1:100 000 topographic maps. Trails walked were located and staff were able to distinguish between the grid numbers and the lines indicating longitude and latitudes. Staff had the use of the GPS explained to them and were competent in its use by the end of the survey period.

Note-taking

Although staff were encouraged to take written notes of trail details, mammal evidence and bird species encountered, evidence of this activity being undertaken was scant. Certain staff recorded bird and mammal species in written form, having consulted relevant reference material, but this was by no means a regular occurrence, nor was it comprehensive. The necessity for detailed wildlife descriptions for accurate identification was stressed, and although there was limited staff comprehension of this issue there was not sufficient time to train staff in such techniques.

Key species recognition

Staff were able to add Lao and Thai names to the bird and mammal Key species, and in some cases completed this task with little guidance or enthusiastically sought help with interpretation problems. Staff were familiar with most of the larger mammal Key species and were keen to locate footprints and other evidence of species presence. The use of a mammal footprint guide (Van Strien undated) in this respect was useful and staff appreciated the value of this document. Staff would often refer to an illustrated book about the mammals of Malaysia, particularly when village interviews were being conducted. It is not thought that staff distinguished between Key bird and mammal species when it came to recording species presence/absence in note form.

Staff have some ability to recognise Key species in the future, in particular genus-level identifications of the larger mammals, involving sightings, scats and prints, although they were often less cautious in assigning identifications to old or indistinct signs than were the specialists. Their bird recognition is probably much less reliable, since the species involved are less familiar and the number of species is greater. Forest-dwelling Key species are particularly difficult to see well. Key bird species were encountered, often with only fleeting views or at times when the counterparts were not present, so very little progress was made with this aspect. The few encounters with storks have improved the ability of two of the counterparts to distinguish species in the future, but further experience and improved ability in taking notes are necessary before their field records can be treated with full confidence.

REFERENCES

Berkmüller, K., Sangthong Southammakoth and Vene Vongphet 1995. *Protected area system planning and management in Lao PDR. Status report to mid-1995*. Vientiane: Lao-Swedish Forestry Cooperation Programme.

Collar, N.J., Crosby, M. C and Stattersfield, A. J. 1994. *Birds to Watch 2: the world checklist of threatened birds.* Cambridge, U.K.: BirdLife International.

Corbett, G.B. and Hill, J.E. 1992. *The Mammals of the Indomalayan Region*. Oxford, U.K.: Natural History Museum and Oxford University Press.

Duckworth, J. W., Timmins, R. J., Thewlis, R. M., Evans, T. D. and Anderson, G. Q. A. 1994. Field observations of mammals in Laos 1992-93. *Nat. Hist. Bull. Siam Soc*. 42: 25-53.

Duckworth, J W, Timmins, R J, Anderson, G Q A, Thewlis, R M, Nemeth, E, Evans, T D, Dvorak, M and Cozza, K E A 1995. Notes on the status and conservation of the gibbon *Hylobates (Nomascus) gabriellae* in Laos. *Tropical Biodiversity* 3 (1): 15.

Duckworth, J. W, Timmins, R. J. and Evans, T. D. 1993. *A wildlife and habitat survey of Xe Piane Proposed Protected Area*. Vientiane: unpublished report to the Lao-Swedish Forestry Cooperation Programme.

Ernst, C. H. and Barbour, R. W. 1989. *The turtles of the world*. Smithsonian Institution Press, Washington D.C. and London.

Evans, T. D., Stones, A. J. and Thewlis, R. C. M 1996. *A wildlife and habitat survey of Phou Xiang Thong National Biodiversity Conservation Area*. Pakxe, Lao PDR: IUCN Biodiversity Conservation Project.

Evans, T. D. and Timmins, R. J. in press. The status of the Green Peafowl *Pavo muticus* in Laos. *Forktail*.

Groombridge, B. 1994. *The 1995 IUCN Red List of Threatened Animals*. Cambridge, U.K.: IUCN.

King, B.F., Woodcock, M. and Dickinson, E.C. 1975. *A Field Guide to the Birds of South-East Asia*. London: Collins.

Lekagul, B and Round, P. 1991. *A Guide to the Birds of Thailand.* Bangkok: Saha Karn Bhaet.

Oriental Bird Club in prep. *A Checklist of the Birds of Indochina*.

Round, P.D. 1988 *Resident Forest Birds in Thailand: their status and conservation.* Cambridge U.K.: ICBP Monograph 2.

Thewlis, R. J., Duckworth, J. W., Evans, T. D. and Timmins, R. J. in prep. A preliminary assessment of the status and conservation of threatened birds in Laos.

Timmins, R. J. and Bleisch, W. V. 1995. *A wildlife and habitat survey of Xe Bang Nouan National Biodiversity Conservation Are*a. Vientiane: The Wildlife Conservation Society.

Timmins, R. J., Evans, T. D. and Duckworth, J. W. 1993. *A wildlife and habitat survey of Dong Hua Sao Proposed Protected Area*. Vientiane: unpublished report to the Lao-Swedish Forestry Cooperation Programme.

Uthai Treesucon and Round, P.D. 1990. Report on threatened birds in Thailand. *Tigerpaper* July-Sept 1990: 1-9.

WCS 1995. *Results of a survey of terrestrial wildlife in the area to be affected by the proposed Xe Nam Noy - Xe Pian Hydroelectric Project*. Vientiane: The Wildlife Conservation Society.

ANNEXES

ANNEX 1: MAPS AND PLACE NAMES

Maps of the RDP Lao Service Geographique d'Etat, 1: 100 000 (1986) were used throughout the fieldwork, and names and spellings of place names follow these except where local usage differed. These exceptions are listed in Table 9, which also lists a few sites where spellings used in Timmins *et al*. (1993) appeared to differ from local usage. Sites where changes were noted correctly by Timmins *et al.* (1993) are not repeated here.

Table 9 Villages and other locality names of DHS area where map details are ambiguous

Local name	**No.on figures**	**Name on topographic map**	**Remarks**
Ban Houay Phoung	33	Not mapped	
Ban Somsup/Ban Nongpop	12	Ban Nongpop	Ban Sungsup in Timmins *et al.* (1993)
Ban Laogna	14	Ban Laogna	Ban Longanwa
Quan Mou	34	Not mapped	Quan Moor in Timmins *et al.* (1993)

ANNEX 2: TERMINOLOGY AND CONVENTIONS

2.1 Key species

Key Species are those of elevated conservation concern, as detailed by the following sources:

Birds:
Globally threatened and *Globally near-threatened* species are listed by Collar *et al.* (1994).
Regionally at risk species are those considered by Treesucon and Round (1990) to be 'At Risk in Thailand'

Mammals:
Globally threatened species are listed by Groombridge (1994).
Regionally at risk species are those which Salter (1993) lists as being of high conservation concern which are not Globally threatened.

2.2 Nomenclature and systematics

Bird nomenclature and systematics
Systematic order and nomenclature for birds follow Lekagul and Round (1991), with King *et al*. (1975) used for species not found in Thailand. Note is also taken of revisions to species limits discussed in Oriental Bird Club (in prep.).

Mammal nomenclature and systematics
Corbett and Hill (1992) is generally followed, with exceptions where noted.

2.3 Altitudes

All altitudes are approximate, and are quoted to an accuracy of +/- 50 m.

2.4 Grid References

Locations are given as six-figure grid references read from the standard grid used on the 1:100 000 maps detailed above. Eastings (3 digits) proceed northings (3 digits).

ANNEX 3: METHODOLOGY

3.1 Limitations

Almost no time was lost through bad health, poor weather or difficult access, in contrast to the 1993 survey.

1. Delays in visa procurement for some team members reduced the amount of time available for fieldwork.
2. Due to time constraints, all survey work was conducted in lowland areas.
3 No nocturnal mammal surveys were conducted, and this aspect of the fauna remains almost unknown.
4. Visits to most sectors were quite brief and a significant proportion of time was spent locating trails and making wide-ranging rapid assessments of habitat type and condition. This reduced the time available for intensive searches for elusive and low-density wildlife species, and it was felt, for example, that small bird assemblages were less thoroughly covered than in 1993.
5. The following parts of DHS have yet to be visited. They are priority areas for subsequent survey.

- Certain remote pools in the lowlands (See Section 3.1.2). Most surveyed pools have been visited only briefly, often during the heat of the day. Evening and early morning observations might prove more productive.
- The lowland reach of Houay Touay-Gnai upstream of Ban Houay Phoung, some of which is likely to lie in unlogged lowland forest and be relatively little used.

- Significant stretches of the courses of the Houay Namphak, Houay Bangliang, Houay Touay-Gnai and Houay Touay-Noy in the logged lowland forests.
- The Houay Bangliang valley between Houay Sout and Ban Thamdin.
- Many parts of the escarpment slope, especially areas above 500 m
- The most remote areas of montane forest (Phou Pong, Phou Dan, Phou Tabeng).

3.2 Methods: Habitat Survey

3.2.1 Habitat evaluation

The major natural vegetation types identified and mapped by Timmins *et al*. (1993) were used as a framework in which to place records of wildlife and human use from the current surveys. Some additional information was gathered in areas where Timmins *et al.* (1993) relied on satellite images for habitat classification. Detailed notes were taken on all individual small wetlands visited.

3.2.2 Human use

Considerable anecdotal information concerning use of DHS was collected by observation during fieldwork and in discussion with local residents. There was no formal survey of human use, since this was not the main objective of the study.

3.3 Methods: Bird Survey

Two main identification sources were used in the field: King *et al.* (1975) and Lekagul and Round (1991). In addition a draft checklist of Indochinese birds (OBC in prep.) was invaluable.

3.3.1 Field observation

This was the chief method, with the emphasis on maximising encounters, especially of key species. Observers moved singly along existing trails or sat where birds concentrated, e.g. fruiting and flowering trees, areas with good understorey visibility and breaks in the canopy. Effort was centred away from areas with heavy human disturbance but all habitats were covered. Careful attention was paid to the altitudes of all important records. Calls were very important in assessing the abundance of many species. All observers had previous experience in South-East Asia and two were familiar with a high proportion of the South Laos avifauna through participation in previous surveys there. Remains found in the field and birds (dead or alive) carried by people were examined. This provided many records of certain key species, especially secretive ground-birds which are readily snared (pheasants and pittas).

3.3.2 Sound-recording

Tape-recorders were used to record vocalisations for identification or to draw birds to the observer using playback.

3.3.3 Hunters' information

Discussions with hunters provided the only information on Green Peafowl and White-winged Ducks. This is discussed in the Key Species Accounts (Section 4.2).

3.4 Methods: Mammal survey

Lekagul and McNeely (1977) was available for reference in Pakxe, and van Strien (undated) was used in the field for identification of tracks. These, together with the observers' previous experience in Laos, formed the basis for mammal identifications.

Diurnal mammals (principally squirrels, treeshrews and primates) were recorded opportunistically during ornithological fieldwork. No timed nocturnal walks or static watches were attempted. A particular effort was made to record gibbons, following the recommendations in Duckworth *et al* (1995). Tracks and signs were identified where possible, chiefly footprints. However, because many genera are polytypic (particularly those of conservation interest, e.g. *Bos*, *Panthera*, *Ursus*, *Cervus*) few prints are unequivocably identifiable to species, even by local hunters.

Discussions with hunters and guides provided useful information about the presence and seasonality of larger mammals.

ANNEX 4: HABITATS AND HUMAN USE

4.1 Notes on terrestrial habitats

Houay Takit area (Sectors 2 and 5)

The flatter lowlands appeared to have been mechanically logged throughout the sector, north to at least 15^{o} 04' N. The intensity of cutting seemed to vary widely. Some areas (for example south of Nong Khouang Gnai) supported tall scrub with a canopy little more than 10 m, thick vine tangles covering any trees emerging higher and many brambles. At the other extreme, parts of the trail west from Nong Pakhao and the trail from Houay Huaxang towards Ban Thamdin, passed through tall, well-structured forest with moderate numbers of trees >1 m dbh and limited evidence of logging.

Stands of tall, stout and very thorny bamboo were a notable feature of this sector.

Several fields, some well-established and at least one freshly cleared, were found near the Houay Bong/Houay Hai confluence. Some of the grassy clearings in this area appear to be natural, since they were associated with dried-out pools which are also salt-licks. Between the foot of the escarpment and Houay Hai, east of the most northerly cultivated field, lies a belt of stunted semi-evergreen forest (few trees taller than 15 m) with many grassy glades. This area was reminiscent of the vegetation at the extensive Houay Kua salt-licks in Xe Pian NBCA. One small salt-lick was found and our guide stated that several others existed nearby. There were many gravelly seasonal stream beds. Close to Houay Hia the forest was not stunted.

The steep spur north of Houay Hai was climbed to 600 m elevation. The lowest slopes showed steep rocky outcrops with sparse, thorny deciduous scrub less than 5 m tall. The majority of the spur was clothed with tall, smooth, stout or narrow bamboos and deciduous trees, chiefly *Lagerstroemia* sp., either mixed together or in almost pure stands of one or the other. Many loose rocks were exposed on the ground At around 500 m a flatter area several hundred metres wide supported tall, unlogged semi-evergreen forest in very good condition. At its upper margin this area gave way to stunted forest with a great many rattans and other thorny plants.

Ban Houay Phoung (Sectors 9, 10, 14)

The forest in this area had been logged throughout. Along the access road and some trails to either side a fairly high, continuous canopy remained and in some stands the natural layered structure was intact, suggesting that logging had not been highly intensive.

The driveable road from Ban Houay Phoung to Houay Touay-Gnai passed largely through fields or narrow belts of secondary forest.

South of Houay Touay-Gnai the forest surrounding Nong Hou, Nong Leenpom and Nong Peu Noy was in poor condition, with a low, thick canopy, very dense understorey and many stands of stout, thorny bamboo. It may have been part of the area of cultivation of the nearby abandoned village of Ban Houaysot, and is indicated on topographic maps as bamboo and open forest. The old logging road running west to Houay Hom was walked, and forest along that had also been very heavily logged.

Middle Houay Namphak (Sectors 6, 8)

No new observations were made on the forest types in areas visited in 1993. However, intensification within the area of coffee plantations has resulted in the loss of some strips of forest and scrub and the felling of some large trees.

The area around Houay Nyat and the nearby Houay Namphak had not been surveyed before. Throughout the area covered, from almost immediately east of the easternmost coffee plantation, the forest was in very good condition and had not been logged. The canopy varied from 15 to 30 m with some emergents above 35 m both along the rivers and on ridgetops.

Thickets of tall bristly ferns were common in treefall sites along the path towards Ban Nonglouang at 450-550 m. The Houay Nyat area seemed to support many long rattans, some of them of medium diameter (20 mm or more) in addition to the commoner, less commercially valuable small-diameter species. Although the rivers followed quite gentle inclines, the surrounding valley sides were steep and this presumably influenced the forest type and habitat quality.

An area south of Houay Nyat close to the path leading to Ban Nonglouang supported impenetrable scrub 2-4 m tall over a fairly flat area of at least 5 hectares. The guides reported that a 'baa' (possibly an oxbow lake) lay in this area, and that the scrub was not the result of past cultivation. It is conceivable that this is the site of a recent landslip.

Houay Bangliang (Sector 4)

The steep relief made the forest in the studied area very heterogeneous. The plateau top north of the valley was low scrub and bamboo with scattered active fields, right up to the lip of the valley. The north slope of the valley was extremely steep, with an uneven canopy of trees and a bamboo understorey. This formation was also found on the steep slopes of Phou Yaut.

Where slopes were more gentle, tall, unlogged semi-evergreen forest predominated, apparently with only a small deciduous component. The forest at 400-600 m on the slopes of Phou Pong along the trail towards Houay Takit was the best developed, with some truly magnificent stands of large trees.

Most of the forest along the trail from Phou Yaut to Houay Sout appeared to be old regrowth from cultivation, with no large trees, an even canopy below 20 m, a shady and moderately open understorey and a high density of medium sized trunks. Our guides indicated that it had been cultivated some 40 years earlier.

An extensive natural field of cane grass (*Saccharum*?) occurred around the Houay Bangliang where it flows through two channels.

Ban Somsup (Sectors 17W and E)

This area was discussed in detail by Timmins *et al*. (1993).

The mixed deciduous forest along the road to Quan Mou became markedly less degraded more than 4-5 km from Ban Somsup, and the areas closer to Quan Mou were particularly tall, well-structured and attractive.

Clearance of forest for coffee and vegetable plantations near Quan Mou appeared to be concentrated around the small stream called Houay Lang by Timmins *et al*. (1993). The original vegetation was semi-evergreen forest, not mixed deciduous.

4.2 Notes on pools

Table 10. Wetlands in DHS visited during 1996 surveys (overleaf)

Notes

All sizes are estimates by eye and are only indicative of true area. Depths are also estimated very approximately. Where no information is available, cells are blank. Locations are all of pools which have been visited, but some are read from topographic maps, others were obtained from a Global Positioning System. All visits were between 0900 and 1600 unless stated. All Sambar were provisionally identified, since other large deer could not be eliminated. SEF = Semi-evergreen Forest

Table 10. Wetlands in DHS visited during 1996 surveys

Wetland and sector (see Figures 1, and 5)	Latitude			Longitude			Size (m)	Area (ha)	Depth (m) of standing water on visit date	Vegetation cover	Surrounding forest condition	Wildlife activity (Key species and other large mammals)	Visit	Human activity
	deg	min	sec	deg	min	sec								
Sector 2														
Nong Pakhao	15	02	48	105	59	39	80x30	0.24	<0.5	Thick grass standing in water. No open water.	Logged SEF		2/2, 4/2 (dawn, dusk)	Party camping for 3 days snaring.
name unknown	15	02	25?	105	59	25?	100x20	0.2	>0.5?	Thick tall grass, apparently standing in deep water. no open water.	Logged SEF		4/2	
Sector 3														
Nong Thamdin	15	04	25	105	58	30	100x150	1.5	>0.5?	Grass and tall papyrus-like rushes standing in water. 10% open water.	SEF		2/2	Campsite
Sector 5														
Nong Ngu	15	02	44	106	01	12	150x150	2.25	>0.5?	Mostly open water, covered by a small, floating-leaved yellow-flowered herb. Some rushes	Logged SEF	Footprints of Sambar, muntjac, pig, stork species and probable Gaur. Few waterbirds.	31/1, 1/2, 5/2 (dawn), 6/2	Many footprints. Campsites.
Nong Kouang Noy	15	03	00	106	01	20	20x60	0.12	0.2	Mostly bare mud, one pool formed by dam-and-scoop. Some short grass.	Logged SEF	Sambar, muntjac and pig prints. Woolly-necked Stork 2.	1/2, 5/2, 6/2	Footprints. Campsite. Dam-and-scoop.
Nong Kouang Nyai	15	02	55	106	02	08	100x40	0.4	<0.3	Mostly thick low grass. <5% open water. Parallel boggy depressions and drier ridges.	Heavily logged SEF	Pig and muntjac prints	6/2	Campsite
Sector 8														
Nong Hia	15	02	15	106	04	05				100% open water with dead trees at edge (recently flooded pool)	Heavily logged SEF		15/2	Regularly used hut. Two fishermen from Lak-25. Paddleboat. Old field.
Nong Titoh	15	02	35	106	04	12			Dry	Wholly dry. Natural vegetation unknown.	Heavily logged SEF		15/2	Hut. Rice stubble. Has been pumped dry. Trench for future pumping.

Table 10 continued

Wetland and sector (see Figure 1, Figure 5)	Latitude			Longitude			Size (m)	Area (ha)	Depth (m) of standing water on visit date	Vegetation cover	Surrounding forest condition	Wildlife activity (Key species and other large mammals)	Date and time visited Recorder	Human activity
	deg	min	sec	deg	min	sec								
Nong Tawai	15	03	00	106	04	12				80% very shallow, muddy with short turf. 20% deep, thick emergent vegetation, decreasing due to buffalos.	Heavily logged SEF		15/2	Hut, fields. 10 water buffalo. Paddleboat.
Nong Houpou	15	02	05	106	03	21				Damp grassy surrounds, Thick, boggy rushes and grass in centre	Heavily logged SEF	Purple Heron	15/2	Campsite
Nong Hin Louang (called Kiatngong by Timmins *et al.* 1993)	15	01	20	106	02	10				Damp with thick grass and a few stands of rushes.	Heavily logged SEF		15/2	Campsite
Nong Kiatngong (=Hinlat) called Hin Louang by Timmins *et al.* (1993)	15	01	30	106	02	30				Shallow water with varied vegetation. Muddy surrounds.	Heavily logged SEF		15/2	Hut. Fields on banks and on bed. Recently pumped out by soldiers.
Nong Ang	?			?						Mostly baked mud, with 5% water and damp grass in centre.	Heavily logged SEF	Sambar prints.	15/2	Abandoned hut. Thatch grass bundled for collection. Dam-and-scoop fishing.
Nong Khe	15	03	15	106	05	10				Thick wet grass, with open pool covering 15%	Heavily logged SEF		15/2	None
Sector 9														
Nong Kuhn	15	00	19	106	03	42	80x40	0.32	<0.3?	100% short, thick grass standing in shallow water.	Logged SEF		11/2	Sign claiming possession of pool. Two people camping, with motorbikes.
Nong Bawa	15	00	43	106	04	08	100x50	0.5		Mostly thick grass over water, some open pools.	Logged SEF		11/2	Campsite
Nong Xangmep	15	00	06	106	02	14	100x30	0.3	>1 m?	Open water with fine rushes emerging 30 cm from water.	Logged SEF		11/2	Campsite
Nong Khampou	14	59	14	106	03	33	200x150	3	<0.3	Entirely short, thick grass standing in shallow water.	Heavily logged SEF		11/2	Campsite
Sector 14														
Nong Hou	14	59	30	106	06	12	150x100	1.5	?	Mainly grassy but with 20% open water, rushes etc in centre	Heavily logged SEF, possibly second growth	Lesser Adjutant. Green Imperial Pigeon. Sambar, muntjac and pig prints	8/2, 9/2 (dusk), 10/2 (dawn)	Campsites. Old hunting platform in centre.

Table 10 continued

Wetland and sector (see Figure 1, Figure 5)	Latitude			Longitude			Size (m)	Area (ha)	Depth (m) of standing water on visit date	Vegetation cover	Surrounding forest condition	Wildlife activity (Key species and other large mammals)	Date and time visited Recorder	Human activity
	deg	min	sec	deg	min	sec								
Nong Peu Noy	14	59	03	106	06	22	70x70	0.49	<0.3?	Entirely short, thick grass standing in shallow water.	Heavily logged SEF, possibly second growth		8/2	Campsite
Nong Leenphom	14	58	15	106	06	08	50x70	0.35	<0.3?	Entirely short, thick grass standing in shallow water.	Heavily logged SEF, possibly second growth	Lesser Adjutant	8/2	Campsite
Sectors 13 and 16														
Bung Tak Laet	14	53	03	106	00	28	800x300	24	0.5-1	60% grasses, 30% rushes	Degraded SEF and bamboo	No footprints noted Grey-headed Lapwing, 5;	25/2 dusk	Snail, frog and fish collection, buffalo grazing; many trails.
Nong Kouang	14	55	35	106	00	25	500x200	10	1	96% grass; 4% open water	Logged SEF	Sambar prints.	26-29/2, incl. dawns and dusks	Part burnt, many trails; old broken tortiseshell; old shelter
Nong Kadan	14	55	08	106	00	06	100x100	1	0.05	100% grass	Logged SEF	Cattle, Sambar and mousedeer prints	27/2	Dam and scoop fishing
Nong Kainok	14	55	08	106	00	06	500x500	25	Dry	80% grasses 20% rushes	Logged SEF	Small cat prints	27/2	Dam-and-scoop fishing
Nong Pasout	14	56	10	106	00	33	50x50	2.5	0.05	95% dry mud 5% open water	Logged SEF	Sambar,small cat & stork/large heron prints	28/2	Trails and campfires
Nong Purnai	14	56	16	105	59	49	400x500	20	? 0.1	10% dry mud 90% tall grass	Logged SEF		28/2	Permanent house with 1 family; logged and burnt trees
Nong Gnai	14	56	34	106	00	37	100x200	2	0.1	90% tall grass 10% open water and mud	Logged SEF	Small cat prints	28/2	
Nong Seng	14	56	25	106	00	29	40x20	0.08	0.1	100% open water	Logged SEF	Mouse deer prints	28/2	
Nong Mor and Bai'jun	14	56	07	106	00	44	30x30	0.09	0.05-0.1	90% dry mud 10% open water	Surrounded by dense scrub	Sambar and stork /large heron prints	28/2	Extensive; many fires. Scoop and dam fishing.

Table 10 continued

Wetland and sector (see Figure 1, Figure 5)	Latitude			Longitude			Size (m)	Area (ha)	Depth (m) of standing water on visit date	Vegetation cover	Surrounding forest condition	Wildlife activity (Key species and other large mammals)	Visit	Human activity
	deg	min	sec	deg	min	sec								
Nong Quan Noy	14	56	05	106	00	54	30x70	0.21	0.05-0.1	90% dry mud 10% open water	Dense scrub and logged SEF	Sambar, mouse deer stork/large herons prints	28/2	Extensive; many fires, dam and scoop fishing.
Nong Louang	14	55	47	106	01	34	500x300	15	0.35	95% grasses 5% water plants	Logged SEF	Sambar prints Purple Heron	28/2	Campfires; many trails
Nong Lum	14	54	59	106	00	53	10x30	0.03	dry	100% dry mud	Logged SEF	Sambar, mouse deer and stork/ large heron prints	29/2	Dam and scoop fishing
Nong Houdini	14	55	05	106	01	08	20x60	0.12	unsure; too murky	100% open water	Logged SEF	Sambar, cattle, dog and porcupine prints	29/2	Trails only
Nong No	14	55	31	106	01	50	100x20	0.2	unsure	80% tall grass 20% weeds	Logged SEF	Sambar and mouse deer prints	29/2	Trails only
Nong Houdon	14	55	19	106	02	05	20x30	0.06	0.2	100% open water	Logged SEF		29/2	Large temporary camp with fires.
Nong Bollok	14	55	19	106	02	05	10x20	0.02	dry	100% dry mud	Logged SEF		29/2	
Houay Sun	14	54	54	106	01	48								
Nong Touay	14	54	34	106	01	10	20x20	0.04	0.30	100% open water	Open SEF		1/3	
Nong Ka	14	54	28	106	01	14	20x10	0.02	0.30	50% open water 50% wet mud	Logged SEF		1/3	Dam and scoop fishing
Sector 17W														
Nong Detmoun	14	55	10	106	04	35	40x80	0.32	<0.5	20% open water, no plants. Remainder mud, rocks and bushes.	Logged SEF		1/3	Campsite.
Nong Louang	14	55	50	106	03	52	20x20	0.04	?	Tall grass, possibly in quite deep water.	Logged SEF	Black-and-red Boradbill	1/3	Campsite.
Nong Ngu Luam? (1-2 km north-west of village.)	?			?			8x8	<0.01	<0.5	Open water.	Logged SEF		1/3	Campsite, small dam to deepen water. Part of bank cleared.
Nong Hin	14	56	25	106	06	35	130x60		<0.5?	Mostly thick grass with <5% open water. Also some bushes.	Logged SEF		1/3	7 water buffalo. Campsite.
Nong Peu	14	56	25	106	06	10				Tall thick grass, damp underfoot. Open water in buffalo wallows.	Logged SEF		1/3	Buffalo wallows.

Table 000 Measurements of footprints taken

Pool	species	length	width
Nong Pasout	stork/large heron	9.0	7.0
Nong Mor and Bai'jun	stork/large heron	13.5	8.5
Nong Quan Noy	stork/large heron	13.5	8.5
Nong Paduk	stork/large heron	16.5	9.0
Nong Lum	stork/large heron	13.5	8.5

4.3 Notes on human uses

Table 11 Human uses in DHS (overleaf).

Notes:

Sectors 1 through 21 are in the lowlands. Sectors 22 through 27 are on the plateau. Sector division serves to facilitate the systematic recording of human impact, most notably the easily localized evidence of habitation, cultivation, and new clearing. The table should be updated periodically as new information becomes available. Cells are left blank if there is insufficient information for meaningful assessments.

knowledge level: poor = not visited and no first hand information available, assessments tentative
medium=visited but only marginally covered by this survey, or only covered by 1993 survey
good=well covered during 1996 survey and by local staff
Intensity of use: by subjective assessment indicated as high, medium, or low
Observations are given in italics.
Impact ratings: XXX=highest X=lowest

The impacts of human land use are highest where they affect existing Key species populations. Impacts are accorded more importance if they affect species of relatively high global concern.

Table 11 Human uses in the sectors of DHS

(Sectors refer to those in Figure 1)

sect. #	know-ledge level	impact rating	Habitation	Cultivation	Fresh clearings	Logging	Hunting	Fishing	Non-timber forest products and and miscellaneous uses
1	poor	**?**							
2	medium	**x**	LOW	LOW *small teak plantations on eastern bank of H. Bangliang*	LOW	LOW limited to teak plantations	HIGH medium impact because stocks already depleted *many hunting parties moving through, numerous camps and fireplaces*	HIGH	Unknown, probably MEDIUM, associated hunting also significant.
3	poor	**?**							
4	good	**xx**	LOW	LOW	LOW	LOW	MEDIUM TO HIGH high impact. because done in prime habitat. Lack of evidence of hunting along upper south slopes of valley may imply lower levels. *large Tiger trap near H. Sout, operated by people from Ban Lak-30.*	HIGH medium impact largely because associated with hunting *high fishing activity along main river (many trails, campsites and active fishing parties).,*	MEDIUM medium impact due to asscoaited hunting *rattan harvest (of the small 'vye savang') reportedly the main use of the trail from H. Sout to H. Takit, (an area of remote, high quality slope forest).*
5	good	**xxx**	MEDIUM high impact because directly at saltlick in remote location *seasonal, two locations, two huts.*	MEDIUM high impact because directly at saltlick *small rainfed wet rice fields in two locations*	MEDIUM low additional impact *3 fresh clearings expanding existing ones, one in old growth forest*	LOW	level and impact HIGH, potentially VERY HIGH at salt-licks in rainy season and at pools. *widespread heavy hunting pressure shown by many fireplaces, remains of snared birds, squirrels etc.. Long snare line (not set) at H. Hia.* *two men met with langur carcasses. Two other hunting parties met.*	levels unknown, associated hunting probably HIGH impact *scoop-and-dam fishing, Nong Kouang-Noy. presumably moderate levels in all pools and streams.*	MEDIUM. may have medium impact due to associated huntiing *two felled 'mak chong' trees seen.* *yang oil wells noted.*
6	good	**xx**	LOW	LOW extent unchanged since 1993. *a few small fields on slopes north-west of Ban Nongkhe.*	LOW	LOW *a few felled trees east of eastern limit of coffee.*	MEDIUM impact potentially high since stocks still high, already high on slopes close to Ban Nongkhe. relatively lttle sign of hunting along H. Nyat. *party of four with one AK rifle met near H. Nyat going from H. Touay-Gnai to Ban Nong Louang.*	MEDIUM impact ofassociated hunting potentially high	MEDIUM to HIGH associated hunting potentially HIGH *large huts 1-3 years old along Houay Nyat said to be made by 'mai dam' (?Eaglewood?) .* *Cutters from outside village.* *many trails on slopes near Ban Nongkhe said to be for mak chong collection in 1995.* *H. Nyat rich in rattans, including larger ones, and may soon be targetted for harvest.* *men collacting mak deua (large figs) on two days)*

sect. #	know-ledge level	impact rating	Habitation	Cultivation	Fresh clearings	Logging	Hunting	Fishing	Non-timber forest products and and miscellaneous uses
7	medium	**?**	MEDIUM several huts but not yet enumerated	MEDIUM numerous rainfed rice-fields	MEDIUM several observed from Ban Nongkhe road but not enumerated; probably extensive	MEDIUM small scale loggging probably widespread	probably HIGH low or medium impacts due to already low stocks	probably HIGH pools probably heavily fished, likley impacts low or medium	HIGH impacts probably medium to low *much polewood cutting*
8	good	**XXX**	HIGH Ban Nongkhe has expanded from 8 to 40+ dwellings since 1993, impact HIGH, especially hunting and disturbance at pools *three pools are occupied by 2/1/1 families, respectively., with an often used hut on a fourth*	HIGH low impact unless use of pesticides initiated. Low impact in village environs, high impact locally at pools. *some rice fields in enclave, and inter-cropping of pineapple amongst coffee.* *fields and huts at Nong Titoh, Nong Tawai, and Nong Hinlat. Nong Hia fields appear neglected. Nong Ang fields abandoned.*	LOW Extent appears not to have grown since 1988 satellite photos, but non-contiguous plantations possibly overlooked. *overgrown mature coffee fields now largely weeded and in active production. A little new infill planting seen.*	MEDIUM low to medium impact, especially long term effects on regeneration *piecemeal logging was noted, and truckloads of planks were sometimes noted moving along the road to Ban Lak-25.*	HIGH impact high, especially at pools around habitation. People claim year-round demands of tending coffee fields reduce hunting to low levels. *300 m line of set bird snares near Ban Nongkhe.* *many plucked feathers found, especially at pools.* *occasional gunshots.*	HIGH especially at pools direct impacts of pumping high. and associated hunting also high. *signs of fishing common army groups have pumped dry at least two pools (Nong Hinlat, Nong Titoh) to take fish. Trench stabilised with trees at Nong Titoh, presumably to ease pumping in future years.* *paddleboat on Nong Hia. Two people from Ban Lak-25 fishing there on our visit.*	probably HIGH *bamboo cutting heavy around H. Namphak, perhaps for new houses. Truckloads noted being taken out of reserve in 1993* *Nong Khaa Nyaa used for thatch grass supply.*
9	medium	**XX**	LOW none observed *one pool 'claimed', as shown by notice posted, purpose uncertain*	LOW	LOW	Unknown, probably MEDIUM	Unknown, probably MEDIUM to HIGH	MEDIUM to HIGH, impact from associated hunting also medium to high *paddleboat on sluggish stretch of H. Touay-Gnai where road reaches mouth of Houay Phoung.*	Unknown.

sect. #	know-ledge level	impact rating	Habitation	Cultivation	Fresh clearings	Logging	Hunting	Fishing	Non-timber forest products and and miscellaneous uses
10	good	**xx**	HIGH, Ban Houay Phoung has 14 families. 16 others maintain coffee here and may move in permanently. rate of expansion unknown but possibly high.	probably MODERATE *large area of dry rice, pineapples etc. south to H. Touay-Gnai.* *Inhabitants claim to clear only scrub, not forest.* *Also inter-cropping vegetables with coffee.*	impact MODERATE, rising. agriculture not confirmed to be expanding but coffee expanding impact MODERATE *freshly planted and mature coffee stands noted. main area at village, other plantations scattered along access road and presumably elsewhere.* *Clearance of understorey of mature forest seen..*	LOW to MODERATE, rising. *piecemeal logging noted, possibly much of it for expansion of village. Reports that outsiders come to cut timber.*	IMODERATE/HIGH. people claim year-round demands of tending coffee fields reduce hunting to low levels. *100 m bird-snare line near village.* *occasional gunshots.* *numerous feather piles along trails.* *party of three soldiers visited for hunting trip. Reports of more and larger parties of soldiers recently.*	MODERATE to HIGH levels. Impacts probably moderate to high from associated hunting. *bomb and chemical fishing reported to be carried out by outsiders (soldiers and villagers from Lak 24/25) in H. Touay-Gnai.* *signs of chemical fishing seen in pools by the river.* *Large 'lee' fish trap across the river, reportedly run by people from Ban Lak 24. Smaller trap on seasonal stream along road, but users unknown.*	Impact possibly LOW/MODERATE. Associated hunting also possibly LOW/MODERATE. .
11	poor	**?**						Unknown *Fishing party descending major trail from Ban Nong Louang to lowland H. Touay-Gnaa*	
12	poor	**?**							
13	good	**x**	LOW/MEDIUM *one hut at a poolside*	LOW *wet rice cultivation noted around hut (see left)*	LOW	MODERATE, impact low (forest already severely logged with few Key species) but preventing regeneration. *piecemeal felling of trees noted.*	VERY HIGH impact moderate to low,since, now few Key species *daily evidence of heavy hunting - many trails, campsites, piles of feathers gunshots and hunting parties observed. Very easy access from west, also reportedly heavy trade in wildlife meat at nearbyBan Lak-30, probably mainly from this sector.*	Levels VERY HIGH. Impact of associated hunting moderate to low, since few Key species remain. *bomb fishing noted daily along H. Touay-Noy.* *dam-and-scoop fishing common at pools.* *fish-racks and campfires by streams, pools common.*	Unknown

sect. #	know-ledge level	impact rating	Habitation	Cultivation	Fresh clearings	Logging	Hunting	Fishing	Non-timber forest products and and miscellaneous uses
14	good	**XXX**	LOW	LOW	LOW	LOW	MODERATE or HIGH impacts high because several Key species affected, especially large waterbirds *occasional gunshots.* *numerous feather piles along trails.* *party of three soldiers visited for hunting trip. Reports of more and larger parties of soldiers recently.* *platform at Nong Hou for hunting deer, three years old, made by outsiders.*	MODERATE OR HIGH high impact of associated hunting *bomb and chemical fishing reported to be carried out by outsiders (soldiers and villagers from Lak 24/25) in H. Touay-Gnai.* *signs of chemical fishing seen in pools by the river.* *large 'lee' fish trap across the river, reportedly run by people from Ban Lak 24*	Probably MODERATE *party of three men from Ban Lak 25 carrying bundles of rattans (20-30 canes each) near Nong Hou.* *one felled mak chong tree noted*
15	medium	**XX**	HIGH Ban Houayton, 24 houses	HIGH in 1993 extensive cultivation and cofee.	Unknown	Unknown	Unknown, presumably high. impacts high on Key species of slope forest	Unknown, probably moderate in H. Touay-Noy.	Unknown.
16	good	**X**	LOW	LOW	LOW	Unknown	VERY HIGH low impacts as few Key species		
17W	good	**XX**	LOW	LOW	LOW	MEDIUM impacts probably medium or low *scattered log piles seen, also piles of smaller poles possibly for charcoal/firewood*	HIGH, impact moderate or high, depending on occurrence of large waterbirds *large hunting group met near Ban Somsup, frequent shots at pools near village (where ducks present)*	Presumably MODERATE in pools and H. Touay-Noy, not studied. *one pool with earth embankement, presumably to keep water year-round for fish*	Presumably MODERATE *orchid-stem collection noted in 1993*
17E	good	**XXX**	HIGH new seasonal settlement at Quan Mou, high impacts expected *nine families with huts, all based at Ban Somsup*	LOW	HIGH coffee plantations being established, also inter-cropping with many vegetables impacts mainly due to increased hunting	HIGH mixed deciduous forests along Quan Mou road being actively logged . *several log piles and side roads.*	HIGH impacts most severe for peafowl and gibbons *many men visiting had guns* *old snare line found* *remains of Sambar, birds, and Yellow Tortoise at huts* *hunting of peafowl reported*	Unknown presumably moderate in H. Touay-Noy. Some impacts expected from associated hunting.	
18	poor	**?**				MEDIUM or higher F\field staff report logging east of Ban Somsup			
19	poor	**?**					Unknown hunting of peafowl, if they occur, would be very high impact.		

sect. #	know-ledge level	impact rating	Habitation	Cultivation	Fresh clearings	Logging	Hunting	Fishing	Non-timber forest products and and miscellaneous uses
20	medium	**XX**	HIGH Ban Nongphu 6 houses Ban Nong Ek 40 houses	HIGH impact moderate, since long-established	Unknown	HIGH logging of mixed deciduous forest reported by field staff in 1996	Presumably quite high	Presumably quite high	
21	poor	**?**							
22	poor	**?**							
23	poor	**?**	LOW in 1993	LOW in 1993	unknown, but rapid expansion of coffee planting from east in 1993 has probably reached this sector	unknown dependent on extent of coffee	unknown dependent on extent of coffee		
24	medium	**XX**	MODERATE several huts in coffee clearings in 1993, not enumerated	HIGH coffee already extensive in 1993	HIGH coffee presumably still expanding. New clearings seen from lowlands at lip of plateau in 1996, as well as large fires from other clearings	MODERATE in 1993	Probably MODERATE to HIGH in 1993	Unknown	Unknown, probably MODERATEto HIGH *collection of palm hearts noted in 1993.*
25	medium	**XX**	MODERATE several huts in coffee clearings in 1993, not enumerated	HIGH coffee already extensive in 1993	HIGH coffee presumably still expanding.	MODERATE in 1993	Probably MODERATE to HIGH in 1993	Unknown	Unknown, probably MODERATE to HIGH *cattle-grazing a major use of open hilltops with pines in 1993*
26	poor	**?**							
27	poor	**?**				HIGH new roads and logging reported by field staff in 1996			

ANNEX 5: BIRD SPECIES OF DONG HUA SAO

5.1 Status of birds of birds in each sector

Bird status was assessed subjectively using the following criteria, as used by Timmins *et al*. (1993):

- overall encounter frequency (the number of records): this baseline is considered in the light of the following factors, to assess how the encounter rate reflects the species's abundance.
- shyness
- activity level
- area of detection, depending on habitat density
- main vegetation storey inhabited
- aerial species are hard to record in dense forest
- calling frequency and seasonality
- distinctiveness of calls
- volume of call
- whether common calls of the species are known
- flocking behaviour
- carrying capacity for the bird of its chosen habitat
- seasonality of occurrence

During recent surveys elsewhere in Laos the abundance of each bird species in each habitat was assessed subjectively on a three-point scale whereby the number of records was assessed in the light of various features of detectability in order to arrive at the bird's true abundance. The three bands of abundance can be loosely defined as follows, for a medium-sized bird of average detectability:

Common: seen daily, often in large numbers, in favoured habitat
Frequent: seen on most days favoured habitat is visited, but not usually in large numbers
Occasional: seen only occasionally, on fewer than half the days

Since individual sites in DHS were visited quite briefly, the lower two abundance categories could not be separated and were pooled as 'Present', a category which also includes species which were confirmed to occur but whose abundance could not be estimated.

Table 12 Bird species recorded from DHS during 1996 wildlife surveys.

The following species list follows the taxonomic order used by Lekagul and Round (1991). Scientific names can be found in that text, except where indicated in the table. Rows for unidentified members of a genus exclude records identified to species. Sites follow Table 2.

Key

C = Common (recorded daily, sometimes repeated records)
P = Present, probably not common or abundance not assessed
rem = Identified only by remains in this sector Provisional records are marked [ ].
w = associated with water deg = in degraded habitats only
s = believed to be only found in unlogged slope forest rather than adjacent logged lowland forest in a given recording area
k = in Houay Bangliang valley, only recorded near Houay Katam, not Houay Sout

Habitats
All sites were predominantly semi-evergreen forest, except for Ban Somsup, where two habitats were present.
MDF = Mixed deciduous forest SEF = Semi-evergreen forest

Table 12

Species	Houay Takit	Ban Houay .Phoung	Middle Houay Namphak	Houay Bangliang	Ban Somsup MDF	Ban Somsup SEF	Houay Touay Noy
Altitudes / m	170-600 m	190-350 m	210-600 m	260-650 m	190-280 m	150-280 m	126-180 m
Little Grebe		Pw					
Purple Heron			Pw				Pw
Cinnamon Bittern	Pw	P(rem)	Pw				
Pond-Heron sp. (1)	Cw	Cw	Cw		Cw	Cw	Cw
Cattle Egret			Pw			Pw	Pw
Intermediate Egret		Pw					
Little Egret	Pw				Pw		Pw
Little Heron	Pw		Cw	Cw			
Lesser Adjutant		Pw					
Woolly-necked Stork	Pw						
Lesser Whistling-duck	Pw					Pw	Pw
Black Baza					P		
Crested Goshawk		P		Pw	P	P	
Shikra					P		P
Small Accipiter (2)	P		P				
Lesser Fish-Eagle		Pw					
Crested Serpent-Eagle	C	C	C	C	P	P	P
Mountain Hawk-Eagle						Pdeg	
Rufous-bellied Eagle					P		
Black Eagle				P			
Collared Falconet					P		
Oriental Hobby			P	P			
Silver Pheasant				P			
Siamese Fireback	P(rem)		P(rem)	P(rem)			
Red Junglefowl	C	C	C	P	C	C	P
Grey Peacock-Pheasant	P(s?) (3)		P(s) (rem)				
Scaly-breasted Partridge	C	C	C	C	C	C	C
Yellow-legged Buttonquail					P		
Slaty-legged Crake				P			
White-breasted Waterhen	Pw	Pw	Pw		Pw		P
Moorhen	Pw	Pw	Pw			Pw	
Pheasant-tailed Jacana							Pw
Bronze-winged Jacana	Pw	Pw	Pw				Pw
Grey-headed Lapwing							Pw
Red-wattled Lapwing	Pw	P			P		
Little Ringed Plover	Pw						
Greenshank							Pw
Green Sandpiper	Pw						Pw
Common Snipe							Pw
Thick-billed Pigeon	P			P		P	P
Green Pigeon spp. (4)	P	C	P	P	P	P	P
Green Imperial Pigeon		P				[P]	
Mountain Imperial Pigeon		P		P			
Spotted Dove		Cdeg			Cdeg		Pw
Emerald Dove	C	C	C		P	C	
Oriental Turtle Dove	Cw	P	P				
Red-breasted Parakeet					C		
Vernal Hanging Parrot	C	C	C	C	C	C	C
Chestnut-winged Cuckoo		P					
Large Hawk-Cuckoo							P
Indian Cuckoo		P	P	P			P
Cuculus sp.				P			
Banded Bay Cuckoo	P	P	P	P			P
Plaintive Cuckoo		P				P	

Table 12 continued

Species	Houay Takit	Ban Houay .Phoung	Middle Houay Namphak	Houay Bangliang	Ban Somsup MDF	Ban Somsup SEF	Houay Touay Noy
Asian Emerald / Violet Cuckoo		P					
Drongo Cuckoo	C	C	C	C		C	C
Common Koel	Pdeg					P	
Green-billed Malkoha	C	C	C	C		C	C
Greater Coucal	C	C	C		C	C	
Bay Owl				P			
Brown Hawk-Owl	P	C	C	P	C		C
Mountain Scops-Owl	P	C	C		P		
Collared Scops-Owl	P		P		P		P
Asian Barred Owlet	C	C	C		C		C
[Javan Frogmouth]	[C]	[P]	[P]		[P]		
Great Eared Nightjar	P	C	C	P	C		P
[Grey Nightjar]				[P]			
Large-tailed Nightjar			[rem]		C		
Swiftlet sp.		P					
Asian Palm-Swift					P		P
House Swift	P	P	P		P		P
White-vented Needletail				P			P
Brown Needletail	P	P		C	P		
Orange-breasted Trogon	C	C	C	C		C	P
Red-headed Trogon	P		C	P		P	
Blyth's Kingfisher			Pw				
Common Kingfisher		Pw	Cw	Pw		Pw	Pw
Blue-eared Kingfisher			P			P	
Banded Kingfisher	C	C	C	C		C	C
Stork-billed Kingfisher		Pw					Pw
White-throated Kingfisher	Pw	Pw	Pw		Pw	Pw	Pw
Chestnut-headed Bee-eater		Cw	Pw		Cw	Pw	Pw
Blue-bearded Bee-eater		P	P			P	
Indian Roller			P		C		Pw
Hoopoe					P		P
Wreathed Hornbill	P	P	P	C			
Wreathed/Great Hornbill	P	P	P	P		P	
Oriental Pied Hornbill	C	C	C	P	P	P	P
Great Hornbill			P(s)				
Red-vented Barbet (5)	C	C	C	C		P	P
Lineated Barbet					C		
Green-eared Barbet	C	C	C		C	C	
Moustached Barbet		C	C	C			
Blue-eared Barbet	C	C	C		C	C	P
Coppersmith Barbet					C		
White-browed Piculet	P		P	P			
Greater Flameback	P		P				
Flameback sp. (6)	C	C	C	C	C	C	P
Laced Woodpecker					P	P	
Streak-breasted Woodpecker		P					
Greater Yellownape	P	P	P				
Red-collared Woodpecker (7)	P						
Rufous Woodpecker	P				P		
Bay Woodpecker	P		C	P		P	
Great Slaty Woodpecker	P	C			C		P
White-bellied Woodpecker						P(deg)	

Table 12 continued

Species	Houay Takit	Ban Houay .Phoung	Middle Houay Namphak	Houay Bangliang	Ban Somsup MDF	Ban Somsup SEF	Houay Touay Noy
Black-and-Buff Woodpecker	P	P		P			P
Heart-spotted Woodpecker		P					
Black-and-Buff/Heart-spotted Woodpecker			P				
Dusky Broadbill		P	P			P(deg)	
Black-and-red Broadbill						Pw	
Banded Broadbill	P	P	C	C		C	P
Silver-breasted Broadbill			P	P			
Long-tailed Broadbill				P			
Bar-bellied Pitta	C	P	P (rem)	P		P(rem)	
Blue Pitta	P(rem)			P		P(rem)	
Eared Pitta	P			C			
Blue/Earded Pitta (call only)	C	P	C	C			
Dusky Crag-Martin			P				
Barn Swallow	P						
Red-rumped Swallow (8)		Cw	P	P			
Common/Asian House-Martin			P				
Nepal House-Martin	Ps		P(s)	P			
House-Martin sp.					P		
Olive-backed Pipit					P		
Richard's Pipit (9)							P
White Wagtail							Pw
Grey Wagtail	Cw	Cw	Cw	C		Pw	Pw
Yellow Wagtail							Pw
Forest Wagtail	Pw		Pw	P		P	Pw
Bar-winged Flycatcher-shrike		P					
Large Wood-shrike			P				P
Large Cuckoo-shrike	Ps	P			C		
Black-winged Cuckoo-shrike	P	P	P			P	P
Indochinese/Black-winged Cuckoo-shrike				P			
Ashy Minivet	P	P					
Brown-rumped (Rosy) Minivet (10)			P	P		P	
Ashy/Brown-rumped (Rosy) Minivet (11)						P	
Scarlet Minivet	C	C	C	C	C	C	C
Great Iora	C	C	C	C	P	C	P
Blue-winged Leafbird		P		P		C	P
Black-headed Bulbul	C	C	C	P		P	P
Black-crested Bulbul	C	C	C	C	C	C	P
Red-whiskered Bulbul		Cdeg	Cdeg	Cw			
Stripe-throated Bulbul		Cdeg				Pdeg	P
Puff-throated Bulbul	C	C	C	C		C	
Grey-eyed Bulbul	C	C	C	C		C	P
Ashy Bulbul				P			
Black Drongo	P						
Ashy Drongo	C	C	C	C	C	C	C
Bronzed Drongo	P	C	C	P		P	
Lesser Racket-tailed Drongo	C	C	C	P			P
Hair-crested Drongo			P	P	C	C	P
Greater Racket-tailed Drongo				P	C		

Table 12 continued

Species	Houay Takit	Ban Houay .Phoung	Middle Houay Namphak	Houay Bangliang	Ban Somsup MDF	Ban Somsup SEF	Houay Touay Noy
Black-naped Oriole		P	P		P		P
Black-hooded Oriole		P	P		C		P
Asian Fairy-Bluebird	C	C	C	C		P	P
Eastern Green Magpie		P					
Green/Eastern Green Magpie			P				
Racket-tailed Treepie		Pdeg					
Large-billed Crow					P		
Velvet-fronted Nuthatch		P			P		
Puff-throated Babbler	C	C	C	C		C	C
Buff-breasted Babbler	C	C	C	C		P	P
Abbott's Babbler			P				
Scaly-crowned Babbler	C	C	C	C		C	C
Large Scimitar-Babbler	C	C			P	P	
Scimitar-Babbler sp.							P
Streaked Wren-Babbler			C	P			
Grey-faced Tit-Babbler (12)	C	C	C	C		C	P
Striped Tit-Babbler	C	C	C	C	C	C	C
White-crested Laughingthrush	P	C	P	P	C		
Fulvetta form B (lowland) (13)	C	C	C	P		C	
White-bellied Yuhina	C		C	C			P
Golden-spectacled Warbler	C	C	C	C		C	P
Yellow-bellied Warbler			P	C			
Dusky Warbler		P					
Radde's Warbler	P	P				C	
Pale-legged Leaf-Warbler	C	C	C	C		C	C
Greenish/Two-barred Greenish Warbler	P	P	C	P	P	C	C
Blyth's Leaf-Warbler				P			
Sulphur-breasted Warbler		[P]		P			
Inornate Warbler	C	C	C	C	C	C	C
Thick-billed Warbler					Pw		
Lanceolated Warbler		P	P		P		P
Dark-necked Tailorbird	C	C	C	C	C	C	C
Stub-tailed Bush-Warbler			P	P			
Rufous-tailed Robin			P				
Siberian Blue Robin	C	C	C	C		C	P
Oriental Magpie-Robin			Pdeg				P
White-rumped Shama	C	C	C	C	C	C	C
Plumbeous Redstart				Pw			
Slaty-backed Forktail			Cw	Pw			
Stonechat	Pdeg	Pdeg	Pdeg				P
White-throated Rock-Thrush			P		P		
Blue Rock-Thrush	Pw		Pw	Pw		Pdeg	
Blue Whistling Thrush	Cw	Cw	Cw	Cw		Prem	Pw
Orange-headed Thrush			P				
Asian Brown Flycatcher	P		P	P	P		P
Red-throated Flycatcher	Cdeg	Cdeg	C	P	C	P	P
Grey-headed Flycatcher	C	C	C	C	C	C	C
Verditer Flycatcher		Pdeg	P	P			
Pale Blue Flycatcher					P		
Blue-throated Blue Flycatcher			C	C			

Table 12 continued

Species	Houay Takit	Ban Houay .Phoung	Middle Houay Namphak	Houay Bangliang	Ban Somsup MDF	Ban Somsup SEF	Houay Touay Noy
[Hill Blue Flycatcher]				[P]			
[Tickell's Blue Flycatcher]		[P]					
Hainan Blue Flycatcher	C	C				P	
Cyornis sp.					C	C	
Black-naped Monarch	C	C	C	C	C	C	C
Asian Paradise-flycatcher	P	P	P				
Brown Shrike	Pw	Cdeg					P
Golden-creasted Myna		P					
Hill Myna	C	C	C		C	C	C
Ruby-cheeked Sunbird		P	P			P	
Purple-naped Sunbird		C	C	C		C	P
Purple-throated Sunbird						P	
Olive-backed Sunbird					C		
[Black-throated Sunbird]		[P]					
Crimson Sunbird			P	P			
Streaked Spiderhunter			P				
Little Spiderhunter	P	C	C	C		C	C
Thick-billed Flowerpecker	C	C	C	P	P	P	
Scarlet-backed Flowerpecker			C				
Flowerpeckers spp.	C		C	C	C	C	
White-eye sp.		P	C	P			
Scaly-breasted Munia				Pw	C		

Notes:

(1) Pond-Herons were not in breeding plumage so not attributable to species.
(2) Excludes Crested Goshawk.
(3) Remains suspected to have been taken on hill slopes.
(4) Most calls thought to have been attributable to Thick-billed Pigeon, but calls of Pin-tailed and Pompadour Pigeon were not known.
(5) *Megalaima lagrandieri*,
(6) *Chrysocolaptes lucidus/Dinopium javanense*,
(7) *Picus rabieri*,
(8) racial identity not confirmed.
(9) racial identity not determined.
(10) *P.* (*r) cantonensis*,
(11) *Pericrocotus divaricatus/ P.* (*r*) *cantonensis*,
(12) *Macronurus kellyr*,
(13) probably *Alcippe peracensis grotei*.

5.2 Selected observations on bird distribution

Timmins *et al.* (1993) discussed several aspects of bird distribution within DHS. Further comments are given below.

Several species were recorded widely in the logged lowlands in 1996 but had been concluded to be absent by Timmins et al. (1993). The most significant were Red-vented Barbet *Megalaima lagrandieri*, Moustached Barbet *Megalaima incognita*, Mountain Scops Owl *Otus spilocephalus* and Red-headed Trogon *Harpactes erythrocephalus*. Some or all may undertake seasonal altitudinal migrations, or they may have been overlooked in 1993.

Three other species found only above 1000 m in 1993 were found down to low altitudes on one or two occasions: Silver Pheasant *Lophura nycthemera*, Ashy Bulbul *Hypsipetes flavala* and Streaked Spiderhunter *Arachnothera magna*.

Blue-throated Flycatchers *Cyornis rubeculoides* of the Indochinese resident race *klossi* were common in unlogged slope forest. This bird has only been found on the Bolovens Plateau during ornithological surveys of Laos, and all recent records are from the narrow altitudinal belt 300-850 m.

Black Eagle *Ictinaetus malayensis*, predicted to occur by Timmins *et al.* (1993), was recorded.

Numbers of non Key waterbird species were again disappointing, so the low numbers noted in May-June 1993 may not be merely a seasonal phenomenon.

5.3 Key bird species accounts

Purple Heron *Ardea purpurea* (Regionally at Risk)
Middle Houay Namphak: one seen on Nong Houpou on 15 February.
Other: one seen on Nong Boua on drive in to Houay Takit, 31 January.

As in 1993, it seemed that only a few individuals were present.

Woolly-necked Stork *Ciconia episcopus* (Regionally at Risk)
Houay Takit: two at Nong Kouang Nyai on 1 February, one there on 3 February. Absent on two other visits during these few days. Very large bird footprints (longest toe 11 cm) at Nong Ngu on 5 February may have been this species.
Houay Touay Noy/Gnai confluence: large footprints of stork, egret or large heron were noted at the following marshy pools: Nong Pasout, Nong Mor/Bai'jun, Nong Quan Noy, Nong Paduk, and Nong Lum.

The lack of records from most pools visited suggested that very few were present, possibly only a single pair. Only a single pair was recorded in 1993, although they were using different pools a few kilometres from Nong Ngu. Woolly-necked Storks occur more commonly in Xe Pian NBCA and are present in unprotected areas east of DHS. For such a wide ranging species these areas can be viewed as part of a single population. The area of suitable habitat is great - hunting and perhaps robbing of nests have probably reduced the population drastically.

Lesser Adjutant *Leptoptilos javanicus* (Globally threatened)
Ban Houay Phoung: one at Nong Leenphom on 8 February and one at Nong Hou three hours later. Two at Nong Hou early on the morning of 10 February were thought to have roosted very near by.
Houay Touay Noy/Gnai confluence: see records of footprints under Woolly-necked Stork, above.

There are no previous records from the reserve. The only other Lao reserve known to support this species is Xe Pian NBCA (Duckworth *et al.* 1993, Thewlis *et al*. in prep.). It is not known where they breed, but it is unlikely that they breed in DHS, since no wetlands are secluded

enough or extensive enough. The population in the reserve is very small, but could be expected to increase if hunting and disturbance were stopped at selected wetlands.

[White-winged Duck *Cairina scutulata* (Globally threatened)
Ban Houay Phoung: the village chief, Lung Noy, clearly described this species and reported that it occasionally visited Nong Hou and nearby pools during the rainy season but did not nest there. This was corroborated by other men in the village.
Other: a guide from Ban Houay Namphak reported seeing one along the Houay Namphak once in 1994.

There are no confirmed records from the reserve, but it seems likely that they do indeed visit seasonally. There is a great extent of suitable lowland forested wetland habitat and they may still breed, but hunting is probably a very severe threat throughout and may well have eliminated any birds which once occurred. There are significant populations nearby in Xe Pian NBCA, Bolovens Southwest PPA and probably Xe Khampho PPA (Thewlis *et al.* in prep.). In this context, any birds in DHS would form part of one of the largest populations known anywhere in the world and should be a management priority. Further surveys are needed to locate any wetlands still used by this species, concentrating on interviews and searches of the remoter wetlands and streams of the lowlands.

Lesser Fish-Eagle *Ichthyophaga ichthyaetus* (Globally near-threatened)
Ban Houay Phoung: one immature seen along Houay Touay-Gnai on 10 February about 2 km downstream of Nong Hou.

This is the first record for the reserve. The lowland reaches of the Houay Bangliang, Houay Namphak, Houay Touay-Noy and Houay Touay-Gnai are all of suitable size to support this species. They occur naturally at low densities, each pair possibly requiring 15-25 km of river in Laos (Thewlis *et al.* in prep.). Thus only 1-2 pairs might be expected on each of these streams within the reserve, even at optimal densities. Of the four stretches well searched (Houay Bangliang above Houay Sout; Houay Touay-Gnai near Nong Kouyang, the Middle Houay Namphak and Houay Touay-Gnai near Nong Hou), only the latter, which was the least disturbed, held the species, and even there no adult was seen. However, less accessible stretches of all four streams remain and it seems likely that a very small breeding population remains.

Silver Pheasant *Lophura nycthemera* (Regionally at Risk)
Houay Bangliang: one seen at 450 m in the Houay Sout valley, 22 February.

Silver Pheasant is not known to occur below 450 m in Laos and the current survey focussed on areas below 400 m, so the small number of records was to be expected. There were a few records above 1000 m in 1993. The birds in DHS are of the race *L. n. engelbachi* endemic to the Bolovens Plateau.

Siamese Fireback *Lophura diardi* (Globally threatened)
Houay Takit: remains of at least three different hunted birds seen. Unidentified pheasant species seen on three occasions were probably this species or Red Junglefowl *Gallus gallus*.
Middle Houay Namphak: remains of one snared male found by Nong Houpou.
Houay Bangliang: remains of a snared female found by a campsite at 500 m.

There were no confirmed records on the 1993 survey. The species clearly occurs quite widely in logged lowland forest, but it is of concern that levels of hunting (presumably snaring) are so high in relation to the number of observations.

Green Peafowl *Pavo muticus* (Globally threatened)
Ban Somsup: there were no records from Quan Mou, despite daytime searches and attempts to listen for calls from widely scattered areas at dawn and dusk. People involved in clearing plantations nearby reported that none had been seen or heard in 1996, but some were present in 1995. At least one (a male) was reportedly shot by someone from Ban Somsup in 1995.

Other: there were reports from Ban Laogna that one was shot near the village in 1995, and that the species still occurs at Nong Boua-Ton, on the route from Ban Nam-Om to Ban Nongek. There was no time to investigate these reports.
Houay Touay Noy/Gnai confluence: no recent records. The head man at Ban Nabon, Mr. Sing, stated that Peafowl occurred in the Ban Nabon area 30 years ago.

The tract of deciduous forest on the southern border is the only area of the reserve likely to support this species, since they avoid semi-evergreen and lower montane forests. Green Peafowl were confirmed to occur in 1993, and local reports then suggested large numbers, but it is clear that the development of a new settlement at Quan Mou has at best forced the birds there to move away and at worst resulted in them being hunted out.. The reports from further south-east in this habitat block suggest that a small population may yet survive, and investigation of this is a priority. The species is at risk of being lost from the reserve within the next few years. It is one of the highest priorities for conservation amongst the birds of Laos, because it is declining so rapidly (Evans and Timmins in press).

Grey Peacock-Pheasant *Polyplectron bicalcaratum* (Regionally at Risk)
Houay Takit: two heard on the slopes of Phou Pong above 500 m. Feathers were found at a campsite beside Houay Huaxang, in flat logged forest several kilometres from the slopes, but our guide was sure that they would have been snared on the slopes and do not occur in the lowlands.
Middle Houay Namphak: one heard in the remotest headwaters of Houay Nyat (400 m), one along the Ban Nonglouang path (450 m) and one on the hill slopes above Ban Nong Khae (500-600 m).

There were no records during the 1993 survey, which was conducted at a time of lower calling and lower snaring activity. It is difficult to assess the abundance of the species from the 1996 records, but higher densities of calling birds, up to several heard per day, have been noted in other reserves (e.g.in parts of Xe Pian and Nakai-Nam Theun NBCAs, Thewlis *et al.* in prep.). Even within the slope forest of Dong Hua Sao, presence seemed to be patchy. The lack of records from the Houay Bangliang sector, where the habitat seemed ideal, is worrying.

Grey-headed Lapwing *Vanellus cinereus* (Globally near-threatened)
Ban Nabon: a party of five was seen on 25 February on the extensive dry margins of the wetland called Bung Tak Laet.

This is the first record for the reserve (this site is just outside the reserve boundary).

Green Imperial Pigeon *Ducula aenea* (Regionally at Risk)
Ban Houay Phoung: up to 2 seen and heard 9-10 February at Nong Hou. One heard very close to Ban Houay Phoung on 11 February and two heard at Nong Bawa on a brief visit on the same day.
Ban Somsup: one was heard in logged semi-evergreen forest north of the village on 1 March (provisional identification)

This is a relatively small number of records, since the species was apparently calling at the time of the survey. There were also few records in 1993. Green Imperial Pigeons require semi-evergreen or mixed deciduous forest at low altitudes, usually close to water, and are vulnerable to hunting (Round 1988).

Great Hornbill *Buceros bicornis* (Regionally at Risk)
Middle Houay Namphak: a party of at least three was seen at 500 m on the slopes above Ban Nong Khae on 14 February, with six there the next day.

This is the first record for the reserve. Densities are clearly low, and the species may be restricted to the hill slopes. No site so far surveyed in Laos has supported healthy densities of this species (Thewlis *et al.* in prep.).

Wreathed Hornbill *Rhyticeros undulatus* (Regionally at Risk)

Wreathed Hornbills were recorded in four sectors (Table 13). Judging from the ratio of Great to Wreathed Hornbills amongst the identified records, it is likely that most of the unidentified records also referred to Wreathed. The highest encounter rates with large hornbills were in the Houay Bangliang and Middle Houay Namphak sectors, predominantly in slope forest, which probably experiences least hunting and has been least heavily logged. There were quite low encounter rates in flatter logged forest around Houay Takit, Ban Houay Phoung, and Ban Somsup. There were no records of large hornbills from the Houay Touay Noy/Touay Gnai confluence, apparently the most heavily hunted sector visited and also the remotest from the slope forests.

Body feathers thought to belong to one of the two large hornbills were found at a hunters' camp in the Houay Takit sector.

Table 13 Encounters with large hornbills in DHS in 1996

Sector	Observer -days	Total encounters	Encounters /observer - day	Wreathed	Great	Unidentified
Houay Takit	14	3	0.3	1(2)	-	2(2+H)
Ban Houay Phoung	8	4	0.5	2(3+4)	-	2(H+H)
Middle Houay Namphak	14	9	0.6	4(1+1+1+1)	2(6+3)	3(1+1+H)
Houay Bangliang*	12	11	1	7(1+1+5+1 +1+13+5)	-	4(1+H+H+H)
Ban Somsup	6	2	0.3	-	-	2(H+2)
Houay Touay confluence	8	0	0	-	-	-

*The campsite had good views of distant hillsides, giving better conditions for detecting hornbills than at other sites. Figures represent total number of encounters, with group sizes of successive encounters in brackets. H indicates wingbeats heard only.

White-bellied Woodpecker *Dryopicus javensis* (Regionally at Risk)
Ban Somsup: a pair was seen on tall trees in a freshly cleared area of plantations at the interface between semi-evergreen and mixed deciduous forest just east of Quan Mou.

There are no previous records for the reserve. The species prefers mixed deciduous forests of the flat lowlands, especially in mosaic with dry dipterocarp forest (Thewlis *et al.* in prep.). It is not under high threat in Laos, or in DHS, but logging of the largest trees will probably reduce the suitability of the habitat.

Red-collared Woodpecker *Picus rabieri* (Globally threatened)
Houay Takit: one was seen in a stand of large trees in an area that had otherwise been quite heavily logged.

Logged forest supports much lower densities of this species than primary forest at most sites surveyed in Laos (Thewlis *et al.* in prep.).

[Javan Frogmouth *Batrachostomus javensis* (Regionally at risk)
Houay Takit: common
Ban Houay Phoung: present
Middle Houay Namphak: present
Ban Somsup: present in mixed deciduous forest near Quan Mou.

According to recent taxonomic revision this bird is more correctly called Blyth's Frogmouth *Batrachostomus affinis* (Oriental Bird Club in prep.). All identifications were provisional, based on calls which are not confirmed to be given solely by this species. There are as yet no confirmed records from anywhere in Indochina, but these calls have been heard commonly in a great many areas in Laos surveyed in recent years, including quite heavily degraded forest (Thewlis *et al*. in prep.), and on this basis the species is not thought to be under significant threat, either in Laos as a whole or in DHS.

Blyth's Kingfisher *Alcedo hercules* (Globally threatened)

Middle Houay Namphak: up to two seen on 13 February and 16-19 February around the Houay Namphak/ Houay Nyat confluence and along the Namphak up to 1 km upstream and the Nyat up to 2 km upstream. Believed to be a single pair. Not present elsewhere on rivers in this sector, downstream to the irrigation dam.

There are no previous records for the reserve. The species is thought to have specialised habitat requirements, namely shallow stony or rocky streams 5-15 m wide with wooded banks which usually shade the water and a moderately strong flow even during the dry season (Thewlis *et al.* in prep.). Only a few other stretches of river within the reserve may be suitable. The most likely are the Houay Touay-Noy, Houay Touay-Gnai and possibly Houay Bangliang downstream of where they leave the hill slopes, but before they flow far out into the lowlands. Some smaller streams, such as Houay Takit, may also be suitable. The maximum population in the reserve is likely to be only a few pairs. They are threatened elsewhere in Laos primarily by loss or inundation of riverside forest - this is not an immediate threat, but the species should be monitored. Water pollution may also become a problem if chemical inputs increase in the coffee plantations.

Bar-bellied Pitta *Pitta ellioti* (Globally near-threatened)
Houay Takit: very numerous. Ten or more could be heard in a day, chiefly near dawn and dusk. Plucked feathers found at two campsites. None heard during one day on the steeper hill slopes.
Ban Houay Phoung: one heard at Nong Bawa on 19 February. Plucked feathers found at campsite near Nong Hou. Apparently much scarcer than at Houay Takit, despite similarities in habitat.
Middle Houay Namphak: feathers of one bird found at a snare line near Ban Nong Khae in flat, logged lowland forest.
Houay Bangliang: two heard at 400 m in Houay Sout valley on 20 February.
Ban Somsup: remains were found near Quan Mou at a hut. One was heard south of Ban Somsup on the road to Ban Laogna, in degraded semi-evergreen forest.

Commonly recorded in both years. The patchy nature of the records suggested that calling rates dropped during the survey since the habitat in the Ban Somsup and Ban Houay Phoung sectors seemed as suitable as that around Houay Takit. The wide range of habitats and locations, together with the high densities noted in the Houay Takit sector, suggest that the species is not severely threatened. However, snaring levels are high around areas occupied by people and this is one of the most frequently caught species.

[Blue-rumped Pitta *Pitta soror* (Globally near-threatened)
Middle Houay Namphak: possible feathers from a snare line near Ban Nong Khae

There was a single confirmed record of this secretive species in 1993.]

Black-and-Red Broadbill *Cymbirhynchus macrorhynchus* (Regionally at risk)
Ban Somsup: two were seen in a mixed species flock beside a pool north of the village.

This species was sporadically found in 1993, invariably associated with pools (and probably also streams) in the flat lowlands. It is not under severe threat, though locally clearance of poolside forest may affect it.

Eastern Green Magpie *Cissa thalassina* (Globally near-threatened)
Ban Houay Phoung: one seen in a mixed species flock with laughingthrushes and woodpeckers in taller logged forest on 9 February.

This is the second record for the reserve. The densities appear to be much lower than in Xe Pian NBCA, which is the national stronghold of this species (Thewlis *et al.* in prep.). This may be because it prefers semi-evergreen forest drier than that in DHS, and/or they are highly sensitive to logging. The only other recent record from Laos is from Bolovens Southwest PPA.

Under the taxonomy of Oriental Bird Club (in prep.) and Collar *et al.* (1994) this bird is called Yellow-breasted Magpie *Cissa hypoleuca*, with the name *C. thalassina* reserved for the population in Borneo, now considered a separate species.

Brown-rumped (Rosy) Minivet *Pericrocotus* (*roseus*) *cantonensis* (Globally near-threatened)
Middle Houay Namphak: two in a mixed flock by Houay Nyat on 18 February and one well downstream next day (260-280 m)
Houay Bangliang: one seen at 500 m on 23 February and two at another site at the same altitude on 24 February
Ban Somsup: one was confidently identified from a party of four Ashy *P. divaricatus*/Brown-rumped Minivets in logged semi-evergreen forest north of the village (180 m).

There are no previous records from the reserve of this non-breeding migrant. They occurred widely at low densities in both logged lowland and unlogged slope forests and are unlikely to be under significant threat in the reserve.

This bird was treated as a race of Rosy Minivet *P. divaricatus* by Lekagul and Round (1991) but as a full species by Oriental Bird Club (in prep.) and Collar *et al.* (1994).

Grey-faced Tit-Babbler *Macronous kelleyi* (Globally Near-threatened)
Houay Takit, Ban Houay Phoung, Middle Houay Namphak, Houay Bangliang, Ban Somsup, Houay Touay Noy/Gnai confluence: common at all these sites in logged and unlogged semi-evergreen forest, with several heard daily (20 or more in a day at Houay Takit). Heard up to at least 500 m.

This species has a highly restricted range (King *et al.* 1975) but is one of the commonest and most frequently heard in the lowland forests of Champassak and Attopeu Provinces. The population in Dong Hua Sao is very large and, since logged forest supports high densities, is under little threat.

Golden-crested Myna *Ampeliceps coronatus* (Regionally at Risk)
Ban Houay Phoung: four over Houay Touay-Gnai on 8 February and ten at Nong Ngu on 10 February.

This species is inconspicuous and may be commoner than the few records in 1993 and 1996 suggest. It seems to occur quite widely in the reserve, but densities are not high. It is taken for the cage bird trade in Thailand, but its conservation status in Laos remains obscure.

Hill Myna *Graculus religiosa* (Regionally at Risk)
Houay Takit, Ban Houay Phoung, Middle Houay Namphak, Ban Somsup, Houay Touay Noy/Gnai confluence: common, with several parties heard daily, in both logged and unlogged forest. Largest flocks were 17 in the Houay Takit and Middle Houay Namphak sectors. Mixed deciduous forest, semi-evergreen forest and clearings on the forest edge were all used.
Houay Bangliang: remarkably, no records.

The high densities recorded in most sectors suggest that the population is very healthy and capture for the cage-bird trade has not yet had a significant impact.

5.4 Key bird species not found

None of the three species of vulture *Gyps*/*Sarcogyps* (all Globally near-threatened) known from neighbouring Xe Pian NBCA have yet been recorded from DHS. Their range has contracted so dramatically in Laos that they may no longer occur regularly in DHS, although they would once have been common.

Pompadour Pigeon *Treron pompadora* (Regionally at risk) is known historically from lowland forest around Pakxe (Engelbach 1932) but there are no recent records from anywhere in southern Laos. Hunting and logging may be responsible for the lack of records from DHS.

Suitable habitat for Coral-billed Ground-Cuckoo (Globally near-threatened) occurs on the escarpment slopes. No surveys have been conducted during March, thought to be the month of peak calling for this elusive species (Thewlis *et al.* in prep.).

Brown Hornbill *Ptilolaemus tickelli* (Globally near-threatened) was historically common on the Bolovens Plateau (Engelbach 1932) and is known to occur in Laos down to quite low altitudes (Thewlis *et al*. in prep.). The continued lack of records from DHS, coupled with the failure to record it in the Xe Nam Noy catchment in 1995 (WCS 1995) suggests that it has declined severely in this region.

Tawny Fish-Owl (Globally near-threatened), Alexandrine Parakeet *Psittacula eupatria* (Regionally at risk) and Yellow-footed Pigeon *Treron phoenicoptera* (Regionally at risk) could all have been overlooked, since only moderate survey effort was devoted to their preferred habitats.

ANNEX 6: MAMMAL SPECIES OF DONG HUA SAO

6.1 Status of mammals in each sector of DHS

Table 14 Mammal species recorded from DHS during 1996 wildlife surveys

C Common sightings or calls (L indicates localised distribution)
P Present based on sightings or calls
Rem only recorded from remains in the field
S Recorded only from signs in that sector
Provisional identifications in a given sector are indicated by square brackets.
This table does not include reports.

Species	Houay Takit	Ban Houay .Phoung	Middle Houay Namphak	Houay Banglian g	Ban Somsup SEF	Ban Somsup MDF	Houay Touay Noy/Gnai confluence
Northern Treeshrew *Tupaia belangeri*			P		P	C	
Macaque *Macaca* sp.			P	P			
Gibbon *Hylobates* sp.	P (slopes)	LC	C (slopes)	C	P		
Bear *Ursus* sp.	S	S	S	S			
[Small cat *Felis* sp.]	[S]	[S]	[S]	[S]			[S]
Tiger *Panthera tigris*			S	(1)			
Otter (Lutrinae)			S				
Pig *Sus* sp.	S	S	S	S	P	(rem)	
Muntjac *Muntiacus*/ *Megamuntiacus* sp.	S	S	S				
Large deer *Cervus* sp.	S	P	S			(rep)	S
[Gaur *Bos gaurus*)	[P]	(rep)		[P]			
Black Giant Squirrel *Ratufa bicolor*				P			
Finlayson's Squirrel *Callosciurus finlaysoni*	P	P	P	P	C	C	P
Pallas's Squirrel *Callosciurus* cf *erythraeus*				P			
Cambodian Striped Squirrel *Tamiops rodolpei*	P	P	P	Psp	C		sp.C
Striped Squirrel sp. *Tamiops* cf *maritimus*						C	
Hodgson's Crestless Porcupine *Hystrix brachyura*	Rem		Rem		Rem		S
Asiatic Brush-tailed Porcupine *Atherurus macrouros*			Rem	Rem			

(1) A trap intended to catch Tiger and built quite recently was seen in this sector.

6.2 Key mammal species accounts

Macaques *Macaca* (Five species possible, all Regionally at risk)
Houay Takit: one macaque, possibly Stump-tailed *M. arctoides*, was seen near Houay Bong. A party of four unidentified primates was heard on the slopes at 500 m.
Ban Houay Phoung: one party of two unidentified primates was seen beside Houay Touay-Gnai. Local reports suggested that two macaques, Pig-tailed *M. nemestrina* and Long-tailed *M. fascicularis*, occurred nearby.
Middle Houay Namphak: a group of at least four Assamese/Rhesus Macaques *M. assamensis*/*mulatta* was seen at 500 m on the slopes above Ban Nongkhe.
Houay Bangliang: a single unidentified macaque was seen and a party of unidentified primates was heard at another location.

Ban Somsup: one unidentified primate was flushed in logged semi-evergreen forest north of the village.

Some of these records could have referred to gibbons or langurs. They are presented in detail to demonstrate the low densities of primates in general found in all sectors of the reserve surveyed to date. The best densities appear to be in the unlogged slope forests.

[Douc Langur *Pygathrix nemaeus* (Globally threatened)
Middle Houay Namphak and Houay Bangliang: local residents reported that a few occurred in the remoter, higher areas of slope forest.
Ban Houay Phoung: local residents reported that the species could not be seen within a day's walk of the village, in part due to heavy hunting by visiting hunters over the past few years.
Ban Somsup: local residents reported that the species was still present on the slopes of Phou Tabeng.

There was one confirmed record in 1993, resulting from five days intensive searches in the company of a local guide who claimed to know where to find the species. There were no records in 1996. It clearly occurs in low numbers in DHS, being restricted to the remotest parts of the escarpment and possibly also the top of the plateau.]

[Silvered Langur *Semnopithecus cristatus* (Regionally at risk)
Houay Takit: hunters leaving the area were encountered carrying two langur corpses without fur which they called 'taloung', the Lao name for Silvered Langur.
Ban Houay Phoung and Middle Houay Namphak: local hunters reported that the species occurred in both these areas.

There are no confirmed records from the reserve. It is expected to be largely restricted to the level lowlands close to water, although the reports of the hunters in 1996 suggested their booty may have come from the hill slopes.]

Gibbon *Hylobates* sp. (Globally threatened)
Houay Bangliang: quite high densities recorded in the Houay Sout valley but apparently less around the Houay Bangliang itself. Up to three parties could be heard in a morning in the Houay Sout valley.
Houay Takit: three parties were heard on the escarpment slopes of Phou Pong (sometimes audible from the logged lowlands as far away as Nong Ngu).
Middle Houay Namphak: typically one party (occasionally two) could be heard during a morning birdwatching from any limited area, including the vicinity of Ban Nongkhe. All parties were in the unlogged slope forests north of Houay Namphak or the hilly unlogged forest on both sides of Houay Nyat.
Ban Houay Phoung: up to three parties audible in lightly logged forest within 2 km of the village to the north and north-west. One lone male heard in heavily degraded forest south of Nong Hou on the one morning spent there. Gibbons were predicted to be absent from these two areas by Timmins *et al*. (1993) on the grounds that the forest had been logged.
Ban Somsup: one party heard well to the west of the village itself. None were recorded here in 1993. Also one party seen and another heard in semi-evergreen forest close to Quan Mou, an area where they were present in 1993.

Figure 9 reassesses the distribution of gibbons in the reserve in the light of the above records. The centre of the population is still thought to be the escarpment slopes, but the occupied area is more extensive than previously thought in the area between Ban Nongkhe and Ban Houay Phoung. A number of outlying groups are scattered across the logged lowlands from Ban Houay Phoung to Ban Somsup.

The reserve continues to support an important population of this gibbon, whose identity remain uncertain. Whether it proves to be *Hylobates* (*concolor*) *gabriellae* or *H*. (*concolor*) *siki*, the global range is restricted and DHS supports a significant proportion of the total population.

Bears *Ursus* (both Globally threatened)
Houay Takit, Ban Houay Phoung, Middle Houay Namphak, Houay Bangliang: scattered signs of bears were found in all four areas - claw marks on trees in three and in the fourth a footprint, along Houay Nyat. The camp cook also reported a Sun Bear *U. malayanus* passing close to the Houay Nyat camp on one evening during the survey period.

One Sun Bear was observed in 1993, but there are no records of Asiatic Black Bear *U. thibetanus*.

[Leopard Cat *Prionailurus bengalensis* (Regionally at risk)
Houay Takit, Ban Houay Phoung, Middle Houay Namphak, Houay Bangliang, Houay Touay Noy/Gnai confluence: scattered signs of small cats, including small footprints and scats, were found in all these sectors. The are most likely to be Leopard Cat, but other small felids, such as Jungle Cat *Felis chaus* and Fishing Cat *Felis viverrina* cannot be eliminated.]

Tiger *Panthera tigris* (Globally threatened)
Ban Houay Phoung: local residents reported that footprints were occasionally seen in the fields around the village, especially during the rainy season.
Middle Houay Namphak: one very clear complete footprint was found in thick moss on a boulder in the rocky upper reaches of Houay Nyat. Local residents reported that footprints were occasionally seen around the village during the rainy season.
Houay Bangliang: we were shown a walk-in Tiger-trap a few hundred metres south of the mouth of Houay Sout. It has reportedly been operated without success for the past two years by people from Ban Lak-30.

Otters *Lutrinae* (Globally threatened or Regionally at risk)
Middle Houay Namphak: a scat containing fish and crab remains and presumed to be from an otter was found along a tributary of Houay Nyat. It was quite old and the diameter could not be measured.

[Sambar *Cervus unicolor* (Regionally sensitive)
Houay Takit: a large animal though to be this species was seen on the trail to Ban Thamdin. Footprints though to be of this species were found at one pool, one stream bed and two salt-lick areas.
Ban Houay Phoung: footprints thought to be this species were found at Nong Hou. Two were seen in forest north of Houay Touay-Gnai and one was heard in forest north of the village.
Middle Houay Namphak: footprints thought to be this species were found at Nong Ang.
Houay Bangliang: no records
Ban Somsup: areas of rubbed bark and scrapes in the soil near Quan Mou were attributed to Sambar by a guide. Large bones near the huts at Quan Mou were reportedly from a Sambar killed in 1995.
Houay Touay Noy/Gnai confluence: two were seen near Nong Khouang. Prints were seen at many pools, but often only a single set at each. There were at least three sets at Nong Khouang.
Other: one was heard from the road east of Ban Houay Namphak and old footprints were found along the road nearby.

Footprints could not be distinguished from other *Cervus* species. All verbal reports referred specifically to Sambar. Lung Noy, of Ban Houay Namphak, mentioned that Brow-antlered Deer *Cervus eldi* had occurred nearby as recently as 1968, but no longer.]

[Southern Serow *Naemorhedus sumatrensis* (Regionally at risk)
Houay Bangliang: hunters met leaving the Houay Katan area stated that they had been (unsuccessfully) pursuing this species.]

Wild Cattle *Bos* (Globally threatened)
Houay Takit: old footprints attributed to wild cattle were found at four locations not far from Houay Bong. All involved single animals, but two different sizes of print were seen. Those prints seen by local hunters were said to be Gaur *Bos gaurus* and differed from suspected Banteng prints seen subsequently in Phou Xiang Thong NBCA (TE, pers. obs.).

Houay Bangliang: footprints thought to be of Gaur were numerous around the Houay Sout valley and the ridge of Phou Yaut. Our guides clearly stated that these were made by Gaur, and dismissed earlier reports that Wild Water Buffalo *Bubalus arnee* might be present. The animals had clearly followed long stretches of footpath, resulting in hundreds of prints made at a time when the ground was very much wetter than during the survey. However, it was possible that only two or three individuals were involved, judging by the sizes of prints and their spacing. These animals were reported to have visited during the rainy season.
Houay Touay Noy/Gnai confluence: cattle prints (measuring approximately 16.5 cm wide x 11 cm long) were seen at Nong Houdin. These could not be identified to species and might have been from a domestic buffalo. There was no sign that domestic buffalo were grazed at any other pools in this sector, so it is possible these tracks were of a wild bovid.
Other: the village chief of Ban Laogna reported that footprints of an individual of one of the wild cattle species were seen north of the village in the 1995 wet season.

These records, together with the single set of tracks found on Phou Pongkham in 1993, suggest a very small population of Gaur is present during the rainy season, with little indication of where they might be during the dry season. They can probably be expected to visit the salt-licks at Houay Bong during the wet season.

Black Giant Squirrel *Ratufa bicolor* (Regionally at risk)
Houay Bangliang: one was seen and another heard.
This is a very small number of records.

Finlayson's Squirrel *Callosciurus finlaysoni* (Regionally at risk)
Present in all sectors surveyed, common in some and possibly all of them.

Cambodian Striped Tree Squirrel *Tamiops rodolphii* (Regionally at risk)
All sectors: present and probably common, in all semi-evergreen forests, logged and unlogged.