WILDLIFE IN LAO PDR

1999 STATUS REPORT

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PREFACE

In 1993 IUCN, in collaboration with the Department of Forestry's Centre for Protected Areas and Watershed Management, published the first status report of wildlife in Lao PDR. Previous information was available through the reports of European collectors and hunters dating back to the 1890s through to the 1960s. Over the past six years, a wealth of additional information on the wildlife of Lao PDR has been gathered as a result of various surveys that have been undertaken as well as enhanced knowledge of species distribution and the factors that influence range, population and conservation status of each species within the country. It is therefore timely and necessary that the earlier report has now been updated to reflect this increased knowledge base. The 1999 Status Report is a result of collaboration between the Centre for Protected Areas and Watershed Management, IUCN - The World Conservation Union, and The Wildlife Conservation Society, supported by funding from the German Federal Ministry for Economic Cooperation and Development (BMZ).

Lao PDR still has a rich wildlife heritage, with wildlife populations and their habitats probably less depleted than in most countries of the region. Many of the mammal, bird, reptile and amphibian species included in this review have been identified as being of national or global conservation significance. Indeed, Lao PDR has shared the discovery of new large and small mammal species in the Sai Phou Luang (Annamite) Range with neighbouring Vietnam since the first status report was published. However, virtually all wildlife is subject to increasing threat from habitat loss and, most significantly, unsustainable levels of harvest for subsistence use and trade. It has been estimated that annual sales of wildlife in Vientiane markets alone include up to 10,000 mammals (more than 23 species), 7,000 birds (more than 33 species) and 4,000 reptiles (more than eight species), with a weight of 33,000 kilograms. Particularly notable is the fact that hunting for the meat trade is higher in years of poor rice harvest, so the well-being of the country's wildlife heritage is clearly linked to resolution of Lao PDR's broader development issues.

As well as the national demand for wildlife and wildlife products, there is the major issue of the illegal, international trade in wildlife. As wildlife resources in nearby countries become more and more depleted, the relatively rich resource in Lao PDR becomes more valuable for illegal trade. The sad fact is that all recent surveys indicate that wildlife throughout Lao PDR's is declining.

The Government of Lao PDR has taken numerous steps in recent years to halt this decline, including laws, policies, gun collection, protection of habitat in National Biodiversity Conservation Areas (NBCAs) and, in 1997, the declaration of the annual 'National Wildlife Conservation and Fish Release Day' held on 13 July.

In the face of an expanding human population and increasing development, the main hope for the conservation of wildlife habitat in Lao PDR is in its protected area system, including NBCAs and provincial conservation areas. This is where the focus of attention, including international financial and technical support, is required. While zoos and captive breeding programmes can play an important role in education, awareness raising and research, the highest level of input is required to support in situ conservation in natural ecosystems. Critical to this approach is the development of collaborative management with local people who live in, as well as outside, protected areas and who depend to a large extent on forest products for subsistence and income generation. In turn, such collaborative approaches will require the formulation and application of effective conservation and development management models.

However, if the Lao people are to maintain their wildlife heritage for future generations then the responsibility cannot only be placed on local people living in or near conservation areas. Effort is required at all levels, from district to national, from those who enforce laws and regulations to those who formulate the policies, laws and regulations. Further, education and awareness raising on wildlife conservation issues is everyone's responsibility: those who purchase wildlife products in cities and towns are as much in need of this education as are villagers in rural areas who supply the demand. Finally, decline in wildlife populations is as much an international issue as it a national one. This means that international conventions on wildlife trade need to be enforced, but it also means that the international community should assist Lao PDR in conserving its wild species and habitats.

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ABBREVIATIONS AND CONVENTIONS

Abbreviations

Note: abbreviations specific to an individual chapter (e.g. those for frequently cited reference sources) are detailed at the front of the chapter in question.

ARL	At Risk in Lao PDR (see conventions)
CARL	Conditionally At Risk in Lao PDR (see conventions)
CESVI	Cooperazione e Sviluppo
CIDSE	Coopération Internationale pour le Developpement et la Solidarité.
CITES	Convention on International Trade in Endangered Species of wild fauna and flora
CPAWM	Centre for Protected Areas and Watershed Management of DoF
DD	Data Deficient (see conventions)
DoF	Department of Forestry of MAF
FOMACOP	Forest Management and Conservation Project
GNT	Globally Near-Threatened (see conventions)
GT-CR	Globally Threatened - Critical (see conventions)
GT-EN	Globally Threatened - Endangered (see conventions)
GT-VU	Globally Threatened - Vulnerable (see conventions)
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit
IUCN	The World Conservation Union
LKL	Little Known in Lao PDR (see conventions)
LSFCP	Lao-Swedish Forestry Cooperation Programme
MAF	Ministry of Agriculture and Forestry, Vientiane
MNHN	Muséum Nationale d'Histoire Naturelle, Paris, France.
NBCA	National Biodiversity Conservation Area
NHM	Natural History Museum, London and Tring, UK; formerly BM(NH)
NR	Nature Reserve
PARL	Potentially At Risk in Lao PDR (see conventions)
PNBCA	Proposed National Biodiversity Conservation Area
Prov. PA	Provincial Protected Area
s.s.	*sensu stricto*; used with species names where the content of the species varies. For example reference to *Hylobates concolor* (*s.s.*) does not include the forms *gabriellae*, *siki* and *leucogenys*, although some authors do include these forms within the species (see species account for further detail).
SSC	Species Survival Commission of IUCN
STENO	National Office for Science, Technology and Environment.
WCMC	World Conservation Monitoring Centre, Cambridge, U.K.
WCS	Wildlife Conservation Society
WWF	WorldWide Fund for Nature/World Wildlife Fund (North America only)
•	(at the start of a species account): the species is considered to be a key species: one of special conservation significance.

Conventions

Global Threat Categories

These categories are taken from the *1996 IUCN Red List of threatened animals* (IUCN 1996) or, for birds, Collar *et al*. (1994). They relate to the threat to the survival of the species across its entire world range.

Globally Threatened - Critical (GT-CR): the species faces an extremely high risk of extinction in the wild in the immediate future. Sometimes 'Critically Endangered' is used.
Globally Threatened - Endangered (GT-EN): the taxon is facing a very high risk of extinction in the wild in the near future.
Globally Threatened - Vulnerable (GT-VU): the taxon is facing a high risk of extinction in the wild in the medium-term future.
Globally Near-Threatened (GNT): the taxon is close to qualifying for Vulnerable.
Data Deficient (DD): a taxon for which there is inadequate information to make a direct, or indirect, assessment of its risk of global extinction in the wild. This category does not imply that the species is certainly Globally Threatened, and further data could show that the species is presently secure globally. All species occurring in Lao PDR classified as Data Deficient (globally) by IUCN (1996) are clearly potentially or actually at risk in Lao PDR.

These categories are discussed and defined formally (sometimes quantitatively) in IUCN (1996). Other categories listed there (e.g. Conservation Dependent) are not currently relevant to any species in Lao PDR.

Lao PDR Risk Categories

These categories relate specifically to the threat to survival of the species in Lao PDR. Elsewhere in its world range, it may be secure, even numerous. The classification system is taken from Thewlis *et al*. (1998), with modifications. Categories have been assigned to individual species specifically for the present work.

At Risk in Lao PDR (ARL): this category is roughly equivalent at a national level to the Globally Threatened categories of IUCN (1996). Minor amendments (see Thewlis *et al*. 1998) result in the exclusion of some species for which the only threat is long-term habitat loss and which might be considered 'Vulnerable' following the criteria of IUCN (1996).

Potentially At Risk in Lao PDR (PARL): this category includes species (a) suspected to be At Risk in Lao PDR but where information about threats or species status is insufficient to make a firm categorisation, and (b) species on or close to the borderline of At Risk in Lao PDR.

Conditionally At Risk in Lao PDR (CARL): this category includes species which are not confirmed to be currently extant in Lao PDR, but if they are, will clearly be At Risk in Lao PDR. Usually, this judgement is made by analogy to the status of related species. This category is used with reptiles and mammals, but not birds: bird species now apparently extinct as breeders may recolonise from neighbouring countries, and some (perhaps all) of them continue to visit Lao PDR as non-breeders in small numbers. Thus, categorisation of them as At Risk in Lao PDR is more appropriate.

Little Known in Lao PDR (LKL): this category provides for species where the conservation status is difficult to assess, i.e. those with detection or identification problems, or where fieldwork within their preferred range and habitats has been restricted, or where threats or species status are not clear for other reasons.

The Lao risk categories ARL/PARL/LKL are intended to be roughly equivalent to the global threat categories GT/GNT/DD applied at a national level. In order to forestall ambiguity, similar and therefore potentially confusable terms (e.g. 'threatened in Lao PDR'/ 'near-threatened in Lao PDR'/ 'data deficient in Lao PDR') were deliberately not chosen.

A species of bird or large mammal not assigned a Lao risk category is assessed to be secure in Lao PDR in the short- to medium-term. There are too few data for reptiles, amphibians, bats, murid rodents and insectivores to make conservation risk status assessments for all species.

CITES Trade Categories

These categories reflect the level of threat posed by international trade. Unlike global threat categories and Lao risk categories, which are merely designations to highlight a species's status, CITES categories have a regulatory effect in trade between countries which are parties to the Convention on International Trade in Endangered Species of Wild Fauna and Flora.

Appendix I: Species threatened with extinction which are or may be affected by trade. Trade in specimens between parties is only authorised in exceptional circumstances (although import and export for scientific purposes may be permitted).

Appendix II: Species which although not necessarily now threatened with extinction may become so unless trade in specimens is subject to strict regulation in order to avoid over-utilisation. Species may also be listed in Appendix II because of their similarity to more threatened species, as an aid to enforcement. Commercial trade in wild specimens listed on Appendix II is permitted between members of the convention, but is controlled and monitored through a licensing system.

Miscellaneous definitions

The region 'Indochina' indicates Lao PDR, Cambodia and Vietnam.

Site names follow, where possible, the gazetteers of historical and recent Lao survey localities in Thewlis *et al*. (1998), Evans and Timmins (1998) and Duckworth *et al*. (1998a). These in turn were standardised to follow the République Democratique Populaire Lao Service Geographique d'Etat (SGE) 1:100,000 map series, with a few exceptions. For example, features straddling international boundaries were given their most usual international name, e.g. Annamite mountains rather than Sayphou Louang. In deference to widespread current usage, the map name 'Nakay' (as used by Thewlis *et al*.) is changed here to 'Nakai'. Showler *et al*. (1998a) used 'Phou Ahyon' for the area spelled 'Phou Ajol' in Thewlis *et al*. (1998); the massif is not named on the map series. Vientiane Municipality is also known as Vientiane Prefecture.

Some of the map names are known to be erroneous, particularly with respect to transcription of Lao language into Roman characters. Rectifying these mistakes to produce a linguistically pure list of site names would be an enormous undertaking. More importantly, it is of very limited value to wildlife conservation to know whether Xaignabouli Province might better be spelt Sayabouri, Xaiaboury, or any of the various other ways in which readers may encounter it: such knowledge is unlikely to affect conservation activity within it. Therefore, no changes are made on such grounds.

Gazetteers in the above sources list co-ordinates and altitudes, except for some historical sites for which the locality was not traced. Names of sites used in the present work, but not in any of the foregoing gazetteers, are spelt as on the standard map series where possible. Otherwise, spelling from the original source is retained.

Name elements of existing and proposed NBCAs follow Berkmüller *et al*. (1995a). Thus Nam Phoun is used here, in favour of Nam Phoui, although the latter is in wider current usage.

Common Lao language elements in place names are: *ban*, village; *don*, island; *dong*, forest; *doy*, mountain; *houay*, river; *lak*, kilometer; *muang*, district capital town; *nam*, river; *nong*, pool or small lake; *pa*, forest; *pak*, river mouth; *pha*, exposed rocky peak (usually limestone); *phou*, mountain or peak; *phouphiang*, plateau; *sayphou*, ridge; *sop*, river mouth; *thon*, open area; *vang*, deep river pool; and *xe*, river. The map presentation for names incorporating *lak* is followed here, so that these names can be located by non-speakers of Lao. Spoken forms of sites of wildlife significance are:

Ban Lak Kao: Ban Lak (9)
Ban Lak Xao: Ban Lak (20)
Ban Lak Xaophet: Ban Lak (28)
Ban Lak Hasipsong: Ban Lak (52)

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INTRODUCTION

J. W. Duckworth, R. E. Salter and W. G. Robichaud

Lao Peoples' Democratic Republic (also widely known as Laos) is rich in wildlife. Historical information is limited primarily to birds and mammals, and to those parts of the country covered by collecting trips (e.g. Thomas 1927, Bangs and Van Tyne 1931, Osgood 1932) or hosting residents interested in wildlife (e.g. Engelbach 1932, David-Beaulieu 1944, 1949-1950), and to the anecdotal accounts of hunters (e.g. Cheminaud 1939, Fraisse 1955).

The first edition of this work (Salter 1993b) updated national species lists, analysed a substantial body of village questionnaire data on wildlife distribution gathered between 1988 and 1993, and summarised the data available for individual species from other sources. Since then there has been a sustained inflow of new information on the wildlife of Lao PDR. As examples, since 1991 approximately 70 bird species have been reliably reported from Lao PDR for the first time, and the first consignment of reptile and amphibian specimens sent from Lao PDR in 1998 to the Chicago Field Museum of Natural History for identification contained 46 species, 24 of which were not listed for Lao PDR in Salter (1993b).

As well as these bald species numbers, there has been a dramatic, sustained, expansion of the knowledge of species distribution and the factors that influence range, population and conservation status of many species within the country. As of 1993, lengthy fieldwork had been undertaken in only three proposed protected areas (the Xe Pian, Dong Hua Sao and Phou Xang He National Biodiversity Conservation Areas). By the end of 1998, however, most of the 20 declared NBCAs and several of the 11 proposed NBCAs had received at least a basic survey, and information had been gathered in several areas outside the NBCA system.

This revised edition of *Wildlife in Lao PDR* incorporates this new information. It provides a more comprehensive assessment of historical data than was possible in the first edition. It reassesses secondary and/or regional sources of information (e.g. King *et al*. 1975, Lekagul and McNeely 1977, Welch 1988, Welch *et al*. 1990, Corbet and Hill 1992) from which the occurrence and/or ranges in Lao PDR of some species had been inferred or extrapolated in the first edition. Similar to the first edition, it synthesises the available information on wildlife status in Lao PDR on a species-by-species basis, attempts to provide a framework for the future gathering of information to fill gaps, and highlights some priorities for species conservation. The volume of information available makes it beyond the scope of this report to identify, synthesise and present all the actions necessary for ensuring the survival in Lao PDR of all species identified here as nationally at risk or potentially so. A national red data book is now needed, to list realistic action points to achieve this long-term aim. For interim consideration and to provide a stimulus for further discussion, this report identifies some actions needed if populations of species at risk in Lao PDR are to be conserved. These actions are not necessarily comprehensive, achievable, or those of the highest priority; they are those that became apparent during the compilation of the status information.

Although this revision considers only land vertebrates (mammals, birds, reptiles and amphibians), it is hoped that future sister publications will cover fish, invertebrates and plants. Some information is already available on these groups (e.g. Vidal 1960, Gressitt 1970 and references therein, Howarth 1985, Fidloczky 1988, Roucou 1990, Evenson 1991, Roberts and Warren 1994, Kottelat 1996: Annex) and the information base is likely to be expanded in the near future.

An up-to-date summary of the currently available information on wildlife species in Lao PDR is particularly important as:

- The Centre for Protected Areas and Watershed Management (CPAWM) of the Department of Forestry, the national agency responsible for management of protected areas and other biodiversity-related matters, supervises management of the 20 declared NBCAs and several more areas may be designated as NBCAs. Among the many provincial protected areas declared or proposed, some rival NBCAs in size and importance for wildlife. Effective management of protected areas requires understanding of their wildlife significance in a national context.

- CPAWM, in collaboration with international conservation organisations, has a sustained interest in surveying wildlife across the country, and a compilation of existing knowledge is essential for planning surveys and setting results in context.

- The Government of Lao PDR is considering accession to CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora), and a summary of information on the status of individual species will assist in identifying conservation and management priorities.

- Lao PDR retains internationally important populations of many declining and otherwise threatened species. A summary of information on their current status and range will assist both the Government and international conservation agencies to identify conservation priorities and to formulate management programmes, and to attract external funding to support management activities.

- National wildlife laws are currently under review. In this process, up-to-date information on species status is essential. Species under decline or otherwise nationally at

risk are more likely to merit specific legal protection than are those where the population appears to be secure. To produce realistic laws, the information on status should be considered together with that of various other aspects of the species (origin of threat, use in subsistence economy, ease of identification).

INFORMATION SOURCES

Sources specific to taxonomic groups are listed under the group. The following section considers only the general sources.

Protected Area Reconnaissance and Planning Surveys 1988-1993

Development of a national protected area system in Lao PDR has been in progress since 1988 (Salter and Phanthavong 1989, Salter *et al*. 1991, Berkmüller *et al*. 1993, 1995a, 1995b). Between 1988 and 1993, field visits were made to sites throughout the country. These included structured interviews with villagers residing in or adjacent to 23 candidate protected areas. As part of these interviews, groups of villagers were shown drawings and photographs (sometimes photocopies) of a standard set of 32 wildlife species. These pictures included species likely to be of importance in village subsistence economies (such as wild pigs, muntjacs, chevrotains, Sambar and pangolins) and all international Red Data Book species that it was felt could be recognised without significant errors. Villagers were also asked what species were (a) most frequently eaten, (b) preferred for food, and (c) crop pests and livestock predators, and what they thought were the recent trends in wildlife population levels in their hunting and gathering areas. Additional interviews using the same format were conducted across southern Lao PDR in late 1989 and early 1990 preparatory to field surveys for Kouprey (Salter *et al*. 1990). Subsequent to 1993, interviews have been conducted sporadically and usually as part of field surveys. A standard format has not been maintained and many different people have been involved in their execution. The results from 1988-1993 village surveys remain valuable as a snapshot of perceived wildlife distribution and are referred to here extensively; maps are reproduced in Annex 5.

Site- and Species-specific Wildlife Surveys

Many wildlife surveys have been conducted in Lao PDR in co-operation with CPAWM since 1991. Surveys have mostly focussed on assessment of habitat cover and condition, and on species inventories for birds and large mammals. There has been a bias in effort towards threatened species. In 1998 many surveys also covered reptiles and amphibians. Most surveys have been centred on existing or proposed NBCAs, and by 1999, most of these areas had received at least a reconnaissance survey. Several similar surveys were conducted in association with hydroelectric power project developments, but only some of these studies are available to the public. Aside from these, specific surveys have included two to assess the status of Kouprey (Cox *et al*. 1991, 1992); ongoing work on the few remaining Irrawaddy Dolphins (Baird and Mounsouphom 1994, 1997); a general wildlife survey (focussed on birds and large mammals) of the Vientiane Forestry College Training and Model Forest in Sangthong District, Vientiane Municipality (Duckworth 1996a); and, during 1989-1992, annual mid-winter counts of waterbirds on selected wetlands as part of the Asian Waterfowl Census (Scott and Rose 1989, Perennou *et al*. 1990, 1994, Perennou and Mundkur 1991, 1992). Reconnaissance surveys of wetlands conducted in 1993-1996 provided additional information on the status of Siamese Crocodiles and large waterbirds in a number of additional areas (Claridge 1996). A multi-disciplinary project in the far south (the dolphin area; Baird and Mounsouphom 1997) has gathered information on various other groups (e.g. birds; Cunningham 1998). Work by the MNHN, Paris, in Nam Kan PNBCA is ongoing. Very little ecological or behavioural research has been conducted on wildlife in Lao PDR: there have been studies on dolphins (Stacey 1996) and a captive Saola (Robichaud 1998c) and a few short notes in periodicals (e.g. Duckworth 1997c, Robinson and Webber 1998b) cover such subjects.

Trade Studies

There are various recent studies of trade in wildlife (particularly fish, mammals and birds) within Lao PDR and between Lao PDR and other countries (Chazee 1990, Mills and Servheen 1990, Martin 1992, Srikosamatara *et al*. 1992, Baird 1993, 1995b, Srikosamatara and Suteethorn 1994, Claridge 1996, La-Ong *et al*. 1997, Nash 1997, Donovan 1998, Etterson 1998, Compton in prep. a, in prep. b). Two notable unpublished sources on trade are: (1) a compilation of observations on wildlife trade made during field surveys in 16 provinces during 1988-1992 (Salter 1993a); and (2) a summary of wildlife trade in Lao PDR, including a compilation of CITES-listed animal specimens reported by CITES parties as exported from or originating in Lao PDR during 1983-1990 (Nash and Broad 1993). It is unclear how much trading has changed since the detailed studies of the early 1990s; their results are presented here, but the date in the citation should remind readers that these findings may not reflect the situation in late 1999.

THE GEOGRAPHY AND BIOGEOGRAPHY OF LAO PDR: AN OVERVIEW

Location and Political Units

Situated in the centre of the Indochinese peninsula between 13º54' and 22º31'N and between 100º05' and 107º42'E, Lao PDR comprises 236,800 km^2 of primarily rugged, mountainous terrain. It is bordered on the west by Thailand, on the north by Myanmar and China, on the east by Vietnam, and on the south by Cambodia. The country is divided into 18

political sub-units, which, although not of biogeographic or ecological significance, are noted here (Fig. 1) as they are important in the administration of conservation activities. The sub-units comprise 16 provinces, Vientiane Municipality and Xaysomboon Special Region. As the latter was created recently from parts of Xiangkhouang, Bolikhamxai and Vientiane Provinces, references to sites within it include the former province. For simplicity, further references in this document to the (18) 'provinces' of Lao PDR include the municipality and special region.

Figure 1. Political subdivisions of Lao PDR.

Human Population and Economy

The human population of Lao PDR was estimated in 1995 at 4.57 million (National Statistics Centre 1997a). Although the overall population density (national average in 1995: 19 people per km^2) is low by regional standards, population density per unit area of agricultural land is already near the regional average. The population growth rate of 2.5% per year is one of the highest in Asia. Approximately 83% of the population lives in small villages (average about 300 inhabitants) in rural areas. The main urban centres are located along the Mekong River, with smaller towns along its major tributaries. The provinces with the lowest population densities are Sekong, Attapu and Xaysomboon, with about eight inhabitants per km^2 (National Statistics Centre 1997a).

Lao PDR retains an essentially undiversified economy that relies heavily on the natural resource base of land, forests, minerals and water. Ninety percent of domestic energy consumption is based on fuel wood. In 1996, agriculture (including forestry) accounted for 52% of gross domestic product. Wood products were by far the largest export earner, bringing in an estimated US$ 125 million, up from 1995 when US$ 88 million were earned. The garment industry comprised the second largest export sector, and the third was hydroelectric power. Other natural resources were also significant contributors to the national economy, including overflight rights to foreign airlines. However, all these figures are dwarfed by the estimated US$ 416.5 million that entered the country as foreign aid, mostly as loans rather than as grants (UNDP 1998).

During the 1990s, economic growth was maintained at approximately 7% and there was a rapid regionalisation of the economy. In 1995 imports and exports accounted for 62% of GDP, whereas the figure for 1990 was only 34% (National Statistics Centre 1997b).

The high population growth rate combined with a continued reliance on natural resources for economic growth is resulting in increasing pressures on forested lands and other currently 'unmanaged' habitats. In mid 1997 a major economic downturn began in South-east Asia, which has affected many countries, including Lao PDR. Even 20 months into the crisis, at the time of writing, the long-term effects of it are unclear. During 1998, total inflation in Lao PDR was estimated at about 140%. The effects on wildlife and habitat are likely to be negative. Levels of logging and other extractive uses are reportedly rising as the short-term need for revenue generation forces re-assessment of plans. Many rural people are likely to have been harvesting wildlife at higher levels. This has been exacerbated by the coincidence of the financial troubles with a particularly severe *El Niño* Southern Oscillation. The resulting drought has meant an especially poor rice harvest; the 1998 annual harvest in some villages in the centre of the country was only enough for two months (I. Craig verbally 1999). Food harvested from forests and other natural habitats will be the main way of attempting to make up the shortfall.

Physiography and Drainage

The major river of the country is the Mekong, which rises in Tibet and flows through Lao PDR into Cambodia and Vietnam. It forms the border between Lao PDR and Myanmar and much of Lao PDR's border with Thailand. Tributaries within Lao PDR contribute 35% of flow in the Mekong. Because rainfall is strongly seasonal across most of the catchment, the Mekong shows one of the largest seasonal variations in flow rates of all the world's major rivers. The habitat exposed in the channel during the low-flow season is of outstanding significance to wildlife.

Plate 1.

Gekko gecko, Vientiane. A common species of forests which has adapted successfully to living commensally in houses. Many are collected for trade; the effect of this on populations is unknown. *S. Chape / IUCN.*

Roosting female Blyth's Kingfisher, Nakai-Nam Theun NBCA, December 1998. *B. L. Stuart / WCS.*

Mixed birds and a squirrel for sale in a food market, Xam-Nua. *S. Chape / IUCN.*

Hog Badger, Nakai-Nam Theun NBCA, late 1998. Killed for food. *R. Boonratana / IUCN.*

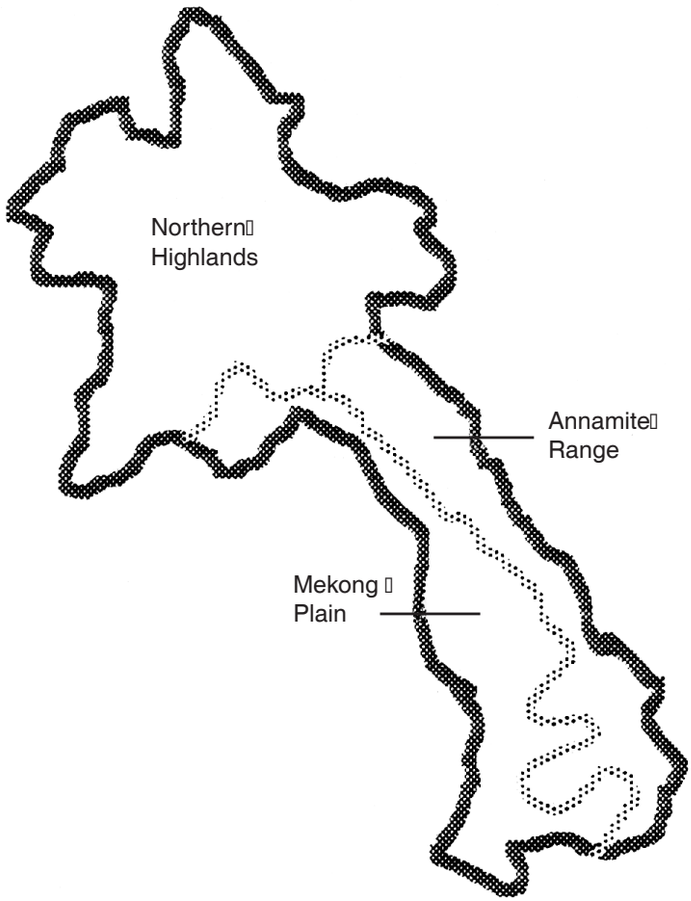
Setting a camera trap, Nam Theun Extension PNBCA, 1998. This technique is invaluable for recording shy ground-living animals. *W. G. Robichaud / WCS and IUCN.*

Southern Serow, Nakai-Nam Theun NBCA, December 1998. Camera-trapped by night. *W. G. Robichaud / WCS and IUCN.*

Male Silver Pheasant, Nakai-Nam Theun NBCA, February 1997. Camera-trapped by day. *W. G. Robichaud / WCS and IUCN.*

Patrol in the Nakai-Nam Theun National Biodiversity Conservation Area. *J. Jarvie / IUCN.*

Figure 2. Physiographic units of Lao PDR.



The Northern Highlands of Lao PDR (Fig. 2) consist of rugged hill topography mostly between 500 and 2000 m in altitude, but including some lower areas along the major river valleys. A few isolated peaks exceed 2000 m, including Phou Bia, the country's highest point at 2820 m. Most of the main massifs, containing by far the highest peaks in Lao PDR, are in the southern part of this region. This is generally known as 'the Xiangkhouang plateau'. All but the extreme eastern part of the Northern Highlands drains into the Mekong River.

The rugged topography of the north continues south-eastwards as the Annamite Range (*Saiphou Louang* in Lao), which forms much of the border between Lao PDR and Vietnam. As in the Northern Highlands, most of this range is between 500 and 2000 m in elevation, although there are a few higher peaks (maximum 2700 m) and some low passes below 500 m. Drainage is all westward into the Mekong River, through the adjacent Mekong Plain physiographic unit. The Annamites act as a barrier to weather systems coming from the east, except in a few areas where the crest is so low that rain-laden clouds cross westwards from Vietnam. Here, the forest is considerably wetter than in areas shielded by the higher ridges.

The Mekong Plain lies south of the Northern Highlands and west of the Annamite Range. It is an area of primarily flat to gently undulating topography with low hills and plateaux, mostly below 200 m. All streams drain into the Mekong, although the connexion of the Xe Kong catchment is in Cambodia.

Climate

The climate is tropical monsoonal, with a rainy season generally lasting from May into October and a pronounced dry season during the rest of the year, although rainfall can occur in any month. Areas adjacent to passes in the Annamites receive more rain (see above) which falls over a longer season. Local and year-to-year differences in rainfall patterns result in periodic regional droughts. Mean annual rainfall ranges between 1500 and 2500 mm over most of the country, although the Bolaven Plateau receives on average over 3500 mm, and areas around Savannakhet and parts of the north generally receive less than 1500 mm.

Maximum daily temperatures during April, generally the hottest month, commonly exceed 40ºC. Although minimum daily temperatures during December and January can drop low enough for frost to form at high altitudes, average minimum daily temperatures are generally about 20ºC throughout the country.

Wildlife Habitats

Lao PDR has long been known as a country of extensive forests. Delaporte (in Garnier 1869-1885) stated (in translation) that:

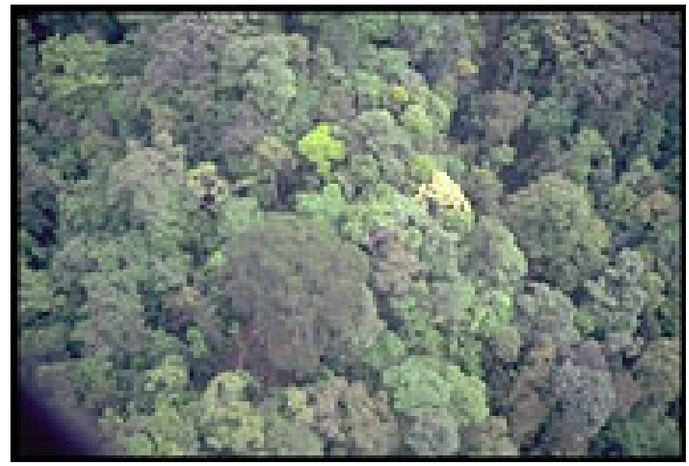
> *"Indeed, our whole story could be said to take place in a single unending forest. We entered it in Cambodia, and we were not going to be out of it before we set foot on the soil of China, eighteen months later. Plains, hills, mountains were covered with tropical vegetation everywhere...the villages and the rice fields surrounding them seemed to be only islands lost amid an immense ocean of greenery. The cultivated land is nothing compared [with] the extent of the woods"*

Although forest cover has declined greatly in Lao PDR in the intervening 130 years, it has done so even more sharply in neighbouring countries. Lao PDR still retains forest cover of outstanding extent when compared with Thailand, China (Yunnan Province) and Vietnam.

The original vegetation cover of the Northern Highlands consisted primarily of dry evergreen forest with, in contrast to the Annamites, substantial areas of deciduous forest at a range of altitudes. There are also patches of forest on limestone and the fragments of a formerly extensive pine forest on the Xiangkhouang (Tranninh) Plateau, about 200 km north-

Plate 2:

One of the most distinctive forest types in the lowlands of Lao PDR is dry dipterocarp forest. Champasak Province, February 1993. *T. D. Evans.*



Mature evergreen forest is the natural vegetation type over much of Lao PDR. Notable in this stand is a large *Fokienia* tree, a species characteristic of parts of the Annamite mountains. Nakai-Nam Theun NBCA, May 1997. *S. Chape / IUCN.*

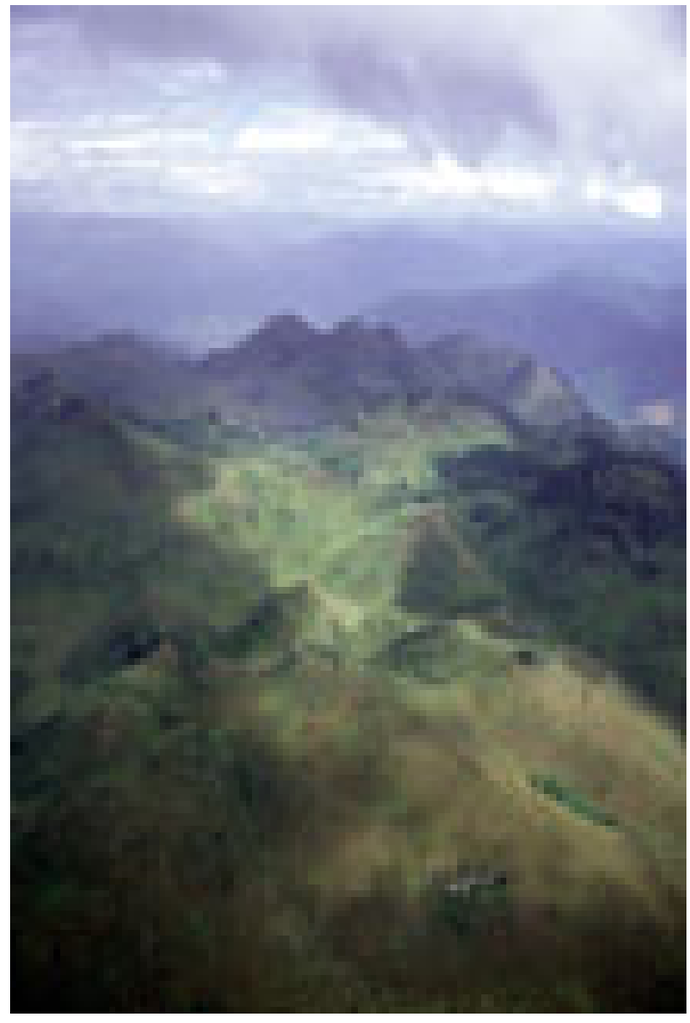
Dry dipterocarp forest is burned widely during the dry season. Fire may be important in maintaining and indeed perhaps in creating the habitat-type. Champasak Province, February 1993. *T. D. Evans.*

Shifting cultivation encroaches on large areas of remaining forest, particularly in north Lao PDR. Houaphan Province, November 1995. *S. Chape / IUCN.*

Natural breaks occur in evergreen forest for various reasons including, as here, rock outcrops. Phou Xiang Thong NBCA, February 1998. *S. Chape / IUCN.*

There is a continuum in tall forests between fully evergreen and fully deciduous. Phou Xiang Thong NBCA, February 1998. *S. Chape / IUCN*.

Limestone karst supports a distinctive vegetation assemblage, with which several rare and/or localised animal species are associated. Hin Namno NBCA, May 1998. *S. Chape / IUCN*.



Repeated burning of forest and regrowth can reduce the landscape to a rather species-poor grassland. Nam Et NBCA, November 1995. *S. Chape / IUCN*.

north-east of Vientiane. Much of the broad-leaved forest has been removed by shifting cultivation (see Fujisaka 1991) and fire and there are now large areas of *Imperata* grassland, bamboo and other secondary vegetation throughout the north (Plate 2). Wetlands consist primarily of swift-flowing rivers and streams, but the area includes also the Nam Ngum Reservoir, the country's largest man-made water-body (230-450 km^2, depending on season) and an important fishery (Claridge 1996).

The Annamite Range was originally covered largely by hill and montane evergreen forest, with extensive pine forests on the Nakai Plateau and in the upper Xe Kong catchment further to the south. The Nakai Plateau may support the only extensive old-growth pine stands in the country (although some has been logged recently); stands on the Xiangkhouang, Dakchung and Bolaven plateaux all comprise smaller and younger trees in much more open formations. Large parts of the Annamites have been affected by shifting cultivation, but forest conversion has not been as extensive as in most of the Northern Highlands. In the south and centre of the country, large expanses of forest remain intact. Wetlands in the Annamite Range consist primarily of fast-flowing streams (Plate 3), although there are also seasonally flooded grasslands on the Nakai Plateau, and in the south a small (about 1 km^2) crater lake and very limited freshwater ponds and marshes.

Extensive limestone karst covered by scrub and forest occurs along the western edge of the Annamites, largely in Khammouan Province (Plate 2). In addition to its vegetation cover, numerous caves and some underground rivers are of wildlife interest.

The Bolaven Plateau is largely cut off from the Annamite Range by the wide valley of the Xe Kong river in southern Lao PDR. It was covered originally by hill and montane evergreen forest (including some stands of pine), but large parts have been subjected to shifting cultivation and fire and some are now under grassland and scrub. There has also been a recent conversion of forest and old shifting cultivation areas to coffee plantations. There are many fast-flowing streams, but pools, crater lakes, marshes and seasonally flooded grasslands are few.

The Mekong Plain physiographic unit was covered originally by lowland semi-evergreen forest, with extensive areas of dry dipterocarp forest (Plate 2) and mixed deciduous forest (Plate 2). Much of the semi-evergreen forest has been logged, although large relatively intact areas still remain, primarily in the south and on the more inaccessible slopes. The lower slope areas are subject to some shifting cultivation pressure, which, along with seasonal fires, is resulting in conversion to more deciduous forest types and, in heavily used areas, to shrubland and savanna. Remaining dry dipterocarp forests are widely subject to seasonal burning and livestock grazing. The most intensive human use of the Mekong plain occurs in low-lying flat areas that are inundated during the rainy season. These areas are now largely converted to rain-fed paddy-fields. Wetlands in this area include fast-flowing watercourses, meandering rivers and streams with oxbow lakes and seasonally inundated floodplains, freshwater ponds and marshes, seasonally flooded grasslands (formerly extensive), reservoirs, and rain-fed and irrigated paddy-fields (Plate 3). Almost all are subject to fishing and other forms of human disturbance, usually at high levels. The Seephandon wetlands or Khon Falls, a widening of the Mekong River at the Lao-Cambodian border, is noteworthy as the world's widest rapids (Plate 3).

An estimated 85% of Lao PDR is covered by vegetation not currently under active management, much of which is secondary. The remaining 15% comprises urban areas, permanent agriculture, and active shifting cultivation. A 1996 analysis suggests that 'mature' forest (defined as areas with at least 20% canopy cover and a 30 m canopy) covers an estimated 40% of land. This forest is being fragmented by logging, agriculture, roads and other development activities (Plates 2, 4). Forest cover in 1989 was estimated, using similar methodology, at 47% and thus the national forest estate seems to be contracting at about 0.5-0.7% per year. Under this definition, there is very little 'mature' forest north of 19º30'N (about the latitude of Xiangkhouang town). The largest and least disturbed blocks of forest remaining are all in or south of the Nam Theun catchment (K. Panzer verbally 1999; see also Stibig 1997).

Several forest classification schemes for Lao PDR have been proposed; none is specifically for wildlife-related purposes. The preliminary national forest inventory (LSFCP 1992) was primarily for silvicultural purposes. At the opposite extreme, recent work by Steinmetz (1998a, 1998b) has documented the complex habitat subdivisions used by villagers. More intensive study of habitats has taken place in neighbouring Thailand, but even here there is no universal agreement on how to classify natural habitats or the nomenclature to be used for them (Graham and Round 1994). This document therefore uses a loose habitat terminology to allow for various interpretations. It is based upon the classification used by Round (1988) with the modifications of Thewlis *et al*. (1998). Most species of birds and large mammals of evergreen forest use also semi-evergreen forest, so (following Lekagul and Round 1991) this habitat is not specifically mentioned unless there are no records from evergreen forest. During recent surveys, forest type classification has been based predominantly on gross physiognomy, rather than floristics. In two cases forests are named after prominent constituent genera, *Fokienia* forest and pine forest. Almost pure stands of pine are not rare, but *Fokienia* forest usually includes substantial numbers of broad-leaved species (Plate 2).

Zoogeographic Relationships

Lao PDR is situated in the Indochinese subdivision (*sensu* Corbet and Hill 1992) of the Indomalayan Realm (Fig. 3). Within this subdivision, MacKinnon and MacKinnon (1986) considered that Lao PDR contained parts of four biogeographic units. Their unit of 'Annam' encompasses the Annamite Range and extends across Vietnam to the South China Sea. The other three zones are sub-units of 'central Indochina': the 'tropical lowlands', the 'tropical montane' and the 'sub-tropical transition zone'. These are shared with Cambodia, Thailand, Myanmar, Vietnam and China. The Indochinese fauna includes species shared with the Himalayan Palaearctic (in the northern mountainous part of the region), with the Chinese Palaearctic (species that have spread along the coast of southern China), with the Sundaic subregion to the south, and with northern India through the Assam-Burma transition zone (MacKinnon and MacKinnon 1986). The Annamite Range and the Mekong River are the main natural barriers in the area, forming the limits of the range of a number of species and subspecies.

Geographical Subdivisions of Lao PDR

King *et al*. (1975) divided Lao PDR into three geographical subdivisions, north, centre and south. These lines were drawn following direct correspondence with J. Delacour (E. C. Dickinson *in litt*. 1999), who, with P. Jabouille (1931, 1940) discussed the geographical distribution of birds in Lao PDR. They made frequent reference to 'haut', 'moyen' and 'bas' Laos, but no formal system was defined. Other historical authors did not always follow their guidelines: for example, Bangs and Van Tyne (1931: 33) refer to Vientiane as lying in "southern Laos" (see also Dickinson 1970b: 481). King *et al*. (1975) provided sketchy textual definitions of the boundaries' locations, and a very small map. Thus, at the resurgence of wildlife fieldwork in Lao PDR in the late 1980s, the most appropriate precise divisions for use on the ground were unclear. Thewlis *et al*. (1996, 1998) therefore set boundaries precisely, as follows: the south-central boundary follows the Xe Banghiang river from its confluence with the Mekong upstream to Xe Pon and thence along the southernmost major affluent (the Xe Pon river) to the Vietnamese border at Lao

Figure 3. Biogeographic context of Lao PDR.

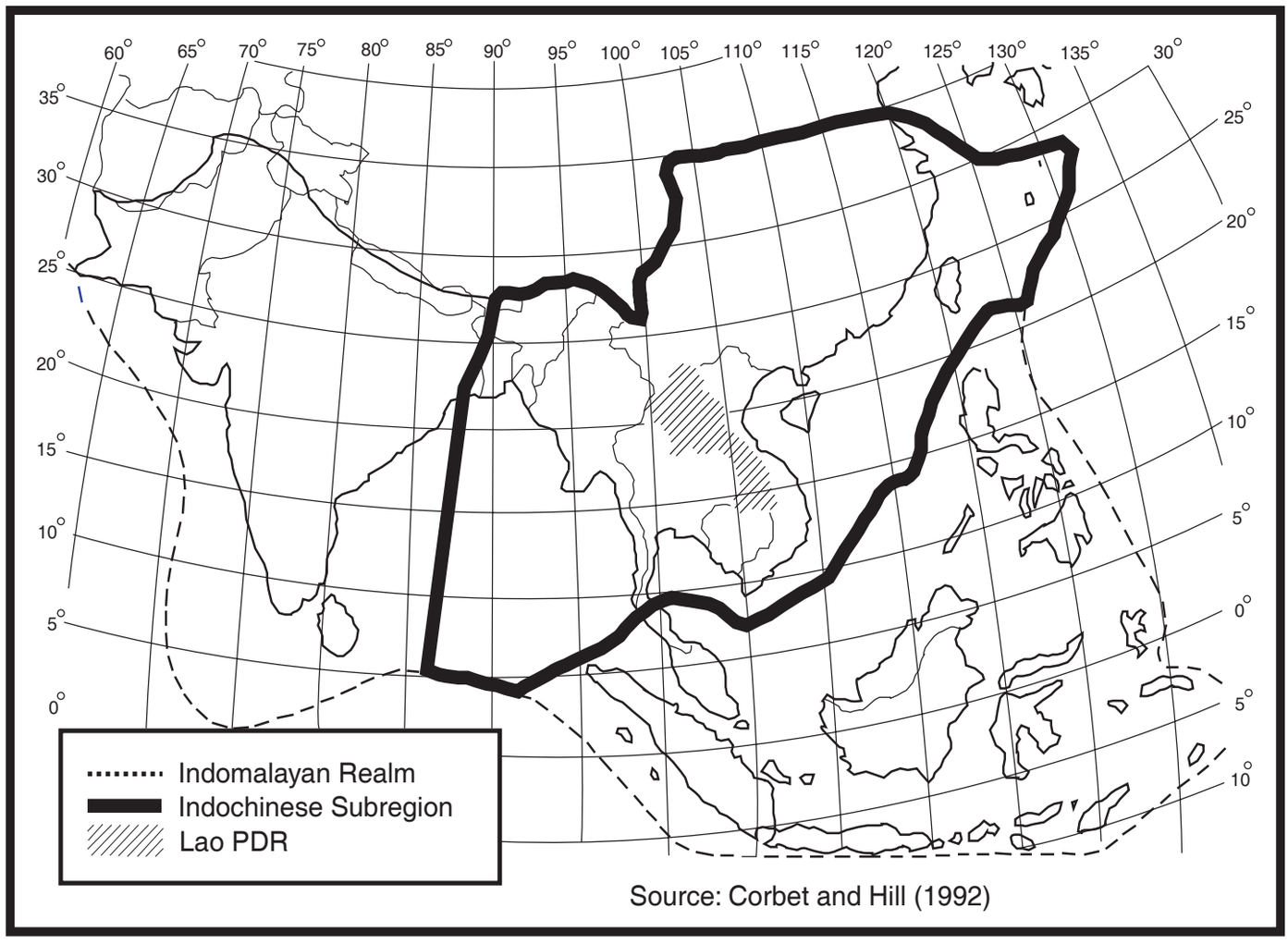


Plate 3:

Sand-bars exposed in slow-flowing rivers during the dry season support a specialised community of birds, reptiles and other wildlife. It is one of the most threatened assemblages in Lao PDR. Nakai Plateau, February 1994. *T. D. Evans / WCS.*

Most static wetlands are heavily used by local communities. This one in Dong Khanthung PNBCA, however, is regarded as an important spiritual area and so habitat and wildlife benefit. February 1998. *K. P. Berkmüller / IUCN.*

Shallow seasonal pools in open grassy areas and dry dipterocarp forest of Champasak Province support an outstanding complement of globally threatened wildlife species. Dong Hua Sao NBCA, May 1993. *T. D. Evans.*

Wide permanent rivers through lowland dry dipterocarp forest are of outstanding conservation importance: in their own right, by virtue of the fringing riverine forest, and as dry season water-sources in an otherwise dry landscape. Xe Pian river, Xe Pian NBCA, February 1998. *S. Chape / IUCN.*

The Mekong wetlands are a very special habitat, particularly where the river widens, as in this stretch of southern Champasak Province. February 1998. *S. Chape / IUCN.*

Pools are among the most important and the most vulnerable habitat features of forests, particularly in the lowlands. Dong Khanthung PNBCA, February 1998. *S. Chape / IUCN.*

In the late dry season, many rivers become in effect a series of pools, e.g. this tributary of the Nam Kading. May 1998. *S. Chape / IUCN.*

Forest rivers (e.g. the Nam Hai) support specially adapted wildlife species. Some of these cannot persist if the forest is felled. May 1997. *S. Chape / IUCN.*

Bao; and the north-central boundary follows route 8 from the Vietnamese border north-east of Ban Lak (20) in a south-south-west direction to join the Mekong at 18ºN.

This northern boundary diverges from the line of King *et al*., running some way to the south. However, the latter's line cuts across major survey and/or management units (e.g. Nam Kading NBCA), whereas the modification of Thewlis *et al*. does not do so. Furthermore, it is easily recognisable on the ground. Using this modification thus greatly simplifies the placement of modern records from this region (which was one of the most extensively surveyed areas in Lao PDR during 1994-1998) into national context. Unfortunately Thewlis *et al*. (1998: Fig. 1) mis-portrayed the line (it should not in fact cut across Nam Theun Extension PNBCA) and stated erroneously that it followed the line of King *et al*. (1975). However, all records classified for that paper (and also Thewlis *et al*. 1996, Duckworth 1996a, Evans and Timmins 1998, Duckworth *et al*. 1998) used the road as the boundary. No published primary source has used any other boundary since the publication of King *et al*. (1975).

Little recent field work has taken place in the area of the centre-south boundary (Evans in prep.). David-Beaulieu's (1949-1950) work around Muang Somoy falls in southern Lao PDR according to the boundary indicated in King *et al*. (1975). Perhaps because Somoy lies north of the Xe Pon (which forms the Lao-Vietnam border for a short length), records from there have sometimes been allocated to central Lao PDR. David-Beaulieu's observations from Xe Pon ("Tchepone") could lie either in central or south Lao PDR, depending on which side of the river his observations were made; here we follow previous authors in regarding them all as central Lao PDR.

These boundaries are basically a convenient latitudinal ladder to indicate the spread of a species's records in Lao PDR. They have little meaning on the ground, and boundaries of true biogeographic units would be blurred over dozens if not hundreds of kilometers. Vidal (1960) gave ample reason using climatic and vegetation patterns to place the north-central divide some way to the north; Nam Kading and Phou Khaokhoay NBCAs, and Nam Theun Extension and Nam Chouan PNBCAs, all fall in central Lao PDR under this scheme. MacKinnon and MacKinnon (1986) placed a divide even further to the north. The selection of the boundaries used here does not imply that we consider them superior in any biological sense; it reflects merely their prior usage for vertebrate records. With the great volume of recent data on distribution, particularly of birds, a meaningful biogeographic analysis would now be possible, perhaps using cladistic principles, e.g. Parsimony Analysis of Endemism (see Morrone 1994, Raxworthy and Nussbaum 1997). Pending this, the present report sets all distributional information into north, central and south Lao PDR, as defined above.

HUMAN USE OF WILDLIFE

Human use of wildlife in Lao PDR is high. There seem to be few if any taxa of wild vertebrates not used by at least some (and in many cases, many) ethnic groups, be it for food, medicine or in trade. Visitors from other countries in the region generally comment on the scarcity of wild birds, bats and other land vertebrates around Lao towns and villages.

While most of the majority ethnic Lao of the lowlands are Buddhists, this seems to have little influence on dampening the exploitation of wildlife, in contrast to some other Buddhist regions (e.g. Sri Lanka, Tibet and Bhutan). Vientiane residents have been observed hunting small birds in the grounds of the city's Buddhist temples. Several non-Buddhist tribes, however, have spiritual taboos against the exploitation of some species. For example, at least some Hmong tribes do not eat or touch snakes, and the Kri have taboos on the killing of all snakes, canids, bears, cats, elephants, rhinos and wild cattle.

Some observers have suggested that the intensity of wildlife exploitation in Lao PDR is a recent artefact of the war and post-war years of the 1960s and 1970s when rural life in many areas was severely disrupted by bombing and fighting, the economy was in disarray, and distribution systems broke down. These features would all dispose people to turn to wildlife to sustain themselves. However, the large variety of traps, evidently of some antiquity, and the observations in historical sources of the varied methods used to catch wildlife (e.g. David-Beaulieu 1944, 1949-1950), all indicate that per capita hunting pressure has been high in Lao PDR for a very long time. The major long-term effect of the war in stimulating harvesting of wildlife is in the prevalence of arms which remain in many areas of Lao PDR.

Human exploitation of wildlife in Lao PDR today has several readily-identified motives and takes many forms. The more significant are discussed below.

Hunting Techniques

Techniques to capture wildlife range from passive methods, such as snare lines, nets and traps (including baited explosives), to active pursuit using dogs, catapults (slingshots), cross-bows (sometimes with poison tipped arrows) and guns (e.g. Tayanin and Lindell 1991, Baird 1993, Claridge 1996). Information about techniques used in harvesting of mammals, birds, reptiles and invertebrates is scattered throughout the literature, often in sources not widely accessible (e.g. David-Beaulieu's (1949) documentation of fish owl trapping in Savannakhet Province). Much remains to be documented and there is a role for a sister publication to that of Claridge *et al*. (1997) which documents fishing techniques in Lao PDR.

Most passive techniques are non- or weakly-selective. This is of special concern when threatened species (e.g. pheasants, Saola, wild cattle, dolphins and crocodiles) are included in the catch. Snares vary in strength depending on the target group, ranging from small birds to very large mammals (Plates

4, 5, 6). Catapults are used primarily by children to take squirrels, lizards, birds and other small game around villages. A variety of nets is used to catch birds and bats, and individuals may be hit out of dense flocks with long bamboo poles. Home-made muskets are in widespread use. Automatic and semi-automatic weapons, many left over from the last Indochina war but distributed also to village defence forces, are widely used for hunting. Poisons and explosives are sometimes used in fishing and hidden in bait for carnivorous mammals (e.g. otters and big cats). Night hunting with powerful spotlights is apparently relatively new, but is rapidly spreading and is used in hunting everything from frogs to large mammals.

Across the country, as in neighbouring lands, trees may be felled to remove pangolins, lorises, monitors and other wildlife. Trees with promising-looking crevices may even be felled speculatively. Whether this activity is having, or will have, limiting effects on the numbers of holes available for cavity-dwelling species is unclear, but it is a very wasteful form of exploitation. Akin to this is the felling of trees to allow easy gathering of fruit. Whether this is yet reducing food supplies for frugivorous wildlife is unclear. Few forest trees regenerate from cut stumps (T. C. Whitmore verbally 1999) and if these felling practices continue, resource levels for wildlife may be reduced.

Subsistence Hunting

The precise role of wild animals in local diet is still under investigation, but it is clear that most animal protein consumed in rural households comes from captured wildlife (including fish and invertebrates), not from domestic animals. In one study in Salavan Province, the respective balance was 82% to 18% (K. Clendon per J. Foppes *in litt*. 1999). Wildlife is, in general, relatively more significant in more remote areas (J. Foppes and R. Dechaineux verbally 1999). Hunting, fishing and gathering are important in most or all village economies in Lao PDR (e.g. Chazee 1990, Hirsch 1991, Ireson 1991, Tayanin and Lindell 1991, Oveson 1993, Foppes and Kethpanh 1997). Many data are being accumulated by the ongoing IUCN Non-Timber Forest Products Project, a

Table 1. Relative frequency of wildlife species used as food in rural Lao PDR.

Species	**Percent of villages reporting species as:**	
	One of three most common food items (n = 317)	**First preference as food item** (n = 215)
Muntjacs	61.2	75.3
Wild pigs	59.3	5.6
Sambar	27.8	11.6
Squirrels	24.6	<1
Civets	21.8	0
Chevrotains	18.9	2.8
Monitors	15.5	0
Junglefowl/pheasants	14.8	2.3
Primates[1]	12.6	0
Rats/bamboo rats	8.8	0
Birds (miscellaneous)[2]	8.5	0
Porcupines	5.7	<1
Pangolins	5.4	0
Hares	4.4	0
Tortoises/turtles	4.1	0
Serow	1.9	<1
Snakes	<1	0
Gaur	0	<1

[1] includes reported use of Douc Langurs, other langurs, gibbons and macaques.
[2] includes reported use of hornbills, doves and other (unspecified) species.

Data were compiled from 1988-1993 village interviews. The low ranking of rats, turtles and birds under 'common food items' does not accord with opportunistic observations made during wildlife survey work in1992-1998. Subsequent observations also suggest that langurs and, locally, gibbons are highly sought-after species.

Plate 4:

Animals are killed for many reasons. Probably the major aim in killing bears is trading internal organs for medicinal use. But other parts are not neglected as there is a wide domestic market for wildlife curios. Asiatic Black Bear now appears to be very scarce in Lao PDR. This skin was confiscated from poachers in Muang Viengthong, Bolikhamxai Province, in 1998. *W. G. Robichaud / WCS.*

In the long-term, habitat loss is likely to be the main challenge to conserving Lao wildlife. Retention of vast tracts of barely-accessible forest is the most efficient way to maintain wildlife populations. Nakai-Nam Theun NBCA, January 1994. *T. D. Evans / WCS.*

Small birds and mammals probably have little international trade value but are traded locally in large numbers in many markets across the country. Recent public awareness activities have resulted in considerable decreases in visible trade in some areas. This stall was one of many in Ban Lak (20) market in 1994, but such trade is no longer obvious at this market. *T. D. Evans / WCS.*

Predators which take domestic livestock are still killed. This large Tiger (a species accorded full legal protection) was shot in late 1998 on the border between Vientiane and Louangphabang Provinces. *Dodongdy Diraporn / IUCN.*

New roads into wildlife areas not only increase accessibility for hunting but may result in a substantial loss of habitat, heavy soil erosion, and act as barriers to mammalian dispersal. Bolikhamxai Province, January 1998. *W. G. Robichaud / WCS.*

A wide variety of wildlife species is eaten. The more spectacular and durable parts are often displayed in village houses. Dong Ampham NBCA, 1997. *W. G. Robichaud / WCS.*

Understanding current threats is central to planning effective conservation action. Snaring is widespread at subsistence levels. But this village militiaman found 500-1000 snares made from bicycle brake cable in one line near the international border in Nakai-Nam Theun NBCA. Such a large undertaking, which is not uncommon in this area, is driven by international wildlife trade opportunities. *W. G. Robichaud / WCS and IUCN.*

Remains of common and rare species alike are displayed, provided they have minimal value in international trade. Saola is one of the rarest large mammals in the world, but its horns fetch a very low price. Bolikhamxai Province, 1998. *W. G. Robichaud / WCS.*

five-year investigation of the current usage patterns of non-timber forest products, including wildlife. Valuable information is present in the progress reports of this project and there is now a need for a synthesis of the importance of wildlife for subsistence purposes in Lao PDR.

Although many wild animals are harvested for family or village consumption, many enter the cash economy through markets (Plates 1, 4, 12, 14). Across Lao PDR, wildlife seems to be the second biggest income earner for rural families (Foppes and Kethpanh 1997; fish is the biggest). The proportion of harvested wildlife which is sold depends on a complex mix of factors including the area and its accessibility to markets, the ethnic group, the season, the success of hunting that day, the prevailing local economic situation and others. This makes a clear analytical cut between hunting for own consumption and for local trading impossible to define and so the two are treated here together. During the late 1990s, overall trade in wildlife meat rose greatly (Foppes and Kethpanh 1997; R. Dechaineux and J. Foppes verbally 1999). Villagers keep a lot of livestock (most commonly chickens, ducks, pigs, cattle and water buffaloes) but these are viewed primarily as 'festival foods' or kept for sale when cash is required.

Subsistence hunting is undertaken by forestry crews and by police and army units assigned to border posts and other rural areas. These groups often rely on wild animals for protein. The effect of this off-take is unknown but is probably substantial within localised areas. One head of a provincial forestry office cited explosives fishing by government soldiers as the second greatest threat to the wildlife of a major NBCA in the province (per WGR). Hunting and fishing by outside groups is often a source of conflict with local villagers (Dobias 1992b, Ireson n/d).

Most wildlife species that are captured are eaten; Foppes and Kethpanh (1997) recorded the consumption of 31 mammal species in one year of study. There is probably some selection for the more common medium- to large-bodied species, tastier species, and/or those that can be hunted most easily (Table 1). This selection probably operates primarily through choice of area to hunt and type of activity to be undertaken, rather than through ignoring the less favoured species encountered during the process. Muntjacs and wild pigs appear to be the most significant wildlife species in village subsistence economies. Table 1 does not include fish or invertebrates. In lowland villages, a much greater weight of fish and aquatic invertebrates is eaten than of all mammal, bird, reptile and amphibian species combined (Foppes and Kethpanh 1997). The contribution of forest mammals and birds is relatively higher in hilly areas away from water-bodies (J. Foppes and R. Dechaineux verbally 1999). Land insects are also major components of village diets. Wildlife meat is probably the main non-woody product (by weight) gathered in forests; in one study in Salavan Province, 77% of the weight of forest-gathered food was meat (K. Clendon per J. Foppes *in litt*. 1999). Skulls, antlers, horns and other parts of hunted animals are often displayed in village houses (Plates 4, 6).

Waterbirds are reportedly hunted heavily in wetlands bordering the Mekong in Savannakhet and Champasak provinces during September to November. These may mostly be migratory waders using the East Asia/Australia flyway (Claridge 1996). Swallows are caught on a huge scale using large net traps in Xiangkhouang Province. This activity has not been documented but hundreds of thousands, if not millions, are caught annually during the autumn migration. The effects of these practices on population viability are unclear, but they are certainly important conservation concerns as they involve international resources.

Subsistence hunting occurs all over Lao PDR, but all indications are that the quarry species populations in the north have been depressed more severely than have those in the centre and south. Hornbills are still recorded widely on surveys in south and central Lao PDR but there were very few records of any species except Oriental Pied Hornbill from the north (Table 11). Medium-sized mammals such as gibbons and Black Giant Squirrels are also recorded much less frequently in the north, even in the largest remaining blocks of forest, than further south. As forest in the former region is more widely degraded and fragmented, wildlife populations are more susceptible to hunting-induced local extinction. Additional factors probably contribute to this pattern, however.

Recreational Hunting

The extent and impacts of recreational hunting, as practised by the urban elite and temporarily resident foreigners, are unknown. It does not appear to require a licence. Waterbirds, and forest birds and small- or medium-bodied mammals appear to be targetted. Weekend hunting occurs around Vientiane (including Phou Khaokhoay NBCA), Thakhek, Savannakhet and Pakxe, and probably also around other urban centres. The Lao government has received enquiries from foreign agents wanting to arrange big-game hunts for Tigers, wild cattle and other species, but to date has not agreed to any of these requests.

Wildlife Trade Within Lao PDR

In addition to subsistence use, various wildlife species are sold as food, medicine, pets and for a variety of decorative purposes to buyers within Lao PDR (Annex 1 and references therein, Srikosamatara and Suteethorn 1994, Baird 1995b, Claridge 1996, Timmins and Evans 1996, Nash 1997, Donovan 1998, Etterson 1998, Showler *et al*. 1998a, 1998b).

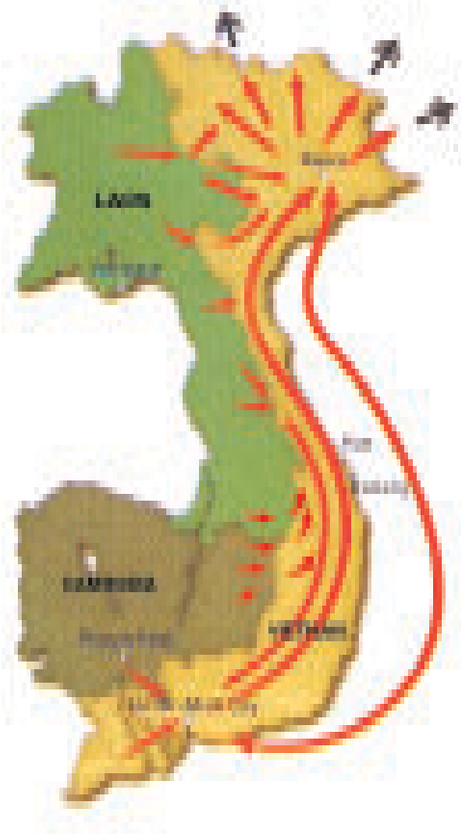
Wildlife meat, often as live animals, was until recently available openly at fresh food markets in provincial capitals and in most district towns (Plates 1, 4, 12, 14), and in restaurants in the larger urban centres. It is more expensive than is that of domestic animals (Sayer 1983, Srikosamatara

et al. 1992) and in towns is purchased primarily as a luxury or health item. Srikosamatara *et al*. (1992) estimated yearly sales through the major market in Vientiane to include 8000-10,000 mammals (of 23+ species), 6000-7000 birds (33+ species) and 3000-4000 reptiles (8+ species), comprising a weight of 33,000 kg and a value of US$ 160,000 per year. There are no more recent estimates for this market, nor any for any other. During the 1990s, with increasing control of the wildlife meat trade, much activity became clandestine. It is now much more difficult to monitor the volume and species range of trade. Indeed, in some major markets (e.g. Pakxan, Bolikhamxai Province), overt trading has ceased. Open trading persists more widely in the north, at airports (Showler *et al*. 1998b) as well as town centres (e.g. Ban Phonsavan, Xiangkhouang Province).

Trade in some, if not most, species, is seasonal, with peaks occurring in particular seasons specific to the species (J. Foppes and R. Dechaineux verbally 1999). Hunting for the meat trade is higher in years of low rice harvest, or under other sources of economic stress (R. Dechaineux verbally 1999). This has important implications for design of trade controls, and for the role of alternative livelihood development in conservation projects.

Lao traditional medicine is mostly herbal-based (Phetsouvanh 1983, Vasilalangsy and Sithimanotham 1985, Sounixay *et al*. 1990) but wildlife parts are used widely. Their use is much more extensive in Chinese traditional medicine, which is also practised in Lao PDR (Baird 1995b and references therein). Bones, claws, teeth, skin, horns, antlers, internal organs, blood, bile and other parts of a number of species, many of them threatened and/or nationally protected, can be found on sale in Vientiane and other parts of the country (Martin 1992, Annex 1).

Figure 4. Wildlife trade from Lao PDR through Vietnam to China. *(Source: WWF Indochina Programme)*



Interprovincial and International Wildlife Trade

Although much wildlife is consumed within the country, there is massive illicit movement of live animals and parts of dead animals into neighbouring lands. Of high significance to wildlife conservation among the various uses are traditional medicine preparation and food. Lao wildlife has been traded for decades and probably centuries; Garnier (1869-1885) observed many wildlife products (specifically noting ivory, rhinoceros horn, peafowl feathers and animal bones) coming out of southern Lao forests for barter, and noted that all fetched high prices in China. It is likely that trading levels increased through the twentieth century. The last 15 years in particular have seen a large rise fuelled by increasing affluence in China and, to a lesser extent, South-east Asia. Villagers in Nakai-Nam Theun NBCA cite 1985 as the year traders and poachers first came over the international border in large numbers (Robichaud 1999).

A well-organised network in Vietnam takes wildlife, mostly alive, to China and much of this comes from Lao PDR (Fig. 4, Plate 5; Compton in prep. a, in prep. b). In the movement to Vietnam, certain Lao towns serve as important nodes. One example is Ban Lak (52), lying 52 km north of Vientiane. This town receives wildlife both caught locally (e.g. Sangthong District) and from as far afield as Xaignabouli, Xiangkhouang, Houaphan and Udomxai Provinces. At Ban Lak (52) it is resold and redistributed, with much heading to Ban Lak (20) on the eastern national border. Here it is joined by large amounts of wildlife caught in Khammouan and Bolikhamxai Provinces. These animals are gathered by an organised network of motorcyclists who visit certain villages on a rotational basis. Wildlife is moved across the international border by various means, including, when the road is watched, human porters through forest paths. As many as 40-50 people in Ban Lak (20) are directly involved in the trade, including a number of Vietnamese (Compton in prep. b). It appears that of wildlife traded at Ban Lak (20), most animals for medicinal use (e.g. pangolins and turtles) are traded to Vietnam, but most meat animals go to Thailand (Khamkeut District Forestry Staff per WGR). There is little information on the proportion of wildlife meat sold in Vietnam which originates in Lao PDR, but it seems likely to be high.

Although the Lao road network is an important conduit of wildlife to Vietnam (see under 'Amphibians and Reptiles') many remote border forests are heavily exploited with the wildlife going straight across the border. These include some

Plate 5:

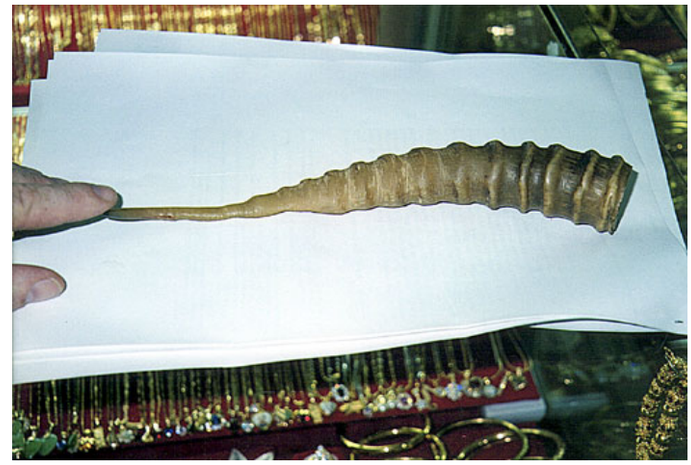
Great Hornbill casques for sale in the Vientiane morning market, early 1994. *T. D. Evans / WCS.*

Frontlets of a variety of ungulates are traded, including this Southern Serow in a Xekong village, December 1997. *P. Davidson / WCS.*

Bear gall bladder drying in a Xekong village, December 1997. *P. Davidson / WCS.*

Much Lao wildlife is believed to be sold in China. This small shop in Kunming displays two Red Pandas (IUCN Endangered), two Owston's Civets (IUCN Vulnerable), two Yellow-throated Martens and two male Common Pheasants. The panda and the pheasant are not known from Lao PDR but at least the panda may be found to occur in the north. *W. G. Robichaud / WCS.*

Specially-trained turtle dogs are used in the Annamites to seek valuable species for sale into international trade. This dog has just smelt out an Indochinese Box Turtle. Nakai-Nam Theun NBCA, December 1998. *W. G. Robichaud / WCS and IUCN.*



Wildlife trade in Lao PDR sometimes involves species not occurring in the country. This Saiga *Saiga tatarica* horn for sale in the Vientiane morning market (in September 1998) presumably originated in central Asia. It bears a passing resemblance to the recently described *Pseudonovibos spiralis*. *W. G. Robichaud / WCS.*

Heavy duty snares made of truck-winch cable are set primarily for animals valuable in international trade, including bears and big cats. Nakai-Nam Theun NBCA, 1998. *W. G. Robichaud / WCS and IUCN.*

One lone hunter was carrying this smoked gibbon carcase and nearly 20 Indochinese Box Turtles. Nam Theun Extension PNBCA, June 1998. *W. G. Robichaud / WCS.*

areas with no road access and regarded as barely accessible in Lao PDR.

Live wild animals are also easily moved across the Lao-Thai border. Ban Mai and Ban Singsamphan (Champasak Province), on the Mekong, appear to be major transshipment points to Thailand for wildlife products originating in Lao PDR and Cambodia. Much wildlife meat sold in Thai markets along the Thai-Lao border originates in Lao PDR (Srikosamatara *et al*. 1992, Baird 1993, Srikosamatara and Suteethorn 1995, La-Ong *et al*. 1997). Much wildlife is moved across the border illicitly, sometimes openly so, rather than through Lao markets. Trade at Ban Singsamphan is facilitated by the lack of any wildlife checkpoint, whereas further to the north in Champasak Province, opposite the Thai town of Chong Mek, tighter control of smuggling of Lao wildlife into Thailand has reduced the number of birds on sale (La-Ong *et al*. 1997). Notable in terms of international threat status is that live bears specially ordered for the restaurant market are traded internationally from Lao PDR (Mills and Servheen 1990).

Probably the major international use of Lao wildlife is in traditional medicine. The most valuable products now are certain turtles and Tiger bones, which are traded to buyers in China. A wide variety of other species is involved, including many which are or were common, such as geckoes, snakes, civets, otters, gibbons and Douc Langurs. The highest volumes traded currently are probably of pangolins and turtles. Rhino horn was formerly moved in bulk to Bangkok for resale, but trade in this product is probably now minimal as regional rhino populations have collapsed. The amount of stockpiled Lao rhinoceros horn is completely unknown.

Some trade in live animals, carried out through fresh food markets, personal contacts and other channels, involves wildlife valued as pets or display species. This trade focusses on birds (primarily parakeets, doves, starlings and mynas, and also larger species such as hornbills; Plate 6), primates (lorises, gibbons, macaques and, reportedly, some Douc Langurs; Plate 13), and bear cubs, primarily destined for sale in Thailand and Vietnam (Chazee 1990, Mills and Servheen 1990, Baird 1993, Salter 1993a, Compton in prep. b). Ban Phalan market in Savannakhet is or was a collecting point for resale of birds and primates to Thai buyers (Phanthavong and Dobias 1993) and is also on a major trade route to Vietnam (Baird 1993). The extent of the trade through this point has not yet been documented. The number of species for live display moving through to Vietnam, at least around Ban Lak (20), appears to be very low compared with animals for consumption as food or in medicine (Compton in prep. b).

Wildlife products are also sold as ornamental souvenirs and trophies (primarily antlers and horns, pig tusks, carnivore claws, teeth and skins, carved ivory products and whole tusks; Plate 5). These products are available in most or all provincial capitals (Annex 1). Thai tourists and other foreigners are frequent buyers (Chazee 1990, Martin 1992, Srikosamatara *et al*. 1992). There are lucrative markets in Vietnam for trophies and stuffed specimens of many mammals from treeshrews to Tigers, and large potentially 'ferocious' birds such as herons and raptors (JWD, RJTim). The proportion of these originating outside Vietnam is unclear, but many are likely to be from Lao PDR. Many trophies offered for sale in Thai border towns, and probably elsewhere in Thailand, seem to originate in Lao PDR (Srikosamatara *et al*. 1992, Baird 1993). Recently, at least with Gaur, it has become harder to find sets of horns with their original skull (La-Ong *et al*. 1997), suggesting a major decrease in source populations.

Possibly the largest trade in any single product is that of pangolin skins, which have been exported in quantity (see systematic list). The largest known tannery, near Vientiane (see Srikosamatara *et al*. 1992), was apparently closed around 1995. Python and ratsnake skins are also exported in some quantity (Nash and Broad 1993, Salter 1993a). There is probably also a relatively low level of trade in Siamese crocodile skins, and of hatchlings destined for Thai crocodile farms (Salter 1993a).

A final reason for capture and trading is the release of small passerine birds for merit at Buddhist temples. The most frequent species involved seem to be munias and swallows. There have also been several records of Pin-tailed Parrotfinches. Based on observations in Cambodia, weavers would probably also be involved, but they are now very scarce in Lao PDR. This activity has not been studied. It seems unlikely that many of captured birds are moved significant distances within Lao PDR, let alone internationally. Many of the birds, weakened by a spell in a cage, probably perish shortly after release. Effects on populations are unknown, but munias seem to be surprisingly scarce in Lao PDR.

Foreign wildlife dealers have been active in Lao PDR for many years (McNeely 1975, Domalain 1977a, 1977b, Lippold 1977, Mills and Servheen 1990) and still operate (Claridge 1996). Wildlife dealers resident abroad take orders for wildlife from Lao PDR, for delivery to the customer in their country (Srikosamatara *et al*. 1992, Baird 1993). Collectors of trophies leave orders and their telephone numbers with traders in at least Ban Singsamphan, Champasak Province (La-Ong *et al*. 1997).

The CITES management authorities of Japan, the USA and some European countries have reported importing live animals (primarily primates, birds of prey, hornbills and snakes), ivory and pangolin and snake skins that were documented as originating in or having been exported from Lao PDR (Nash and Broad 1993). Some listed species do not occur in Lao PDR (Annex 2). The extent to which the individuals of species known to occur in Lao PDR were actually captured in the country is unclear. Also unclear is whether animals captured in Lao PDR are documented as being from other countries. Some wildlife products sold domestically in Lao PDR belong to species not occurring in the country (Plate 5).

Trading is driven by entrepreneurs in response to market forces. Compton (in prep. b) was told by Lao villagers on several occasions that if the Vietnamese did not want to buy wildlife, they themselves would not hunt so much. It is unclear whether trade at the current high levels has been underway long enough for sectors of the rural populace to be now dependent upon it. Enforcement of existing laws in Lao PDR is hampered by several factors from ambiguity and direct conflict between statutes, to low manpower, a basic communications network and a perceived low priority by various government bodies.

Net Effects of Hunting

Extreme hunting pressure has already reduced the populations and species richness of wildlife in towns, noticeably including various birds that are elsewhere abundant in urban environments (e.g. crows, Coppersmith Barbet). Wildlife numbers are also at reduced levels even in lightly populated rural areas. Trade-driven hunting is the major factor pushing wildlife species in Lao PDR to extinction (Table 6). Among such species, very few of the mammals and reptiles are not traded internationally. Reptile species sought specifically for international trade (particularly crocodiles, turtles and tortoises) are under steep decline across the country and national extinction of many species seems inevitable. The section on amphibians and reptiles gives further detail.

Among wildlife valued mainly in the subsistence economy, the species most affected by over-harvesting seem to be those of edge habitats and open wetlands which do not have large populations in extensive dense forest. This is because open habitats, especially wetlands, are foci of human activity and incidental hunting pressure is enormous within them. Species adapted to extensive forest blocks, by contrast, have large areas of relatively lower human presence, in which populations can remain viable. Among bird species at risk in Lao PDR, only hornbills are typical of evergreen forest; the vast majority of birds at risk inhabit open woodland or wetlands (Thewlis *et al*. 1998).

Eighty percent of 1988-1993 village interviews ($n = 208$) expressed concern that wildlife populations were decreasing within their hunting areas. Over-hunting and human disturbance were the most commonly given reasons. Eighty-eight percent indicated that fish populations were decreasing, citing over-fishing, disease and parasites as causes. Declines in fish populations may have major repercussions for bird, mammal, reptile and amphibian quarry species, as villagers primarily dependent on fish then turn to other sources of protein (Baird 1993). Major local concern is felt at the wholesale removal of wildlife from Lao forests along the eastern international border (J. Baker and W. G. Robichaud verbally 1999).

Wildlife Farming

There are few commercial wildlife farms in Lao PDR. In the early 1990s, about 40 Sambar were held near Vientiane and excess animals were believed to be harvested for meat, but it appears that this operation has ended. Burapha (1989) investigated the feasibility of commercial farming in southern Lao PDR of Sambar for meat, skins and antlers in velvet, but because of logistical problems (live animals would have to be shipped to Thailand, the main market for meat) and marginal economics, the idea was not pursued (Salter 1992c). However, deer farming is being considered by other parties in various areas of Lao PDR.

Recent expressions of interest in pangolin farming to the Department of Forestry come from, among others, Taiwanese bodies. So far none has been approved. Pangolins are difficult to maintain in captivity, let alone propagate, and any captive operation would need careful regulation to ensure that it was not merely a laundering exercise for wild-caught animals. Such activities appear to be frequent in Vietnamese macaque 'farms' (Lippold and Vu Ngoc Thanh 1998) and this potential threat attends all wildlife farming proposals.

A crocodile ranch that would collect hatchlings from the wild and raise them for skins and meat was proposed during the early 1990s (NAF n/d) and apparently approved by Government, but foundered as a result of funding problems. This proposal was of particular concern as it was based on an incomplete feasibility study in which there was no attempt to determine current levels of crocodile populations in Lao PDR. Furthermore, it identified the species occurring in Lao PDR as *Crocodylus porosus* (whereas it is *C. siamensis*, a species of major global conservation concern). Although it included provisions for returning crocodiles to the wild to maintain breeding stock, the proposed levels of harvesting (10,500 hatchlings per year) from wild populations were far above sustainable levels. At least one other such scheme is being considered, details of which are unclear, but apparently it might produce hybrid crocodiles between *C. siamensis* and another species. There would be a very high risk of genetic pollution of remaining wild *C. siamensis* from escaped animals (see species account for *C. siamensis*).

There is at least one frog farm in Vientiane (J. Foppes verbally 1999; see Amphibians and Reptile section) and others may exist. The frogs are farmed for human consumption.

Zoos

Lao PDR's major zoo is at Ban Keun, some 70 km north of Vientiane. This keeps a wide variety of local and exotic species and has had notable success in breeding some of them. The zoo is a popular destination for residents of Vientiane and other areas, and has considerable potential in stimulating interest in wildlife. The 22 ha site is run as a joint venture between the Ministry of Defence and a private (Thai) company.

The many small, sometimes short-lived, menageries

around the country are usually associated with hotels, 'resorts', up-market restaurants, or State Enterprises. They are characterised by small and inadequate cages, often with little shade, water or resting cover; by inadequate and inappropriate diets; by a lack of veterinary care; by a lack of visitor safety standards; and by high levels of animal mortality. At least one and probably others were established with animals confiscated from animal dealers and 'rescued' from local markets.

Other Wildlife-Human Interactions

Wild animals are commonly reported as crop pests and as predators of livestock in rural Lao PDR (Table 2). Problems are severe in some areas such as Xe Bang-Nouan NBCA, Sangthong District and Louang-Namtha Province (Dobias 1992b; C. Inthavong, CPAWM, verbally 1997), bringing wildlife and villagers into direct conflict. Wild pigs, macaques and rodents are the major crop pests, although others, including Sambar, bears and various birds, are involved. Occasional elephant depredation of crops occurs in many areas, but seems to be a chronic problem only in few.

Tigers (Plate 4) and wild dogs (perhaps mainly Dhole) are reported as the major predators of large livestock such as water buffaloes, cattle and pigs. Water buffaloes and cattle are left untended for long periods in rural Lao PDR, sometimes in very remote areas (including within NBCAs), and this compounds problems of wildlife depredation. The figures reported for depredation by Tigers and possibly by wild

Table 2. Reported frequency of wildlife species as crop pests and livestock predators in rural Lao PDR.

Species	**Percent of villages reporting species as:**	
	Crop pests (*n*=317)	**Livestock predators** (*n*=317)
Wild Pigs	90.5	-
Primates	22.1	-
Rats	20.5	-
Porcupines	18.3	-
Sambar	11.7	-
Bears	10.4	<1
Birds[1]	6.9	-
Elephant	4.7	-
Muntjacs	3.5	-
Gaur	<1	-
Serow	<1	-
Hare	<1	-
Bats	<1	-
Monitors	<1	-
Tiger	-	43.8
Dhole	-	36.3
Civets/mongooses	-	11.4
Small cats	-	9.5
Raptors	-	3.1
Leopard	-	1.9
Clouded Leopard	-	1.6
Snakes	-	<1

[1]includes parakeets, doves, junglefowl and other (unspecified) species.

Data were compiled from 1988-1993 village interviews.

dogs in Table 2 may be inflated by villagers' assumptions that any large stock lost or found dead have been killed by these species. Conversely, predation on small livestock (including poultry and village dogs) by civets, mongooses, small cats and snakes may be under-reported.

During 1988-1993 village interviews, no cases of people being killed by mammals or crocodiles were reported, but there are several recent incidents (Table 3). Snake bite is probably the most common form of wildlife-induced injury to humans. Most victims do not get modern medical treatment. Even in Vientiane, antivenins are in short supply and most bites are treated with herbal medicines.

Until recently, many elephants were taken from the wild for use as work animals, although this practice has waned recently (see species account). This special form of harvesting merits separate consideration because: legal provision is needed for the disposal of ivory trimmed from these elephants; the elephants may be used in programmes to rebuild wild populations; and they may have a powerful role in conservation activities such as protected area management and awareness-raising programmes.

Wild ancestor populations of several domestic animals kept in Lao PDR occur naturally (or did so): Red Junglefowl, Eurasian Wild Pig and, provisionally, Wild Water Buffalo. Domestic cattle are closely related to Kouprey, Gaur and Banteng. Domestic stock may affect the wild populations in several ways, principally though genetic contamination, disease transmission, competition for food and other resources. There is no information available on these subjects.

Table 3. Some recent reports of mammals attacking people in Lao PDR.

Species	Location, year	Notes	Source
Bear	Nakai-Nam Theun NBCA, about 1994	Mauled a youth, who survived	Robichaud 1999
Bear	Louang-Namtha, 1996	Mauled one person	M. Meredith per RJTiz
Big cat	Nakai Plateau, around 1990	Reports in 1994 of two fatalities	RJTim
[Leopard]	Dong Ampham NBCA, 1997	Mauled a person, who perished	Robichaud 1998e
Tiger	Dong Hua Sao NBCA, 1999	Killed a person	K. P. Berkmüller *in litt.* 1999
Elephant	Phou Xang He, mid 1990s	Killed one person	TDE
Elephant	Sangthong District, mid 1998	Killed one person	KK
Gaur	Dong Hua Sao NBCA, late 1998	Charged a woman; no long-term damage	K. P. Berkmüller verbally 1998

WILDLIFE CONSERVATION IN LAO PDR

Threats to Wildlife

In Lao PDR, institutions and activities dedicated to wildlife conservation are under-resourced. Currently, the richness of Lao PDR's wildlife has less to do with active human interventions than with the country's low human population density, and consequent extensive forest cover. Although hunting pressure is high, the relative abundance of habitat and, in some areas, its remoteness from human settlements, has provided partial protection to Lao PDR's wildlife. But human population and development pressures are rising, especially since about 1990. Wildlife throughout Lao PDR is declining, precipitously so in some areas and/or among some species. Remoteness from human pressure can no longer ensure all species' conservation in the country, and recently initiated management interventions will need to be continued into the long term and expanded.

Threats to wildlife in Lao PDR include the direct human uses detailed above, of which the most important are:

- local hunting for consumption, recreation, internal trade, and to protect crops and livestock;
- hunting and capture of wildlife for international trade. This is principally for traditional oriental medicines, but also for meat, captive display or rearing and horn and antler trophies.

In addition, principal indirect threats to wildlife in Lao PDR are:

- clearance of forest and other habitats for agriculture (principally rice) and plantation forestry;
- commercial logging (legal and illegal);
- proposed hydropower development (including logging of proposed inundation areas, in some cases long before the

Table 4. Threats to wildlife in Lao PDR, their root causes, and counter measures in place or in advance stages of planning as of January 1999.

Threat	Root causes	Current counter measures
Local hunting for consumption, recreation, crop and livestock protection and small-scale internal trade	• predominantly rural population • broad spectrum of cultural and sociological antecedents such as strongly season agricultural cycles that allow time for hunting, and enjoyment of hunting among some ethnic groups • destruction of crops and livestock by wildlife • declining fish stocks as protein source • limited government capacity for conservation education, enforcement and livelihood assistance • confusing legal status of wildlife • demand for wild meat as a luxury food item in towns	• establishment of NBCA system • experimental conservation and community development projects in several NBCAs • nation-wide education initiatives aimed at protecting selected key species and reducing hunting • gun collections in several provinces and districts • draft revisions of national wildlife protection laws • locally enforced bans in several districts and provinces on the sale of wildlife in markets and restaurants
Trans-border wildlife trade	• high prices paid in other countries for some species, especially in China • large population and high unemployment in neighbouring Vietnam • limited government staff capacity to patrol border areas and monitor border crossings	• increased vigilance and confiscation of wildlife in several districts and provinces • bilateral conservation workshops between Lao PDR and neighbouring states • draft revisions of national wildlife protection laws
Clearance for agriculture	• expanding human population • cultural preference for swidden cultivation in many ethnic groups • limited government capacity to assist with alternative agriculture schemes	• Lao government policy to stabilise swidden agriculture • rural agriculture improvement projects
Hydropower development	• national need for export income • regional demand for electricity • profitability for international investors	• prioritisation of hydropower projects • designs for mitigation and watershed forest protection at some proposed projects (e.g. Nam Theun 2)
Commercial logging (legal or illegal)	• national need for export income • high commercial value of some native timber species • deforestation in several regional countries, leading to aggressive pursuit of logging opportunities in Lao PDR • limited government capacity to control illegal logging	• establishment of NBCA system to protect some forest areas from commercial exploitation • inducement from hydropower • development to protect forested watersheds

project is confirmed to proceed);
- road network development (often in support of the three foregoing factors);
- over-harvesting of prey species (for example, suppression of Tiger numbers by over-hunting of ungulates, or possibly, of otter numbers by over-fishing).

Table 4 summarises principal threats to wildlife in Lao PDR, the roots of these threats, and counter-measures in use or planned for Lao PDR. The alleviation of threats to wildlife and their habitats requires five types of activities, and all are necessary to achieve success. They are:

- unambiguous and active legal protection (generally of specified taxa and/or key habitats);
- public conservation education;
- field management to insulate wildlife and habitats from human pressure;
- research on the status of wildlife and the nature of the threats to it; and
- capacity building of government staff in all activities.

Each of these five has progressed in Lao PDR to varying degrees in recent years, especially since 1990.

Legal Protection of Wildlife

All wildlife in Lao PDR is the property of the State. Presently, the use and protection of wildlife is regulated by an array of confusing and sometimes contradictory laws, executive and ministerial decrees, and directives. The principal ones and their key provisions are listed in Table 5. Provincial programmes to collect guns from villagers (see below) may also be of considerable long-term significance to wildlife conservation in Lao PDR.

At present, many species that require complete protection are not apparently listed (e.g. Black Ibis), while some common species that do not require any protective measures are listed as subject to hunting controls (e.g. drongos). The latter situation severely compromises the credibility and enforceability of the legislation. The Wildlife Unit of CPAWM is currently drafting a much more comprehensive code of wildlife protection laws. It will be supplemented by proposed new definitions of protected species, based on information gathered from the past several years of surveys.

Penalties for violation of the existing decrees and instructions are outlined in the Penal Code of the Lao PDR (23 October 1989), and refined in the Instructions for the Implementation of Decree No. 118 and in the Forestry Law of 1996. They include provisions for imprisonment for up to two years and fines of up to 500,000 kip (US$ 700 at the time of legislation, but only about $ 100 as of early 1999).

Under the Lao government system, implementation of conservation and other forest policy is the responsibility of the Provincial Agriculture and Forestry Offices. The role of CPAWM as a central agency is confined to co-ordination, support and external liaison; it has no enforcement arm, nor are protected areas field staff directly accountable to it. Provinces, districts and even villages write and enforce their own regulations. Enforcement has been uneven, but in the early to mid 1990's a noticeable shift occurred as both central and local governments elevated the priority of wildlife conservation. By 1994, arrests and prosecutions had been made for killing dolphins, Tigers, elephants and Gaur, and for trafficking in bears (KPL 1991a-c, Baird 1993). Since the end of 1995 a ban has been enforced on the sale of wildlife in the markets of Ban Lak (20) and Pakxan in Bolikhamxai Province (Plate 4), That Luang market in Vientiane and other sites. There has also been a publicised ban on the sale of wild game in Vientiane restaurants, and increased interdiction in the movement of trade animals out of the country, especially pangolins.

Despite this progress, enforcement remains irregular. This is in part a consequence of inconsistencies between regulations and also reflects the lack of trained staff. At least one shop in the Vientiane Morning Market openly displays and sells various parts of several Globally Threatened animals, e.g. Tiger and Siamese Crocodile. In Ban Lak (20) it is now forbidden to sell birds and mammals in the market, but a vendor there has openly kept a captive young gibbon for nearly a year (Plate 13). A uniform, minimum legal code of basic wildlife protection would be a solid basis for enforcement throughout the country.

Public Conservation Education

The collective impression of visiting biologists to Lao PDR is that the persecution of wildlife is high. Many villagers kill common species (e.g. Red Muntjac) and rare ones (e.g. Saola) without distinction. For most, this is simply a consequence of their lack of awareness concerning the national, let alone global, rarity of species in the latter group. Public conservation education is a very high priority for relieving the general human pressure on all wildlife in Lao PDR.

In many countries, conservation awareness activities are conducted principally by locally-based conservation-oriented non-governmental organisations. As these do not exist in Lao PDR, the government has taken the lead. In 1997, 13 July marked a significant event as the first official 'National Wildlife Conservation and Fish Release Day'. Established by the Forestry Law of 1996, this event and the second annual celebration in 1998 included the national distribution of tens of thousands of wildlife conservation posters, t-shirts, pamphlets, buttons and the airing of radio and television messages. These materials reached the far corners of many provinces (Plate 7). Most work was led by the Extension Unit of CPAWM (DoF), with the financial support of several donors.

The sustainable development organisation CIDSE has recently produced and distributed an introductory book on Lao wildlife in the Lao language (O'Shea 1998). This aims

Table 5. Principal legal instruments addressing wildlife protection in Lao PDR.

Legal instrument	Key provisions
Decree of the Council of Ministers No. 185/ CCM, in Relation to the Prohibition of Wildlife Trade, 21 October 1986	• prohibits export of all wildlife
Decree of the Council of Ministers No. 47/ CCM, on the State Tax System, 26 June 1989	• lists types of natural resources, including various species of wildlife, aquatic animals and parts thereof and their associated resource tax rates and special fees; 67 species or species groups of wild animals are listed • subsistence level users of natural resources are exempted from resource taxes • 1996 New Tax law does not mention natural resource tax
Decree of the Council of Ministers No. 118/ CCM, on the Management and Protection of Aquatic Animals, Wildlife and on Hunting and Fishing, 5 October 1989	• defines wildlife as state property with mandate to MAF to manage it (including through awareness programmes) and local people to use it pursuant to regulations • allows import/export of wildlife with specified authorisation • prohibits hunting and breeding of protected or endangered species (unspecified), except where human life is endangered • prohibits hunting by means of mass destruction (explosives, poisons, etc.)
Decree of the Prime Minister No. 164, 29 October 1993	• establishes NBCAs and states that to chase, hunt or fish any species within them is illegal • explosives, chemicals, poisons and other substances harmful to wildlife are banned in NBCAs • MAF may warn or fine anyone who disobeys the decree, and may confiscate illegal items
Order 54/MAF on the Customary Rights and the Use of Forest Resources, 7 March 1996; followed by recommendations 377/MAF on the Customary Use of Forest Resources	• Secures legal right for local people to use forest resources for subsistence, including the hunting and fishing of non-protected species • customary rights may be recognised by signed agreement or by law, and local people shall be compensated for loss of customary means of livelihood
Decree 1074 of the Ministry of Agriculture and Forestry, 11 September 1996	• prohibits wildlife trade • prohibits hunting of protected species "such as Asian Elephant, Banteng, Saola, Douc Langur, etc." • prohibits hunting during a closed (breeding) season, and/or by dangerous methods, and/or by the use of weapons in NBCAs, protected areas and towns • bans wildlife trade, except for research and/or conservation • bans exporting wildlife used for food • responsibility for PAFO to co-ordinate with other agencies to collect and register weapons used for hunting
Declaration of the President No. 125/PO on the Forestry Law approved by the National Assembly No. 04/NA on 11 October 1996	• grants state ownership of and authority to manage wildlife • prohibits possession of wildlife without permission • mandates state to define two categories of protected wildlife • prohibits hunting during a closed season (unspecified) and/or by means of mass destruction • prohibits hunting of and trade in prohibited species, with certain exceptions • states that all guns and hunting equipment must be registered with certificates • Article 46, Part 5, establishes by law Wildlife Day on 13 July annually

to guide the interest shown by rural people in wildlife books (even in foreign languages; Plate 6) into thought about conservation. The positive results from initial distribution suggest that much potential remains for further such work, and at least one further book is in preparation.

Field Management

There are of over 60 Globally Threatened species of mammals, birds, amphibians and reptiles in Lao PDR, several of which are near-endemic to the country. There is now a written conservation strategy for one species, Saola, and there are research and recovery efforts underway for several others, notably Irrawaddy Dolphin in southern Lao PDR (part of an integrated aquatic resources conservation project) and Green Peafowl in Phou Khaokhoay NBCA. Several further species-focussed initiatives are planned, of which work on elephants is the most advanced.

Conservation interventions are mainly directed towards entire wildlife communities. They involve (1) various projects to establish effective management in gazetted NBCAs, (2) the efforts of several districts and provinces to halt the wildlife trade, and (3) local collection of hunting arms.

The principal constraints on more active wildlife conservation have been limited staff and training, and the low priority of wildlife conservation for a government faced with issues of food security, basic health care, education and poverty alleviation. In the medium term the macroeconomic constraints caused by the Asian financial crisis will also limit activities.

Potential management measures for wildlife conservation can be grouped as hunting reduction, habitat conservation and the protected area system, and captive breeding.

Hunting Reduction

The various forms of harvesting (hunting, snaring, trapping and other means of extraction of adults, young and eggs) are not sustainable at present levels for many quarry species in Lao PDR. If they continue at today's levels, many wildlife resources used by local people for subsistence and local economic purposes will suffer precipitous declines (as have many already).

In 1996 a major government initiative was launched to reduce the number of guns in civilian hands and notable progress is being made (Plate 7). In parts of Bolikhamxai Province, only 20% of guns (1996 levels) remain to be collected (IUCN 1998). Progress in parts of Khammouan Province has been even more rapid, with the once-ubiquitous home-made muskets now almost absent from some districts (J. Baker verbally 1999).

Reduction in hunting levels benefits wildlife and rural people alike. As reduction in one method of hunting may stimulate increases in another, reduction of human demand for wildlife is likely to produce the longest-lasting benefits to wildlife. Achieving such reduction could encompass various activities aimed at providing alternative sources of protein and shifting human attitudes towards wildlife, and with attention to less direct needs such as family planning programmes. The current high population growth rates in some areas inhibit stabilisation of activities by rural development and food security. Nonetheless, as Lao PDR's economy develops and the population achieves a more urbanised lifestyle, the seriousness of incidental hunting is likely to fall in importance of threats to wildlife relative to those from trade-driven hunting and habitat loss.

Of the two principal types of hunting, for local use and for cross-border trade, the latter is the more serious from a wildlife conservation standpoint. Commercial hunters focus on valuable species, the supply of which cannot meet demand. If exploitation causes a target species to decline, the species's value usually increases. Commercial hunters thus pursue them even more avidly. If some way to relieve wildlife trade in Lao PDR is not found, within several years viable populations of some large mammals and various turtles will be eliminated from some areas, especially along the eastern international border.

Accession to CITES by Lao PDR would have little immediate effect on reducing international wildlife trade in the absence of field measures, as most animals are already moved surreptitiously across unofficial border crossings into states which are CITES parties. Rather, increased surveillance and disciplinary activity is likely to have more effect. This is already occurring in some border districts (e.g. Khamkeut in Bolikhamxai Province) and has resulted in numerous confiscations of wildlife destined for neighbouring countries.

Recent national-level attention has been paid to the trade problem through bilateral trans-boundary conservation meetings between Lao PDR, Vietnam and China. However, the economic incentives (e.g. US$ 50 for an otter pelt, and up to US$ 400 for a turtle), exacerbated by the recent crisis in the region's economy, mean that solution will not come easily. An immediate priority is an increase in armed patrolling of the border forests for snare lines and poachers (Plates 1, 4). As well as patrolling of trade routes and border areas, considerably increased vigilance in all source areas, many of which are legally established National Biodiversity Conservation Areas, would do much to reduce trade levels.

Habitat Conservation and the Protected Area System

The Government of Lao PDR, with the technical assistance of IUCN (through the Lao-Swedish Forestry Cooperation Programme) and other international agencies, has been developing a national protected area system for several years (Salter and Phanthavong 1989, Salter *et al*. 1991, Berkmüller *et al*. 1993, 1995a, 1995b). Surveys towards this aim began in 1988, and in 1993, 18 areas covering approximately 10% of the land area of the country were decreed as National Biodiversity Conservation Areas. A further two (Dong Phou Vieng and Xe Sap) were added in 1995-1996, meaning that

Plate 6:

Residents of Ban Sivilai, Vientiane Province, designed and enacted a sustainable fish management programme which involves the protection of birds. Bird usage of the site today is remarkably high, compared with other areas where shooting still occurs. February 1998. *S. Chape / IUCN.*

Residents of the limited Lao range of Irrawaddy Dolphin neither kill nor molest them, but indirect anthropogenic mortality (such as entanglement in fishing nets) is driving a sharp population decrease. Southern Champasak Province, March 1995. *I. G. Baird.*

Rural people of all ages are fascinated by wildlife books. The educational potential this gives, especially among the young, has so far been limited by the lack of Lao-language wildlife books. Dong Ampham NBCA, 1997. *W. G. Robichaud / WCS.*

Hmong village territory boundary marker near Nam Ha NBCA. *P. Davidson / WCS.*

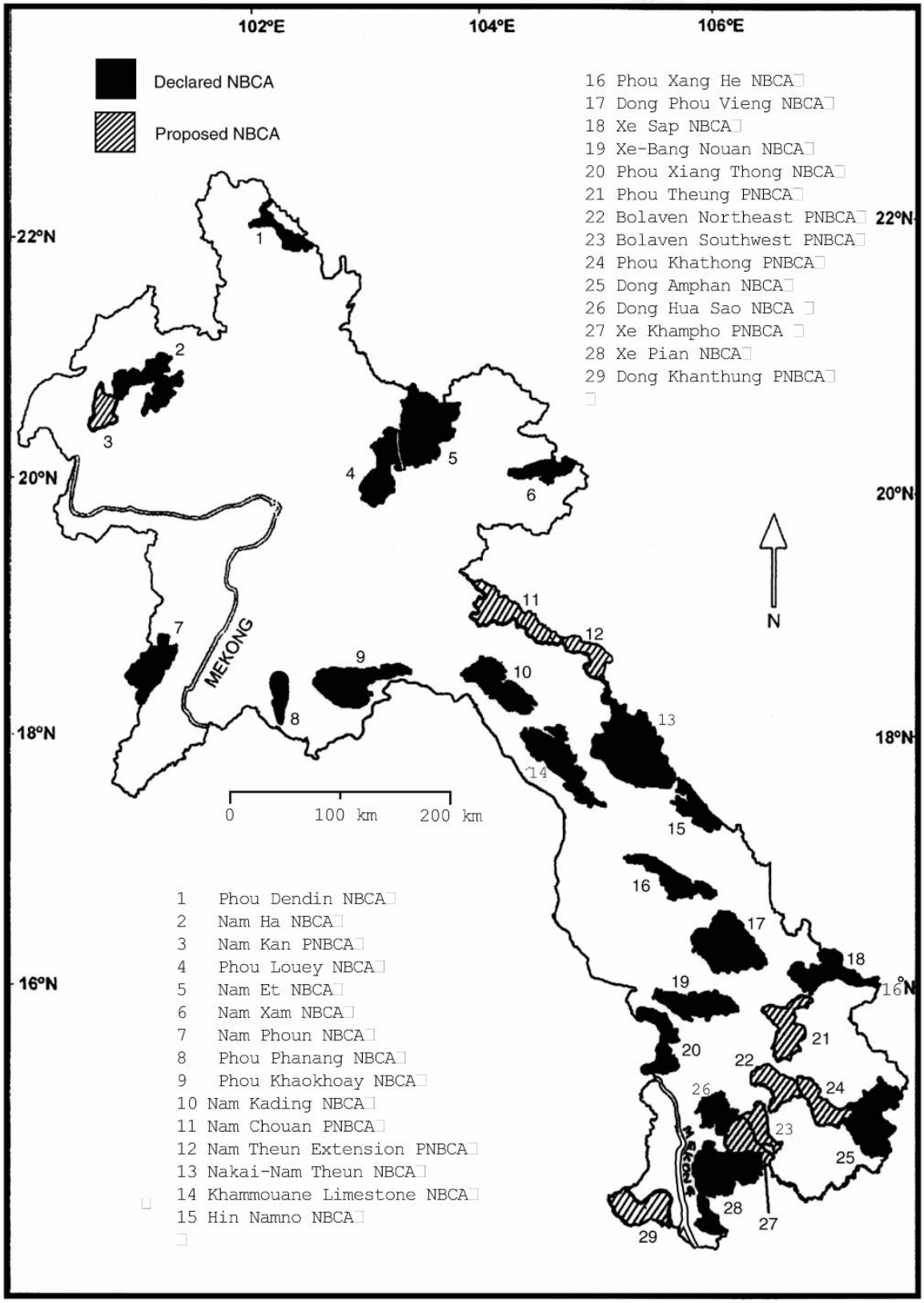
Snaring levels in some international border areas are extremely high and villagers' traditional gathering areas are being depleted by foreigners. This head man of a village in Nakai-Nam Theun NBCA holds two snares (suitable for catching big cats, bears and wild cattle) found in his village area in late 1998. Local communities and international conservation NGOs work together to reduce these problems. *W. G. Robichaud / WCS and IUCN.*

Many animals have strong cultural importance in Lao PDR. This temple near Phou Khaokhoay NBCA celebrates the Green Peafowl. This is the only area in north Lao PDR known to retain the species, which used to be widespread across the country. *T. D. Evans / WCS.*

Many wild animals are kept as pets, particularly if obtained young. Some are moved large distances. The origin of these two Brown Hornbills in Vientiane (in 1996) in unknown.
W. G. Robichaud / WCS.

Spectacular parts of hunted animals are often retained for ornamental display. Crested Argus tail feathers are the largest feathers of any bird in the world. Nakai-Nam Theun NBCA, 1998.
W. G. Robichaud / WCS and IUCN.

Figure 5. Existing and proposed National Biodiversity Conservation Areas in Lao PDR.



NBCAs currently cover about 12.5% of Lao PDR. Ten more areas recommended by Berkmüller *et al*. (1995a) for NBCA status remain under consideration, as does one area subsequently investigated, Dong Khanthung (Berkmüller and Vilawong 1996, Timmins and Vongkhamheng 1996b, Round 1998). All areas are shown in Fig. 5.

Twelve of these areas have an established management staff and two more are anticipated to form staff in 1999. Some areas have yet only a few staff; only Phou Khaokhoay NBCA (with nearly 80) has more than 30. Management plans are in various stages of preparation and implementation for these areas, with Phou Khaokhoay NBCA by far the most advanced.

Surveys of areas with the potential to fill the gaps in the network of existing and proposed NBCAs will continue as appropriate. A few (P)NBCAs are also in urgent need of survey: those where surveys have not yet been undertaken, or where they were foreshortened or were heavily focussed on some areas and/or taxonomic groups at the expense of others. However, the main focus for biological work related to the protected area system is likely to shift in 1999 towards re-surveys of existing areas and the establishment and implementation of biological monitoring programmes.

The system is intended to place representative areas of all significant and natural habitat (forest and wetland) types occurring within the country under protected area management. This should result in inclusion of representative populations of most wildlife species, but specific attention is needed for certain species in the design and management of the system, including:

- very large and/or wide ranging species where the home ranges of a sufficient number of individuals to constitute a viable population cannot feasibly be included within individual protected areas (e.g. Tiger, Dhole, Asian Elephant, wild cattle; see Duckworth and Hedges 1998a);
- species occupying habitats that are also the foci for human activity (e.g. waterbirds; see Thewlis *et al*. 1998);
- threatened species of which the Lao population is of very high global importance and thus all populations merit protection (e.g. Saola);
- species with very restricted distributions in Lao PDR (e.g. Black-cheeked Crested Gibbon and Pileated Gibbon, whose limited known ranges are not included within any declared NBCA); and
- species with very narrow habitat requirements (e.g. a species occurring only in level lowland evergreen forest below 500 m in Lao PDR north of Vientiane; such habitat has been almost entirely cleared and no large tracts are included within declared NBCAs).

As well as NBCAs, many areas are protected at the provincial and district level. A full inventory of these is under compilation. Some rival entire NBCAs in size (e.g. Nam Ghong, Attapu Province) and can have a major role in conservation of wildlife including declining and otherwise threatened species. Others are much smaller but may still be significant for smaller wildlife species, e.g. passerine birds.

At the community level, there are many sacred areas where residents do not generally hunt. There is at least one example of community-led application of modern management techniques to resource harvesting: Ban Sivilai's Nong Bo in Vientiane Province (Parr and Parr 1998; Plate 6). The value of such areas as touchstones for introducing biodiversity conservation to the rural populace remains underplayed (see, e.g., Steinmetz 1998a).

Captive Breeding

Captive breeding is not a conservation priority for most species of wildlife in Lao PDR in the late 1990s. The current extent of habitat has meant that few species are believed to have become nationally extinct. Even all the carnivore species (in many countries, a vulnerable group) are believed still to occur, simply because it is difficult to eradicate elusive, often nocturnal, low-density populations of non-herding mammals from across large areas of dense forest. Habitat fragmentation is the greatest predisposing factor to local extirpation of these mammal species as the smaller the area, the easier it becomes to reduce populations to levels too low to be viable. Therefore, conserving habitat integrity in entire NBCAs is, and should remain, the long-term imperative (Plate 4). By contrast, captive breeding programmes may deflect finite vital resources (personnel, financial, media and, most importantly, government administrative time and interest) from large-scale habitat conservation (which requires confronting many unpalatable issues) and other work addressing the causes of biodiversity loss (e.g. Caughley 1994).

The Carnivore Preservation Trust, an NGO based in the U.S.A., aims to establish a centre for conservation research and genetically managed breeding programmes, largely of carnivores. They are based near Ban Lak (20) in Bolikhamxai Province. Currently over 70 individuals of 19 mammalian species (not just carnivores) are held, some of which were confiscated by local authorities from trade (B. Bouphaphan verbally 1999). The trust has already facilitated research in subjects of high relevance to conservation in Lao PDR, including non-carnivores (e.g. the taxonomy of lorises) and intends to pursue a major role in raising public awareness on issues related to wildlife conservation. Much conservation-related research could be undertaken on captive animals and these aims could be usefully emulated by other collections in Lao PDR. The need for a broader conservation role for captive-breeding undertakings is discussed by Balmford *et al*. (1995, and references therein).

There is a clear role for a captive breeding programme for selected species of Lao turtles and for genetically pure Siamese Crocodiles. Trade-driven harvesting is eradicating wild stocks. Turtles have slow breeding rates. The ground-

living species are easily found by trained dogs, while the aquatic species are tied to small and shrinking water-bodies in the late dry season from which they can easily be taken. These attributes mean that they can be removed from even large areas of natural habitat in Lao PDR (see amphibians and reptiles section).

Research

Wildlife conservation and management in Lao PDR at the central level is the responsibility of CPAWM. Within CPAWM, national wildlife research and management is co-ordinated mainly by its Wildlife Unit. The CPAWM Wildlife Unit lacks sufficient staff, training and funds for the tasks facing it. As a consequence, field research on wildlife in Lao PDR (outlined above) is usually conducted with technical assistance from foreign organisations (particularly WCS and IUCN), in partnership with staff from CPAWM and the provinces and districts.

On-the-ground wildlife management at the local level is generally the responsibility of Provincial Agriculture and Forestry Offices (PAFOs), and District Agricultural and Forestry Offices. However, none has a unit devoted to wildlife research, nor any staff with formal education in this field. In recent years, some training has been provided, partly by the CPAWM Extension Unit and partly by foreign conservation organisations. Wildlife research needs are many and the more important are identified in the Conclusions section.

Staff Capacity Building

Although staff training is not a wildlife conservation tool *per se*, it is a high priority for long-term conservation in Lao PDR, for upon it hinges the continuity and sustainability of all other activities discussed above. Several short-term training programmes (usually less than one month) in concepts and techniques of biodiversity conservation have been given to central and local government staff in recent years, often as co-operative projects between CPAWM and foreign conservation organisations (Plate 7). Furthermore, several long-term projects intending to strengthen protected area staff capability are having very promising results by recognising that long-term benefits are most likely to come with long-term (years, perhaps a decade or more) commitment.

CONCLUSIONS

1. Lao PDR still harbours a rich fauna, with many species' populations and their habitats probably being less depleted within Lao PDR than within several other countries of the region. Information on local distribution, habitat use and population status is most complete for birds and large mammals, but even for these groups several species are still discovered new for the country each year. Bats have also been subject to considerable survey since 1995, but coverage remains uneven. The first year's fieldwork of an intended nation-wide coverage for reptiles and amphibians has had notable findings at various sites, but several more years of similar work are needed to allow an understanding of each species's distribution, habitat use and conservation status. Insectivores and murid rodents are the least studied groups of those included in this report. They have been surveyed recently in only two areas, although there are incidental records from several others. Presenting precise species totals for Lao PDR for each of these groups could therefore be misleading at this stage, particularly were they used to compare species richness with that in other, better studied, countries.

2. A total of 319 of the 1140 species included in this review are of national or global conservation significance: 67% of the large mammals, 53% of the bats, 6% of the Insectivora, 14% of the murid rodents, 22% of the birds, 25% of the reptiles and 2% of the amphibians (Annex 6). Were the reptile and birds split into large and small species, a similar imbalance would be seen with size as is shown by mammals. These figures for insectivores, murids and amphibians may need substantial revision following further survey work. National species conservation priorities are given in Table 6. Over-harvesting is by the far the greatest immediate threat to these species. Large areas of most of the ancestral habitat-types in Lao PDR remain, yet within them populations of quarry species are at very low density or even apparently absent. Unless issues of over-harvesting are addressed, the future in Lao PDR for most species of medium- and large-bodied mammals, birds and reptiles is bleak. Many species (13 large mammals, ten birds and two reptiles) are close to extinction in Lao PDR (Table 6), and some waterbirds are already extinct as breeders. Only immediate and effective action with the highest level of political support will preserve remaining populations of these species and their habitats. Timely action could ensure that viable populations of most key species of Immediate Action Priority (Table 6) remain in Lao PDR. The most efficient and perhaps the only effective way to achieve this is to maintain large intact wilderness areas with limited human activity, although as yet habitat degradation is currently a direct factor in the declines of only a few key species. Most of the last remaining large habitat blocks fall within NBCAs. If they are degraded and fragmented, entire wildlife communities will become at risk, and many more species will merit classification as of Acute, High or Indeterminate Action Priority.

3. The basis for wildlife conservation in Lao PDR will continue to be the conservation of adequate habitat under a legal framework which provides for year-round bans on hunting and harvesting in substantial core areas within them. A ma-

jor increase in protected area management and wildlife law enforcement capacity is needed. However, some species are unlikely to be conserved solely through a protected areas system, and the most vulnerable species require specific measures. For various reasons they will only persist if attention is given to the wider environment. These species include:

- very large mammals (notably big cats) which need enormous areas to support populations viable in the long term;
- species of strongly seasonal environments, which therefore make local movement (notably large waterbirds, sand-bar nesting birds and floodplain ungulates);
- long-distance migrants (e.g. birds nesting in the Palaearctic and wintering in South-east Asia);
- species of habitats largely converted for other uses, where the remaining examples support heavy human use (notably densely-vegetated swampy lowland wetlands).

Most species which fall within more than one of these categories are in an extremely perilous situation in Lao PDR or may even be extinct (e.g. Wild Water Buffalo).

4. The following management and research actions are therefore required to ensure the long-term conservation of Lao mammals, birds, reptiles and amphibians:

Protected areas and other areas important for wildlife

- Consolidation of the protected areas system, to include representative areas of Lao habitats and constituent wildlife communities not yet under conservation management. A formal review of the contribution of existing and proposed national and provincial protected areas to protecting Lao wildlife is needed. This would determine priorities within the system, particularly among NBCAs, and clarify gaps. Some NBCAs currently accorded high management and donor prominence are probably lower in conservation value than are others not yet gazetted. Dong Khanthung and the Nam Theun Extension are two clear areas meriting, on biological grounds, immediate declaration as NBCAs. Technical capacity and funding are both potentially limiting resources at the national level. Effective long-term conservation of Lao PDR's wildlife will depend on sensible allocation of the available resources to priorities determined from realistic analysis of the conservation value of each proposed action. Difficult decisions may be called for, and swift action will be needed, particularly when new information sets previous proposals and activities in a new light.

- Designation and management of habitat corridors linking protected areas. Wide-ranging forest species that are unlikely to remain completely within individual protected areas include Asian Elephants, Tiger, Dhole, wild cattle and hornbills. Two complexes of corridors linking existing protected areas have already been identified (Berkmüller *et al*. 1995a), based on the Nam Theun and the Xe Kong basins respectively. These merit legal declaration and management implementation while the opportunity remains.

- Immediate identification and protection of key wetland areas throughout the country. Small, standing-water wetlands provide essential habitat to a number of Lao PDR's most threatened species, but are currently one of the most heavily disturbed habitat types. Riverine habitats, particularly sand banks and mud-flats, are also important for a number of species but are subject to a high level of human disturbance.

- Identification and protection of other key habitat areas, including concentrations of salt-licks, Francois's Langur sleeping cliffs*, caves supporting bat colonies*, nesting and roosting sites of colonial birds*, nesting and roosting sites of large raptors of open habitats (e.g. vultures, fish eagles)*, breeding grounds and/or display areas of cranes and Crested Argus*, wader migration stops and waterfowl wintering areas, as well as microhabitat features for specific species (e.g. vegetated waterholes supporting Asian Golden Weaver colonies). Asterisked features may merit protective action even if far from existing NBCAs.

- Identification, legal designation and active protection of large core zones within NBCAs within which no extractive use is permitted. Such areas offer species sensitive to human pressure (directly or through habitat modification) the best chances of survival in the long term.

- Substantial strengthening of the management capability of NBCAs. Protected area staff are engaged in an activity with no history of development within Lao PDR. Lessons, both positive and negative, from other countries brought in to Lao PDR at an appropriate pace can guide development to maximum efficiency.

Trade

- Development of a central government policy regarding commercial use of wildlife, with particular regard to trade but also including zoos, captive breeding operations, wildlife farming and ranching operations, fish farming operations using natural wetlands, and eco-tourism. Government approval and regulation of these operations

Plate 7:

Several NBCAs are investigating the possibilities of eco-tourism. Elephant-back rides through wildlife habitat are an obvious possibility in areas with captive elephants. Champasak Province, December 1996. *S. Chape / IUCN.*

Across the country, gun collections have been undertaken and some have greatly reduced the numbers of guns in civilian hands. Residents of Dong Hua Sao NBCA favoured outlawing gun use entirely. December 1996. *K. P. Berkmüller / IUCN.*

Posters are important starting points in broader awareness raising activities. Crested Argus and Saola both occur in internationally important numbers in Bolikhamxai Province. 1998.
W. G. Robichaud / WCS.

Posters are tailored to local needs. There are no Crested Arguses or Saola in Champasak Province, but Dong Khanthung PNBCA retains important numbers of several large waterbirds. 1997.
W. G. Robichaud / WCS.

Training of NBCA staff in wildlife monitoring techniques helps understanding of the aims and outcomes of protected area management. Phou Xiang Thong NBCA, 1998. *R. Boonratana / IUCN.*

NBCA staff and local militia co-operating in the burning of large numbers of wildlife traps, Nakai-Nam Theun NBCA, 1998. *J. Baker / IUCN.*

Shirts and badges were distributed in large numbers during the annual wildlife weeks of 1997 and 1998. Nam Theun Extension PNBCA, 1998. *W. G. Robichaud / WCS and IUCN.*

Vongsadeth Phommavong (Grade 11, Don Noun High School, Vientiane) submitted the winning entry in a 1997 competition within the schools of Vientiane Prefecture for conservation art. *V. Phommavong.*

Table 6. National species conservation priorities for amphibians, reptiles, birds and mammals in Lao PDR.

Species	Status in Lao PDR	Current threats from			Global significance of Lao populations
		Habitat loss[1]	Harvesting[2]	Trade[3]	
ACUTE NATIONAL PRIORITY[4]					
[Chinese Three-striped Box Turtle]	No field or village records	+	+++++	+++++	Very high*
Siamese Crocodile	Massive decline	+++	++++	+++++	Very high
White-winged Duck	2-3 population centres	+++	+++++	+	High
Sarus Crane	Imminent extinction as breeder	+++	+++++	+++	Moderate
Little Tern	One pair in far south	+	(+++++)	0	Low?
White-rumped Vulture	Very few; breeding status?	+++	+++++	+	Moderate
Long-billed Vulture	Very few; breeding status?	+++	+++++	+	Moderate
Red-headed Vulture	Very few; breeding status?	+++	+++++	+	Moderate
Black Ibis	Very few; breeding status?	+++	+++++	+	Very high
Giant Ibis	Very few; breeding status?	+++	+++++	+	Very high
Black-necked Stork	One pair known in far south	+++	+++++	+	Moderate
Greater Adjutant	No recent confirmed records	+++	+++++	+	High*
Black-cheeked Crested Gibbon	Very small numbers in one area	++++	++++	+++	Very high
Asiatic Black Bear	Probably widespread but rare	++	++++	+++++	High?
Jungle Cat	Only one recent record	?	+++++	?	Moderate
Tiger	Widespread in low numbers	++	++++	+++++	High
Irrawaddy Dolphin	Very low numbers	+++	(+++++)	0	Low
Lesser One-horned Rhinoceros	No recent records	+	++++	+++++	Very high*
Asian Two-horned Rhinoceros	No recent records	+	++++	+++++	Very high*
Eld's Deer	Very few, and only one small area	++++	+++++	++++	High
Hog Deer	No recent records	++	+++++	++++	High*
Kouprey	No recent records	++	+++++	+++++	Very high*
Banteng	Scattered small populations	++	+++++	+++++	High
[Wild Water Buffalo]	No recent records	++	+++++	+++++	Very high*
Saola	Very local, population small	++++	+++++	++	Very high
HIGH NATIONAL PRIORITY[4,5]					
Big-headed Turtle	Widespread	+	+++++	+++++	Moderate
Malayan Box Turtle	South	0	+++++	+++++	Low
Indochinese Box Turtle	Annamites	+	+++++	+++++	High
Keeled Box Turtle	North and centre	+	+++++	+++++	High
Yellow-headed Temple Turtle	South (two records)	+	+++++	+++++	Moderate
Elongated Tortoise	Widespread; lowlands	++	+++++	+++++	Low
Impressed Tortoise	Widespread; hills and mountains	+	+++++	+++++	Moderate
Asian Giant Softshell Turtle	South (one record)	+	+++++	+++++	Low
Crested Argus	Scattered across Annamites	+++	++++	++++	High
Green Peafowl	Scattered small numbers	+++	+++++	++++	High
Great Hornbill	Scattered small numbers	++++	+++++	++	Moderate?
Rufous-necked Hornbill	Scattered across Annamites	++++	+++++	++	High
Pied Kingfisher	Small numbers in far south	?	?	0	Low
Alexandrine Parakeet	Now restricted to far south	+	+++++	+++++	Moderate
Masked Finfoot	Small numbers in south	++++	++++	0	Moderate
Great Thick-knee	Very few on Mekong and Xe Kong	+	(+++++)	0	Moderate
River Tern	Small numbers in far south	+	(+++++)	0	Moderate
Brahminy Kite	Small numbers in far south	++	+++++	+	Low
Little Cormorant	Small numbers in far south	++	+++++	0	Low
Woolly-necked Stork	Small numbers in far south	++	+++++	+	Moderate
Lesser Adjutant	Small numbers in far south	++	+++++	+	Moderate
Chinese Pangolin	Widespread?, but declining?	0	++++	+++++	High
Sunda Pangolin	Widespread heavy decline	0	++++	+++++	Moderate
Douc Langur	Widespread but patchy distribution	+++	++++	++++	High
White-handed Gibbon	One area only, patchy distribution	++++	+++++	+++	Low
Pileated Gibbon	Fair numbers in one area	+++++	+++++	+++	Moderate
White-cheeked Crested Gibbon	Widespread, several very large populations	+++	++++	+++	High
Dhole	Widespread low densities	++	++++	++	High
Sun Bear	Widespread low densities	++	++++	+++++	High?

Species	Status in Lao PDR	Current threats from			Global significance of Lao populations
		Habitat loss[1]	Harvesting[2]	Trade[3]	
Eurasian Otter	No recent records	+++	++++	++++	Low?
Smooth-coated Otter	Probably widespread	+++	+++++	++++	Moderate?
Oriental Small-clawed Otter	Probably widespread	+++	+++++	++++	Moderate?
Binturong	Probably widespread	++	++++	++	Low?
Clouded Leopard	Probably widespread	++	++++	+++++	High?
Leopard	Probably widespread	++	++++	+++++	Moderate?
Asian Elephant	Several notable populations	++	++++	+++++	High
Gaur	Widespread in low numbers	++	++++	+++++	High
INDETERMINATE NATIONAL PRIORITY					
Four-eyed Turtle	North and Annamites	0	+++++	+++++	High
Asiatic Softshell Turtle	Widespread	0	+++++	+++++	Low
Bengal Monitor	Widespread	0	+++++	+++++	Moderate
Water Monitor	Widespread	0	+++++	+++++	Low
Burmese Python	Widespread	0	+++++	+++++	Moderate
Reticulated Python	Widespread	0	+++++	+++++	Low
King Cobra	Widespread	0	+++++	+++++	Low
Cotton Pygmy-goose	Small numbers in south	+++	+++++	?	Low?
Pale-capped Pigeon	Scattered records	?	?	+	Moderate?
Pompadour Green Pigeon	Now, Vientiane only; major decline	?	?	+	Low?
Watercock	Scattered small numbers	+++	+++++	+	Low?
Purple Swamphen	Scattered small numbers	+++	+++++	+	Low?
River Lapwing	Widespread; viability unclear	++++	(+++++)	0	Moderate
Lesser Fish Eagle	Small numbers at many sites	+++	+++++	+	Moderate
Grey-headed Fish Eagle	Small numbers at 2-4 sites	+++	+++++	+	Low
Asian Pied Starling	North-west only; no recent records	?	?	?	Low
Chestnut-vented Nuthatch	Sole Lao site under threat	+++++	+	0	Low
Laughingthrush sp. A	One site in south-east	++++	?	0	High
Asian Golden Weaver	Small numbers in south	+++++	++++	+++?	Moderate?
Silvered Langur	Small numbers in south	++	++++	?	Moderate
Phayre's Langur	Large range in north and centre but no known large populations	+++	+++++	?	Moderate?
[Yellow-cheeked Crested Gibbon]	May occur in far south	++++	++++	+++	Moderate?
Large-spotted Civet	Known from only two sites	++++	++++	?	High
Owston's Civet	Probably very local	++	++++	?	High
Fishing Cat	Probably widespread	?	?	+++	Moderate?
Asian Golden Cat	Widespread	+	++++	+++	Moderate
Marbled Cat	Widespread, probably patchy	+++	++++	++++	Moderate?
Heude's Pig	Unclear	?	+++	?	High
Annamite Muntjac	Unclear	?	?	?	High
Roosevelts' Muntjac	Unclear	?	?	?	High
SHORT- TO MEDIUM-TERM NATIONAL PRIORITY[5] All other key species					
LONG-TERM NATIONAL PRIORITY All other species					

Notes:

Species are listed only if there is a validated record, or a reasonable claim of their occurrence in Lao PDR. Species where it seems possible that the national breeding population is nearly or already extinct are marked 'breeding status?'. Species in **bold face** are of international conservation significance (listed in Collar *et al*. 1994 or IUCN 1996).

The degree of threat is reflected in the number of '+' signs. '0' indicates that the factor currently presents no substantial threat.

[1]Threats from habitat loss are intended to represent those relating directly to the habitat degradation or fragmentation, and to reflect current / very recent practices. In reality, habitat modification has, for most mammal and large bird species listed here, its most direct effect through increased hunting levels.

[2]Assessments are intended to indicate the threats from non-selective and opportunistic hunting, and specific hunting for home consumption; threats from hunting driven by national / international trade are not included. Vulnerability to harvesting is assessed subjectively using several features: day / night activity (diurnal animals are at greater risk from opportunistic hunting than are nocturnal animals), ground-living *vs* arboreal (ground-living animals are at risk from snares and other non-selective ground traps, arboreal animals are so only when they descend to the ground), habitat choice (species frequenting habitat types favoured by people, e.g. open flatland areas on fertile soil, are likely to be exposed to higher opportunistic hunting levels than are those occurring only in dense evergreen forest), local taste (Table 1, supplemented with subsequent unquantified experience) and other pertinent factors. Thus, box turtles are assessed to be at high risk from hunting as they are terrestrial, diurnal, avidly eaten, cannot run away, are hunted using dogs, and under steep decline. Conversely, Spotted Linsang (although there are few records) is assessed as at much lower risk from hunting as it is nocturnal, at least partially arboreal, does not appear to be specifically favoured for food, and lives in large barely penetrable tracts of hill forest. Harvesting assessments in parentheses indicate incidental threats during operations harvesting other species or resources, and pest control operations, as well as directed harvesting. Nest loss by disturbance to sandbar nesting birds, and dolphin death in fishing nets, are included in the first category.

[3]Trade threats do not include those from local trading within the rural economy (which are considered here to form part of 'harvesting'). The threat indicated here is that assessed as being driven by the financial rewards from the trade to supply international markets or those in a distant part of Lao PDR.

[4]The following bird species are not confirmed to persist in Lao PDR, or are now known only as seasonal visitors. It seems quite likely that all are extinct as breeders. If breeding populations of any were found, they would merit treatment as Acute action priority: Indian Skimmer, Black-bellied Tern*, White-bellied Sea Eagle, Darter*, Great Cormorant, Black-headed Ibis, Spot-billed Pelican*, Painted Stork*, Asian Openbill* and Black-billed Magpie. Asterisked (*) species have been recorded recently and protection of any sites used regularly, even by non-breeders, is of High priority.

[5]For the following migrant bird species, causes of decline or scarcity may lie outside Lao PDR and thus action within Lao PDR may not serve any purpose. Were the primary, or a major contributory, cause of the At Risk status found to lie in Lao PDR, the species's national action priority would need re-assessment: Wood Snipe*, Black Kite*, Greater Spotted Eagle*, Imperial Eagle*, Lesser Kestrel, Black Stork* and Grey-sided Thrush*. Asterisked (*) species have been recorded recently and appropriate protective measures at any sites used regularly may be of High priority.

Criteria for assignment of action priority category:

Priorities are assessed from a national perspective. The international priorities can be deduced by combining the priority assessment with information in the global importance column.

Acute: species with very low and/or drastically reduced population levels, and that are unlikely to persist in Lao PDR unless all remaining populations and their habitats receive effective protection.

High: species that can still be maintained at viable levels in Lao PDR, but only if immediate and effective action to address the threats to them is taken; all are particularly vulnerable to habitat modification and / or hunting (and usually the interaction between these), and are likely soon to be reduced to critical levels if action is not taken.

Indeterminate: poorly known species that there are reasonable grounds for thinking that they may be under threat to the extent of being of Acute or High national priority, but for which status information is lacking.

Assessments are made on the best available information and are subjective. In some cases extrapolations are made from other countries / related species, to give the best indication for action. In cases where threats really are unclear, a question mark is used. Note that the assessments for birds differ from those in Thewlis *et al*. (1998), as the latter used an international perspective to assign priority for action.

Criteria for assignment of global significance category:

The contribution of the current Lao population to the conservation of the species is assessed, using maintenance of population numbers, of ancestral range or of genetic diversity (e.g. a well-marked subspecies endemic to Indochina is considered of higher significance than would be the same population if it belonged to a species not or weakly differentiated from those in neighbouring countries).

Very high: Species is very close to global extinction.

High: Species has a small global population and / or restricted range, and Lao populations comprise a significant proportion of remaining individuals; or subspecies potentially close to global extinction.

Moderate: Species has a small regional (Lao PDR, Cambodia, Vietnam and Thailand) population but is more numerous outside the region, or has a large regional population but is limited in distribution outside the region, and Lao numbers comprise a significant proportion of remaining individuals.

Low: The species occurs in good numbers in at least one of Cambodia, Vietnam or Thailand and there is no obvious special role of the Lao population in international conservation.

*Species is not confirmed to be extant in Lao PDR; assessment relates to Lao population if found to be present.

should continue to be based on sound biological and conservation principles which are not compromised by considerations of short-term economic gain.

- Accession to CITES, to strengthen international linkages and to facilitate regulation and control of trade in animal and plant species. Much of the most damaging trade in Lao wildlife is driven by external demand and international co-operation, notably with Vietnam, China and Thailand, will be required for its control. Recommendations specific to this topic will be made in Compton (in prep. b).

- Awareness-raising activities in border areas and in rural and urban markets, supported by enhanced monitoring of trade volumes and routes of wildlife products from capture to final destination.

- Greatly increased patrolling of border areas to limit illegal removal of wildlife from Lao PDR to neighbouring countries. Robichaud (1999) discussed some of the issues and appropriate measures confronting management of border NBCAs.

Legislation and policy

- Review and revision of existing national legislation with respect to wildlife, habitats, protected areas and wildlife trade. This is the essential base without which none of the present recommendations can be implemented fully. There is currently a deal of uncertainty regarding the intent and interpretation of existing legislation, particularly regarding wildlife trade (Table 5; see Baird 1993). Methods of strengthening enforcement of existing laws are still under investigation. The concept of providing complete protection to the most vulnerable and/or seriously threatened species, and seasonal protection to others, follows accepted wildlife management principles and should be maintained. Wildlife and fish are an essential food source for much of Lao PDR's human population. To be enforceable, harvest regulations will need to make sense to these major users of the resource, at minimum permitting un- or lightly-regulated subsistence harvest of common, widespread species by rural residents. Attention to the species listed as subject to management controls is urgent. Other high-priority activities are: updating existing laws to incorporate developments in the protected areas network; revising the laws relating to wetlands to prevent their degradation; and drafting laws to reduce pollution threats and promote sustainable use of resources.

- Formulation and promotion of policies relating to conservation of wildlife and habitats. These include national policy statements to guide management of protected areas, to state actions to address the severe trade pressure on wildlife, and on the destiny of confiscated wildlife and wildlife products.

- Development of a strategy to address the issue of crop destruction and livestock depredation by wildlife. This may need action to compensate farmers for major crop damages and livestock losses attributable to wildlife, in exchange for protection of areas and/or species of special conservation interest. The issue is complex and merits attention from a suitably qualified panel of experts.

- Continued gun collection and the initiation of a scheme to reduce snaring and other non-selective trapping. Activities should focus initially on protected areas, to reduce opportunistic and non-selective wildlife killing. Programmes would need careful formulation to minimise unnecessary impacts on current harvesting practices. Objective documentation of the gun collection scheme would be invaluable in designing further initiatives, such as one to reduce snaring. Measures related to gun collection are most important in NBCAs supporting large waterbirds, gibbons and langurs. Snare and trap reduction is most urgently needed in NBCAs supporting good populations of one or more of Crested Argus, Green Peafowl, large rails, bears, Large-spotted Civet, Owston's Civet, cat species (other than Leopard Cat), Eld's Deer, Hog Deer, muntjacs (other than Red Muntjac), wild cattle and Saola.

- Acceding to international conventions which enhance the conservation of wildlife and habitats. Appropriate steps include: nominating protected areas as ASEAN Heritage Sites or World Heritage Sites; nominating wetlands of international conservation value as Ramsar sites; and becoming a party to CITES. Lao PDR has already become a signatory to the Convention on Biological Diversity and is likely shortly to accede to it.

- Inclusion of mandatory independent environmental impact assessments of major development projects (including plans for large-scale logging and building or upgrading roads), with impacts on wildlife species and their habitats evaluated and mitigated according to international standards.

Education and awareness building

- Education and training of national, provincial and district personnel, including customs officers, charged with protected area and wildlife management in issues relating to protected area management, species conservation, and wildlife trade. This would be assisted by the compilation and distribution of relevant training manuals and

educational materials. Generating capable and enthusiastic staff is essential if legal declarations related to protection of areas or wildlife are to translate into effective conservation tools.

- Production and wide distribution of Lao language field guides. These have a pivotal role in raising wildlife interest and thus conservation awareness.

- Promotion of conservation extension programmes concerning sustainable use of wildlife and other conservation issues to rural populations, and to encourage the latter's active participation in management programmes. The more important and threatened NBCAs merit early action, with programme content tailored to local priorities and stressing the negative effects of over-harvesting and habitat degradation.

- Development of environmental educational programmes by the Ministry of Education, incorporating issues relating to wildlife, within the national curricula at all educational levels. Training of, and liaison activities for, interested teachers also merit promotion. Content for nationwide programmes should include considerable attention to the problems generated by unsustainable trade, those from unregulated development, and the benefits to the country of maintaining wildlife populations.

- Promotion and development of nature-orientated youth groups.

- Encouragement to the national media in understanding and promoting wildlife-related issues for dissemination to the general public.

- Maximising the potential of existing zoos and wildlife collections to set the animals into ecological and conservation context, particularly by signs and other interpretative aids. Strengthening links between existing zoos and CPAWM/DoF would facilitate transfer of up-to-date field information for dissemination to the zoo-visiting public.

- Designing and delivering a specific course in wildlife conservation biology to BSc. level at Dong Dok University. This would increase the number of competent and qualified Lao conservation biologists, and facilitate their entry onto overseas MSc. courses. Both outcomes could play a major role in strengthening the capability of CPAWM and local offices.

Research

- Compilation of existing Lao-language species names and work towards forming a set of Lao names usable in legal terms and other circumstances. Currently, some individual species have many names over the country; some similar species share a name, even in the same region; and the same name may even be used for dissimilar species, usually in different areas. These and other current ambiguities over Lao names mean that legal status of wildlife species is and will continue to be unclear to many minds. Considerable attention is needed towards designing effective interpretative materials for legal documents naming wildlife species. This includes not only national laws but also regional regulations such as those associated with NBCAs.

- Compilation of a national Red Data Book of the declining and otherwise threatened wildlife species of Lao PDR, with the primary aim of identifying for each species long-term goals and achievable short-term actions to ensure their survival.

- Development of a wildlife monitoring programme for selected species both within and outside the protected areas system. The programme should begin with species which can be identified and monitored relatively easily and which are likely to be indicators of conservation status, not only of themselves, but also of the wider faunal community, e.g. gibbons, River Lapwing, civets, Asian Elephant and large waterbirds. Nomadic species such as hornbills, although conspicuous, are less suitable as changes in numbers may reflect movement more than population status. Habitat must also be monitored as, particularly for long-lived species, current population may not be a fair indication of long-term habitat suitability, and sufficient habitat conservation is a prerequisite for species conservation. However, reliance on habitat alone would be unacceptable as quarry species can be eradicated from suitable habitat without any obvious change in the habitat. For habitat monitoring potential linkages with existing initiatives (e.g. satellite-based land use and forest cover monitoring) should be explored.

- Development of a standardised database of species information. Style of data management should be tailored to allow for differences between taxonomic groups. Techniques should be accessible to protected area staff.
- Promotion of research activities on all aspects of wildlife by visiting scientists which prioritise skills transfer to Lao students. Establishment of a corps of highly trained wildlife scientists in Lao PDR is a pre-requisite for long-term biodiversity conservation activity in the country.

- Establishment of field research stations in areas rich in wildlife. These can stimulate visitors into careers in wildlife conservation research while simultaneously collecting valuable primary data about Lao wildlife.

Surveys

Substantial further survey work is needed to allow the formulation of guidelines to ensure long-term conservation of all species of mammals, birds, reptiles and amphibians in Lao PDR. The following taxonomic groups and/or areas are particularly in need of baseline status and distribution survey work:

- Mammals: pangolins*, insectivores (gymnures, moles and shrews), certain bat genera (*Taphozous*, *Tadarida* and other high-flying species that are difficult to catch away from roosts), lorises, *Semnopithecus* langurs*, bears*, weasels, badgers*, otters*, *Viverra* civets*, otter civets*, cats*, pigs, muntjacs*, *Callosciurus* and *Tamiops* squirrels, flying squirrels and murid rodents. Asterisked (*) groups are very likely to contain potential key species.

- Birds: quails*, buttonquails*, large owls*, swiftlets*, crakes and rails*, *Accipiter* hawks, *Riparia* martins*, and the warbler genera *Cettia*, *Bradypterus*, *Acrocephalus*, *Phylloscopus* and *Seicercus*. Asterisked (*) groups are very likely to contain potential key species.

- Birds and large mammals in Nam Kan, Nam Chouan, Phou Theung, Xe Khampho, Bolaven Northeast, Bolaven Southwest and Phou Kathong PNBCAs, Phou Dendin, Phou Phanang, Phou Khaokhoay and Xe Sap NBCAs, wetland complexes in Savannakhet Province, and unsurveyed areas of Bolikhamxai Province.

- Large mammals in the unprotected lowland open deciduous forests of Savannakhet Province.

- Bats in north Lao PDR, across the country in suitable habitat outside NBCAs (especially limestone areas), in forest above 1000 m (especially in the Annamites where several unusual species have been found), and in the remaining NBCAs which have not yet been surveyed for bats. An inventory of major cave roosts of bats is also desirable. Studies of seasonal changes in activity patterns and movements of bats across Lao PDR would allow clear interpretation of survey findings.

- Murid rodents across the country, especially in natural forests; work should involve intensive surveys over protracted periods and using various methods to ensure all species in the areas are trapped, and the collection of museum specimens to work out taxonomy.

- Birds in Nam Theun Corridor PNBCA, Nam Phoun, Khammouan Limestone and Dong Phou Vieng NBCAs, the Xiangkhouang Plateau, the Phou Ahyon area, and the entire length of the Mekong north of Phou Xiang Thong NBCA.

- Reptiles and amphibians throughout the country, particularly in northern Lao PDR and in all areas above 1000 m.

- All vertebrate groups in wetlands outside the NBCA system; in areas of southern North Lao PDR of low human population density, including the areas between the Nam Xan and the Nam Mouan, and between Nam Chouan and Nam Kading NBCAs; and the very high peaks of Xiangkhouang Province (including those on the northern edge of Nam Chouan PNBCA).

- All key species classified as Little Known in Lao PDR.

There are also many cases where more specific survey work is needed, focussing on certain species or areas. All field surveys should be structured towards skills transfer to Lao counterparts. Scheduling and external funding should reflect this primary aim.

AMPHIBIANS AND REPTILES

B. L. Stuart

INTRODUCTION

Knowledge of which species occur where is fundamental to conservation of biodiversity, yet the amphibian and reptile composition of Lao PDR has long remained unknown. Previous reports on the herpetofauna (Gressitt 1970, Salter 1993b) are based largely on secondary, regional accounts or are extrapolations from documented occurrence in adjacent countries. Even the single attempt to catalogue any component of the herpetofauna, Deuve's *Serpents du Laos* (1970), contains suppositions and records that could not be traced to museum specimens by this author. Some small museum collections were made by various workers earlier in the century, yet no attempt has been made to compile these records.

Recent surveys by the author, supplemented with specimen and photographic contributions of other conservation workers and the holdings of specimens in various museums, have recorded at least 166 species of amphibians and reptiles for Lao PDR. Presented here is an inventory of the known conservation status, distribution, and habitat use of the amphibians and reptiles of Lao PDR.

Records of most species listed here are verifiable with voucher specimens. Sight records of only the more easily identified species (platysternid, testudinid and some emydid turtles, monitors, pythons and King Cobra), and photographic records only of species of unambiguous taxonomy have been included to maintain a conservative list. With the exceptions of two species of turtles whose names are contained in brackets and of Siamese Crocodile, interview reports of species that were unconfirmed with voucher specimens have not been used, because of easily mistaken identifications and incongruencies between folk and scientific taxonomy.

Because exploration of the herpetofauna of Lao PDR is still in its infancy, the following inventory is not exhaustive. Species should not be considered limited in Lao PDR to the reported habitats, elevation, or range, as further sampling will certainly expand these aspects for many of the species. The habitat descriptions and elevations are based on specimens encountered in the field by the author or on data associated with other Lao records: extrapolations from habitat use in neighbouring countries have not been made. Most of the sampling to date has been conducted in the central region, with the north and other areas over 1000 m being particularly under-represented.

A number of taxa have proven difficult to identify. These will require further studies and in some cases, a revision of the genus, before specific names can be properly assigned. These have been included only to the genus, except for several frogs which are listed under 'groups'.

CONVENTIONS

Nomenclature is primarily from Zhao and Adler (1993) and R. F. Inger (*in litt*. 1998-1999), with supplementations from Ernst and Barbour (1989) and Taylor (1962, 1963, 1965). Common names, when available, mostly follow Cox (1991) and Ernst and Barbour (1989).

A bullet (•) indicates that the species is considered a Key Species (those of special conservation significance). These are species listed by the *1996 IUCN Red List of Threatened Animals* (IUCN 1996) or determined by the author as meriting categorisation as At, Potentially At, or Conditionally At Risk, or Little Known, in Lao PDR (see general Introduction). Species included in Appendix I or Appendix II of CITES (WCMC 1998) are listed in Annex 3. The revised list of key species is presented in Annex 6. Species of high national conservation priority are identified in Table 6.

[Brackets] are placed around the names of two species of turtles that probably occur in Lao PDR, but for which only tentative records currently exist. These unverified records were included because of their conservation significance.

Lao ranges are given as north, centre, south and throughout (implying all of these). The north region is divided into 'vicinity of Vientiane', 'Annamite mountains' and 'North' for the remainder of the records which fall within the sector. The centre region is divided into 'limestone region', 'Nakai Plateau', 'Annamite foothills', 'Annamite mountains' and 'Centre' for the remainder of the records, including market records from Ban Lak (20) and Thakhek. The south sector is divided into 'Annamite mountains' and 'South' for the remainder of the records (Table 7). Citations refer to field records unless otherwise noted. Field records are specifically stated as such when known for turtles, monitors *Varanus bengalensis* and *V. salvator*, pythons *Python molurus* and *P. reticulatus*, King Cobra *Ophiophagus hannah* and Siamese Crocodile *Crocodylus siamensis*, because of the paucity and importance of field records for these species. All market information is from BLS except where stated.

The word 'specimen' refers to one or more specimens held in the cited museum. Permission to cite these specimens was granted by the curatorial staff of all listed museums, with the disclaimer that the present author has not personally examined the preserved material and that errors with specimen identifications and locality records do occur. Syntheses are pending of the Lao collections held in the MNHN, Paris, and the NHM, London, as a complete review of these holdings will require a visit to these institutions.

All specimens reported from Stuart (1998a-1998e), and a substantial number hitherto not written up, are currently housed in the FMNH, Chicago, and those from Ohler (1997) are believed to be held in MNHN, Paris.

'Taxonomic Issues' refer to recent name changes, alternative names that are commonly encountered in the literature for the same taxon, or warn of imminent taxonomic revision.

Table 7. Regions and divisions of Lao PDR as used for herpetological records.

Region	Division	Sites
North	Vicinity of Vientiane	Vientiane Municipality
	Annamite mountains	Nam Theun Extension PNBCA
	North	Phou Khaokhoay NBCA, Phou Louey NBCA, all other areas in north region
Centre	Limestone region	Hin Namno and Khammouan Limestone NBCAs
	Nakai Plateau	Parts of Nakai-Nam Theun NBCA and Nam Theun Corridor PNBCA
	Annamite foothills	Vicinity of Ban Lak (20), mid elevations west of Annamites in Nakai-Nam Theun NBCAand in Hin Namno NBCA
	Annamite mountains	Mountains in Nakai-Nam Theun NBCA
	Centre	All other areas in centre region
South	Annamite mountains	Xe Sap NBCA
	South	Dong Khanthung PNBCA, all other areas in south region

Collections are abbreviated as follows:

AMNH: American Museum of Natural History, New York, U.S.A.
CAS: California Academy of Sciences, San Francisco, U.S.A.
FMNH: Field Museum of Natural History, Chicago, U.S.A.
MCZ: Museum of Comparative Zoology, Harvard University, Cambridge, U.S.A.
TNSM: Thailand National Science Museum, Bangkok, Thailand.
UMMZ: University of Michigan Museum of Zoology, Ann Arbor, U.S.A.
USNM: Smithsonian Institution, Washington DC, U.S.A.

ANNOTATED LIST OF SPECIES

Ichthyophiidae: Caecilians (1 species)

Ichthyophis sp. Centre in limestone region (Stuart 1998b), Annamite foothills (FMNH specimen) and Annamite mountains (FMNH specimen, Plate 8), probably throughout. Thrives in disturbed areas. Larvae are aquatic and have been found in paddies and buffalo wallows, while adults are terrestrial and live in leaf litter and under ground cover. 200-700 m. *Taxonomic Issues:* The taxonomy of this South-east Asian genus is confused, and requires revisionary work before a specific name can be assigned to the Lao specimens.

Salamandridae: Salamanders (1 species)

• ***Paramesotritron* sp.** Salamander sp. *Conservation Significance:* Little Known in Lao PDR. *Documented Range and Habitat:* North (FMNH specimen). Habitat unknown at present. *Status Information:* Known in Lao PDR from seven specimens caught in Xiangkhouang Province, in 1998. Three of these specimens are currently held at FMNH and are being described at the time of writing.

Megophryidae: Asian horned frogs (6 species)

Leptolalax pelodytoides. North (as *Leptobrachium pelodytoides* in Ohler 1997, as *Micrixalus* sp. in Stuart 1998c, FMNH specimen), centre in Annamite foothills (Stuart 1998a) and Annamite mountains (FMNH specimen), south in Annamite mountains (TNSM specimen). On leaf litter and vegetation along streams in evergreen forest. 300-1400 m.

Leptobrachium banae. South in Annamite mountains (TNSM specimen). Wet evergreen forest. 1400 m.

Leptobrachium pullum. Centre (FMNH specimen from Ban Lak (20) market) and in Annamite foothills (photographed in Nakai-Nam Theun NBCA by R. Boonratana in 1998). Evergreen forest. *Taxonomic Issues:* Sometimes referred to as *L. hasseltii* (R. F. Inger *in litt*. 1998).

Megophrys lateralis. North (as *Megophrys* sp. in Stuart 1998c), centre (FMNH specimen from Ban Lak (20) market) and in Annamite mountains (FMNH specimen; Plate 8). Along fast-flowing streams in evergreen forest. 600-1200 m.

Megophrys parva. North (as *Megophrys* sp. in Stuart 1998c). Single specimen found along rocky stream in evergreen forest. 800 m.

Ophryophryne poilani. Centre in Annamite mountains (FMNH specimen). Single specimen found along rocky stream in evergreen forest. 700 m.

Bufonidae: True toads (3 species)

Bufo galeatus. Centre in Annamite foothills (Stuart 1998a) and Annamite mountains (FMNH specimen), south in Annamite mountains (TNSM specimen). Evergreen and evergreen mixed with deciduous forest. 500-600 m.

Bufo macrotis. South (Stuart 1998e; TNSM specimen). Dry dipterocarp forest with grassland. 60 m.

Bufo melanostictus. North (Ohler 1997) and in vicinity of Vientiane (AMNH specimen, FMNH specimen), centre in limestone region (Stuart 1998a, 1998b) and Annamite foothills (FMNH specimen), south (Stuart 1998e). Thrives in disturbed areas, and is regularly encountered near human habitation. 100-600 m. Most common species of toad in Lao PDR.

Ranidae: Typical frogs (24 species)

Amolops cremnobatus. Centre in Annamite mountains (FMNH specimen). The type locality of this recently described species is in Nakai-Nam Theun NBCA (Inger and Kottelat 1998). A second population was found in the same protected area 60 km south-east of the type locality shortly after publication of the species description (FMNH specimen; Plate 8). On boulders and rock faces along stream cascades and waterfalls. 600-700 m.

Hoplobatrachus rugulosa. North (FMNH specimen from Xiangkhouang market) and in vicinity of Vientiane (AMNH specimen, FMNH specimen from Vientiane market), centre in limestone region (Stuart and Davidson 1999), south (field and market record in Stuart 1998e, Salavan market record in February 1999 by TC). Pools in open forest such as dipterocarp forest with grassland, or disturbed areas such as paddies and bomb crater ponds (Stuart and Davidson 1999). 60-220 m. This large-sized frog is commonly seen in markets. Seven hundred and ninety individuals were counted on a single afternoon at the Pakxe Km. 2 market in July 1998 (Stuart 1998e). *Special Significance:* CITES Appendix II (as *H. tigerina*). *Taxonomic Issues:* Alternatively placed in the genus *Rana*; *rugulosa* sometimes placed with *H. tigerina*.

Huia nasica. Centre in Annamite mountains (FMNH specimen). On rock faces and bladed vegetation in spray zones of waterfalls in evergreen forest. 600-700 m.

***Limnonectes blythii* group**. North (as *Rana laticeps* in Stuart 1998d), centre in limestone region (Stuart 1998a, 1998b), Nakai Plateau (Stuart 1998b) and Annamite foothills (Stuart 1998a, FMNH specimen). Along streams in evergreen forest. 200-600 m. *Taxonomic Issues:* The taxonomy of this species is confused, and more than one species is probably harboured under this name. Alternatively placed in the genus *Rana.*

Limnonectes kohchangae. North (Ohler 1997). Habitat not reported. *Taxonomic Issues:* Alternatively placed in the genus *Rana.*

***Limnonectes kuhlii* group**. North (Ohler 1997, Stuart 1998c, 1998d, FMNH specimen from Xiangkhouang market), Annamite foothills (Stuart 1998a, FMNH specimen) and Annamite mountains (FMNH specimen), south in Annamite mountains (TNSM specimen). Rocky streams in evergreen forest. 300-1200 m. *Taxonomic Issues:* The taxonomy of this species is confused, and more than one species is probably harboured under this name. Alternatively placed in the genus *Rana.*

Limnonectes limborgi. Centre in limestone region (FMNH specimen), Nakai Plateau (FMNH specimen) and Annamite foothills (Stuart 1998a). On leaf litter in dry stream beds in evergreen mixed with deciduous forest. 220-500 m. *Taxonomic Issues:* Alternatively placed in the genus *Rana.*

Limnonectes pileata. North (Ohler 1997). Habitat not reported. *Taxonomic Issues:* Alternatively placed in the genus *Rana.*

Occidozyga lima. North in vicinity of Vientiane (AMNH specimen, Ban Lak (52) market record in March 1998), centre in limestone region (Stuart 1998b) and Annamite foothills (FMNH specimen), south (Stuart 1998e, USNM specimen). Ponds in open forest such as dipterocarp forest with grassland, or in disturbed wet areas such as paddies and drainage ditches. 60-600 m.

Occidozyga martensii. North (as *Phrynoglossus laevis* in Ohler 1997) and in vicinity of Vientiane (BLS), centre in limestone region (Stuart 1998a, 1998b) and Annamite foothills (FMNH specimen), south (as *O. martensi* (*sic*) in Stuart 1998e). Ponds in open forest such as dipterocarp forest with grassland, or in disturbed, wet areas such as paddies and bomb crater ponds (Stuart and Davidson 1999). 60-600 m. *Taxonomic Issues:* The taxonomy of this genus is confused. Lao specimens assigned to *O. laevis* (or *Phrynoglossus laevis*) and *O. magnapustulosa* by some workers are regarded here as *O. martensii* until revisionary work better elucidates the relationship among these species.

Plate 8:

An unusually melanistic *Microhyla berdmorei* from disturbed evergreen forest in Nakai-Nam Theun NBCA, December 1998. The species is regularly encountered in disturbed areas.
B. L. Stuart / WCS.

Rhacophorus calcaneus from vegetation above a stream in wet evergreen forest in Nakai-Nam Theun NBCA, December 1998.
B. L. Stuart / WCS.

Paa microlineata from cascading stream in evergreen forest, Nakai-Nam Theun NBCA, November 1998. Recorded in Lao PDR from only two localities to date. *B. L. Stuart / WCS.*

Rana livida along stream in evergreen forest in Phou Louey NBCA, April 1998. This species is common in this habitat in Lao PDR.
B. L. Stuart / WCS.

Rhacophorus reinwardti from vegetation above a stream within mixed evergreen and deciduous forest near Hin Namno NBCA, February 1998. This canopy-dwelling species is not regularly encountered. *B. L. Stuart / WCS.*

Amolops cremnobatus from wet rock face along stream in evergreen forest, Nakai-Nam Theun NBCA, November 1998. This species was described to science only in 1998. *B. L. Stuart / WCS.*

Calling male *Megophrys lateralis* on vegetation along a stream in evergreen forest in Nakai-Nam Theun NBCA, December 1998, where the species was frequently encountered. *B. L. Stuart / WCS.*

Adult caecilian *Ichthyophis* sp. from disturbed evergreen forest in Nakai-Nam Theun NBCA, December 1998. The aquatic larvae are more frequently encountered than are the semi-fossorial adults. *B. L. Stuart / WCS.*

Paa microlineata. North (as *Rana* sp. 1 in Stuart 1998c), centre (FMNH specimen from Ban Lak (20) market), in Annamite mountains (FMNH specimen, Plate 8), south in Annamite mountains (TNSM specimen). Wet rocks and rock faces along stream cascades and waterfalls. 600-1200 m. *Taxonomic Issues:* Alternatively placed in the genus *Rana*.

Rana andersonii. North (as *Amolops* sp. in Stuart 1998c), centre in Annamite mountains (FMNH specimen). On low tree branches and rocks along rocky streams in evergreen forest. 600-1200 m.

Rana archotaphus. Centre in Annamite mountains (FMNH specimen). On vegetation along rocky streams in evergreen forest. 600-700 m.

Rana attigua. South in Annamite mountains (TNSM specimen). Along streams in wet evergreen forest. 1000 m.

Rana erythraea. North in vicinity of Vientiane (photographed in Ban Lak (52) market by S. Ling in March 1999), centre in limestone region (Stuart 1998a, Stuart and Davidson 1999) and in Annamite foothills (FMNH specimen), south (Stuart 1998e). Ponds, slow-moving streams, and rivers in open or closed forest, sometimes in disturbed habitat such as bomb crater ponds (Stuart and Davidson 1999). 60-600 m.

Rana johnsi. North (FMNH specimen), centre in Annamite foothills (Stuart 1998a, FMNH specimen), Nakai Plateau (Stuart 1998b) and Annamite mountains (FMNH specimen), south in Annamite mountains (TNSM specimen). On leaf litter and low vegetation in evergreen forest near streams. 500-700 m.

Rana lateralis. North in vicinity of Vientiane (Vientiane market record in Ohler 1997), centre in Annamite foothills (FMNH specimen), south (Stuart 1998e). Open forest such as dipterocarp forest with grassland, sometimes at a considerable distance from a source of water. 100-600 m.

***Rana limnocharis* group**. North (as *Limnonectes limnocharis* in Ohler 1997, as *R*. cf. *limnocharis* in Stuart 1998c, FMNH specimen) and in vicinity of Vientiane (Vientiane market record as *Limnonectes limnocharis* in Ohler 1997, AMNH specimen, FMNH specimen), centre (Thakhek Km. 3 market record in April and October 1998), in limestone region (Stuart 1998a, 1998b), Annamite foothills (FMNH specimen) and Annamite mountains (BLS), south (field and market record in Stuart 1998e, USNM specimen). Thrives in disturbed wet areas such as paddies or drainage ditches, often near human habitation. 60-1000 m. Most common ranid frog in Lao PDR. Regularly seen in markets. Approximately 500 individuals were counted on a single morning at the Thakhek Km. 3 market in October 1998. *Taxonomic Issues:* This widespread taxon probably harbours more than one species.

Rana livida. North (Ohler 1997, Stuart 1998c (Plate 8), photographed in Nam Xam NBCA by DAS in 1998), centre in limestone region (Stuart 1998b), Annamite foothills (Stuart 1998a, FMNH specimen) and Annamite mountains (FMNH specimen), south in Annamite mountains (TNSM specimen). Along streams in evergreen forest. 220-1400 m.

Rana macrodactyla. North in vicinity of Vientiane (AMNH specimen), south (Stuart 1998e, TNSM specimen, Salavan market record in February 1999 by TC), probably throughout. Open forest such as dipterocarp forest with grassland. 100 m.

Rana maosonensis. Centre in Annamite mountains (FMNH specimen). On leaf litter banks and in shallow water along rocky streams in evergreen forest. 600-700 m.

Rana montivaga. North (as *Rana* sp. 2 in Stuart 1998c). Single specimen on a rocky stream bank in evergreen forest. 1200 m.

***Rana nigrovittata* group**. North (Ohler 1997, Stuart 1998c, 1998d, FMNH specimen from Xiangkhouang market), centre (FMNH specimen from Ban Lak (20) market), in limestone region (Stuart 1998a, 1998b), Nakai Plateau (Stuart 1998b), Annamite foothills (Stuart 1998a) and Annamite mountains (FMNH specimen), south (Stuart 1998e, photographed in Xe Pian by TC in 1997) and in Annamite mountains (TNSM specimen). Slow-moving streams or side-pools of faster streams in evergreen forest. 60-1000 m. *Taxonomic Issues:* This widespread and variable taxon probably harbours more than one species.

Rana taipehensis. Centre in limestone region (Stuart 1998a, 1998b), Nakai Plateau (Stuart 1998b) and Annamite mountains (FMNH specimen), south (Stuart 1998e). Near slow-moving streams in evergreen mixed with deciduous forest, near ponds and marshes in open forest such as dipterocarp forest with grassland, and wet areas of agricultural lands. 100-700 m.

Rhacophoridae: Tree frogs (11 species)

Chirixalus doriae. North (as *Polypedates* sp. 1 in Stuart 1998c). Grassy marsh in opening of hill evergreen forest. 985 m.

Chirixalus nongkhorensis. South (Stuart 1998e). Around ponds and slow-moving streams in grassland with dipterocarp forest. 60-100 m.

Chirixalus vittatus. North (as *Polypedates* sp. 2 in Stuart 1998c). Single specimen in grassy marsh in opening of hill evergreen forest. 985 m.

Philautus asperrimus. Centre in Annamite foothills (Stuart 1998a). Single specimen on low vegetation along temporary stream in evergreen mixed with deciduous forest. 500 m.

Polypedates feae. Centre in Annamite mountains (FMNH specimen). On low vegetation above stream in disturbed evergreen forest. 600 m.

***Polypedates leucomystax* group**. North (Stuart 1998c, Xiangkhouang market record in February 1999, FMNH specimen) and in vicinity of Vientiane (BLS), centre in limestone region (Stuart 1998b), Nakai Plateau (Stuart 1998b), Annamite foothills (Stuart 1998a, FMNH specimen) and Annamite mountains (FMNH specimen), south (Stuart 1998e) and in Annamite mountains (TNSM specimen). Found in all habitat types, including disturbed areas and near human habitation. 60-985 m. Most common tree frog in Lao PDR. *Taxonomic Issues:* This group exhibits wide geographic variation, and is most certainly composed of a number of sibling species.

Rhacophorus baliogaster. South in Annamite mountains (TNSM specimen). Wet evergreen forest. 1000 m.

Rhacophorus bisacculus. North (as *Theloderma* sp. in Stuart 1998c), centre in Annamite foothills (Stuart 1998a) and Annamite mountains (FMNH specimen). On low vegetation near streams in evergreen and evergreen mixed with deciduous forest. 500-1200 m.

Rhacophorus calcaneus. Centre in limestone region (as *Rhacophorus* sp. in Stuart 1998b) and in Annamite mountains (FMNH specimen). On vegetation above streams, limestone outcrops, or in caves in evergreen forest. 220-600 m. *Taxonomic Issues:* These samples consist of two forms which may prove to be distinct species.

Rhacophorus exechopygus. South in Annamite mountains (TNSM specimen). On low vegetation in wet evergreen forest. 1200-1400 m.

Rhacophorus reinwardti. North (as *R. nigropalmatus* in Ohler 1997 and in Stuart 1998c), centre in Annamite foothills (Stuart 1998a, Plate 8). In canopy of evergreen forest, but occasionally seen on lower vegetation near streams and marshes. 545-985 m.

Microhylidae: Narrow-mouthed frogs (12 species)

Calluella guttulata. North (photographed in Phou Khaokhoay NBCA by T. Hansel in 1997) and in vicinity of Vientiane (Vientiane market record as *C. guttulosa* in Ohler 1997), south (USNM specimen from Seephandon market). Disturbed vegetation near human habitation.

Glyphoglossus molossus. South (photographed in Salavan market by TC in February 1999).

Kalophrynus pleurostigma. Centre in limestone region (Stuart 1998a) and Annamite foothills (photographed in Nakai-Nam Theun NBCA by R. Boonratana in 1998, FMNH specimen), south (TNSM specimen). On leaf litter in evergreen and evergreen mixed with deciduous forest. 200-600 m.

Kaloula mediolineata. South (photographed in Salavan market by TC in February 1999).

Kaloula pulchra. North (Stuart 1998d) and in vicinity of Vientiane (Vientiane market record in Ohler 1997, AMNH specimen, FMNH specimen), centre in limestone region (Stuart 1998a, 1998b), south (Stuart 1998e, Salavan market record in February 1999 by TC). This highly adaptable species is found in most habitat types, from evergreen forest to vegetation along drainage ditches in Vientiane. 100-600 m.

Microhyla annamensis. Centre in Annamite mountains (BLS), south in Annamite mountains (TNSM specimen). Wet evergreen forest. 600-1200 m.

Microhyla berdmorei. North (Ohler 1997, FMNH specimen), centre (Thakhek Km. 3 market record in October 1998), in limestone region (Stuart 1998a), Nakai Plateau (Stuart 1998b), Annamite foothills (Stuart 1998a, FMNH specimen) and Annamite mountains (FMNH specimen, Plate 8), south (Stuart 1998e, photographed in Xe Kong Province by DAS in 1997, TNSM specimen) and in Annamite mountains (Xe Sap NBCA by TC). Near stream banks in most forest types, including open forest and disturbed vegetation near human habitation. 100-1000 m.

Microhyla butleri. North (Stuart 1998c), centre in limestone region (Stuart 1998b) and Annamite foothills (FMNH specimen), south (Stuart 1998e, photographed in Xe Pian NBCA by TC in 1997, Salavan market record in February 1999 by TC). Evergreen forest, evergreen mixed with deciduous forest, and grassland with dipterocarp forest. 100-1000 m.

Microhyla heymonsi. North (Ohler 1997, Stuart 1998c) and in vicinity of Vientiane (USNM specimen), centre in limestone region (Stuart 1998a, 1998b) and in Annamite foothills (FMNH specimen), south (Stuart 1998e, Salavan market record in February 1999 by TC, TNSM specimen). Open forest such as dipterocarp forest with grassland, and in gaps in evergreen forest. 60-1000 m.

Microhyla inornata. North (as *Micryletta inornata* in Ohler 1997), centre in limestone region (Stuart 1998a, 1998b) and Annamite foothills (Stuart 1998a, FMNH specimen), south and in Annamite mountains (TNSM specimen). Evergreen, deciduous, and evergreen mixed with deciduous forest. 200-1000 m.

Microhyla ornata. North in vicinity of Vientiane (Ban Lak (52) market record in March 1998, AMNH specimen), centre in limestone region (Stuart 1998a, 1998b) and Annamite foothills (FMNH specimen), south (Stuart 1998e, Salavan market record in February 1999 by TC, TNSM specimen). Found in most habitat types, including evergreen forest, open forest such as dipterocarp forest with grassland, or under vegetation in disturbed wet areas such as paddies, drainage ditches, and around bomb crater ponds (Stuart and Davidson 1999). 60-600 m.

Microhyla pulchra. North in vicinity of Vientiane (Vientiane market record in Ohler 1997, Ban Lak (52) market record in March 1998, AMNH specimen), centre (Thakhek Km. 3 market record in April 1998), in limestone region (Stuart 1998a, 1998b), south (Stuart 1998e, TNSM specimen, Salavan market record in February 1999 by TC). Under logs, chunks of dried mud, or other debris around ponds in open forest or in disturbed areas such as buffalo wallows, rice paddies, or drainage ditches. 60-200 m. Regularly seen in markets.

Platysternidae: Big-headed Turtle (1 species)

• ***Platysternon megacephalum*** Big-headed Turtle. *Conservation Significance:* Data Deficient (Global); At Risk in Lao PDR. *Documented Range and Habitat:* North, centre in Annamite foothills and Annamite mountains, south (see below). Higher elevations in rocky streams in evergreen forest. *Status Information:* North: village record (Stuart 1998c, photographed in Phou Khaokhoay NBCA by T. Hansel in 1997 and in Nam Et NBCA by DAS in 1998 after confiscation from traders by local officials); Vietnamese trader possession record (Robichaud 1998a); specimen record (USNM); Louangphabang market record (Pritchard 1995); unspecified (Bour 1997) and in vicinity of Vientiane, market record (whole dried specimen at morning market medicinal stall in 1997 by TDE). Centre: in Annamite mountains, field record (at 750 m in Tobias 1997); village record (Ban Navang in Nakai-Nam Theun NBCA by RJTim); Vietnamese trader possession record (Nakai-Nam Theun NBCA by BLS). South: village record (Showler *et al*. 1998a); photographed (field record at 540 m in Nam Ghong Provincial Protected Area, Attapu Province, by RJTiz in 1998). Reported to be eaten for food (Stuart 1998b) and sold to Lao traders (Pritchard 1995) and Vietnamese traders at relatively high prices (Stuart 1998c, 1998d, BLS), presumably for the Vietnamese and Chinese consumption trade.

Emydidae: Typical turtles (9-11 species)

• ***Cuora amboinensis*** Malayan Box Turtle. *Conservation Significance:* Globally Near-Threatened; At Risk in Lao PDR. *Documented Range and Habitat:* South (see below). Lowland open forest such as dipterocarp forest with scattered pools. *Status Information:* South: field record (Xe Kong Plains in Xe Pian NBCA by TDE); village record (Stuart 1998e (Plate 9), Ban Tahin in Dong Khanthung PNBCA by RJTim). Hunted for food (Stuart 1998e) and reported to be sold to Thai traders (Baird 1993) and probably sold to Vietnamese traders for the Vietnamese and Chinese consumption trade.

• ***Cuora galbinifrons*** Indochinese Box Turtle. *Conservation Significance:* Globally Near-Threatened; At Risk in Lao PDR. *Documented Range and Habitat:* North in Annamite mountains, centre in Nakai Plateau and Annamite mountains (see below). Higher elevations in evergreen forest or closed forest. *Status Information:* North: in Annamite mountains, Vietnamese trader possession record (Robichaud 1998a). Centre: in Nakai Plateau, village record (Timmins and Evans 1996), and Annamite mountains, field record (FMNH specimen at 900 m in Nakai-Nam Theun NBCA); village record (Timmins and Evans 1996); market record (Ban Lak (20) market record in 1994 by TDE). A carapace from a consumed specimen in a village in the limestone region was reported to have been obtained locally (Stuart 1998b), suggesting the species may also be present at lower elevations (village at 200 m) in dry evergreen mixed with deciduous forest. Hunted for food by local people (Stuart 1998b; Plate 5) and by Vietnamese poachers (Robichaud 1998a), and reported to be sold to Lao traders (Stuart 1998b) and Vietnamese traders (BLS), presumably for the Vietnamese and Chinese consumption trade. One villager interviewed in 1998 in Ban Maka-Neua (Nakai-Nam Theun NBCA) predicted that the species would disappear from over-harvesting within a few years (BLS). *Taxonomic Issues:* Alternatively assigned to the genus *Cistoclemmys* (Zhao and Adler 1993).

[• ***Cuora trifasciata*** Chinese Three-striped Box Turtle]. *Conservation Significance:* Globally Threatened - Endangered; Conditionally At Risk in Lao PDR. *Documented Range and Habitat:* No field or village records exist in Lao PDR, although animals believed to be this species (as *thao kham*, meaning 'golden turtle') have been reported from several villages in climatically wet evergreen forest near the Vietnam border in Nakai-Nam Theun NBCA and the Nam Theun Extension PNBCA (Robichaud 1998a, Timmins and Khounboline in press, BLS). At least five specimens of *C. trifasciata* in the Ban Keun Zoo in 1995 were said to originate in Lao PDR (Timmins and Khounboline in press), but in 1996 all seven animals which had been acquired were stolen from the zoo (zoo staff verbally 1999). *Status Information:* The most sought after species by Vietnamese traders, presumably for the Vietnamese and Chinese consumption trade. This species was reported in 1994 to command the kip

equivalent of US$ 95 from Vietnamese traders per animal (Timmins and Khounboline in press), but by 1998 the prices had soared to, depending on exchange rate, US$ 250-375 (BLS) to US$ 520 (Robichaud 1998a) per animal. This dramatic price increase suggests that the demand has far outstripped the supply of this species. Indeed, drastic population declines have been reported by local people, e.g. one villager interviewed in 1998 in Ban Maka-Neua (Nakai-Nam Theun NBCA) predicted that the species would disappear from over-harvesting within a few years (BLS). The species is likely to be extirpated in Lao PDR, and possibly pushed to extinction in its total known range of northern Vietnam and southern China (Zhao and Adler 1993), in the very near future. Verification of the species's occurrence in Lao PDR is a high priority. This task will remain difficult since the species is likely to be traded rather than eaten and so carapaces from individuals consumed in villages are not likely to be encountered, and captured specimens are kept secret (Robichaud 1998a) and traded away quickly. Records of this species commanding US$ 50-150 each in Vietnamese markets in 1993 (Le Dien Duc and Broad 1995) strengthen the likelihood that *C. trifasciata* is the reported species in question. Captive breeding is required if the species is to persist until cultural changes in Vietnam and China relieve the demand. CITES listing should be considered.

• ***Cyclemys dentata*** Asian Leaf Turtle. *Conservation Significance:* Potentially At Risk in Lao PDR. *Documented Range and Habitat:* North, south, probably throughout (see below). Habitat presumably streams in closed forest. *Status Information:* North: photographed (Nam Kading NBCA by K. Khounboline per RJTim); Louangphabang market record (Pritchard 1995). South: village record (Ban Nongpon, Ban Houayton, and Ban Nongkhe in Dong Hua Sao NBCA and Ban Phapho in Xe Pian NBCA, by RJTim). Probably throughout. Sold in Lao PDR for food (Pritchard 1995) and probably to Vietnamese traders for the Vietnamese and Chinese consumption trade. *Taxonomic Issues:* Several new forms of this highly variable genus have been recently described from Thailand and Cambodia (Iverson and McCord 1997, van Dijk 1998). Most authors have previously recognised only two species in the genus, *C. dentata* and *C. tcheponensis*, although the relationship between these species remains unclear (Ernst and Barbour 1989). It has been proposed that the colour differences that are currently used to distinguish *C. dentata* and *C. tcheponensis* may reflect only altitudinal variation within a single species (Iverson and McCord 1997), and that all *Cyclemys* are best referred to as only the '*C. dentata* complex' (van Dijk 1998). All *Cyclemys* from Lao PDR examined to date by the author have had facial striping and better fit the description of *C. tcheponensis*, although the specimens examined by RJTim had brown heads lacking obvious facial stripes, which better fit the description of *C. dentata*. In the aims of taxonomic stability, two distinct taxa will continue to be recognised here, pending further analyses of variation within the genus.

• ***Cyclemys tcheponensis*** Stripe-necked Leaf Turtle. *Conservation Significance:* Potentially At Risk in Lao PDR. *Documented Range and Habitat:* North, centre in Nakai Plateau, possibly south (see below). Streams in evergreen or evergreen mixed with deciduous forest. *Status Information:* North: field record (at 300 m in Stuart 1998d). Centre: in Nakai Plateau, field record (at 570 m in Stuart 1998b). South: field record (at 540 m in Nam Ghong Provincial Protected Area, Attapu Province, by RJTiz in 1998); type locality may be in South Lao PDR (Bourret 1941, see below). Hunted for food (Stuart 1998b, 1998d) and like other turtles in Lao PDR is probably sold for food and to Vietnamese traders for the Vietnamese and Chinese consumption trade. *Taxonomic Issues:* See *C. dentata*. The type locality is "Centre Annam" in the upper reaches of the Xe Banghiang river, near Xe Pon (Bourret 1941). Xe Pon is in Lao PDR, but it is unclear whether the type specimen was taken from the Lao or Vietnamese side of the border.

• ***Heosemys grandis*** Giant Asian Pond Turtle. *Conservation Significance:* Globally Near-Threatened; Potentially At Risk in Lao PDR. *Documented Range and Habitat:* Centre in limestone region, south (see below). Wet areas in open forest such as dry dipterocarp forest with grassland at low elevation. *Status Information:* Centre: village record (Dong Phou Vieng NBCA by TC) and in limestone region, village record (Stuart 1998b, Ban Lak (9) in Khammouan Limestone NBCA by RJTim). South: field record (at 60 m in Stuart 1998e); photographed (Xe Kong Plains in Xe Pian NBCA by G. Q. A. Anderson per RJTim); village record (Stuart 1998e, Ban Houayton in Dong Hua Sao NBCA and Xe Bang-Nouan NBCA by RJTim). Hunted for food (Stuart 1998b, 1998e), carapaces are sold to Lao traders (Stuart 1998b), and animals are probably sold for food and to Vietnamese traders for the Vietnamese and Chinese consumption trade.

• ***Hieremys annandalii*** Yellow-headed Temple Turtle. *Conservation Significance:* Globally Threatened - Vulnerable; At Risk in Lao PDR. *Documented Range and Habitat:* South (see below). Habitat presumably wet areas at low elevation. *Status Information:* South: village record (Stuart 1998e, Xe Pian NBCA in 1997 by TC). One of the records was of a carapace in a village at 60 m. Hunted for food (Stuart 1998e) and is probably sold to Vietnamese traders for the Vietnamese and Chinese consumption trade.

• ***Malayemys subtrijuga*** Malayan Snail-eating Turtle. *Conservation Significance:* Potentially At Risk in Lao PDR. *Documented Range and Habitat:* North, centre in limestone region, south (see below). In slow-moving or standing bodies of water at low elevation. *Status Information:* North:

village record (Phou Khaokhoay NBCA by C. Sisomphone per RJTim); in vicinity of Vientiane, Vientiane Sisavat market record (June 1998). Centre: village record (Dong Phou Vieng NBCA by TC) and in limestone region, village record (Stuart 1998b, Ban Lak (9) in Khammouan Limestone NBCA, RJTim). South: village record (Stuart 1998e, Xe Pian NBCA by RJTim and TC). Heavily hunted for food (Stuart 1998b, 1998e) and reportedly for sale to Vietnamese traders (Stuart 1998b), presumably to Vietnamese and Chinese consumption trade. Carapaces reported to be sold to Thai traders in the south (Baird 1993).

• ***Pyxidea mouhotii*** Keeled Box Turtle. *Conservation Significance:* At Risk in Lao PDR. *Documented Range and Habitat:* North, centre in limestone region (see below). *Status Information:* North: field record (limestone section of Nam Kading NBCA by RJTim). Centre: in limestone region, village record (several villages in Hin Namno NBCA by RJTim). The type locality may be in Lao PDR, although this is debated (Zhao and Adler 1993). Hunted for food in Hin Namno NBCA (RJTim) and reported to be hunted for food elsewhere (Stuart 1998b), and like other turtles in Lao PDR is probably sold to Vietnamese traders for the Vietnamese and Chinese consumption trade.

• ***Sacalia quadriocellata*** Four-eyed Turtle. *Conservation Significance:* Globally Threatened - Vulnerable; Potentially At Risk in Lao PDR. *Documented Range and Habitat:* North, centre in Annamite mountains (see below). At higher elevations in streams in evergreen forest. *Status Information:* North: field record (in hunters' camp at 985 m as *S. bealei* in Stuart 1998c). Centre: in Annamite mountains, field record (FMNH specimen at 600 m in Nakai-Nam Theun NBCA; Plate 9). Collected for food and reported to be sold to Vietnamese traders (Stuart 1998c, BLS), presumably for the Vietnamese and Chinese consumption trade. *Taxonomic Issues:* This taxon was formally recognised as the subspecies *S. bealei quadriocellata* (Ernst and Barbour 1989), but is best regarded as a distinct species (Zhao and Adler 1993).

[• ***Siebenrockiella crassicollis*** Black Marsh Turtle]. *Conservation Significance:* Conditionally At Risk in Lao PDR. *Documented Range and Habitat:* Presumably south (see below). *Status Information:* A report is frequently cited on the trade of this species in Champasak Province (based on villager interviews in Baird 1993), yet no specimens or photographic records from Lao PDR have been presented to date. Like other turtles in Lao PDR, it is probably eaten and sold to Vietnamese traders for the Vietnamese and Chinese consumption trade. Reported to be sold to Thai traders (Baird 1993).

Testudinidae: Tortoises (2 species)

• ***Indotestudo elongata*** Elongated Tortoise. *Conservation Significance:* Globally Threatened - Vulnerable; At Risk in Lao PDR; CITES Appendix II. *Documented Range and Habitat:* North, centre in limestone region and Nakai Plateau, south (see below). At low to mid elevations in open forest such as dipterocarp forest. *Status Information:* North: specimen record (USNM); Louangphabang market record (Pritchard 1995); unspecified (Boonratana 1997). Centre: field record (Dong Phou Vieng NBCA by TC), in limestone region, village record (Stuart 1998b), and Nakai Plateau, village record (Timmins and Evans 1996); market record (Salavan by RJTim). South: field record (Evans *et al*. 1996a, Davidson *et al*. 1997, Boonratana 1998a); photographed (Xe Pian NBCA by TC in 1997); village record (Timmins *et al*. 1993, Timmins and Bleisch 1995, WCS 1995a, Evans *et al*. 1996a, Stuart 1998e, Xe Bang-Nouan NBCA, Dong Hua Sao NBCA, and Ban Nahin in Dong Khanthung PNBCA by RJTim, Xe Pian NBCA by TDE); Pakxe Km. 2 market record (Stuart 1998e). Heavily hunted for food (Stuart 1998b, 1998e); turtle remains in lowland villages are more frequently of this species than of any other (RJTim).

• ***Manouria impressa*** Impressed Tortoise. *Conservation Significance:* Globally Threatened - Vulnerable; At Risk in Lao PDR; CITES Appendix II. *Documented Range and Habitat:* North, centre including Annamite mountains, south (see below). Evergreen forest above 400 m. *Status Information:* North: field record (photographed at 800 m in Nam Et NBCA in 1998 by PD); village record (Bour 1997, Stuart 1998c, Nam Kading NBCA by RJTim, carapace from Phou Dendin NBCA by WGR per RJTim, Phou Khaokhoay NBCA by JWKP); Louangphabang market record of carapaces (Pritchard 1995, RJTim). Centre: field record (Duckworth *et al*. 1993); Ban Lak (20) market record (Tobias 1997), and in Annamite mountains: field record (Timmins and Evans 1996, Robichaud 1999); village record (Timmins and Evans 1996). South: village record (Timmins and Bleisch 1995, Xe Namnoy by TDE per RJTim, Dakchung Plateau by RJTim), and in Annamite mountains, village record (Xe Sap NBCA by TC). The meat is eaten and the shells are sold to Lao traders (Pritchard 1995, Stuart 1998c) who reportedly resell them to Vietnamese and Chinese traders (Stuart 1998c).

Trionychidae: Softshell turtles (2 species)

• ***Amyda cartilaginea*** Asiatic Softshell Turtle. *Conservation Significance:* Globally Threatened - Vulnerable; Potentially At Risk in Lao PDR. *Documented Range and Habitat:* North, centre including limestone region and Annamite foothills, south (see below). Streams and rivers. *Status Information:* North: village record (photographed in Nam Et NBCA by

DAS in 1997 after confiscation from traders by local officials); Louangphabang market record (Pritchard 1995); unspecified (Bour 1997), and in vicinity of Vientiane, market record (Vientiane market record by RJTim and Pritchard 1995, Ban Lak (52) market record by RJTim). Centre: field record (Nakai Plateau by RJTim); village record (Phou Xang He NBCA by RJTim); Thakhek Km. 3 market record (February 1998); in limestone region, village record (Stuart 1998b), and Annamite foothills, village record in Nakai-Nam Theun NBCA (BLS); Ban Lak (20) market record (RJTim). South: field record (Xe Kong Plains in Xe Pian NBCA by RJTim, Phou Xiang Thong NBCA by TDE); village record (Stuart 1998e, Ban Nongping in Xe Pian NBCA by RJTim); photographed (Khonphapheng Falls in Champasak Province by I. Baird, Xe Pian NBCA by TC in 1997). Heavily hunted for food (Stuart 1998b, 1998c, 1998e) and sale to Lao traders (Pritchard 1995, Stuart 1998b, 1998d, 1998e) and Vietnamese (BLS) and reportedly Chinese traders (Stuart 1998c), presumably for the Vietnamese and Chinese consumption trade. Most common species of softshell turtle in markets.

• ***Pelochelys cantorii*** Asian Giant Softshell Turtle. *Conservation Significance:* Globally Threatened - Vulnerable; At Risk in Lao PDR. *Documented Range and Habitat:* South (see below). Presumably large streams and rivers at low elevations. *Status Information:* South: village record (photographed in Ban Hangkhon, Champasak Province by I. Baird). This single record was said to have been caught locally in the Mekong at 60-70 m. Reported to be hunted for food and sale to Lao traders (Stuart 1998e). *Taxonomic Issues:* Formerly recognised as *P. bibroni*, however, a neotype designation now restricts this name to the distinctive population in southern New Guinea (Webb 1995).

Gekkonidae: Geckos (10 species)

Cosymbotus platyurus. North (FMNH specimen) and in vicinity of Vientiane (AMNH specimen), centre in Thakhek (BLS), south in Pakxe (BLS). Human commensal, commonly seen in houses and other human-made structures. Natural habitat is probably open forest or forest gaps.

Cyrtodactylus interdigitalis. Centre in Nakai Plateau (as *Cyrtodactylus* sp. B in Stuart 1998b) and Annamite mountains (FMNH specimen). Evergreen forest. 570-720 m.

Cyrtodactylus jarujini. North (as *Cyrtodactylus* cf. *peguensis* in Stuart 1998d), centre in limestone region (as *Cyrtodactylus* sp. A in Stuart 1998b). In caves and rock outcroppings in evergreen forest. 220-300 m.

Gehyra mutilata. North (FMNH specimen) and in vicinity of Vientiane (AMNH specimen). Human commensal found on buildings and other human-made structures.

Gekko gecko. North (UMMZ specimen, USNM specimen) and in vicinity of Vientiane (BLS), centre in limestone region (Stuart 1998a, 1998b), south (Davidson *et al*. 1997, Stuart 1998e, USNM specimen). Human commensal, commonly seen on houses and other people-made structures. Naturally occurs in the canopy of most forest types, where it is more commonly heard calling than seen. Harvested and dried in the sun after being gutted and flayed on bamboo crucifixes (J. Foppes verbally 1999); more than 7000 individuals of this genus (and probably of this species based on its abundance and frequent contact with people) were reported to be legally exported from Lao PDR in 1995-1996 (Foppes and Kethpanh 1997). Heavily traded in markets in Vietnam (BLS) and China (Zhao and Adler 1993). Seen preserved in alcoholic beverage in Pakxe in July 1998 (BLS). (Plate 1)

Gekko petricolus. South (TNSM specimen). Rock outcroppings and human dwellings.

Hemidactylus frenatus. North (Stuart 1998d, FMNH specimen, USNM specimen) and in vicinity of Vientiane (FMNH specimen), centre (FMNH specimen), south (FMNH specimen). Human commensal, commonly seen on houses and other people-made structures. One natural habitat record of a specimen on a rocky river bank in disturbed evergreen forest at 300 m (Stuart 1998d).

Hemidactylus garnotii. North (FMNH specimen, UMMZ specimen), south (TNSM specimen). Human commensal, found in houses and other people-made structures.

Hemiphyllodactylus yunnanensis. North (FMNH specimen). Habitat not reported.

Phyllodactylus siamensis. North (Stuart 1998d), south (Stuart 1998e). Open forest such as gaps in evergreen forest and dipterocarp forest with grassland. 100-300 m.

Agamidae: Agamas (12 species)

Acanthosaura capra. South in Annamite mountains (TNSM specimen). On tree trunks in wet evergreen forest. 1400 m.

Acanthosaura crucigera. North (Bour 1997, FMNH specimen). Habitat not reported.

Acanthosaura lepidogaster. North (Stuart 1998c, 1998d, FMNH specimen), centre in Nakai Plateau (Stuart 1998b), Annamite foothills (Stuart 1998a), and Annamite mountains (FMNH specimen), south (TNSM specimen). On ground and low vegetation in evergreen and evergreen mixed with deciduous forest. 240-1200 m.

Plate 9:

Four-eyed Turtle *Sacalia quadriocellata* from a stream in evergreen forest in Nakai-Nam Theun NBCA, December 1998. This remarkably patterned species is restricted to Lao PDR, Vietnam and China. Its best chances for survival are probably in Lao PDR.
B. L. Stuart / WCS.

Malayan Box Turtle *Cuora amboinensis* held captive in a paddy-field house near Ban Khem village, Dong Khanthung PNBCA, July 1998. The animal was destined to be eaten. This species is regularly harvested for food and sale to the consumption trade.
B. L. Stuart / WCS.

Cyrtodactylus jarujini from boulder pile in Phou Khaokhouay NBCA 1998. This species was described to science in 1993 from the type locality in Nong Khai Province, Thailand.
B. L. Stuart / WCS.

Ptyctolaemus phuwuanensis from boulder pile in Phou Khaokhouay NBCA, June 1998. This poorly-known species had not been previously reported outside of the type locality in Nong Khai Province, Thailand, from which it was described in 1991.
B. L. Stuart / WCS

Adult Water Monitor *Varanus salvator* caught with baited hook and held alive in a fisherman's camp while awaiting sale to traders on the Nam Lepou river, Dong Khanthung PNBCA, July 1998. This species is heavily harvested for food and sale to the consumption trade. *B. L. Stuart / WCS.*

A wild hatchling Bengal Monitor *Varanus bengalensis* found under the bark of a fallen dead pine tree on the Nakai Plateau, March 1998. Adults of this species are heavily harvested for food and sale to the consumption trade. *B. L. Stuart / WCS.*

Draco maculatus found in dry evergreen mixed diciduous forest in Hin Namno NBCA, February 1998. This gliding species is widespread, but is difficult to capture for verification of identity. *B. L. Stuart / WCS.*

Calotes emma from disturbed evergreen forest in Phou Khaokhoay NBCA, June 1998. This species is common in Lao PDR. *B. L. Stuart / WCS.*

Calotes emma. North (Bour 1997, Stuart 1998d (Plate 9), centre (photographed in Dong Phou Vieng NBCA by TC in 1997), in limestone region (Stuart 1998a, 1998b), Nakai Plateau (Stuart 1998b), Annamite foothills (FMNH specimen) and Annamite mountains (FMNH specimen), south (FMNH specimen). Found in most forest types, sometimes in open or disturbed areas near human habitation. 100-720 m.

Calotes mystaceus. North (FMNH specimen, UMMZ specimen), centre (photographed in Dong Phou Vieng NBCA by TC in 1997), south in Annamite mountains (Xe Sap NBCA by TC). Evergreen forest.

Calotes versicolor. North (USNM specimen) and in vicinity of Vientiane (AMNH specimen, USNM specimen), centre in limestone region (Stuart 1998a, 1998b), Annamite foothills (FMNH specimen) and Annamite mountains (BLS), south (Stuart 1998e). On low vegetation in open forest or disturbed areas near human habitation. 60-600 m.

Draco maculatus. North (FMNH specimen, UMMZ specimen), centre in limestone region (Stuart 1998a), south (TNSM specimen). Dry evergreen mixed with deciduous forest. 200 m. Several individuals of a different species of *Draco* were seen in Dong Khanthung PNBCA in July 1998, but escaped capture and proper identification (as *Draco* sp. in Stuart 1998e).

Leiolepis belliana. North (UMMZ specimen), south (TNSM specimen). Habitat not reported, but probably open forest at lower elevations in Mekong floodplain.

Leiolepis rubritaeniata. South (as *L. belliana* in Stuart 1998e). Grassland with dry dipterocarp forest. 100 m.

• ***Physignathus cocincinus*** Water Dragon. *Conservation Significance:* Potentially At Risk in Lao PDR. *Documented Range and Habitat:* Centre (photographed in Dong Phou Vieng NBCA by TC in 1997, Ban Lak (20) market record in Tobias 1997), in limestone region (Stuart 1998a), Nakai Plateau (Stuart 1998b) and Annamite mountains (FMNH specimen), south (Stuart 1998e, photographed in Xe Pian NBCA by TC in 1997), probably throughout. In vegetation above streams in evergreen forest. 60-700 m. *Status Information:* Adults and eggs are extensively harvested for food (Stuart 1998b, 1998e).

Pseudocalotes microlepis. North (FMNH specimen), south in Annamite mountains (TNSM specimen). Wet evergreen forest. 1000 m.

Ptyctolaemus phuwuanensis. North (as "unknown agamid" in Stuart 1998d). In rock crevices and boulder piles in evergreen forest. 300 m.

Anguidae: Legless lizards (at least 1 species)

***Ophisaurus* sp**. Centre in Annamite foothills (photographed in Nakai-Nam Theun NBCA by S. Vannalath), south (Boonratana 1998a, photographed in Dong Hua Sao NBCA by TDE in 1993). *Taxonomic Issues:* The specific name could not be determined from the photographs or the field encounter. Specimens are needed for formal identification.

Varanidae: Monitors (2 species)

• ***Varanus bengalensis*** Bengal Monitor. *Conservation Significance:* Potentially At Risk in Lao PDR; CITES Appendix I. *Documented Range and Habitat:* North, centre in Nakai Plateau, south (see below). Open forest such as dipterocarp or coniferous forest with grassland. *Status Information:* North: unspecified (Bour 1997, Boonratana 1997). Centre: field record (Dong Phou Vieng NBCA by TC); market record (Thakhek Km. 3 market record in April 1998, Ban Lak (20) market record in Tobias 1997, photographed in Ban Lak (20) market by RJTiz in 1998); village record (photographed in Dong Phou Vieng NBCA by TC in 1997), and Nakai Plateau, field record (at 570 m in Stuart 1998b; Plate 9). South: field record (WCS 1995a, Evans *et al*. 1996a, Davidson *et al*. 1997); village record (Stuart 1998e); market record (Attapu market in January 1997 by D. Davenport). Hunted for food (Baird 1993, Stuart 1998c, 1998e) and sale to Lao traders (Baird 1993, Stuart 1998b, 1998e, 1998d), Vietnamese traders (BLS) and Thai traders (Baird 1993). A single village in Dong Khanthung PNBCA estimated an annual harvest of 100 individuals for consumption and sale to Lao army soldiers and Lao traders (Stuart 1998e). Reported to be locally extirpated in recent years in one area of Phou Louey NBCA (Stuart 1998c). *Taxonomic Issues:* Sometimes referred to as *V. b. nebulosus* or *V. nebulosus* (TC).

• ***Varanus salvator*** Water Monitor. *Conservation Significance:* Potentially At Risk in Lao PDR; CITES Appendix II. *Documented Range and Habitat:* North, centre in Annamite mountains, south (see below). Along large streams and rivers in evergreen forest. *Status Information:* North: unspecified (Boonratana 1997). Centre: field record (Dong Phou Vieng NBCA by TC), and in Annamite mountains, Vietnamese trader possession record (Nakai-Nam Theun NBCA by BLS); village record (photographed in Ban Lak (20) market by RJTiz in 1998). South: field record (Davidson *et al*. 1997); village record (at 60 m in Stuart 1998e (Plate 9), Nam Ghong Provincial Protected Area in Attapu Province by RJTiz in 1998); market record (Stuart 1998e); unspecified (Boonratana 1998a). Hunted for food (Baird 1993, Stuart 1998c, 1998e) and sale to Lao traders (Baird 1993, Stuart 1998d, 1998e) and Thai traders (Baird 1993).

Lacertidae: Old-world lizards (1 species)

Takydromus sexlineatus. North in vicinity of Vientiane (FMNH specimen), centre in Nakai Plateau (Stuart 1998b), south in Annamite mountains (TNSM specimen). Grassy areas, such as in grassland mixed with pine and dipterocarp forest, or in disturbed habitat. 190-1000 m. *Taxonomic Issues:* These specimens belong to the subspecies *T. s. ocellatus*, which are sometimes referred to as *T. ocellatus*.

Scincidae: Skinks (10 species)

Lipinia vittigera. South (TNSM specimen, BLS). On banana tree in disturbed evergreen forest. 100 m.

***Lipinia* sp.** Centre in Annamite mountains (FMNH specimen). Under leaf litter in wet evergreen forest. 600 m. *Taxonomic Issues:* These specimens do not fit into any known species, and probably represent a new taxon. Further museum comparisons with allied species are being undertaken.

Mabuya longicaudata. North (Bour 1997) and in vicinity of Vientiane (BLS), centre in limestone region (Stuart 1998a), south (Stuart 1998e, TNSM specimen). Open forest and disturbed areas near human habitation. 100-240 m.

Mabuya macularia. North (UMMZ specimen), centre in limestone region (Stuart 1998a, 1998b) and Annamite foothills (FMNH specimen), south (Stuart 1998e, TNSM specimen). Open forest and disturbed areas near human habitation. 60-600 m.

Mabuya multifasciata. North (Bour 1997, Stuart 1998d, FMNH specimen, UMMZ specimen) and in vicinity of Vientiane (AMNH specimen), centre in limestone region (Stuart 1998a) and Annamite mountains (BLS), south (Stuart 1998e, TNSM specimen). Open forest, edges and gaps in evergreen forest, and disturbed areas near human habitation. 60-600 m.

Scincella reevesi. Centre in limestone region (Stuart 1998b) and Annamite mountains (FMNH specimen). Evergreen mixed with deciduous forest near limestone outcroppings or gaps in evergreen forest. 200-700 m. *Taxonomic Issues:* This taxon probably harbours more than one species.

Scincella rufocaudata. Centre in Annamite foothills (Stuart 1998a). Evergreen mixed with deciduous forest. 500 m.

Sphenomorphus indicus. North (as *Mabuya* sp. in Stuart 1998c, FMNH specimen), centre in Annamite foothills (Stuart 1998a), south in Annamite mountains (TNSM specimen). On leaf litter of forest floor in evergreen and evergreen mixed with deciduous forest. 545-1200 m.

Sphenomorphus maculatus. Centre in limestone region (Stuart 1998a), south in Annamite mountains (TNSM specimen). Near rocks and logs in forest gaps and temporarily dry stream-beds in evergreen mixed with deciduous forest. 200-700 m.

Tropidophorus laotus. North (FMNH specimen, UMMZ specimen). Habitat not reported.

Typhlopidae: Blind snakes (1 species)

Ramphotyphlops braminus Flowerpot Snake. North (CAS specimen) and in vicinity of Vientiane (AMNH specimen), south (Stuart 1998e (Plate 10); TNSM specimen), probably throughout. Fossorial species encountered under logs and other cover, or on ground surface after heavy rains. 100 m.

Xenopeltidae: Sunbeam snakes (1 species)

Xenopeltis unicolor Sunbeam Snake. North in vicinity of Vientiane (AMNH specimen). Habitat not reported.

Uropeltidae: Pipe snakes (1 species)

Cylindrophis ruffus Red-tailed Pipe Snake. North in vicinity of Vientiane (BLS), probably throughout. Single record of road-killed specimen in urban Vientiane. 190 m. *Taxonomic Issues:* This widespread taxon probably harbours more than one species (R. F. Inger *in litt*. 1999).

Boidae: Pythons (2 species)

• ***Python molurus*** Burmese Python. *Conservation Significance:* Globally Near-Threatened; Potentially At Risk in Lao PDR; CITES Appendix II. *Documented Range and Habitat:* Centre including Annamite foothills and Annamite mountains, south (see below). Evergreen forest. *Status Information:* Centre: Ban Lak (20) market record (Tobias 1997), in Annamite foothills, field record (near Ban Lak (20) in 1996 by D. Davenport); village record (photographed in Nakai-Nam Theun NBCA by S. Vannalath after confiscation from traders by local officials in 1998), Annamite mountains, field record (at 850 m in Tobias 1997). South in Annamite mountains: field record (Davidson *et al*. 1997), village record (Xe Sap NBCA by TC). Reported to be hunted for food (Stuart 1998c) and sale to Lao traders (Stuart 1998e), and killed because thought to eat domestic dogs (Stuart 1998d). Skins sold to Thai traders in southern Lao PDR (Baird 1993). *Taxonomic Issues:* Lao specimens belong to the subspecies *P. m. bivittatus*.

• ***Python reticulatus*** Reticulated Python. *Conservation Significance:* Potentially At Risk in Lao PDR; CITES Appendix II. *Documented Range and Habitat:* North, centre in limestone region, south (see below). Probably occurs in most forest types, including disturbed areas such as agricultural lands. *Status Information:* North: unspecified (Bour 1997, Boonratana 1997) and in vicinity of Vientiane, village record (live specimen in January 1999 by TDE); market record (Ban Lak (52) market record of skin in March 1998 and February 1999, Vientiane morning market record of skin in April 1998). Centre: field record (Phou Xang He NBCA by RJTim) and in limestone region, village record (Stuart 1998b, near Ban Lak (20) by RJTiz). South: field record (at 60 m in Stuart 1998e, Showler *et al*. 1998a, Dong Ampham NBCA by T. Hansel); village record (Dong Hua Sao NBCA by RJTim), and in Annamite mountains, village record (Xe Sap NBCA by TC). One of the field records was seen in a tree over a stream in evergreen forest at 60 m (Stuart 1998e; Plate 10). Hunted for food (Stuart 1998b) and reported for sale to Lao traders (Stuart 1998e), and killed because the species is thought to eat domestic dogs (Stuart 1998d). Skins sold to Thai traders in southern Lao PDR (Baird 1993).

Colubridae: Typical snakes (40 species)

Ahaetulla nasuta Long-nosed Whip Snake. South (Stuart 1998e). Single record in dry dipterocarp forest with grassland. 100 m.

Ahaetulla prasina Oriental Whip Snake. North (USNM specimen) and in vicinity of Vientiane (AMNH specimen), centre in limestone region, Nakai Plateau (Stuart 1998b; Plate 10) and Annamite foothills (FMNH specimen), south (photographed in Xe Kong by PD in 1997, photographed in Xe Pian NBCA by TC in 1997), and in Annamite mountains (Xe Sap NBCA by TC). Open forests with grassland or in agricultural areas, occasionally evergreen forest. 200-600 m.

Amphiesma stolata White-striped Keelback. North in vicinity of Vientiane (AMNH specimen). The specimen was found on a main road, presumably in disturbed habitat.

Boiga cyanea Green Cat Snake. North in vicinity of Vientiane (AMNH specimen), centre in limestone region (Stuart 1998b), Nakai Plateau (Stuart 1998b) and Annamite foothills (Stuart 1998a), south (Stuart 1998e). Found in most forest types, usually in vegetation above streams and other water bodies. 100-570 m.

Boiga ocellata Dog-toothed Cat Snake. South (as *B. cynodon* in Stuart 1998e). Single record from near a village in disturbed evergreen forest. 60 m.

Boiga multomaculata Spotted Cat Snake. North (photographed in Phou Khaokhoay NBCA by JWKP in 1998) and in vicinity of Vientiane (road-killed specimen near Ban Keun in March 1999, BLS), centre in Annamite foothills (FMNH specimen), south in Annamite mountains (TNSM specimen). Evergreen and open pine forest, and near agricultural lands. 200-800 m.

Chrysopelea ornata Ornate Flying Snake. North (USNM specimen) and in vicinity of Vientiane (BLS, AMNH specimen), centre in limestone region (Stuart 1998a), south (Stuart 1998e). Found in most forest types, sometimes in disturbed areas near human habitation. 60-200 m.

Dendrelaphis cyanochloris Wall's Bronzeback. Centre in limestone region (Stuart 1998a), Nakai Plateau (Stuart 1998b) and Annamite foothills (Stuart 1998a). Dry evergreen mixed with deciduous forest. 200-570 m.

Dendrelaphis pictus Common Bronzeback. North (photographed in Phou Khaokhoay NBCA by JWKP in 1998), and in vicinity of Vientiane (AMNH specimen), south (Stuart 1998e). Found in most forest types, including disturbed areas near human habitation. 100-500 m.

Dryocalamus davisonii Common Bridle Snake. Centre in limestone region (Stuart 1998a). Single specimen from dry evergreen mixed with deciduous forest. 200 m.

Elaphe porphyracea Red Mountain Racer. North (Stuart 1998c, FMNH specimen). Hill evergreen forest.

Elaphe prasina Green Ratsnake. South in Annamite mountains (TNSM specimen). Wet evergreen forest. 1000 m.

Elaphe radiata Radiated Ratsnake. North (MCZ specimen) and in vicinity of Vientiane (AMNH specimen), centre in limestone region (Stuart 1998b) and Annamite foothills (FMNH specimen), south (photographed captive in village in Xe Sap NBCA by T. Hansel in 1997). Found in most forest types and in disturbed areas near human habitation. 200-600 m.

Elaphe taeniura Asian Ratsnake. North (based on photographs by DAS and PD in Stuart 1998c). Single specimen from along a stream in hill evergreen forest. *Taxonomic Issues:* The subspecies could not be determined from the photograph.

Enhydris jagori Striped Water Snake. North in vicinity of Vientiane (AMNH specimen), south (Stuart 1998e), probably throughout. Ponds in open forest. 60 m.

Enhydris plumbea Plumbeous Water Snake. North in vicinity of Vientiane (AMNH specimen), centre in limestone region (Stuart 1998a) and Annamite foothills (FMNH specimen), south (Stuart 1998e, photographed in Xe Pian by TC in 1997). Ponds, slow streams, and buffalo wallows in open forest or agricultural lands. 60-600 m.

Gonyosoma oxycephalum Red-tailed Green Ratsnake. Centre in limestone region (as *G. prasina* in Stuart 1998a, Stuart 1998b). Dry evergreen mixed with deciduous forest. 200-220 m.

Homalopsis buccata Puff-faced Water Snake. South (near Pakxe in 1999 by TC, photographed in Champasak Province by I. Baird). Pond and slow-moving river in open forest. 60-100 m.

Liopeltis frenatus. North (FMNH specimen). Habitat not reported.

Liopeltis stoliczkae. Centre in Annamite foothills (FMNH specimen). Single record of road-killed specimen near Ban Lak (20). Habitat not reported. 600 m.

Lycodon laoensis Laotian Wolf Snake. North (as *Lycodon* cf. *subcinctus* in Stuart 1998c, AMNH specimen). Along stream in evergreen forest at 1200 m. The type locality may be in Lao PDR, although this is debated (Zhao and Adler 1993). *Taxonomic Issues:* The relationship between this species and *L. subcinctus* is unclear (R. F. Inger *in litt*. 1999). Alternatively placed in the genus *Ophites* (Zhao and Adler 1993).

Oligodon cinereus. North (as *Oligodon* sp. in Stuart 1998c, USNM specimen). Disturbed evergreen forest near human habitation. 1330 m.

Oligodon cyclurus. North (as *Oligodon* sp. in Stuart 1998d (Plate 10), FMNH specimen). Evergreen forest. 300 m.

Opisthotrophis praemaxillaris Angel's Mountain Keelback. North (Zhao and Adler 1993). The type locality is in Xiangkhouang Province (Zhao and Adler 1993).

Pareas carinatus Keeled Slug Snake. North (Stuart 1998d), centre in Annamite foothills (FMNH specimen). Near streams in evergreen forest. 300-600 m.

Pareas hamptoni Hampton's Slug Snake. North in vicinity of Vientiane (AMNH specimen), centre in Annamite mountains (FMNH specimen). Evergreen forest. 700 m.

Pareas margaritophorus White-spotted Slug Snake. South (photographed on Dakchung Plateau, Xe Kong Province, by DAS in 1997). Habitat not reported.

Psammodynastes pulverulentus Mock Viper. Centre (photographed in Dong Phou Vieng NBCA by TC in 1997). Disturbed evergreen forest.

Psammophis condanarus Indochinese Sand Snake. South (Stuart 1998e; Plate 10). Single specimen from paddy-field in vicinity of grassland with dipterocarp forest. 100 m.

Pseudoxenodon macrops Big-eyed Mountain Keelback. South in Annamite mountains (Xe Sap NBCA by TC). Evergreen forest. 1000 m.

Pseudoxenodon bambusicola Chinese Mountain Keelback. Centre in Annamite mountains (FMNH specimen). 700 m.

• ***Ptyas korros*** Indochinese Ratsnake. *Conservation Significance:* Potentially At Risk in Lao PDR. *Documented Range and Habitat:* North (BLS, FMNH specimen) and in vicinity of Vientiane (FMNH specimen). Centre (Thakhek Km. 3 market record in April 1998), in limestone region (Stuart 1998a) and Annamite foothills (BLS). South (Pakxe Km. 2 market record in Stuart 1998e, photographed at Khonphapheng Falls in Champasak Province by I. Baird). Open forest or disturbed areas such as agricultural lands and paddies. 200-600 m. *Status Information:* Members of this genus reported to be hunted for food and regularly sold in markets (Baird 1993). Recent observations of both *P. korros* and *P. mucosus* in Lao markets suggest that the large exports of *P. mucosus* previously reported from Lao PDR (Salter 1993b, citing CITES information in Nash and Broad 1993) may also have included both of these species.

• ***Ptyas mucosus*** Common Ratsnake. *Conservation Significance:* Potentially At Risk in Lao PDR; CITES Appendix II. *Documented Range and Habitat:* Centre (Thakhek Km. 3 market record in April 1998), south (Pakxe Km. 2 market specimen as *P. mucosas* in Stuart 1998e). *Status Information:* Members of this genus reported to be hunted for food and regularly sold in markets (Baird 1993; see *P. korros*).

Rhabdophis chrysargus Speckle-bellied Keelback. Centre in Nakai Plateau (Stuart 1998b), south in Annamite mountains (TNSM specimen). Along streams in evergreen forest. 570-1000 m.

Rhabdophis nigrocinctus Green Keelback. North (Bour 1997), centre in Annamite foothills (Stuart 1998a). Along streams in evergreen mixed with deciduous forest. 545 m.

Rhabdophis subminiatus Red-necked Keelback. North (FMNH specimen), centre in Annamite foothills (FMNH specimen) and Annamite mountains (FMNH specimen), south (Stuart 1998e, photographed in Xe Pian by TC in 1997) and in Annamite mountains (Xe Sap NBCA by TC). Near water bodies in open forest such as dipterocarp forest with grassland and in disturbed areas such as paddies and agricultural lands. 60-600 m.

Sibynophis collaris Collared Snake. South in Annamite mountains (TNSM specimen). Wet evergreen forest. 1000 m.

Sinonatrix aequifasciata Mountain Keelback. Centre in Annamite mountains (FMNH specimen). Along streams in evergreen forest. 700 m.

Sinonatrix percarinata Chinese Keelback. North (as *Sinonatrix* sp. in Stuart 1998c). In shallow water among vegetation and debris at edges of rocky streams in evergreen forest. 985 m.

Xenochrophis piscator Checkered Keelback. North (as *Xenochrophis* sp. in Stuart 1998d, AMNH specimen, CAS specimen, MCZ specimen, USNM specimen) and in vicinity of Vientiane (photographed by R. Jelinek in 1998), centre in limestone region (Stuart 1998b) and Annamite foothills (FMNH specimen), south (as *X. flavipunctata* in Stuart 1998e). Near water bodies in open forest and in disturbed areas such as paddies. 60-600 m. *Taxonomic Issues:* Some authors have elevated the subspecies *X. p. flavipunctatum* to the specific status of *X. flavipunctatum* (Taylor 1965), but the conservative position is taken here of using only the name *X. piscator* (Zhao and Adler 1993).

Elapidae: Elapid snakes (6 species)

Bungarus candidus Malayan Krait. North (Stuart 1998c, FMNH specimen), centre in Annamite foothills (Stuart 1998a), south (Stuart 1998e). Along streams in evergreen forest. 60-1200 m.

Bungarus fasciatus Banded Krait. North (photographed in Phou Khaokhoay NBCA by JWKP in 1998, MCZ specimen, USNM specimen), centre in limestone region (Stuart 1998b) and Annamite foothills (FMNH specimen). Open forest or agricultural lands, often near paddies. 200-600 m.

Bungarus multicinctus Narrow-Banded Krait. North (MCZ specimen). Habitat not reported.

• ***Naja kaouthia*** Monocellate Cobra. *Conservation Significance:* Potentially At Risk in Lao PDR; CITES Appendix II (as *N. naja* WCMC 1998). *Documented Range and Habitat:* Centre in Annamite foothills (see below), probably throughout. Disturbed evergreen forest near human habitation. 600 m. *Status Information:* Centre in Annamite foothills (FMNH specimen), probably throughout. Threats unclear but may be heavily traded. *Taxonomic Issues:* Alternatively placed within the species *Naja naja*.

• ***Naja siamensis*** Indochinese Spitting Cobra. *Conservation Significance:* Potentially At Risk in Lao PDR. *Documented Range and Habitat:* Centre, probably south in lowlands of Mekong floodplain. *Status Information:* Photographed captive in village in Dong Phou Vieng NBCA by TC in 1997. Threats unclear but may be heavily traded.

• ***Ophiophagus hannah*** King Cobra. *Conservation Significance:* Potentially At Risk in Lao PDR; CITES Appendix II. *Documented Range and Habitat:* North, centre in Annamite foothills, south (see below). Found in most forest types, including bamboo stands. *Status Information:* North: unspecified (Boonratana 1997). Centre: in Annamite foothills, field record (Tobias 1997). South: field record (Davidson *et al*. 1997); village record (Stuart 1998e; Plate 10); unspecified (Boonratana 1998a). Hunted for food (Stuart 1998e) and sale to Lao (Stuart 1998e) and Vietnamese traders, presumably for the Vietnamese and Chinese consumption trade.

Viperidae: Vipers (6 species)

Calloselasma rhodostoma Malayan Pit Viper. North in vicinity of Vientiane (AMNH specimen also road-killed specimen near Ban Keun in March 1999 by BLS), probably throughout. Near agricultural lands and probably most forest types.

Ovophis monticola Mountain Pit Viper. South in Annamite mountains (TNSM specimen). Wet evergreen forest. 1400 m.

Trimeresurus albolabris White-lipped Pit Viper. North (as *T. stejnegeri* in Stuart 1998d, FMNH specimen, MCZ specimen), centre in limestone region (Stuart 1998a) and Nakai Plateau (Stuart 1998b), south (as *T. stejnegeri* in Stuart 1998e). Disturbed and gallery evergreen or evergreen mixed with deciduous forest, and agricultural lands. 60-570 m.

Trimeresurus mucrosquamatus Checker-backed Pit Viper. Centre in limestone region (Stuart 1998a, Stuart 1998b) and Annamite mountains (FMNH specimen, Plate 10). Evergreen or evergreen mixed with deciduous forest. 200-600 m.

Trimeresurus popeiorum Popes' Pit Viper. Centre in Annamite foothills (FMNH specimen) and Annamite mountains (FMNH specimen). Evergreen forest. 600 m.

Trimeresurus stejnegeri Bamboo Pit Viper. North (FMNH specimen). Habitat not reported.

Crocodylidae: Crocodiles (1 species)

• ***Crocodylus siamensis*** Siamese Crocodile. *Conservation Significance:* Globally Threatened - Critical; At Risk in Lao PDR; CITES Appendix I. *Documented Range and Habitat:*

Table 8. Results of interviews with local people on the presence of crocodiles.

Interview locality	Province	P	A	Reference
Nam Ha River	Louang-Namtha	x		Salter 1993b
Phou Louey NBCA	Houaphan		x	Stuart 1998c
Nam Phoun NBCA	Xaignabouli		x	Salter 1993b
Nam Ngum Reservoir	Vientiane	x		Salter 1993b
Nam Ngum River Wetlands	Vientiane	x		Salter 1993b
Phou Khaokhoay NBCA	Bolikhamxai / Vientiane	x[1,2]	x[3]	Salter 1993b[1]; JWKP verbally[2]; Stuart 1998d[3]
Khammouan Limestone NBCA	Khammouan	x[1]	x[2]	Salter 1993b[1]; Stuart 1998b[2]
Hin Namno NBCA	Khammouan		x	Stuart 1998a
Phou Xang He NBCA	Savannakhet	x		Salter 1993b
Xe Banghiang River	Savannakhet	x		Salter 1993b
Xe Champon Wetlands	Savannakhet	x		Salter 1993b
Nong Louang Wetlands	Savannakhet	x		Salter 1993b
Dong Phou Vieng NBCA	Savannakhet	x		TC pers. comm. 1999
Xe Bang-Nouan NBCA	Savannakhet / Salavan	x		Salter 1993b; Timmins and Bleisch 1995
Phou Xiang Thong NBCA	Champasak / Salavan	x[1]	x[2]	Salter 1993b[1]; Evans *et al*. 1996a[2]
Houay Khamouane Stream	Champasak	x		Salter 1993b
Nam Lepou River (Dong Khanthung PNBCA)	Champasak	x[1]	x[2]	Salter 1993b[1]; Stuart 1998e[2]
Seephandon Wetlands	Champasak	x		Salter 1993b
Dong Hua Sao NBCA	Champasak	x		Salter 1993b
Xe Khampho River	Champasak	x		Salter 1993b
Xe Pian NBCA	Champasak / Attapu	x[1]	x[2]	Salter 1993b[1]; Duckworth *et al*. 1993[2]
Ban Nathongsomlong/Nong Houay Soymong Wetlands (Bolaven Southwest PNBCA)	Champasak / Attapu	x		Salter 1993b
Upper Xe Kong River Drainage	Xekong	x[1,2]		Salter 1993b[1]; Showler *et al*. 1998a[2]
Xe Kaman and Xe Xou Rivers	Attapu	x[1,2]		Salter 1993b[1]; Davidson *et al*. 1997[2]
Nam Ghong Provincial Protected Area	Attapu	x		RJTiz verbally 1999

P = the conclusion from the interview was that crocodiles may still be present in the region;
A = the conclusion from the interview was that crocodiles are absent or extirpated from the region.

South, although other populations have been reported by local people in scattered localities in North and centre (Salter 1993b; see also report localities below). Rivers, lakes, and other wetlands, but the habitat attributes preferred by the species remain unknown in Lao PDR. *Status Information:* Historically the species was probably abundant, for example, Bassenne (1912) wrote "...on the sandy river-banks (near Pakxan), crocodiles stretched their long, scaly bodies...One of the attractions of traveling up the Mekong was to shoot at these large saurians". Likewise, Wharton (1966), on observations of late dry season hunting activities along the Lao-Cambodian border in the 1950s and 1960s, wrote "every permanent water hole...is repeatedly visited...crocodiles (*C. siamensis*) are captured in drying up stream beds within heavy gallery forest such as along the Tonle Repou [Cambodian name of Nam Lepou]". Few recent field records exist, and the species is presumed to have drastically declined in Lao PDR. The distribution of surviving populations remains unclear. South: field records: a 1.5 m crocodile basking on a grassy bank in February 1998 at Nong Khe wetlands, Sanamsai District, Attapu Province and a fresh set of faeces in the same location (S. Khounthikoumane, CPAWM, verbally 1999). Previously in the Nong Khe wetlands in January 1997, night vocalisations of crocodiles were heard and

Plate 10:

Checker-backed Pit Viper *Trimeresurus mucrosquamatus* from evergreen forest in Nakai-Nam Theun NBCA, December 1998. Currently known in Lao PDR from only three specimens. *B. L. Stuart / WCS.*

Indochinese Sand Snake *Psammophis condanarus* from rice paddy in Dong Khanthung PNBCA, July 1998. Sole record for Lao PDR. *B. L. Stuart / WCS.*

Adult Flowerpot Snake *Ramphotyphlops braminus* found under a log at the edge of a rice paddy near evergreen forest in Dong Khanthung PNBCA, July 1998. This diminutive species is widespread in Lao PDR but is rarely seen because of its fossorial habits. *B. L. Stuart / WCS.*

A yellow phase Oriental Whip Snake *Ahaetulla prasina* from a shrub in grassland on the Nakai Plateau, March 1998. Green and grey colour phases of this polymorphic species have also been recorded in Lao PDR. *B. L. Stuart / WCS.*

Wild sub-adult Reticulated Python *Python reticulatus* found above a stream in evergreen forest in Dong Khanthung PNBCA, July 1998. This species is heavily harvested for food and sale in the skin and consumption trade. *B. L. Stuart / WCS.*

Oligodon cyclurus from evergreen forest in Phou Khaokhoay NBCA, June 1998. Sole record for Lao PDR. *B. L. Stuart / WCS.*

King Cobra *Ophiophagus hannah* killed for food in Ban Kadan village, Dong Khanthung PNBCA, July 1998. This species is usually harvested for sale to the Vietnamese and Chinese consumption trade. *B. L. Stuart / WCS.*

Dead adult Common Ratsnake *Ptyas mucosus* in Thakhek Km. 3 market, April 1998. One of two records of this species for Lao PDR, although members of this genus are reported to be regularly harvested for food. *B. L. Stuart / WCS.*

fresh faeces, slides and tracks were observed (Davenport *et al*. 1997). Wild Siamese Crocodiles have been nearly extirpated from Thailand (Cox *et al*. 1998) and Vietnam (MRCS/UNDP 1998), and their continued existence is questionable in Malaysia and Indonesia (MRCS/UNDP 1998). Lao populations of Siamese Crocodiles are of extreme global importance, as the last viable populations are thought to exist there and in Cambodia (MRCS/UNDP 1998). The supposed viability of populations in Lao PDR has not been examined, but remains in doubt based on the drastic declines reported by local people (Salter 1993b) and by the paucity of recent field records. Field surveys specifically to assess the distribution, status, and threats to Siamese Crocodiles in Lao PDR have not been undertaken and are urgently needed.

Salter (1993b) detailed occurrences of crocodiles based on interviews with local people throughout the country. The results of these and more recent interviews are summarised in Table 8. However, some reports of the presence of crocodiles may be over-optimistic, as in 1995 the majority of local people in Xe Bang-Nouan NBCA initially reported the species to be frequently encountered, but after laboured interviewing it was learned that perhaps only a few people had actually seen a crocodile in the last ten years (RJTim).

The above records are assumed with confidence to be *C. siamensis*. Although some authors report that Estuarine Crocodile *C. porosus* occurs throughout South-east Asia (Levy 1991, Cox *et al*. 1998), it is doubted that the records in Lao PDR refer to this species. *Crocodylus porosus* is a large and aggressive species that today seems limited on mainland South-east Asia to coastal estuaries, as is the case in Cambodia (MRCS/UNDP 1998).

Three main threats have been identified for crocodiles in Lao PDR:

Harvest for skin trade and the collection of eggs and live animals for stocking crocodile farms in Thailand (Baird 1993) and Cambodia (MRCS/UNDP 1998). Some local people seem to hunt crocodiles opportunistically, while others target the species with set lines and perhaps night spotlighting (Claridge 1996). A young crocodile that was believed to come from the Xe Kaman river was reportedly confiscated from traders in 1993 in Saysetha District, Attapu Province (Baird 1995a). A 2.5 m crocodile was reported to be captured alive (date unreported) near Savannakhet but died before it was sold to Thai traders, although the skin was later smuggled to Mukdahan, Thailand (Baird 1993). A skull and 2 m skin that appeared in late 1997 in the Vientiane morning market was reported by the vendor to have come from the Nam Ngum river downstream of the Nam Ngum Reservoir (RJTiz). Local people in Ban Nam Leuk (Phou Khaokhoay NBCA) reported catching and eating a crocodile from the upper Nam Leuk river in 1995 (JWKP). A resident of Xe Bang-Nouan NBCA reported shooting a crocodile in 1993 for commercial purposes, but the carcase was abandoned before a buyer could be found (Timmins and Bleisch 1995, RJTim).

Habitat destruction through drainage and clearing of wetlands for conversion to agricultural lands, intensification of the use of remaining wetlands exposing any remaining crocodiles to higher risk of opportunistic killing, and the construction of hydropower reservoirs which flood breeding sites and allow hunters with boats easier access to crocodiles (Claridge 1996).

Hybridisation of Siamese Crocodiles in commercial crocodile farms threatens the genetic integrity of captive stock and diminishes chances for supplementing wild populations in the future with reintroduced captive animals. Large numbers of Siamese Crocodiles are bred successfully in Thai and Cambodian crocodile farms, and to a lesser extent in Vietnam, Indonesia, and some European and American zoos (MRCS/UNDP 1998). Therefore, this species could be a candidate for re-introductions should suitable habitat persist and hunting be controlled. No captive breeding populations are known in Lao PDR at the present, although a large group is maintained at the Ban Keun Zoo. Two of these animals were reported by zoo staff to have originated from southern Lao PDR, while the rest originated from Thai crocodile farms (RJTim). Unfortunately, in the 1960s many crocodile farms in Thailand began to hybridise Siamese Crocodile with Estuarine Crocodile for improved skin quality and growth rates (Cox *et al*. 1998), and at least one farm in Vietnam has begun hybridising with the exotic Cuban Crocodile *C. rhombifer* (MRCS/UNDP 1998). Other farms may begin hybridising with Cuban Crocodiles as well, since six females from a consignment of 100 animals sent to Vietnam several years ago are now residing at a commercial crocodile farm in Siem Reap, Cambodia (MRCS/UNDP 1998).

THREATS TO AMPHIBIANS AND REPTILES

The greatest threat to herpetofauna in Lao PDR is harvest, for domestic consumption, for internal trade and for unregulated export. Many amphibians and reptiles are eaten for food, and many are collected for their perceived value in Lao (Baird 1995b), Vietnamese (Jenkins 1995, Le Dien Duc and Broad 1995), and Chinese (Zhao and Adler 1993) traditional medicine. Turtles, monitors, other lizards, snakes and crocodiles are all used in traditional medicines. For example, Baird (1995b) reported uses in Lao traditional medicine for crocodile gall-bladders, head skin and teeth, for turtle scales, shells and gall-bladders, for python bone, oil and gall-bladders, for monitor oil, for Water Dragon bones and chin meat, for pit viper bones, and for cobra and King Cobra bones. However, since many species are consumed not only for curing specific ailments but also because of general health

benefits gained by eating the species, it is probably meaningless to attempt to distinguish between the food trade and medicinal trade (Jenkins 1995). Therefore, both trades are referred to here as the 'consumption trade'. The value of some reptile species, particularly turtles, for the consumption trade in Vietnam and China provides great incentive to local people in Lao PDR to collect and sell them to traders. A demand for turtles, monitors, and crocodiles by Thai traders has also been identified in southern Lao PDR by Baird (1993), although work in 1998 indicated a much greater influence from Vietnamese traders in most of Lao PDR.

The major trade routes for reptiles and other wildlife originate in Lao PDR and Cambodia and pass northwards through Hanoi (Vietnam) and onto China. Two Forest Protection Department (FPD) officers in Khe Sanh, Quang Tri Province, estimated that 70% of the wildlife in trade in central Vietnam originates in Lao PDR (Compton in prep. a). Most wildlife in trade in Vietnam is exported on to China. For example, only an estimated 10% of the turtles collected in Vietnam are consumed domestically (Le Dien Duc and Broad 1995). The volume of reptiles traded through Vietnam is staggering. In 1997 the Ninh Binh Provincial FPD in Vietnam confiscated from traders approximately 187 kg of frogs, 580 kg of turtles, 12 kg of geckos, 1522 kg of monitors *Varanus bengalensis* and *V. salvator*, 2422 kg of ratsnakes (probably *Ptyas korros* and *P. mucosus*), 53 kg of cobras (probably *Naja kaouthia*), 119 kg of King Cobras *Ophiophagus hannah*, and 637 kg of miscellaneous snakes (Compton in prep. a). These figures represent only a fraction of trade that was intercepted passing through a single area in Vietnam in one year, and so the actual volume of wildlife that passes annually from Lao PDR through Vietnam and onto China must be enormous. Without question, this trade is the most significant threat to national populations of herpetofauna in Lao PDR and elsewhere in Indochina.

Turtles are the most heavily exploited group of herpetofauna in Lao PDR for both domestic consumption and sale, and export to Vietnam and China. Turtles have probably long been collected for domestic consumption. Softshell turtles are especially valued for the taste of their meat. However, local people report that in the last ten years or so, a strong market for turtles has developed with Vietnamese traders. This demand has resulted in turtles being collected at much higher levels than before, and subsequently many species have reportedly declined rapidly. Without controls on the harvest and export of turtles, most populations in Lao PDR are seriously threatened, and at least a couple of species may even be extirpated in the near future. For this reason, all turtles are considered Key Species.

Monitors, pythons and King Cobra are also consistently reported throughout Lao PDR to be heavily targetted for food or sale to Lao or foreign traders, and indeed monitors and snakes were two of the three most heavily traded groups of wildlife in Ninh Binh Province, Vietnam in 1997 (Compton in prep. a).

Many of these species are hunted by local people with specially-trained dogs (Plate 5), among other methods. These dogs are highly revered by their owners for the large income which they can potentially generate. One man in Pu Mat Nature Reserve (Nghe An Province, Vietnam) in 1998 told the author that he was unable to estimate the monetary worth of his hunting dog, and that the dog had long financially supported his family. By probably no coincidence, most of the more seriously threatened turtle species are those which are terrestrial and can be harvested in large numbers with the use of hunting dogs.

It is unknown at present which species of amphibians and reptiles are seriously threatened by habitat loss in Lao PDR. Those species most in jeopardy probably inhabit the Mekong floodplain. Many of the wetlands used by Siamese Crocodile have been cleared and drained for agricultural lands (Claridge 1996), but wild crocodiles in Lao PDR are far more seriously threatened by hunting. At present there is no evidence that any species of herpetofauna in Lao PDR is more threatened by habitat loss than by harvesting.

No frogs have been listed as key species because it is yet unclear whether their populations are declining in Lao PDR. A number of villages in Khon District, Champasak Province, have reported a decline in the ranid frog *Hoplobatrachus rugulosa*, which they have attribute to over-harvesting for sale to markets outside the district (I. Baird verbally 1999). One village in Khammouan Limestone NBCA reported also a decline in frogs, which was blamed on unsuccessful reproduction because of sporadic rains in recent years (Stuart 1998b). The three frog species most commonly seen in markets, *Hoplobatrachus rugulosa*, *Rana limnocharis* and *Microhyla pulchra*, all thrive in agricultural and disturbed areas, and so are not confounded with the added threat of habitat loss. However, recent use of pesticides in agricultural lands and increased access to headlamps for night searching pose new threats to frogs.

The threat to amphibians and reptiles from introduction of exotic species is low in Lao PDR. However, two potential sources are worthy of mention. First, the Red-eared Slider *Trachemys scripta elegans*, a turtle native to south-east U.S.A., has been introduced in many countries around the world, including neighbouring Thailand, by released animals from the pet trade (Jenkins 1995, Cox *et al*. 1998). This species was seen for sale in a Vientiane aquarium shop in December 1998 (BLS). Escaped individuals of this successful colonist could pose a threat to native populations of turtles by competitive exclusion or spread of disease, were the species to become popular for food, as pets or as release animals in Buddhist tradition. Whether the threat of colonisation by this exotic outweighs the possible benefits from relieving pressure on native species as food and trade commodities is unknown. Secondly, at least two commercial frog farms, one in Vientiane (J. Foppes verbally 1999) and one near the Lao border in Udom-Ratchatani, Thailand (T. Hansel verbally 1998) reportedly rear native ranid frogs that have

been hybridised with a large African ranid (of a yet undetermined species) for domestic sale in markets. Native populations of frogs could be displaced or genetically altered by escaped individuals of these larger products of artificial selection.

CONSERVATION OF AMPHIBIANS AND REPTILES

Without question, the most significant conservation action required for herpetofauna in Lao PDR is control of the trade of reptiles to Vietnam and China. Some general objectives are outlined for control of this trade and other measures to conserve populations of amphibians and reptiles in Lao PDR.

Increased security measures preventing the entry of illegal Vietnamese incursionists into the country, particularly in Nakai-Nam Theun NBCA and the Nam Theun Extension PNBCA. Both of these areas are major exit sources for reptiles and other wildlife and natural resources via Vietnamese traders and poachers (Robichaud 1998a; BLS). This will require forest patrols to apprehend harvesters of wildlife who have illegally crossed the border into the country. Patrol units should be based in border villages, and compensation programmes should be enacted for Lao villagers who escort foreign intruders to district authorities (Tobias 1997). Vietnamese traders do provide benefits for Lao villagers, and this increased security measure is not intended to exclude those who enter and exit the country with supervision.

Revision of the national wildlife laws of Lao PDR which can afford protection to the reptile species identified here as At, Conditionally At, or Potentially At Risk, and most importantly, dissemination of these laws in a useable format to Provincial Agriculture and Forestry Office and District Agriculture and Forestry Office staff and local people. A useable format will require photographs of the species in question. The use of Lao names in these wildlife laws will be a problematic issue to tackle in that the local names of many species, for example turtles, vary from region to region, and sometimes even between neighbouring villages (Stuart 1998e). Thus, if only local names are used in the national laws, many protected species will be considered exempt because of a failure to recognise the listed name. Common species which are difficult to distinguish from species of conservation concern should be protected in order to avoid the problem of erroneous identifications both by villagers in the act of harvesting and by officials attempting to curb the trade. For example, all hard-shelled turtle species may have to be blanketed under the same law because of their morphological similarities. A major capacity and motivation building programme would assist in implementation of the revised laws.

Training and education of border police to enforce the national wildlife laws on Lao and foreign traders attempting to leave the country with wildlife at legal border crossings. Areas highlighted or suspected to be major exit points for reptiles include:

Nakai-Nam Theun NBCA (BLS)

Nam Theun Extension PNBCA (Robichaud 1998a)

Major roads into Vietnam, including route 2 from Phongsali Province, route 7 from Xiangkhouang Province, route 8A from Bolikhamxai Province [Ban Lak (20)], route 9 from Savannakhet Province, route 6 from Houaphan Province and route 18 from Attapu Province into Vietnam (Compton in prep. a) and route 12 from Khammouan Province (RJTim).

Major roads into China, including the arteries from routes 3 and 17 from Louang-Namtha Province and the arteries from route 1 from Phongsali Province (suspected).

Major roads outside Vientiane that pass into Thailand, including route 10 from Champasak Province (Baird 1993) and route 13 from Khammouan Province (suspected).

Maintenance of large core zones within NBCAs where no harvesting of wildlife is permitted would greatly benefit amphibians and reptiles, including those of little commercial value. Few species of amphibians and reptiles are spared from consumption by local people, even minute frogs such as *Microhyla* spp. and *Amolops cremnobatus*. Although evidence does not presently exist that these non-commercially valuable species are threatened by harvest, the release from these hunting pressures can only better ensure the viability of these populations.

Pressure on Vietnam and China from CITES to improve significantly their efforts on controlling international trade in listed species, should these countries wish to continue as signatory parties to the convention. CITES-listed reptiles, specifically tortoises, pythons, monitors and King Cobra, are currently imported into Vietnam and China with apparently little regard to the terms of the convention. Conservation workers in these countries are encouraged to report violations to the CITES convention.

Initiation by the government of Lao PDR of discussions with Vietnam and China on controlling the illegal trade of turtles and other reptiles. These natural resources are leaving Lao PDR at unsustainable levels, often without remuneration, and the government of Lao PDR will benefit economically in the long term from gaining control of this trade.

The installation of projects that monitor frog populations, in both human-altered habitats and intact ecosystems, are needed to determine if frog populations are at risk in Lao PDR. Baseline data are required for examining population changes over the future. Although frogs are heavily harvested for food in Lao PDR, the sustainability of current harvest rates is unknown. Additionally, various threats that have been thought responsible for amphibian declines elsewhere in the world have not been examined in Lao PDR: pesticides and chemical fertilisers, diseases, and the effects of environmental changes such as global warming and increased acidification of rain.

Development of village regulations on frog harvests. At least 50 villages in Khon District, Champasak Province, have initiated village regulations that restrict frog harvests, particularly *Hoplobatrachus rugulosa*, in reaction to a noticeable decline in frog populations. The village regulations include banning harvest at spawning time (determined by when the frogs are calling heavily), a ban on tadpole collection, and a ban on certain activities that can easily over-exploit frogs, such as using spotlights along the banks of the Mekong during the dry season, baited hooks in rice paddies, trap lines of bamboo frog traps, using metamorphosed froglets as fish bait, and constructing large water pits (called *khoum khiat*) in rice paddies at the end of the rainy season that attract frogs but prevent their escape up the steep sides. Some villages have reported that these banning efforts have revived some of the frog populations in just a few years (I. Baird verbally 1999). There is a clear need for a documentation of the success of the conservation actions of these villages with a view to allowing their adaptation for use elsewhere in Lao PDR.

Captive breeding needs to be encouraged in the international zoo community of Chinese Three-striped Box Turtle *Cuora trifasciata*, Indochinese Box Turtle *Cistoclemmys galbinifrons* and Keeled Box Turtle *Pyxidea mouhotii*. The Chinese Three-striped Box Turtle is maintained and bred in captivity in the private and zoo sectors in the United States and Europe, yet the importance of these captive populations may not yet be widely appreciated. All three species, but particularly *C. trifasciata*, are likely to be soon hunted out of the wild in Lao PDR, and possibly throughout their entire ranges (although *C. trifasciata* has not yet been verified to occur in Lao PDR). Sufficient intact habitat probably remains within their reported ranges in Lao PDR, considering how much of the Annamite mountains and limestone karst falls within declared or proposed protected areas. Captive populations of these species will be needed for future reintroduction programmes. Any captive breeding activity for these species in Lao PDR, especially *C. trifasciata*, would have to work around the high risk of theft of the stock (see account for *Cuora trifasciata*). Likewise, crocodile farms in South-east Asia should be encouraged to maintain at least a small stock of genetically pure strains of Siamese Crocodile *Crocodylus siamensis* for the same reason, although the inherent dangers of using hybrid stock from these farms in any future reintroduction programmes is already so great that populations from international zoos may have to be relied on to provide animals.

Properly recording information when collecting or photographing specimens. Many of the Lao specimens held in international museums, particularly those from collections made in the first half of this century, could not be used for locality or habitat records because information recorded with the specimens is inadequate. The amphibian and reptile composition of Lao PDR still remains poorly understood, and records of distribution and habitat use are essential for determining the requirements of species for their conservation.

BIRDS

J. W. Duckworth, P. Davidson and R. J. Timmins

INTRODUCTION

Species Included

The following list includes all bird species recorded from Lao PDR. Provisional records (those modern ones where observers are confident of the identification but were unable to clinch it, and those historical ones where subsequent information suggests a re-examination of any extant specimens would be desirable) are placed in square brackets. There are also a few 'potential' records. These refer to cases where it is difficult to distinguish between a closely similar pair of species (e.g. *Riparia riparia* and *R. diluta*; *Phylloscopus sichuanensis* and *P. chloronotus*) and most or all sight records of birds in these groups are best left unidentified to species. There are many records of birds observed in Thailand at sites such as Chiang Saen (Chiang Rai Province) which include records in the Mekong channel and on islands in the river. The latter are part of Lao territory. All such records known to us are incorporated in the following list, but others doubtless remain to be traced. A few species which have been stated to occur in Lao PDR in largely authoritative sources, but for which adequate supporting evidence cannot currently be traced, are listed in the Appendix to this chapter. Recent field work has added many new species to the country's list and others will undoubtedly be found as work continues; Table 9 lists some potential further additions. Approximately 700 species of bird are known or provisionally recorded from Lao PDR and another 100 or so are reasonably likely to occur. Although birds are by far the best surveyed class of animals in Lao PDR, a more precise total would be of limited use. The pace at which species new to the country are being found would render any 'accurate' figure obsolete within months of publication.

Taxonomy and Nomenclature

Sequence, species limits and scientific and English nomenclature follow *An annotated checklist to the birds of the Oriental region* (Inskipp *et al*. 1996). Differences in species limits and nomenclature from the two field guides most frequently used in Lao PDR (King *et al*. 1975, Lekagul and Round 1991) and from *The distribution and taxonomy of birds of the world* (Sibley and Monroe 1990, as amended 1993) are indicated. The decisions of Inskipp *et al*. (1996) are retained uniformly, as the present list is not a taxonomic work. Names differing only in orthography from those in Inskipp *et al*. (1996) are not presented as alternatives. References for alternative treatments are abbreviated as in Inskipp *et al*. (1996): ^K, King *et al*. (1975); ^Sm, Sibley and Monroe (1990, as updated 1993); ^Sm[1], Sibley and Monroe (1990 only); ^Sm[2], Sibley and Monroe (1993 only); ^T, Lekagul and Round (1991).

Distribution Within Lao PDR

For each species, one primary source is cited for each of north, central and south Lao PDR (see main Introduction) in which it has been recorded. Where one source listed records for adjacent regions, it is only cited after the last. For example, 'centre, south (Thewlis *et al*. 1998)' implies that Thewlis *et al*. (1998) listed the species for both centre and south. No attempt is made to indicate the first record for the region, and indeed the focus is on recent (post-1988) information. Where possible, citation is to records in refereed journals rather than to those in internal survey reports or other grey literature. More details are given for significant records not yet formally published than for those published.

Key distribution references are abbreviated as follows: (recent) [B1]Duckworth (1996a), [B2]Thewlis *et al*. (1996), [B3]Timmins and Vongkhamheng (1996a), [B4]Tizard (1996), [B5]Davidson *et al*. (1997), [B6]Tizard *et al*. (1997), [B7]Tobias (1997), [B8]Davidson (1998), [B9]Duckworth *et al*. (1998a), [B10]Evans and Timmins (1998), [B11]Round (1998), [B12]Showler *et al*. (1998a), [B13]Showler *et al*. (1998b), [B14]Thewlis *et al*. (1998), [B15]Evans *et al*. (in prep. a), [B16]Evans (in prep.), [B17]Walston (in prep.), (historical) [B18]Bangs and Van Tyne (1931), [B19]Engelbach (1932), [B20]Delacour and Greenway (1940a), [B21]David-Beaulieu (1944), [B22]David-Beaulieu (1949-1950).

Seasonality of Occurrence

Seasonality of occurrence is based on the compilers' and other reviewers' experience. No comprehensive analysis of seasonality of Lao records has previously been attempted for most species. Some species are covered nationally in Thewlis *et al*. (1996), Duckworth (1996a) and Duckworth *et al*. (1998a), and locally in various sources, notably Engelbach (1932), David-Beaulieu (1944) and Cunningham (1998).

Objective categorisation of the seasonal status of all species based solely on Lao records is difficult. Many species are still known by few records. Recent bird survey work has been concentrated in the months of December to May with very little during July to October. Few areas have had multiple visits spread across seasons. Therefore, seasonal categorisations have incorporated understanding of species' seasonal status from neighbouring countries (particularly Thailand; Lekagul and Round 1991). It is possible that some assessments will turn out to be misleading. The alternative would have been the cumbersome insertion of 'presumed' before the seasonal status assessment of most species. This has only been used for species where although we believe the assessment given to be correct, a larger-than-usual doubt remains. The selection of species where 'presumed' is used is necessarily somewhat subjective. Ongoing analysis of recent and historical records will doubtless allow resolution of

Table 9. Possible future additions to the Lao avifauna.

Species	Predicted seasonality	Neighbouring countries recorded	Other remarks
Coturnix coromandelica Rain Quail	Resident	Thailand, Myanmar, Vietnam (S Annam), Cambodia	
Syrmaticus humiae Mrs Hume's Pheasant (GT:VU)	Resident	Thailand (NW), Myanmar, SW China	
Chrysolophus amherstiae Lady Amherst's Pheasant (GNT)	Resident	Myanmar (N and E), SW China	
Anser erythropus Lesser White-fronted Goose (GT:VU)	Winter	Myanmar (E) (Vagrant)	
Aix galericulata Mandarin Duck (GNT)	Winter	Thailand (NW, C), Myanmar (C), Vietnam (W Tonkin)	
Anas strepera Gadwall	Winter	Thailand (NW), Myanmar, Vietnam (E Tonkin)	
Anas platyrhynchos Mallard	Winter	Myanmar (N, C, E), Thailand (NW), Vietnam (E Tonkin)	
Anas clypeata Northern Shoveler	Winter	Thailand, Myanmar, Cambodia, Vietnam (E Tonkin and C Annam)	Noted by Srikosamatara *et al*. (1992), but record is not verifiable
Anas formosa Baikal Teal (GT:VU)	Winter	Thailand (C, ?NW)	
Rhodonessa rufina Red-crested Pochard	Winter	Thailand (C), Myanmar (N, C, E), Vietnam (E Tonkin)	
Aythya ferina Common Pochard	Winter	Thailand (NW), Myanmar (N, C, E), Vietnam (E Tonkin)	
Aythya nyroca Ferruginous Pochard (GT:VU)	Winter	Thailand, Myanmar (N, C, E,W), Vietnam (E Tonkin)	
Aythya baeri Baer's Pochard (GT:VU)	Winter	Thailand (NW, C), Myanmar, Vietnam (E Tonkin)	Recorded at Chiang Saen*
Aythya fuligula Tufted Duck	Winter	Myanmar, Thailand (C, NW), Vietnam (E Tonkin, C Annam)	Noted by King *et al*. (1975), but record is not now traceable
Aythya marila Greater Scaup	Winter	Myanmar (N), Vietnam (E Tonkin)	
Mergus squamatus Scaly-sided Merganser (GT:VU)	Winter	Vagrant Thailand (NW), Vietnam (W and E Tonkin)	
Dendrocopos hyperythrus Rufous-bellied Woodpecker	Resident / winter	Thailand (NW, NE), Myanmar, Vietnam (S Annam), where resident. Winter visitor to Vietnam (W and E Tonkin), Myanmar (?E)	Previous claim refuted (see text)
Apus acuticauda Dark-rumped Swift (GT:VU)	?Non-breeding visitor	Thailand (NW)	
Tyto capensis Grass Owl	Resident	Myanmar (C, S, E), S China, Vietnam (E Tonkin, C, S Annam, Cochinchina)	
Treron vernans Pink-necked Green Pigeon	Resident	Thailand (except NE), Cambodia, Vietnam (S Annam, Cochinchina)	Mainly coastal in South-East Asia, so perhaps unlikely in Lao PDR
Grus virgo Demoiselle Crane	Winter / passage	Myanmar (W, E)	
Grus grus Common Crane	Winter / passage	Myanmar (SW, N, E), Vietnam (E Tonkin, N, C Annam)	Predicted by McNeely (1975) to occur in Lao PDR

Species	Predicted seasonality	Neighbouring countries recorded	Other remarks
Porzana paykullii Band-bellied Crake (GNT)	Passage	Thailand (C), Vietnam (E Tonkin, Cochinchina)	Predicted by McNeely (1975) to occur in Lao PDR
Lymnocryptes minimus Jack Snipe	Winter / passage	Myanmar, Thailand (C, NW), Vietnam (W Tonkin, Cochinchina)	
Limosa limosa Black-tailed Godwit	Winter / passage	Thailand, Myanmar (W, C, S), Vietnam (C, S Annam, E Tonkin)	
Limicola falcinellus Broad-billed Sandpiper	Passage	coastal Thailand (except SE), Myanmar (except N), Vietnam (except N Annam)	Mainly coastal in South-East Asia
Recurvirostra avosetta Pied Avocet	Winter	Thailand (NW, W, C), Myanmar (N, C, S), Vietnam (Cochinchina, E Tonkin)	Recorded at Chiang Saen*
Charadrius hiaticula Common Ringed Plover	Winter	Thailand (NW), Myanmar (SW)	Recorded at Chiang Saen*
Gelochelidon nilotica Gull-billed Tern	Winter / passage	Thailand (W, C, SE, S), Myanmar (except N, W), Cambodia, Vietnam (E Tonkin, Cochinchina)	Mainly coastal, but does visit freshwater marshes
Sterna caspia Caspian Tern	Non-breeding visitor	Thailand (W, C, S), Myanmar (S), Cambodia, Vietnam (E Tonkin, Cochinchina)	
Sterna hirundo Common Tern	Passage	Coastal Thailand, ?Myanmar, Vietnam, Cambodia	Mainly coastal, but does visit freshwater marshes
Circus macrourus Pallid Harrier (GNT)	Winter / passage	Myanmar (SW, C, S, E), Vietnam (E Tonkin)	
Accipiter gentilis Northern Goshawk	Winter / passage	Thailand (NW), Myanmar (NE), Vietnam (W and E Tonkin), Cambodia	
Aquila rapax Tawny Eagle	Winter / passage	Thailand (NW), Vietnam (W and E Tonkin), Myanmar (S, ?C)	Predicted by McNeely (1975) to occur in Lao PDR
Aquila nipalensis Steppe Eagle	Winter / passage	Myanmar (S, C, E), Thailand (C, SW, S), ?Vietnam (E Tonkin)	
Podiceps cristatus Great Crested Grebe	Winter	Myanmar (NE, C, E), Thailand (NW)	
Phalacrocorax fuscicollis Indian Cormorant	?	Thailand (C, SE), Myanmar (S), Cambodia, Vietnam (Cochinchina)	
Ardeola grayii Indian Pond Heron	?	Myanmar, Thailand (W, C, S)	
Ardeola speciosa Javan Pond Heron	?	Thailand (C, S), Cambodia, Vietnam (Cochinchina)	
Plegadis falcinella Glossy Ibis	Visitor (?)	Thailand (C), Myanmar (W, C, E), Cambodia, Vietnam (Cochinchina)	
Platalea leucorodia Eurasian Spoonbill	Winter	Thailand (NW), Myanmar (W, S), Vietnam (E Tonkin)	
Pelecanus onocrotalus Great White Pelican	Visitor	Cambodia, Myanmar (S), Vietnam (Cochinchina)	Possible future addition to the Thai list (Lekagul and Round 1991). Some historical records of pelicans in Lao PDR may have involved this species rather than Spot-billed Pelican (David-Beaulieu 1949-1950)
Oriolus mellianus Silver Oriole (GT:VU)	Winter / passage	Thailand (NW, NE, SE, W), Cambodia	
Zoothera mollissima Plain-backed Thrush	Winter / passage	Myanmar (N), Vietnam (W Tonkin)	
Turdus hortulorum Grey-backed Thrush	Winter	Vietnam (E Tonkin, N Annam)	

Species	Predicted seasonality	Neighbouring countries recorded	Other remarks
Turdus ruficollis Dark-throated Thrush	Winter	Thailand (NW), Myanmar (N), SW China	
Turdus naumanni Dusky Thrush	Winter	Thailand (NW), Myanmar (N, S), Vietnam (E Tonkin)	
Rhinomyias brunneata Brown-chested Jungle Flycatcher (GT:VU)	Passage	Thailand (W, S), ?Vietnam (E Tonkin)	
Muscicapa muttui Brown-breasted Flycatcher (GNT)	?Breeding visitor	Thailand (NW), Myanmar (N, E, W, ?C), Vietnam (W Tonkin)	
Ficedula narcissana Narcissus Flycatcher	Passage	Thailand (S, W), Vietnam (C Annam, E Tonkin)	
Ficedula superciliaris Ultramarine Flycatcher	Winter	Thailand (NW), Myanmar (C, E)	
Luscinia pectoralis White-tailed Rubythroat	Winter	Thailand (NW, C)	Recorded at Chiang Saen*
Luscinia ruficeps Rufous-headed Robin (GT:VU)	Winter / passage	Malaya (once), breeds central-west China	Winter range unknown
Luscinia obscura Blackthroat (GT:VU)	Winter / passage	Thailand (NW), breeds central-west China	Winter range unknown
Tarsiger chrysaeus Golden Bush Robin	Winter	Thailand (NW), Myanmar (N, W, E) Vietnam (W Tonkin)	
Enicurus immaculatus Black-backed Forktail	Resident	Thailand (NW), Myanmar	
Saroglossa spiloptera Spot-winged Starling (GNT)	Winter	Thailand (NW, W), Myanmar (N, E, C, S)	
Sturnus vulgaris Common Starling	Winter	Thailand (NW, NE), Myanmar (N), Vietnam (E Tonkin, N Annam)	
Sturnus cineraceus White-cheeked Starling	Winter	Thailand (NW, C), Myanmar (N), Vietnam (E Tonkin)	
Sitta magna Giant Nuthatch (GT:VU)	Resident	Thailand (NW), Myanmar (C, E), SW China	
Pseudochelidon sirintarae White-eyed River Martin (GT:CR)	?	Thailand (C)	Breeding range unknown; may already be extinct
Riparia diluta Pale Martin	Winter	Vietnam (E Tonkin), S China	Difficult to separate from Sand Martin (see species account)
Spizixos semitorques Collared Finchbill	Resident	Vietnam (W and E Tonkin), S China	
Iole virescens Olive Bulbul	Resident	Thailand (NW, W), Myanmar	
Prinia criniger Striated Prinia	Resident	Myanmar (N, C, E), SW China	
Cettia major Chestnut-crowned Bush Warbler	Winter	Thailand (NW), SW China	
Acrocephalus dumetorum Blyth's Reed Warbler	Winter	Myanmar (SW, C, S, E), also as far east as Hong Kong	Possible future addition to the Thai list (Lekagul and Round 1991)
Phylloscopus affinis Tickell's Leaf Warbler	Winter	Myanmar	Possible future addition to the Thai list (Lekagul and Round 1991)
Phylloscopus chloronotus Lemon-rumped Warbler	Winter	Under re-assessment	Previous claims under review (see text)
Phylloscopus emeiensis Emei Leaf Warbler	Winter	?Myanmar (S)	Recently described (Alström and Olsson 1995). Winter range not known

Species	Predicted seasonality	Neighbouring countries recorded	Other remarks
Tickellia hodgsoni Broad-billed Warbler (GNT)	?Resident	Myanmar (W), Vietnam (W Tonkin)	Previous claim refuted (see text)
Abroscopus schisticeps Black-faced Warbler	Resident	Myanmar (W, N, E), Vietnam (W Tonkin)	
Garrulax albogularis White-throated Laughingthrush	Resident	Vietnam (W Tonkin), SW China	
Garrulax rufogularis Rufous-chinned Laughingthrush	Resident	Myanmar (N), Vietnam (W Tonkin)	
Garrulax squamatus Blue-winged Laughingthrush	Resident	Myanmar (W, N, E), Vietnam (W Tonkin) SW China	
Rimator malacoptilus Long-billed Wren Babbler (GNT)	Resident	Myanmar (N), Vietnam (W Tonkin)	
Pnoepyga albiventer Scaly-breasted Wren Babbler	Resident	Myanmar (N, W), Vietnam (W Tonkin)	
Spelaeornis chocolatinus Long-tailed Wren Babbler	Resident	Myanmar (N, E, W), Vietnam (W Tonkin)	
Alcippe chrysotis Golden-breasted Fulvetta	Resident	Myanmar (N), Vietnam (W Tonkin, C Annam)	
Alcippe vinipectus White-browed Fulvetta	Resident	Myanmar (N), Vietnam (W Tonkin)	
Alcippe cinereiceps Streak-throated Fulvetta	Resident	Myanmar (N, W), Vietnam (W Tonkin, C Annam)	Previous claim refuted (see text)
Yuhina diademata White-collared Yuhina	Resident	Myanmar (N, W), Vietnam (W Tonkin)	
Paradoxornis alphonsianus Ashy-throated Parrotbill	Resident	Vietnam (W Tonkin)	
Anthus godlewskii Blyth's Pipit	Winter	Myanmar (N, W, S)	Possible future addition to the Thai list (Lekagul and Round 1991)
Anthus roseatus Rosy Pipit	Winter	Thailand (NW, C), Myanmar, Vietnam (W and E Tonkin)	
Anthus rubescens Buff-bellied Pipit	Winter	Thailand (NE), Myanmar (N), Vietnam (W Tonkin)	
Ploceus manyar Streaked Weaver	Resident	Thailand (NW, C), Myanmar, Cambodia, Vietnam (C, S Annam, Cochinchina)	Predicted by McNeely (1975) to occur in Lao PDR. David-Beaulieu (1949-50) observed unidentified weavers in Savannakhet (see Baya Weaver)
Amandava amandava Red Avadavat	Resident	Thailand (NW, C, SE), Myanmar, Cambodia,Vietnam (E Tonkin, Cochinchina)	Predicted by McNeely (1975) to occur in Lao PDR. Known from Chiang Saen*
Fringilla coelebs Chaffinch	Winter	Thailand (NW)	
Fringilla montifringilla Brambling	Winter	Thailand (NW), Vietnam (W Tonkin)	
Carpodacus nipalensis Dark-breasted Rosefinch	Winter	Thailand (NW), Myanmar (E, N), Vietnam (W Tonkin)	Predicted by McNeely (1975) to occur in Lao PDR
Carpodacus eos Pink-rumped Rosefinch	Winter	Thailand (NW)	
Loxia curvirostra Red Crossbill	?Resident	Vietnam (S Annam, where resident), Myanmar (N, where status uncertain)	Most likely in south-east Lao PDR, in high altitude mature pine forest
Emberiza chrysophrys Yellow-browed Bunting	Winter	Nearest records S China and Hong Kong	Possible future addition to the Thai list (Lekagul and Round 1991)
Emberiza elegans Yellow-throated Bunting	Winter	Myanmar (N), S China (where not uncommon)	Possible future addition to the Thai list (Lekagul and Round 1991)

GT:CR = Globally Threatened - Critical (Collar *et al*. 1994)
GT:VU = Globally Threatened - Vulnerable (Collar *et al*. 1994)
GNT = Globally Near-Threatened (Collar *et al*. 1994)

Under "Other countries recorded", where a species has been recorded widely across a country, no specific area is given in parentheses. The areas (e.g. Vietnam: W Tonkin) follow those defined in King *et al*. (1975) and Robson (in prep.). Cambodia has not been regionally subdivided by these authors.

*Chiang Saen lies on the Mekong in NW Thailand directly opposite Lao PDR and there records quoted here were of birds by or on the Mekong River, which forms the Lao-Thai border. Not all species with such records are known to the authors.

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the status of some species listed here as 'Seasonal status unclear'. The assessment given relates to any or all of Lao PDR. It does not imply that the species is of uniform seasonal occurrence throughout the country. Where seasonality is suspected to vary across the country, this is indicated. Further work will undoubtedly reveal many more species with complex patterns of seasonal occurrence.

Some species, most or all of which breed, visit Lao PDR only during the wet season (approximately May - October). Early arrivals of most of these species turn up in March, in the last few weeks of the dry season.

Passage migrants are individual birds which neither breed nor winter in Lao PDR. With resident species and those which visit Lao PDR to breed or to winter, it is often unclear if substantial numbers of passage migrants also occur. Birds which appear during migration in areas where they do not winter may not be passage migrants in the national sense, as they may have wintered or bred elsewhere in Lao PDR. However, the Annamites are a major migration route for many Palaearctic species wintering in Indochina and south-east Thailand, and so many species are probably numerous as true passage migrants. In the following list, bird species are specifically noted as passage migrants only when numbers are markedly greater during migration (for most northern visitors, September - November and March - May) than during winter (roughly November - March). Stopover migrants frequently occur in habitats and at altitudes outside the species's usual wintering grounds.

The term 'vagrant' implies that the species is outside its usual range. It is applied only to few species, where records from neighbouring countries suggest that the Lao records truly were unusual events. Many of the other species known in Lao PDR by only a single or a few records may in fact be regular visitors (e.g. the pulse of waders recorded on the southern Mekong during the only spring it has been surveyed; Evans *et al*. in prep. a) and many others are clearly likely to be resident (e.g. various woodpeckers). Observation has not yet been sufficient to allow clear understanding of their status, but to categorise species as vagrants simply on the basis of the small number of records to date would be misleading.

Breeding status across Lao PDR is often unclear. Small birds that occur throughout the year are likely to breed. Wide-ranging large birds (e.g. storks and vultures) may be present in Lao PDR in all months merely as non-breeders.

Habitats and Altitudes

Habitats used in Lao PDR by each species are assigned to simple categories (see Introduction). King *et al*. (1975) listed habitats used by each species across its South-east Asian range, and in the absence of information specific to Lao PDR, these were used in the first edition of the present work (Salter 1993b). They are left unchanged here only when adjudged to reflect accurately the species's actual habitat use in Lao PDR. As habitat use often varies across a species's range, every attempt is made to present information specific to Lao PDR. If there is no information from Lao PDR, this is stated, and in some cases a predictive habitat is given, usually derived from adjacent parts of Thailand, Cambodia and Vietnam.

Altitudes are sometimes given descriptively (e.g. 'lowlands'), but for many species a quantified range is given, based on recent survey information. This is not intended to be a predictive range outside of which the species should be considered unusual, but merely to lay a baseline to stimulate more attention to altitudinal zonation in Lao PDR. Most species for which no altitudinal information is given are largely passage migrants, many of which may occur at almost any altitude. For others, e.g. some large owls, there are simply not enough records for anything meaningful to be said. Many species occur at lower altitudes in Lao PDR, especially in evergreen habitats, than in the more westerly parts of their range. This trend continues east into Vietnam (C. R. Robson verbally 1998). Even within Lao PDR, many bird species use lower altitudes in the east than in the west. Also within Lao PDR, there is a tendency for hill species to occur at lower altitudes in areas of limestone karst than they do in non-calcareous forests.

Key Species of Special Conservation Significance

Key species (those of special conservation significance) are bulletted (•). Global status information is from *Birds to watch 2: the world list of threatened birds* (Collar *et al*. 1994). Globally Threatened species are listed (in increasing order of threat) as Vulnerable, Endangered and Critical (see Conventions). Globally Near-Threatened species are not yet believed to be Globally Threatened. A Red Data Book specifically for Asian birds is currently in preparation by BirdLife International and some of the status assessments of Collar *et al*. (1994) are expected to change. However, proposed new assessments are not incorporated here as their citation prior to finalisation by BirdLife might lead to later confusion.

National risk status categories are based upon 'The conservation status of birds in Laos: a review of key species' (Thewlis *et al*. 1998), issued as a special supplement of the journal *Bird Conservation International*. Species are categorised into At Risk in Lao PDR, Potentially At Risk in Lao PDR and Little Known in Lao PDR. Some species were considered by Thewlis *et al*. (1998) to be Not At Risk in Lao PDR, but many species were not assessed. Their analysis was limited to species of global conservation concern (in Collar *et al*. 1994, or its predecessor Collar and Andrew 1988), those highlighted by Round (1988) and/or Treesucon and Round (1990) as being At Risk or Rare in Thailand, and those for which, within remaining habitat in Lao PDR, a clear decline was perceptible when recent records were compared with those in historical sources.

Thewlis *et al*. (1998) did not consider information gathered after 31 December 1996. Therefore the present work modifies their list to incorporate information and insights up to 28 February 1999. Only 11 presumed resident species recorded historically in Lao PDR have not been found in the field since 1990 and were not listed by Thewlis *et al*. (1998) as key species. All 11 are categorised here as Little Known in Lao PDR. While for some of these species there is no *a priori* reason to assume that they are not secure in Lao PDR (particularly montane species), listing as Little Known is intended to stimulate publication of any recent records so that a considered judgement can be made in future. This policy is confined to resident species, as many non-breeding visitors to Lao PDR occur only irruptively or irregularly. Little purpose would be served by designating as key species all those lacking recent records. Other key species newly listed as such here have populations which seem at lower density than would be expected and/or (using the criteria in Thewlis *et al*. 1998) a clear threat is operating. Limited Lao range alone has not been considered a sufficient criterion, because for some such species (e.g. Yellow-vented Bulbul) there is no evidence that they are at risk. All unclassified species are considered to be Not At Risk in Lao PDR, but this categorisation is stated explicitly in the species accounts only for those species considered to be Globally Threatened or Near-Threatened by Collar *et al*. (1994).

Assessments are made only for species. The limited information available on threat levels for subspecies has been included and referenced to source, but no original synthesis has been attempted here. A revised list of key species in Lao PDR is given in Annex 6. Table 10 details changes to the classification from that of Thewlis *et al*. (1998).

Several species are still recorded frequently and are under no immediate threat, but if apparent or likely recent declines continue, they may merit conservation attention. The historical and recent status of these should be reviewed in the style of Thewlis *et al*. (1998) as soon as possible. These species include: Lesser Whistling-duck, Oriental Pied Hornbill, Red-breasted Parakeet, Grey-headed Parakeet, Red Collared Dove, Red-wattled Lapwing and Large-billed Crow. The status of several other species remains unclear, and they could plausibly be under decline. These include: Brown Wood Owl, Savanna Nightjar, Wedge-tailed Green Pigeon, Mountain Imperial Pigeon, Slaty-breasted Rail, Ruddy-breasted Crake, Greater Painted-snipe, Collared Falconet, Vinous-breasted Starling and Hwamei. Additionally, the status of Ratchet-tailed Treepie and Hill Myna should be assessed at regular intervals. Compilers of future survey reports could usefully detail information on these species to aid future review.

A status summary, usually with detail for less widely available records, is included under each key species account. Key species occurrence in each recent survey area is given in Table 11. Thewlis *et al*. (1998) detailed all records, historical and recent, of which they were aware for all species included in their review, and information for the 1992-1996 period is specifically referenced to this source only where necessary to prevent ambiguity. It is envisaged that a similar treatment will be published elsewhere for the species newly designated here as key species. Therefore, information here is merely in sufficient detail to validate the categorisation.

Proposed Conservation Management and Research Measures

A synopsis of conservation requirements is given for key species. Major needs for action are usually summarised by group. As well as the specific recommendations, there is a general need for further information on (1) the distribution, abundance and particularly the seasonality of many species and (2) trade in all species, to allow refinement of conservation measures. Many species require active management of Lao PDR's protected area system to maintain viable populations. National species conservation priorities are identified in Table 6.

CITES-listed and Restricted-range Species

CITES information is from WCMC (1998). Species are indicated as being listed in Appendices I or II as appropriate (see Conventions). As many CITES-listed species are common and widespread, surveyors have not specifically detailed field records of all species in survey reports. Therefore, comprehensive review of status information of the latter species is impracticable and anyway would be of limited use. All species in these appendices which are known from Lao PDR are listed in Annex 3.

Breeding ranges are given for resident species with restricted global ranges (local or regional endemics), to indicate the significance of the Lao range to the conservation of the species. Extralimital ranges are not therefore given for other species, which are all more widespread. World ranges are taken from Sibley and Monroe (1990) with modifications. Indochina indicates Lao PDR, Cambodia and Vietnam. Southeast Asia includes Myanmar, Thailand and peninsular Malaysia as well as Indochina.

Table 10. Changes to the list of key species of birds from Thewlis *et al*. (1998).

Species	*BCI* category	Modified category	Reason for change	Global status
Japanese Quail	not assessed	LKL	4	0
Blue-breasted Quail	not assessed	LKL	4	0
Swan Goose	not assessed	ARL	4	GT
Greylag Goose	not assessed	ARL	4	0
Bar-headed Goose	not assessed	ARL	4	0
Ruddy Shelduck	not assessed	ARL	4	0
Common Shelduck	not assessed	ARL	4	0
Comb Duck	PARL	ARL	5	0
Cotton Pygmy-goose	not assessed	ARL	4	0
Small Buttonquail	not assessed	LKL	6	0
Fulvous-breasted Woodpecker	not assessed	LKL	4	0
Yellow-crowned Woodpecker	PARL	ARL	4	0
Crimson-breasted Woodpecker	LKL	0	1	0
Great Spotted Woodpecker	not assessed	LKL	6	0
Bamboo Woodpecker	not assessed	LKL	4	0
Collared Kingfisher	not assessed	LKL	4	0
Blue-tailed Bee-eater	not assessed	PARL	4	0
Moustached Hawk Cuckoo	not assessed	LKL	4	0
Blossom-headed Parakeet	not assessed	PARL	4	0
Barn Owl	not assessed	LKL	4	0
Spot-bellied Eagle Owl	LKL	PARL	4	GNT
Brown Fish Owl	not assessed	PARL	4	0
[Buffy Fish Owl]	not assessed	LKL	6	0
Spotted Wood Owl	not assessed	LKL	4	0
Ashy Wood Pigeon	not assessed	LKL	4	0
Little Cuckoo Dove	not assessed	PARL	6	0
Orange-breasted Green Pigeon	not assessed	PARL	4	0
Yellow-vented Green Pigeon	LKL	0	1	GNT
Black-tailed Crake	not assessed	LKL	6	0
Watercock	not assessed	ARL	4	0
Purple Swamphen	not assessed	ARL	4	0
Eurasian Thick-knee	not assessed	LKL	4	0
[Cinereous Vulture]	not assessed	ARL	4	GNT
Rufous-winged Buzzard	PARL	0	2	GNT
Malayan Night Heron	LKL	0	2	0
Black-crowned Night Heron	not assessed	PARL	4	0
Great Bittern	not assessed	ARL	4	0
Black Stork	not assessed	ARL	4	0
Black-billed Magpie	not assessed	LKL	6	0
Yellow-bellied Fantail	LKL	0	1	0
Grey-winged Blackbird	not assessed	LKL	6	0
White-browed Shortwing	LKL	0	1	0
Purple Cochoa	not assessed	LKL	4	GNT
Jerdon's Bushchat	PARL	0	1	GNT
Asian Pied Starling	not assessed	LKL	6	0
Chestnut-vented Nuthatch	not assessed	LKL	4	0
White-tailed Nuthatch	not assessed	LKL	6	0
Yellow-billed Nuthatch	LKL	PARL	4	GT
Paddyfield Warbler	not assessed	LKL	4	0
Broad-billed Warbler	LKL	not assessed	3	GNT
Rufous-vented Laughingthrush	not assessed	LKL	4	0
Laughingthrush sp. A	not assessed	LKL	4	0
Spotted Wren Babbler	PARL	0	1	GNT
Sooty Babbler	PARL	0	4	GT
Black-crowned Barwing	not assessed	LKL	4	not assessed

Species	*BCI* category	Modified category	Reason for change	Global status
Stripe-throated Yuhina	not assessed	LKL	6	0
Spot-breasted Parrotbill	LKL	0	1	0
Short-tailed Parrotbill	LKL	0	1	GT
Baya Weaver	not assessed	PARL	4	0
Black-headed Munia	not assessed	LKL	6	0

Lao risk category codes:
(P)ARL, (Potentially) At Risk in Lao PDR; LKL, Little Known in Lao PDR; 0, Not At Risk in Lao PDR.

Global status category codes:
G(N)T, Globally (Near-)Threatened; 0, considered secure.

Reasons:
1, species occupies areas or habitats under no obvious threat and seems unlikely to be under specific threat.
2, although undoubtedly harvested whenever opportunity permits, species is clearly widespread, still relatively numerous, and tolerant of degraded habitat
3, sole Lao record found to be in error.
4, further information gathered: see species account.
5, status is analogous to that of various large waterbirds, so species is reclassified accordingly.
6, resident species with no recent field records.

Historical Sources

The ongoing *Annotated checklist and bibliography of the birds of Indochina* (Mlikovsky and Inskipp in prep.) presents a cross-referenced species checklist of all literature (published and 'grey') and the many unpublished notes available to the compilers. This base is invaluable to all bird surveyors in the region. A synopsis of the historical information sources for Lao PDR is given in Thewlis *et al*. (1998).

Recent Information

Bird surveys exceeding one week have taken place in 30 areas of Lao PDR, supplemented by intermittent observations in and around the towns of Vientiane and Savannakhet (Table 11, Fig. 6). All surveys used a similar approach, except that in Nam Kan PNBCA (Pasquet 1997).

Ethical, conservation and practical grounds meant that these surveys relied overwhelmingly on sight records rather than specimen collection. Where specimens would be desirable to confirm a record, records are square bracketed. Specimen collection allows objective subsequent verification of records (except in cases of fraud: see e.g. Knox 1993). This is not possible with sight records, but the problem can be minimised by observers documenting unusual records in detail and securing photographs and tape-recordings.

To minimise the number of mistaken identifications in this review, a conservative approach is taken to inclusion of records. Where a bird list in a report is dominated by species likely to occur and where unexpected records are discussed, and/or where observers are known to be experienced in the region and to make identifications critically (with detailed field notes and subsequent examination of specimen collections) all records are included, unless specifically retracted by the original observer(s). By contrast, species lists which present a number of unlikely records without comment suggest that the observer may not have been aware of the records' significance, and thus was unfamiliar with the avifauna in general. The cautious course is taken of excluding the whole of such lists from this review.

Many survey reports are written with insufficient time for surveyors to check skin collections or elusive references. The need for speedy output means that many of them contain a few errors, both typographical and of fact. Therefore, in cases of inconsistency, journal papers are assumed here to be more accurate than survey reports. It is particularly helpful where they detail the retractions and corrections made to survey report lists, as it is then unambiguous that a record omitted in the journal paper was not accidentally deleted (see, e.g., Thewlis *et al*. 1996: 64). The more significant records subsequently retracted or modified from internal reports are mentioned here.

Figure 6. Areas where birds were surveyed for periods exceeding one week during 1992-1998 inclusive.

ANNOTATED LIST OF SPECIES

Key species recorded from each major survey area are shown in Table 11.

Phasianidae: Francolins, quails, partridges, pheasants etc. (13 species)

Francolinus pintadeanus **Chinese Francolin**. Resident; north (JWD), centre[B10], south[B2]. Open deciduous forest, especially dry dipterocarp forest, exceptionally open grass and scrub; lowlands up to at least 1000 m. Records from Sangthong District (north) were inadvertently omitted by Duckworth (1996a). The species is commonly sold, roasted, at roadside stalls in south and central Lao PDR, and locally in Vientiane.

• *Coturnix japonica* **Japanese Quail**. *Conservation Significance:* Little Known in Lao PDR. *Documented Range and Habitat:* Winter visitor; north (historically[B21]). Rice-fields and other open areas over 1000 m. *Status information:* Formerly an abundant winter visitor to Xiangkhouang Province between 12 October and 30 April (David-Beaulieu 1944), but no recent records, despite a substantial amount of recent activity in north Lao PDR. Pending more specific effort in agricultural areas above 1000 m, the species is retained as Little Known in Lao PDR, although it seems likely that it has declined.

• *Coturnix chinensis* **Blue-breasted Quail**. *Conservation Significance:* Little Known in Lao PDR. *Documented Range and Habitat:* Presumed resident; north[B9], centre (provisionally, Robichaud 1999; historically[B22]). Delacour and Jabouille (1940) listed the species as occurring across Lao PDR but we have traced no primary record for the south. Open areas, grass, scrub and cultivation. *Status Information:* Records prior to 1996 were reviewed by Duckworth *et al*. (1998a). Historical records come from Xiangkhouang and Savannakhet Provinces; the species was common in at least the former (David-Beaulieu 1944, 1949-1950). The only recent records are of a female at Phou Khaokhoay NBCA in October 1994 (Duckworth *et al*. 1998a) and a few, provisionally, in Nakai-Nam Theun NBCA in December 1998 (Robichaud 1999). However, quails occupy habitats outside the foci of recent survey effort and field identification is difficult (they are often seen only in flight and are difficult to identify to species). Blue-breasted Quail may in fact be well distributed, but since there are very few recent records even of unidentified quails in Lao PDR, it should be regarded as Little Known in Lao PDR. There is also concern for its status in the Sundaic subregion (McGowan and Gillman 1997).

Arborophila rufogularis **Rufous-throated Partridge**. Resident; north, centre[B14], south[B12]. Evergreen forests and secondary growth, generally above 900 m. Records prior to 1997 were reviewed by Thewlis *et al*. (1998). In view of the species's apparently secure status, it was dropped from the recommended list of key species.

Arborophila brunneopectus **Bar-backed Partridge**. Resident; north, centre, south[B14]. Evergreen forest and secondary growth, generally between 500 and at least 1650 m, occasionally as low as 180 m. Records prior to 1997 were reviewed by Thewlis *et al*. (1998). In view of the species's apparently secure status, it was dropped from the recommended list of key species.

Arborophila charltonii **Scaly-breasted Partridge** (separated as *A. chloropus* Scaly-breasted Partridge by ^Sm, ^T). Resident; north[B1], centre, south[B2]. Lowland evergreen forests, tall secondary growth and sometimes cultivation edge; exceptionally up to 1170 m. The morphology and calls of these partridges vary somewhat across Lao PDR. Given the current debate over the taxonomy of this group (Inskipp *et al*. 1996), this may warrant further investigation. *A. charltonii* (*s.s.*), which occurs in northern Vietnam and so may perhaps be found in Lao PDR, is listed by Collar *et al*. (1994) as Globally Threatened - Vulnerable.

Bambusicola fytchii **Mountain Bamboo Partridge**. Resident; north[B8]. Open scrub, grass, bamboo and secondary growth, generally above 1000 m, but occasionally down to 630 m.

Gallus gallus **Red Junglefowl**. Resident; north[B1], centre, south[B2]. Forest, forest edge, secondary growth, scrub and cultivation; mainly lowland but up to at least 1250 m. No assessment has yet been made of the genetic purity of wild-living stocks in Lao PDR. There is considerable concern for the global status of wild Red Junglefowl (Peterson and Brisbin 1998).

Lophura nycthemera **Silver Pheasant**. Resident; north, centre, south[B14]. Hill and montane forests (mainly evergreen) and tall secondary growth, generally at 500-2020 m, occasionally as low as 200 m. Records prior to 1997 were reviewed by Thewlis *et al*. (1998). In view of the species's apparently secure status, it was dropped from the recommended list of key species. Several races occur in Lao PDR: *L. n. engelbachi* (Bolaven Plateau, and probably north and west to Xe Bang-Nouan NBCA), *L. n. beaulieui* (the north, south to 17ºN) and *L. n. berliozi* (western slopes of the Annamites and the Nakai Plateau). Birds in the south-east, e.g. Phou Ahyon area, have dark plumage and thus could either represent a significant eastward extension of the known range of *L. n. engelbachi*, or the race *L. n. beli*, which occurs in adjacent Vietnam (Delacour 1951a, McGowan and Panchen 1994, Thewlis *et al*. 1998). *L. n. engelbachi* was considered to be globally endangered by McGowan and Garson (1995), but this assessment was made on the assumption that it was restricted to the Bolaven Plateau. (Plate 1)

Table 11. Records of key species of birds in survey areas across Lao PDR as of 28 February 1999.

(a) North Lao PDR

Species	**Phou Dendin NBCA**	**Nam Et NBCA**	**Phou Louey NBCA**	**Nam Ha NBCA**	**Nam Kan PNBCA**	**Nam Xam NBCA**	**Phou Khaokhoay NBCA**	**Sangthong District**	**Houay Nhang NR**	**Vientiane***	**Nam Kading NBCA**	**Nam Theun Extension PNBCA**
Survey effort	low	mid	mid	mid	low	mid	low	high	high	low	mid	high
Japanese Quail												
Blue-breasted Quail							X					
Siamese Fireback							X	X			**?**	
Crested Argus												X
Green Peafowl			†	†	†	†	X				**?**	
Swan Goose												
Greylag Goose												
Bar-headed Goose												
Ruddy Shelduck										X		
Common Shelduck												
White-winged Duck								†				
Comb Duck												
Cotton Pygmy-goose												
Small Buttonquail												
Fulvous-breasted Woodpecker												
Yellow-crowned Woodpecker												
Great Spotted Woodpecker												
White-bellied Woodpecker												
Streak-throated Woodpecker												
Red-collared Woodpecker						X	X	X			X	X
Bamboo Woodpecker								X				
Great Hornbill	X	?	?			X					X	X
Brown Hornbill	X					?					X	X
Rufous-necked Hornbill	X		X			?						X
Wreathed Hornbill	X										X	X
Blyth's Kingfisher	X	X	X	X		X					X	X
Ruddy Kingfisher					X							X
Collared Kingfisher												
Pied Kingfisher												
Blue-tailed Bee-eater								X				X
Moustached Hawk Cuckoo												
Coral-billed Ground Cuckoo							X	X			X	X
Alexandrine Parakeet												
Blossom-headed Parakeet								X				

Species	Phou Dendin NBCA	Nam Et NBCA	Phou Louey NBCA	Nam Ha NBCA	Nam Kan PNBCA	Nam Xam NBCA	Phou Khaokhoay NBCA	Sangthong District	Houay Nhang NR	Vientiane*	Nam Kading NBCA	Nam Theun Extension PNBCA
Barn Owl										?		
Spot-bellied Eagle Owl		X					?					X
Brown Fish Owl												
Tawny Fish Owl												X
[Buffy Fish Owl]												
Fish owl sp.							X					
Spotted Wood Owl												
Ashy Wood Pigeon												
Pale-capped Pigeon											X	
Little Cuckoo Dove												
Orange-breasted Green Pigeon												
Pompadour Green Pigeon								X				
Yellow-footed Green Pigeon												
Yellow-vented Green Pigeon											X	X
White-bellied Green Pigeon											X	
Green Imperial Pigeon												
Sarus Crane												
Masked Finfoot												
Black-tailed Crake												
Watercock					X		X					
Purple Swamphen							X					
Wood Snipe												
Eurasian Thick-knee												
Great Thick-knee								X				
Long-billed Plover								X		X	X	
River Lapwing	X							X			X	X
Grey-headed Lapwing			X	X			X		X	X		
Small Pratincole								X		X	X	
Indian Skimmer												
River Tern										X		
Little Tern												
Black-bellied Tern												
Jerdon's Baza							X		X			
Black Kite									X	X		
Brahminy Kite												
White-bellied Sea Eagle												
Lesser Fish Eagle	X											X

Species	Phou Dendin NBCA	Nam Et NBCA	Phou Louey NBCA	Nam Ha NBCA	Nam Kan PNBCA	Nam Xam NBCA	Phou Khaokhoay NBCA	Sangthong District	Houay Nhang NR	Vientiane*	Nam Kading NBCA	Nam Theun Extension PNBCA
Grey-headed Fish Eagle	?											
Fish eagle sp.							X					
White-rumped Vulture												
Long-billed Vulture												
[Cinereous Vulture]												
Red-headed Vulture												
Rufous-winged Buzzard											X	
Greater Spotted Eagle												X
Imperial Eagle												
White-rumped Falcon												
Pied Falconet			X	X		X						X
Lesser Kestrel												
Darter								†			X	
Little Cormorant												
Great Cormorant												
Grey Heron										X	X	
Purple Heron							X			X		X
Black-crowned Night Heron										X		
Von Schrenck's Bittern									X			X
Great Bittern												
Black-headed Ibis												
Black Ibis												
Giant Ibis												
Spot-billed Pelican												
Painted Stork												
Asian Openbill												
Black Stork												
Woolly-necked Stork												
Black-necked Stork												
Lesser Adjutant												
Greater Adjutant												
Blue-naped Pitta		X				X					X	X
Blue-rumped Pitta											X	X
Bar-bellied Pitta								X				
White-winged Magpie												X
Indochinese Green Magpie												X
Black-billed Magpie												
Swinhoe's Minivet								X			X	X

Species	Phou Dendin NBCA	Nam Et NBCA	Phou Louey NBCA	Nam Ha NBCA	Nam Kan PNBCA	Nam Xam NBCA	Phou Khaokhoay NBCA	Sangthong District	Houay Nhang NR	Vientiane*	Nam Kading NBCA	Nam Theun Extension PNBCA
Japanese Paradise-flycatcher												
Brown Dipper	X		X			X					X	X
Black-breasted Thrush												
Grey-winged Blackbird												
Grey-sided Thrush												
Fujian Niltava						X					X	X
Blue-fronted Robin												
Purple Cochoa												
Green Cochoa	X		X	X		X					X	X
Jerdon's Bushchat		X	X					X				X
Asian Pied Starling												
Golden-crested Myna												X
Chestnut-vented Nuthatch												
White-tailed Nuthatch												
Yellow-billed Nuthatch												
Beautiful Nuthatch			X			X						
Brown-throated Treecreeper						X						
Plain Martin								X		X		
Wire-tailed Swallow								X			X	
Paddyfield Warbler										X		
Yellow-vented Warbler	X		X	X			X					X
Black-hooded Laughingthrush												
Grey Laughingthrush		X	X			X					X	X
Rufous-vented Laughingthrush		X										
Laughingthrush sp. A												
Spot-breasted Laughingthrush			X			X						
Red-tailed Laughingthrush			X									X
Short-tailed Scimitar Babbler												X
Spotted Wren Babbler		X	X									X
Sooty Babbler											X	
Grey-faced Tit Babbler												
Black-crowned Barwing												

Species	Phou Dendin NBCA	Nam Et NBCA	Phou Louey NBCA	Nam Ha NBCA	Nam Kan PNBCA	Nam Xam NBCA	Phou Khaokhoay NBCA	Sangthong District	Houay Nhang NR	Vientiane*	Nam Kading NBCA	Nam Theun Extension PNBCA
Yellow-throated Fulvetta												
Spectacled Fulvetta												
Rufous-throated Fulvetta	X	X	X	X			X	X			X	X
Stripe-throated Yuhina												
Short-tailed Parrotbill				X	X	X		X				
Lesser Rufous-headed Parrotbill						X						
Greater Rufous-headed Parrotbill			X			X						
Yellow-bellied Flowerpecker			X									
Baya Weaver										X		
Asian Golden Weaver												
Black-headed Munia												

*Vientiane includes the urban area of the town and the Mekong river downstream as far as Ban Thadua, and upstream for 15 km from the town centre. Other parts of Vientiane Municipality (Houay Nhang NR and Sangthong District) are listed separately.

(b) Centre Lao PDR

Species	Nakai - Nam Theun NBCA*	Nakai Plateau**	Khammouan Limestone NBCA	Hin Namno NBCA	Phou Xang He NBCA	Savannakhet***
Survey effort	high	high	low	mid	mid	low
Japanese Quail						
Blue-breasted Quail	?					
Siamese Fireback		X		X	X	
Crested Argus	X			X		
Green Peafowl	?	?		†	?	
Swan Goose						
Greylag Goose						
Bar-headed Goose						

Species	Nakai - Nam Theun NBCA*	Nakai Plateau**	Khammouan Limestone NBCA	Hin Namno NBCA	Phou Xang He NBCA	Savannakhet***
Ruddy Shelduck						
Common Shelduck						
White-winged Duck		X		†		
Comb Duck						
Cotton Pygmy-goose						
Small Buttonquail						
Fulvous-breasted Woodpecker				X		
Yellow-crowned Woodpecker						
Great Spotted Woodpecker						
White-bellied Woodpecker						
Streak-throated Woodpecker						
Red-collared Woodpecker	X	X	X	X˜	X	
Bamboo Woodpecker						
Great Hornbill	X	?		X		
Brown Hornbill	X	X		X	X	
Rufous-necked Hornbill	X			X^		
Wreathed Hornbill	X	X	X	X	X	
Blyth's Kingfisher	X	X				
Ruddy Kingfisher					X	
Collared Kingfisher						
Pied Kingfisher						
Blue-tailed Bee-eater						X*
Moustached Hawk Cuckoo						
Coral-billed Ground Cuckoo	X	X		X	X	
Alexandrine Parakeet						
Blossom-headed Parakeet						
Barn Owl		?	X			
Spot-bellied Eagle Owl						
Brown Fish Owl			?			
Tawny Fish Owl	X	?				
[Buffy Fish Owl]						
Fish owl sp.	X	X				
Spotted Wood Owl						
Ashy Wood Pigeon						
Pale-capped Pigeon						
Little Cuckoo Dove						
Orange-breasted Green Pigeon						

Species	Nakai - Nam Theun NBCA*	Nakai Plateau**	Khammouan Limestone NBCA	Hin Namno NBCA	Phou Xang He NBCA	Savannakhet***
Pompadour Green Pigeon						
Yellow-footed Green Pigeon						
Yellow-vented Green Pigeon	X	X		X		
White-bellied Green Pigeon	X	X				
Green Imperial Pigeon		X				
Sarus Crane						
Masked Finfoot						
Black-tailed Crake						
Watercock						
Purple Swamphen						
Wood Snipe		X				
Eurasian Thick-knee						
Great Thick-knee						X*
Long-billed Plover						
River Lapwing	X	X		X^		X*
Grey-headed Lapwing		X				
Small Pratincole		X				X
Indian Skimmer						†
River Tern						X*
Little Tern						
Black-bellied Tern						
Jerdon's Baza		X				
Black Kite	X	X				
Brahminy Kite						
White-bellied Sea Eagle						
Lesser Fish Eagle	X	X		X		
Grey-headed Fish Eagle		?				
Fish eagle sp.						
White-rumped Vulture						
Long-billed Vulture						
[Cinereous Vulture]						?
Red-headed Vulture						
Rufous-winged Buzzard					X	
Greater Spotted Eagle		?				
Imperial Eagle		?				
White-rumped Falcon						
Pied Falconet	X	X		X		
Lesser Kestrel						
Darter						
Little Cormorant						
Great Cormorant						
Grey Heron		X			X	X
Purple Heron		X			X	

Species	Nakai - Nam Theun NBCA*	Nakai Plateau**	Khammouan Limestone NBCA	Hin Namno NBCA	Phou Xang He NBCA	Savannakhet***
Black-crowned Night Heron						
Von Schrenck's Bittern						
Great Bittern						
Black-headed Ibis						
Black Ibis						
Giant Ibis						
Spot-billed Pelican				X		
Painted Stork						
Asian Openbill						
Black Stork		X				
Woolly-necked Stork						
Black-necked Stork						
Lesser Adjutant						
Greater Adjutant						
Blue-naped Pitta						
Blue-rumped Pitta		X		X		
Bar-bellied Pitta				X	X	
White-winged Magpie	X	X		X		
Indochinese Green Magpie	X			X		
Black-billed Magpie						
Swinhoe's Minivet	X	X			X	
Japanese Paradise-flycatcher	X					
Brown Dipper	X					
Black-breasted Thrush	?	X				
Grey-winged Blackbird						
Grey-sided Thrush		X				
Fujian Niltava	?	?		?		
Blue-fronted Robin						
Purple Cochoa						
Green Cochoa	X					
Jerdon's Bushchat						
Asian Pied Starling						
Golden-crested Myna	X				X	
Chestnut-vented Nuthatch						
White-tailed Nuthatch						
Yellow-billed Nuthatch						
Beautiful Nuthatch	X					
Brown-throated Treecreeper						
Plain Martin						
Wire-tailed Swallow						X
Paddyfield Warbler						
Yellow-vented Warbler	X	X				

Species	Nakai - Nam Theun NBCA	Nakai Plateau	Khammouan Limestone NBCA	Hin Namno NBCA	Phou Xang He NBCA	Savannakhet
Black-hooded Laughingthrush						
Grey Laughingthrush	X					
Rufous-vented Laughingthrush						
Laughingthrush sp. A						
Spot-breasted Laughingthrush						
Red-tailed Laughingthrush	X					
Short-tailed Scimitar Babbler	X					
Spotted Wren Babbler						
Sooty Babbler			X	X		
Grey-faced Tit Babbler					X	
Black-crowned Barwing						
Yellow-throated Fulvetta						
Spectacled Fulvetta	X					
Rufous-throated Fulvetta	X	X		X˜	X	
Stripe-throated Yuhina						
Short-tailed Parrotbill						
Lesser Rufous-headed Parrotbill	X					
Greater Rufous-headed Parrotbill						
Yellow-bellied Flowerpecker						
Baya Weaver						
Asian Golden Weaver						
Black-headed Munia						

*excluding that part of the NBCA lying on the Nakai Plateau; **including that part of the plateau within the boundaries of Nakai-Nam Theun NBCA; ***Savannakhet town and the Mekong river as covered by Evans (in prep.), including records south of the mouth of the Xe Banghiang and thus in south Lao PDR (marked*). Some species listed under Hin Namno NBCA were found only some distance to the south, in the headwaters of the Xe Bangfai (^), or about 15 km to the west in an area of forest on non-calcareous rock (˜).

(c) South Lao PDR

Species	Xe Bang-Nouan NBCA	Xe Sap NBCA	Phou Ahyon	Dakchung Plateau	Phou Xiang Thong NBCA	Phou Kathong NBCA	Dong Ampham NBCA	Nam Ghong Provincial PA	Xe Namnoy Catchment	Dong Hua Sao NBCA	Bolaven Southwest PNBCA	Xe Pian NBCA	Southern Mekong	Dong Khanthung PNBCA
Survey effort	mid	low	low	low	mid	mid	mid	low	mid	high	low	high	mid	high
Japanese Quail														
Blue-breasted Quail														
Siamese Fireback	X			?	X	X	X	X	X	X		X		X
Crested Argus		?	X				?							
Green Peafowl	?	?			X	?	†	†		X	?	X		X
Swan Goose														
Greylag Goose														
Bar-headed Goose														
Ruddy Shelduck														
Common Shelduck														
White-winged Duck							†			?	X	X		X
Comb Duck														
Cotton Pygmy-goose									X			X		X
Small Buttonquail														
Fulvous-breasted Woodpecker														X
Yellow-crowned Woodpecker														X
Great Spotted Woodpecker														
White-bellied Woodpecker	X						X		X	X		X		X
Streak-throated Woodpecker	X											X		X
Red-collared Woodpecker	X				X	X	X			X		X		
Bamboo Woodpecker														
Great Hornbill	X	X				X	X	X		X	X	X		X
Brown Hornbill	X						X							
Rufous-necked Hornbill														
Wreathed Hornbill	X					X	X			X	X	X	X	
Blyth's Kingfisher									X	X				
Ruddy Kingfisher														
Collared Kingfisher														
Pied Kingfisher												X	X	
Blue-tailed Bee-eater													X	X
Moustached Hawk Cuckoo												X		X
Coral-billed Ground Cuckoo	X					X								X
Alexandrine Parakeet												X	X	
Blossom-headed Parakeet						X						X	X	X
Barn Owl													X	X
Spot-bellied Eagle Owl				X		X	X	X	?					X
Brown Fish Owl	X					?	?			X			?	
Tawny Fish Owl														
[Buffy Fish Owl]														
Fish owl sp.								X			X	X		X
Spotted Wood Owl												?	X	
Ashy Wood Pigeon														
Pale-capped Pigeon									X					
Little Cuckoo Dove														

Species	Xe Bang-Nouan NBCA	Xe Sap NBCA	Phou Ahyon	Dakchung Plateau	Phou Xiang Thong NBCA	Phou Kathong NBCA	Dong Ampham NBCA	Nam Ghong Provincial PA	Xe Namnoy Catchment	Dong Hua Sao NBCA	Bolaven Southwest PNBCA	Xe Pian NBCA	Southern Mekong	Dong Khanthung PNBCA
Orange-breasted Green Pigeon								X	X			X	X	X
Pompadour Green Pigeon														
Yellow-footed Green Pigeon									X			X	X	X
Yellow-vented Green Pigeon							X							
White-bellied Green Pigeon														
Green Imperial Pigeon	X				X	X	X	X	X	X	X	X	X	X
Sarus Crane										?		X		X
Masked Finfoot						X	X				X	X		X
Black-tailed Crake														
Watercock										X		X		X
Purple Swamphen									X			X		
Wood Snipe														
Eurasian Thick-knee												X		
Great Thick-knee													X	
Long-billed Plover														
River Lapwing	X					X	X		X			X	X	
Grey-headed Lapwing										X	X	X		
Small Pratincole					X				X			X	X	
Indian Skimmer													†	
River Tern												X	X	
Little Tern													X	
Black-bellied Tern													?	
Jerdon's Baza													X	
Black Kite														
Brahminy Kite													X	X
White-bellied Sea Eagle														
Lesser Fish Eagle						X	X	X	X	X	X	X		X
Grey-headed Fish Eagle												X		X
Fish eagle sp.													X	
White-rumped Vulture												X	X	X
Long-billed Vulture												X	X	
[Cinereous Vulture]														
Red-headed Vulture						X						X	X	X
Rufous-winged Buzzard	X				X	X		X	X			X		X
Greater Spotted Eagle														
Imperial Eagle														X
White-rumped Falcon	X					X			X			X	X	X
Pied Falconet														
Lesser Kestrel														
Darter										X	?	X	X	X
Little Cormorant													X	X
Great Cormorant														
Grey Heron					X				X		X	X	X	X
Purple Heron									X	X	X	X	X	X
Black-crowned Night Heron												X	X	
Von Schrenck's Bittern												X		
Great Bittern												X		

Species	Xe Bang-Nouan NBCA	Xe Sap NBCA	Phou Ahyon	Dakchung Plateau	Phou Xiang Thong NBCA	Phou Kathong NBCA	Dong Ampham NBCA	Nam Ghong Provincial PA	Xe Namnoy Catchment	Dong Hua Sao NBCA	Bolaven Southwest PNBCA	Xe Pian NBCA	Southern Mekong	Dong Khanthung PNBCA
Black-headed Ibis														
Black Ibis												X		?
Giant Ibis												X		X
Spot-billed Pelican													?	X
Painted Stork													?	
Asian Openbill														X
Black Stork														
Woolly-necked Stork						X	X	X		X	X	X	X	X
Black-necked Stork														X
Lesser Adjutant										X		X	?	X
Greater Adjutant											?		?	?
Blue-naped Pitta														
Blue-rumped Pitta					?	X	X	X		X		X		
Bar-bellied Pitta					X	X	X			X	X	X		X
White-winged Magpie														
Indochinese Green Magpie										X	X	X		
Black-billed Magpie														
Swinhoe's Minivet					X		X			X		X		X
Japanese Paradise-flycatcher														
Brown Dipper														
Black-breasted Thrush														
Grey-winged Blackbird														
Grey-sided Thrush														
Fujian Niltava														
Blue-fronted Robin														
Purple Cochoa														
Green Cochoa			X						X	X				
Jerdon's Bushchat														
Asian Pied Starling														
Golden-crested Myna	X					X	X		X	X	X	X		
Chestnut-vented Nuthatch									X					
White-tailed Nuthatch														
Yellow-billed Nuthatch			X	X										
Beautiful Nuthatch														
Brown-throated Treecreeper														
Plain Martin												X	X	
Wire-tailed Swallow					X	X	X		X		X	X	X	
Paddyfield Warbler														X
Yellow-vented Warbler														
Black-hooded Laughingthrush			X				X							
Grey Laughingthrush														
Laughingthrush sp. A			X											
Rufous-vented Laughingthrush														
Spot-breasted Laughingthrush														
Red-tailed Laughingthrush			X	X						X				

Species	Xe Bang-Nouan NBCA	Xe Sap NBCA	Phou Ahyon	Dakchung Plateau	Phou Xiang Thong NBCA	Phou Kathong NBCA	Dong Ampham NBCA	Nam Ghong Provincial PA	Xe Namnoy Catchment	Dong Hua Sao NBCA	Bolaven Southwest PNBCA	Xe Pian NBCA	Southern Mekong	Dong Khanthung PNBCA
Short-tailed Scimitar Babbler														
Spotted Wren Babbler														
Sooty Babbler														
Grey-faced Tit Babbler					X	X	X	X	X	X	X	X	X	
Black-crowned Barwing				X										
Yellow-throated Fulvetta														
Spectacled Fulvetta			X											
Rufous-throated Fulvetta														
Stripe-throated Yuhina														
Short-tailed Parrotbill														
Lesser Rufous-headed Parrotbill														
Greater Rufous-headed Parrotbill														
Yellow-bellied Flowerpecker														
Baya Weaver								X				X	X	X
Asian Golden Weaver												?		X
Black-headed Munia														

Status information:
X, present in the survey area; ?, record for the survey area is provisional; † species appears to have occurred formerly, but to be now extinct. Survey areas are shown in Fig. 6.

References: **North**: Phou Dendin NBCA: Duckworth *et al*. (1998a), RJTiz and WGR (*in litt*. 1998); Nam Et NBCA: Davidson (1998); Phou Louey NBCA: Davidson (1998); Nam Ha NBCA: Tizard *et al*. (1997); Nam Kan PNBCA: Pasquet (1997); Nam Xam NBCA: Showler *et al*. (1998b); Phou Khaokhoay NBCA: Duckworth *et al*. (1998a); Sangthong District: Duckworth (1996a); Houay Nhang NR: Thewlis *et al*. (1996); Vientiane: Thewlis *et al*. (1996), Duckworth *et al*. (1998a); Nam Kading NBCA: Duckworth *et al*. (1998a); Nam Theun Extension PNBCA: Tizard (1996), Tobias (1997), Evans and Timmins (1998). **Centre**: Nakai-Nam Theun NBCA: WCS (1996a), Tobias (1997), Evans and Timmins (1998), Duckworth *et al*. (1998a), Robichaud (1999); Nakai Plateau: WCS (1996b), Tobias (1997), Evans and Timmins (1998), Duckworth *et al*. (1998a); Khammouan Limestone NBCA: Timmins (1997), Robinson and Webber (1998a); Hin Namno NBCA: Timmins and Khounboline (1996), Walston (in prep.); Phou Xang He NBCA: Thewlis *et al*. (1996); Savannakhet: Evans (in prep.). **South**: Xe Bang-Nouan NBCA: Evans and Timmins (1998); Xe Sap NBCA: Timmins and Vongkhamheng (1996a), Showler *et al*. (1998a); Phou Ahyon: Timmins and Vongkhamheng (1996b), Showler *et al*. (1998a); Dakchung Plateau: Timmins and Vongkhamheng (1996b), Showler *et al*. (1998a); Phou Xiang Thong NBCA: Evans *et al*. (1996a, in prep. a); Phou Kathong PNBCA: Davidson *et al*. (1997); Dong Ampham NBCA: Davidson *et al*. (1997); Xe Namnoy Catchment: Duckworth *et al*. (1998a); Dong Hua Sao NBCA: Thewlis *et al*. (1996), Evans *et al*. (1996b, in prep. a); Bolaven Southwest PNBCA: Duckworth *et al*. (1998a); Xe Pian NBCA: Thewlis *et al*. (1996), Duckworth *et al*. (1998a); Southern Mekong: Cunningham (1998), Evans *et al*. (in prep. a); Nam Ghong Provincial PA: RJTiz verbally (1998); Dong Khanthung PNBCA: Timmins and Vongkhamheng (1996b), Round (1998). **General**: Evans and Timmins (1997), McGowan *et al*. (1998), Thewlis *et al*. (1998), incidental records as explicitly incorporated into the species accounts.

Species in **bold face** are listed in Collar *et al*. (1994) as of global conservation concern: either Globally Threatened, Globally Near-Threatened, or Data Deficient. Other key species are those defined in Annex 6 as (Potentially) At Risk in Lao PDR or Little Known in Lao PDR.

Records listed under individual NBCAs do not necessarily come from within present-day boundaries of the NBCA. Most surveys are designed to influence the location of boundaries and it would be impracticable, and of limited biological use (given current survey effort) to classify retrospectively all records from each survey as within or outside the NBCA boundary.

• *Lophura diardi* **Siamese Fireback**. *Conservation Significance:* Globally Threatened - Vulnerable; Potentially At Risk in Lao PDR; endemic to Indochina and parts of Thailand. *Documented Range and Habitat:* Resident; north, centre, south[B14]. Forest (evergreen and, locally, deciduous areas), scrub, secondary growth, mostly below 500 m, exceptionally up to 800 m and possibly 1150 m (Showler *et al*. 1998a). *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). The species has been recorded in at least 14 recent survey areas from Sangthong District to the far south of the country (Table 11). Particularly large populations remain in Xe Pian and Dong Ampham NBCAs and in other parts of the Xe Kong basin. Large populations were also found or suspected in most other survey areas with a substantial area below 500 m altitude, including Xe Bang-Nouan and Phou Xiang Thong NBCAs, Dong Khanthung PNBCA and Sangthong District. Smaller numbers occur in those recent surveys areas primarily at higher altitude but with parts below 500 m. Occurrence at Phou Khaokhoay NBCA has recently been confirmed (T. Hansel verbally 1998). Despite being widespread and locally abundant, the species is subject to very heavy snaring and is commonly sold in food markets and is therefore categorised as Potentially At Risk in Lao PDR. (Plate 11)

Polyplectron bicalcaratum **Grey Peacock Pheasant**. Resident; north, centre, south[B14]. Evergreen forests, tolerant of degradation, from lowlands up to 1850 m. Records prior to 1997 were reviewed by Thewlis *et al*. (1998). In view of the species's secure status, it was dropped from the recommended list of key species. *Special Significance:* CITES Appendix II.

• *Rheinardia ocellata* **Crested Argus**. *Conservation Significance:* Globally Threatened - Vulnerable; At Risk in Lao PDR; CITES Appendix I; endemic to Malaysia (*R. o. nigrescens*; see Mamat and Yasak 1998) and Vietnam and Lao PDR (*R. o. ocellata*). *Documented Range and Habitat:* Resident; north, centre, south[B14]. Evergreen forest, particularly climatically wet forest, at 350-1500 m. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). Distribution in Lao PDR is local: it occurs in four recent survey areas along the Annamites (Table 11). There are no certain recent records from elsewhere. Numbers were only found to be high in climatically wet forest, as in the Nam Theun Extension PNBCA. Snaring may be an extreme threat to some populations. (Plates 6, 11)

• *Pavo muticus* **Green Peafowl**. *Conservation Significance:* Globally Threatened - Vulnerable; At Risk in Lao PDR; CITES Appendix II. *Documented Range and Habitat:* Resident; north[B14], centre (provisionally, McGowan *et al*. 1998; historically[B22]), south[B14]. Open forest and edge, rocky savanna, forest river banks, secondary growth; lowlands and foothills. *Status Information:* The status of the species in Lao PDR was reviewed by Evans and Timmins (1996, 1997) and Thewlis *et al*. (1998). McGowan *et al*. (1998) set the Lao records in a global context. While common and widespread throughout Lao PDR only 50 years ago, populations are known today in only six areas; there are reports from 10 others (Table 11). Formerly the species was so abundant that Harmand (1878-1879) characterised the worst place for wildlife he went as lacking even peafowl and junglefowl. Few areas are likely to retain populations large enough to be viable. Phou Khaokhoay, Xe Pian and Phou Xiang Thong NBCAs and Dong Khanthung PNBCA perhaps hold the most practically conservable populations. A previously unpublished record is of one heard calling by the Xe Pian river upstream of Ban Sompoy (Xe Pian NBCA) in early 1998 (RJTiz). (Plates 6, 11)

Conservation Management and Research Proposed for Phasianidae:

- Complete protection from hunting for Green Peafowl, Crested Argus and arguably Siamese Fireback.
- Cessation of snaring in NBCAs, with action prioritised to those retaining Green Peafowl, Crested Argus and large populations of Siamese Fireback.
- Establishment of sustainable hunting practices for other species. Birds of this family, especially Red Junglefowl, are frequently eaten in rural Lao PDR (Table 1).
- Assessments of the effects of snaring (and procedure for control where necessary) on all species in areas outside NBCAs.
- Assessment of the effects on Green Peafowl in Lao PDR of trade in peafowl train feathers. Peafowl train feathers are traded in large numbers along the Lao-Thailand border, but it is unclear how many, if any, are from wild Green Peafowl (McGowan *et al*. 1998).
- Monitoring and control of trade in these species and their parts. Birds of this family, especially Red Junglefowl, are widely sold in urban markets (Annex 1) and junglefowl claws are used as an ingredient in traditional medicine (Martin 1992, Annex 1). International trading seems likely (Compton in prep. b).
- Co-ordinated recovery programme for Green Peafowl, involving education programmes, stronger legislation with more effective enforcement, and assessment of progress by a population monitoring programme. The peafowl monitoring and protection project in Phou Khaokhoay NBCA (in which most of the local people are participating) should be replicated (with appropriate modification) in Xe Pian and Phou Xiang Thong NBCAs and in Dong Khanthung PNBCA.
- Co-ordinated conservation programme for Crested Argus, involving education programmes, stronger legislation with more effective enforcement, an investigation of the threat posed by trade, and assessment of progress by a

population monitoring programme.
- Field investigation of the status and conservation needs of quails. There are very few recent records of quails. Declines in them could be going un-noticed as conservation attention is currently focussed on forests and wetlands.
- Long-term continuation of the existing CPAWM/WCS poster campaign urging protection of Green Peafowl, Siamese Fireback and Crested Argus.

Dendrocygnidae: Whistling-ducks (1 species)

Dendrocygna javanica **Lesser Whistling-duck** (= Lesser Tree-duck, ^K). Resident; north[B2], centre[B10], south[B2]. Marshes, lakes, paddy-fields, slow rivers; generally lowlands and plateaux. The species remains widespread although numbers are generally small, presumably because of persecution; the highest numbers recorded recently (over 1200) were at Ban Sivilai, Vientiane Province (Parr and Parr 1998). The species's conservation status should be reconsidered at regular intervals.

Anatidae: Geese, ducks (14 species)

• *Anser cygnoides* **Swan Goose**. *Conservation Significance:* Globally Threatened - Vulnerable; At Risk in Lao PDR. *Documented Range and Habitat:* Vagrant; north (per PDR). Large wetlands. *Status Information:* The sole Lao record was of a single in the main Mekong channel seen from Chiang Saen (Thailand) on 1 January 1996 (Robson 1996; per PDR).

• *Anser anser* **Greylag Goose**. *Conservation Significance:* At Risk in Lao PDR. *Documented Range and Habitat:* Winter visitor; centre[B10]. Large wetlands. *Status Information:* Sole Lao record, in 1994, was on a large pool on the Nakai Plateau among 200 wild ducks (Evans and Timmins 1998).

• *Anser indicus* **Bar-headed Goose**. *Conservation Significance:* At Risk in Lao PDR. *Documented Range and Habitat:* Winter visitor; north (per PDR). Large wetlands. *Status Information:* Lao records come only from the main Mekong channel around Chiang Saen (Thailand): four in January 1984 and five in January 1996 (per PDR).

• *Tadorna ferruginea* **Ruddy Shelduck**. *Conservation Significance:* At Risk in Lao PDR. *Documented Range and Habitat:* Winter visitor; north[B9]. Large wetlands. *Status Information:* So far only recorded from the Mekong River. The first explicit Lao record was in 1995 (Duckworth *et al*. 1998a), although birds seen from Thailand may pre-date this.

• *Tadorna tadorna* **Common Shelduck**. *Conservation Significance:* At Risk in Lao PDR. *Documented Range and Habitat:* Vagrant; north (Robson 1989). Large wetlands. *Status Information:* The sole Lao record was of a single in the main Mekong channel seen from Chiang Saen (Thailand) on 16 December 1988 (Robson 1989).

• *Cairina scutulata* **White-winged Duck**. *Conservation Significance:* Globally Threatened - Endangered; At Risk in Lao PDR; CITES Appendix I. *Documented Range and Habitat:* Resident; centre, south[B14]. Slower-moving stretches of forested streams and rivers, pools in forest; up to 600 m (Evans *et al*. 1997). *Status Information:* Records prior to 1997 were reviewed by Evans *et al*. (1997) and summarised in Thewlis *et al*. (1998). Green's (1993) detailed global status review pre-dated most of the recent Lao information, but Lao results were set in an international context by Rose and Scott (1997), who estimated a world population of only 450 birds. The species still occurs both on the Nakai Plateau and in the Xe Kong basin / Bolaven Plateau area (the two foci of historical records), but numbers are small. Small numbers persist also in Dong Khanthung PNBCA (Round 1998; Plate 11). The population in southern Lao PDR is likely to be contiguous with those in northern Cambodia and adjacent Thailand, and so may form a component of one of the largest populations in the world. Suggestions for further survey areas and conservation action are given in Evans *et al*. (1997).

• *Sarkidiornis melanotos* **Comb Duck**. *Conservation Significance:* At Risk in Lao PDR; CITES Appendix II. *Documented Range and Habitat:* Seasonal status unclear; centre (historically[B22]). Sole Lao record was on a large pool. *Status Information:* The species has only ever been recorded once in Lao PDR (David-Beaulieu 1949-1950, Thewlis *et al*. 1998) and perhaps was only ever an irregular visitor or scarce resident. Although Thewlis *et al*. (1998) listed the species as Potentially At Risk in Lao PDR, if any individuals do persist in or visit Lao PDR, they are surely At Risk.

• *Nettapus coromandelianus* **Cotton Pygmy-goose**. *Conservation Significance:* At Risk in Lao PDR. *Documented Range and Habitat:* Resident; north (historically[B21]), centre (Perennou and Mundkur 1991), south[B2]. Wetlands. *Status Information:* Birds were observed daily on pools or in open marshes in the Northern Zone of Xe Pian NBCA in dry season 1992-1993 (up to 55) and on the Bolaven Plateau in early 1995 (up to 24) (Thewlis *et al*. 1996, Claridge 1996, Duckworth *et al*. 1998a). Small numbers (under 11) were found in Dong Khanthung PNBCA in 1996 and 1998 (Round 1998; J. Barzen *in litt*. to TDE). The only recent record from central Lao PDR is of 15 at Nong Kom, Savannakhet Province in January 1991 (Perennou and Mundkur 1991; Claridge 1996). In all areas the species is local and not numerous; e.g. Round (1998) in extensive work in Dong Khanthung PNBCA

recorded the species on only one day. Historically the species occurred throughout the country (Oustalet 1898, Engelbach 1927, 1932, David-Beaulieu 1944, 1949-1950). It now appears to occur predominantly in a small area of the south, and while recent data are insufficient to demonstrate that the apparent contraction in range is real, the small numbers observed recently, the species's likely vulnerability to hunting, and the generally precarious state of resident wetland bird populations in Lao PDR indicate that the species is At Risk in Lao PDR.

Anas falcata **Falcated Duck** (= Falcated Teal, ^K, ^T). Winter visitor; north (historically, Delacour and Jabouille 1927). Wetlands.

Anas penelope **Eurasian Wigeon**. Winter visitor; north (historically[B21]). Wetlands.

Anas poecilorhyncha **Spot-billed Duck**. Resident and winter visitor; north[B2], south[B15]. Marshes, slow-flowing parts of wide rivers, lakes. Records prior to 1997 were reviewed by Evans *et al*. (in prep. a). Delacour and Jabouille (1940) implied that the species occurs in central Lao PDR, but we have not traced a primary source. The form sometimes regarded as a full species *A. zonorhyncha* Yellownib Duck (see Inskipp *et al*. 1996) probably occurs as a winter visitor, while recent summer records were probably of *A. p. haringtoni*. The only historical birds identified to race were of *A. p. haringtoni* (Delacour and Jabouille 1927).

Anas acuta **Northern Pintail** (= Common Pintail, ^K). Winter visitor; north (TDE), centre[B10]. Wetlands.

Anas querquedula **Garganey**. Winter visitor; north (PD), centre[B10], south[B2]. Pools, slow-flowing rivers and other wetlands.

Anas crecca **Common Teal**. Winter visitor; north (TDE), centre[B10]. Pools and other non- or slow-flowing wetlands. Delacour and Jabouille (1940) implied that the species occurs in south Lao PDR, but we have not traced a primary source.

Conservation Management and Research Proposed for Whistling-ducks, geese and ducks:

- Identification and protection of all remaining White-winged Duck populations and their habitat, particularly nesting areas: sites so far identified are Dong Khanthung PNBCA, Xe Pian NBCA / Bolaven Southwest NBCA, and the Nakai Plateau.
- Identification and management of wetland habitats supporting nationally significant wintering populations (more than 40 birds) of any species (except whistling-ducks). Duck numbers seem very low, but it is unclear how much this reflects persecution, and how much a lack of suitable water-bodies. There is no evidence in historical literature (e.g. David-Beaulieu 1944) that large flocks of wintering *Anas* or *Aythya* species were ever found. It is unlikely that any of the wintering species is present in internationally significant numbers.
- Complete legal protection of White-winged Duck (already listed as such), Cotton Pygmy-goose, Comb Duck and all geese.
- Imposition of a closed season or other controls on hunting during the breeding season of all duck species.
- Assessment of the current status of Cotton Pygmy-goose in Xe Pian NBCA and establishment of a population monitoring programme by NBCA staff.
- Conservation education programmes in areas supporting White-winged Duck and/or Cotton Pygmy-goose.

Turnicidae: Buttonquails (3 species)

• *Turnix sylvatica* **Small Buttonquail** (= Little Buttonquail, ^K). *Conservation Significance:* Little Known in Lao PDR. *Documented Range and Habitat:* Resident; north (historically[B21]), centre (historically[B22]). Level areas below 1200 m, probably mainly grassland (David-Beaulieu 1944). *Status Information:* There are no recent field records of this species. Historically it was recorded in Xiangkhouang (common breeder on the Plain of Jars, more widespread in the winter) and Savannakhet Provinces (common where it occurred, but very local) by David-Beaulieu (1944, 1949-1950). South Lao PDR is implied within the species's range in Delacour and Jabouille (1940) but we have not traced a primary record. The species occupies habitats outside the foci of recent survey effort and field identification is difficult (buttonquails are generally seen only in flight and are difficult to identify to species), so the species may in fact remain well distributed. Pending demonstration of this it should be regarded as Little Known in Lao PDR.

Turnix tanki **Yellow-legged Buttonquail**. Resident; north[B9], centre[B10], south (Evans *et al*. 1996b). Grassland, including damp areas, scrub and cultivation at low and mid altitudes.

Turnix suscitator **Barred Buttonquail**. Resident; north (PD), centre (JWD), south[B9]. Scrub (including quite dense areas), grassland, cultivation up to at least 900 m. Records prior to 1996 were reviewed by Duckworth *et al*. (1998a).

Conservation Management and Research Proposed for Buttonquails:

- Investigation of the possibility that buttonquails are under excessive pressure from harvesting. At times large numbers of Barred and Yellow-legged are sold in markets. They inhabit areas outside the foci of recent wild-

life surveys, but incidental observations suggest that they are now scarce in agricultural land. Active capture with nets occurs (TDE) and they may also be snared.
- Formulation of protective measures if needed.

Picidae: Woodpeckers (26 species)

Jynx torquilla **Eurasian Wryneck**. Passage migrant and winter visitor; north[B2], centre (historically[B22]), south (A. J. Stones *in litt*. 1999). Secondary growth, cultivation and open deciduous forest.

Picumnus innominatus **Speckled Piculet**. Resident; north[B9], centre[B10], south[B2]. Evergreen forests and adjacent tall secondary growth, up to at least 1400 m, rare in extreme lowlands.

Sasia ochracea **White-browed Piculet**. Resident; north, centre, south[B2]. Evergreen forest and secondary growth, especially in areas with mid-storey bamboo; mostly lowlands and foothills, but up to at least 1480 m.

Dendrocopos canicapillus (= *Picoides canicapillus*, ^K, ^T) **Grey-capped Pygmy Woodpecker** (= Grey-capped Woodpecker, ^K, ^T). Resident; north[B9], centre[B10], south[B2]. Open deciduous forest, especially dry dipterocarp. Also in hill and mountain evergreen forest (including degraded areas), up to at least 1700 m.

• *Dendrocopos macei* (= *Picoides macei*, ^K, ^T) **Fulvous-breasted Woodpecker**. *Conservation Significance:* Little Known in Lao PDR. *Documented Range and Habitat:* Resident; centre[B17], south[B11]. Recent records come from dry dipterocarp forest (south) and mixed deciduous woodland (centre) in the lowlands; one historical record comes from the Bolaven Plateau (presumably at about 1000-1200 m). *Status Information:* Two singles were seen in Dong Khanthung PNBCA and one in Hin Namno NBCA, all in 1998 (Round 1998, Walston in prep.). Although Timmins *et al*. (1993) gave a provisional record from Xe Pian NBCA, this was retracted in Thewlis *et al*. (1996). Historically the species was known from two records from Savannakhet town (one a specimen; David-Beaulieu 1949-1950) and one from the Bolaven Plateau (Dickinson 1970a). The species is categorised as Little Known in Lao PDR because of the paucity of records and lack of clarity over habitat use. There are many areas superficially similar to those inhabited by the species in which it has not been recorded.

Dendrocopos atratus (= *Picoides atratus*, ^K, ^T) **Stripe-breasted Woodpecker**. Resident; north[B4], centre[B10], south[B2]. Evergreen forest, including fragmented areas and adjacent open areas, generally above 600 m and up to at least 1880 m.

• *Dendrocopos mahrattensis* (= *Picoides mahrattensis*, ^K, ^T) **Yellow-crowned Woodpecker**. *Conservation Significance:* At Risk in Lao PDR. *Documented Range and Habitat:* Resident; south[B11]. Lowland dry dipterocarp forest. *Status Information:* The first location record for Lao PDR came from Dong Khanthung PNBCA on 28 July 1998, when two birds were seen together (Round 1998). The only historical record stated to be from Lao PDR is from 'Kouys', which appears to be in modern-day Cambodia (see *D. hyperythrus*, Appendix). The Dong Khanthung area faces a variety of threats (Round 1998) and until it is declared and managed as an NBCA this species is best considered At Risk in Lao PDR.

Dendrocopos cathpharius (= *Picoides cathpharius*, ^K, ^T) **Crimson-breasted Woodpecker**. Resident; north[B8]. Evergreen forest above 1400 m. Records prior to 1997 were reviewed by Thewlis *et al*. (1998) who categorised the species as Little Known in Lao PDR. There are historical records from two montane areas of Xiangkhouang Province (David-Beaulieu 1944). Recent records come also from the montane north (Nam Ha and Phou Louey NBCAs; Tizard *et al*. 1997, Davidson 1998). The species is probably scattered across the montane forests of northern Lao PDR and need no longer be considered Little Known.

• *Dendrocopos major* (= *Picoides major*, ^K) **Great Spotted Woodpecker**. *Conservation Significance:* Little Known in Lao PDR. *Documented Range and Habitat:* Resident; north (historically[B21]). Pine forests over 1000 m. *Status Information:* The species has been recorded only from Xiangkhouang Province, where it was fairly common above 1000 m (David-Beaulieu 1944). The lack of recent records indicates that the species should be considered Little Known in Lao PDR.

Celeus brachyurus (= *Micropternus brachyurus*, ^K) **Rufous Woodpecker**. Resident; north[B1], centre, south[B2]. Evergreen and deciduous forest and secondary growth, generally below 750 m.

• *Dryocopus javensis* **White-bellied Woodpecker**. *Conservation Significance:* Potentially At Risk in Lao PDR. *Documented Range and Habitat:* Resident; centre (historically[B22]), south[B14]. Open mixed deciduous forest in association with denser forest patches, particularly evergreen riverine strips, and dry dipterocarp forest; below 300 m. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). The species has been found in six survey areas (Table 11). Historically it was recorded widely in the south (Engelbach 1932) and was fairly frequent in Savannakhet Province (David-Beaulieu 1949-1950). However, it seems to use a narrow range of habitats in Lao PDR. In most areas it is known only by a few records; only in Xe Pian was it assessed to be locally common. This low density, together with the lack of records from other areas containing open

deciduous forest (e.g. Phou Xang He and Phou Xiang Thong NBCAs) makes the species's future in Lao PDR uncertain.

Picus chlorolophus **Lesser Yellownape**. Resident; north[B10], centre, south[B2]. Evergreen and closed deciduous forest, including secondary areas, up to at least 1400 m.

Picus flavinucha **Greater Yellownape**. Resident; north[B1], centre, south[B2]. Forests, mainly evergreen, and tall secondary growth up to at least 1850 m.

Picus vittatus **Laced Woodpecker**. Resident; north[B1], centre, south[B2]. Tall forests (especially mixed deciduous) and secondary growth, below 500 m; infrequent in extensive evergreen blocks.

• *Picus xanthopygaeus* **Streak-throated Woodpecker**. *Conservation Significance:* Potentially At Risk in Lao PDR. *Documented Range and Habitat:* Resident; south[B14]. Deciduous forest, including dry dipterocarp, below 500 m. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). The only historical information comes from an unspecified part of the Bolaven Plateau (Engelbach 1932). Recently, small numbers have been recorded in Xe Bang-Nouan and Xe Pian NBCAs and in Dong Khanthung PNBCA (Round 1998). There are no descriptions of the appearance of females in Lao PDR; in adjacent Thailand and Vietnam they possess a red forecrown (PDR, JWD), whereas across the rest of the wide tropical Asian range it is black (Winkler *et al*. 1995). The taxonomic significance of this has not been assessed.

• *Picus rabieri* **Red-collared Woodpecker**. *Conservation Significance:* Globally Threatened - Vulnerable; endemic to Lao PDR, Vietnam and extreme south-west China (south-east Yunnan Province). *Documented Range and Habitat:* Resident; north, centre, south[B14]. Evergreen forests and locally in tall secondary growth, largely in areas of gentle relief below 600 m, exceptionally to 1050 m. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). Recent records come from 16 areas, from Nam Xam NBCA south to the Cambodian border (Table 11). The species is relatively common in mature forest in all NBCAs with substantial areas below 600 m. In some areas it is scarcer in logged forests, but in others even this habitat supports large numbers (e.g. Xe Bang-Nouan NBCA and Sangthong District).

Picus erythropygius **Black-headed Woodpecker**. Resident; centre, south[B14]. Dry dipterocarp forest below 300 m and, locally, pine forest up to 1000 m. Records prior to 1997 were reviewed by Thewlis *et al*. (1998). In view of the species's apparently secure status, it was dropped from the recommended list of key species. *Special Significance:* Endemic to Myanmar, Thailand and Indochina.

Picus canus **Grey-headed Woodpecker** (= Grey-faced Woodpecker, ^Sm). Resident; north[B1], centre, south[B2]. Wooded areas, largely open, deciduous and below 500 m; but up to 1420 m in mixed deciduous forest with conifers in the north. Probably occurs in other forest types.

Dinopium javanense **Common Flameback** (= Common Goldenback, ^K). Resident; north[B9], centre, south[B2]. Open wooded areas, cultivation, sometimes in extensive forest, generally below 800 m. More often in deciduous habitats than Greater Flameback, a pattern not reflected in other areas where the two flamebacks are sympatric (C. R. Robson *in litt*. 1999).

Chrysocolaptes lucidus **Greater Flameback** (= Greater Goldenback, ^K). Resident; north[B1], centre, south[B2]. Wide range of forest types including open forests and tall secondary growth; up to 1100 m.

Gecinulus grantia **Pale-headed Woodpecker**. Resident; north, centre, south[B14]. Tall bamboo in evergreen and mixed deciduous forests, possibly using a limited range of bamboo species. Rarely in habitat apparently lacking large bamboos. Generally below 600 m, but up to 1170 m. Records prior to 1997 were reviewed by Thewlis *et al*. (1998). In view of the species's apparently secure status and wide distribution, it was dropped from the recommended list of key species.

• *Gecinulus viridis* **Bamboo Woodpecker**. *Conservation Significance:* Little Known in Lao PDR; endemic to South-east Asia. *Documented Range and Habitat:* Resident; north[B1]. Tall bamboo in degraded forest at 200 m. The species is probably parapatric with Pale-headed Woodpecker; the boundary between them is not clear, but Bamboo Woodpecker is likely to have a small range in Lao PDR, primarily west of the Mekong. *Status Information:* There was one historical record, from Ban Muangliap, north Lao PDR. This is probably west of the Mekong (Robinson and Kloss 1931, Delacour 1951a). The only recent records are from just east of the Mekong, in Sangthong District, where the species was not uncommon (Duckworth 1996a). Nam Phoun NBCA has not yet been surveyed for birds; this area, west of the Mekong, could potentially hold large numbers of this species. Until this is established, it would be prudent to regard Bamboo Woodpecker as Little Known in Lao PDR, especially as the Sangthong area is small and not protected at the national level.

Blythipicus pyrrhotis **Bay Woodpecker**. Resident; north[B10], centre, south[B2]. Forests, especially evergreen, from lowlands (where generally scarce) up to 1850 m.

Meiglyptes jugularis **Black-and-Buff Woodpecker**. Resident; north[B1], centre, south[B2]. Evergreen forests, generally in lowlands and foothills.

Hemicircus canente **Heart-spotted Woodpecker**. Resident; north[B1], centre, south[B2]. Evergreen forests from lowlands up to 1100 m.

Mulleripicus pulverulentus (= *Muelleripicus pulverulentus*, ^T) **Great Slaty Woodpecker**. Resident; north[B9], centre[B10], south[B2]. Evergreen and deciduous forests, below 1000 m, primarily in more open areas.

Conservation Management and Research Proposed for Woodpeckers:

- Conservation of adequate areas of habitat; woodpeckers as a group may be sensitive to forest degradation and fragmentation in Lao PDR, being absent or scarce from areas like Houay Nhang NR and Dong Nathat Conservation Area (Thewlis *et al*. 1996, Evans in prep.). Conserving all species will require attention to most major forest types. Open lowland deciduous forest supports several key species.

Megalaimidae: Asian barbets (10 species)

Megalaima virens **Great Barbet**. Resident; north[B9], centre[B10]. Evergreen and mixed deciduous forests above 700 m.

Megalaima lagrandieri **Red-vented Barbet**. Resident; north, centre, south[B14]. Evergreen forests, deciduous forest in mosaic with more evergreen formations, including degraded and fragmented areas; from plains to at least 1500 m. Records prior to 1997 were reviewed by Thewlis *et al*. (1998). In view of the species's apparently secure status, it was dropped from the recommended list of key species. *Special Significance:* Endemic to Indochina east of the Mekong.

Megalaima lineata **Lineated Barbet**. Resident; north[B1], centre, south[B2]. Deciduous forest and other open wooded areas, generally lowlands and foothills.

Megalaima faiostricta **Green-eared Barbet**. Resident; north, centre, south[B2]. Evergreen and deciduous forests, tolerant of degradation, up to at least 900 m.

Megalaima franklinii **Golden-throated Barbet**. Resident; north, centre[B10], south[B3]. Evergreen forests, largely above 800 m, exceptionally down to 500 m.

Megalaima oorti **Black-browed Barbet**. Resident; south[B2]. Evergreen forests over 600 m.

Megalaima asiatica **Blue-throated Barbet**. Resident; north[B9]. Evergreen forests, generally above 600 m. Records prior to 1996 were reviewed by Duckworth *et al*. (1998a). A record from south Lao PDR (Davidson *et al*. 1997) was an editorial error.

Megalaima incognita **Moustached Barbet**. Resident; north, centre, south[B2]. Evergreen forests, mainly below 1000 m, occasionally up to 1560 m. *Special Significance:* Endemic to South-east Asia.

Megalaima australis **Blue-eared Barbet**. Resident; north[B1], centre, south[B2]. Forests and open wooded areas, mainly below 800 m.

Megalaima haemacephala **Coppersmith Barbet**. Resident; north, centre, south[B2]. Open wooded areas and villages.

Bucerotidae: Hornbills (5 species)

Anthracoceros albirostris **Oriental Pied Hornbill** (= Indian Pied Hornbill, ^K). Resident; north[B1], centre, south[B2]. Forests, mainly evergreen but including quite deciduous or fragmented patches and dense riverine forest through otherwise open areas; generally in lowlands and foothills. Although still widespread and fairly numerous in many recent survey areas, flocks are small and distribution is irregular in more accessible areas, e.g. Sangthong District (Duckworth 1996a). The species's conservation status should be reconsidered at regular intervals. *Special Significance:* CITES Appendix II.

• *Buceros bicornis* **Great Hornbill**. *Conservation Significance:* At Risk in Lao PDR; CITES Appendix I. *Documented Range and Habitat:* Resident; north, centre, south[B14]. Evergreen forests, ranging into open deciduous areas to visit fruit trees; up to at least 1560 m. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). Although recorded in at least 15 recent survey areas (Table 11), it is apparently uncommon, with flocks over a dozen being recorded only in parts of Nakai-Nam Theun NBCA (Thewlis *et al*. 1998). Historically it was widespread, and widely described as common (Delacour 1929a, Engelbach 1932, Delacour and Greenway 1940a, David-Beaulieu 1944). A major decline has clearly occurred. Incidental hunting pressure is high on all large birds, particularly those with predictable feeding sites (such as fruiting trees, as used by hornbills). This species is probably at elevated risk, as heads and casques are widely displayed and traded as trophies (Plate 5).

• *Anorrhinus tickelli* (= *Ptilolaemus tickelli*, ^K, ^T) **Brown Hornbill**. *Conservation Significance:* Globally Near-Threatened; Potentially At Risk in Lao PDR; CITES Appendix II. *Documented Range and Habitat:* Resident; north, centre, south[B14]. Evergreen forests, locally in open forest with dense patches, up to at least 1500 m; scarcer in lowlands. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). Historically the species was widely recorded and sometimes described as numerous (see Thewlis *et al*. 1998) and recently it has been found in at least eight survey

areas (Table 11). Although in some areas flocks of up to 30 suggest that numbers are healthy, in others only singles or small groups were found. Furthermore, the species may have declined or even disappeared from the Bolaven Plateau. The species is sometimes sold as food, and young are reared in captivity (Plate 6).

• *Aceros nipalensis* **Rufous-necked Hornbill**. *Conservation Significance:* Globally Threatened - Vulnerable; At Risk in Lao PDR; CITES Appendix I. *Documented Range and Habitat:* Resident; north, centre[B14]. Evergreen forests, mainly at 700-1800 m. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). Historically the species was recorded only from mountainous areas of the north (David-Beaulieu 1944). While recent records come from a wider area (extending from Phou Dendin NBCA south down the Annamites into central Lao PDR), there are records from only five survey areas (Table 11). The number of remains of shot birds found, and the general vulnerability of large hornbills, indicate that it is clearly at risk. (Plate 11)

• *Aceros undulatus* (= *Rhyticeros undulatus*, ^K, ^T) **Wreathed Hornbill**. *Conservation Significance:* At Risk in Lao PDR; CITES Appendix II. *Documented Range and Habitat:* Resident; north, centre, south[B14]. Evergreen forests (ranging into deciduous forests to visit fruit trees) from extreme lowlands to at least 1300 m. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). Historically, the species was recorded widely, and often considered common (Engelbach 1932, Delacour and Greenway 1940a, David-Beaulieu 1944). Recent records come also from many areas, spread across the country, but in most places only small numbers were found. Of the 15 survey areas with records (Table 11), flocks of over a dozen were found only (and rarely) in Nakai-Nam Theun, Nam Kading, Dong Hua Sao and Xe Pian NBCAs, and Nam Theun Extension PNBCA. These are all big expanses of habitat; smaller numbers were seen in the smaller and more isolated survey areas. Occasionally, flocks exceeding 60 have been observed, e.g. in Nakai-Nam Theun NBCA in November 1998 (BLS). As with all other hornbills, this species has been recorded recently at many fewer sites to the north of Vientiane than to the south (Table 11).

Conservation Management and Research Proposed for Hornbills:

- Legal protection of all species from hunting. Hornbills are eaten in rural Lao PDR (Table 1). Casques (for ornamental or perhaps medicinal use) and dead whole birds are sold in urban markets (Salter 1993a, Srikosamatara *et al*. 1992, Showler *et al*. 1998b, Annex 1), some for international trade (Compton in prep. b). Some are kept as pets (Plate 6).
- Consideration of hornbill habitat requirements in land use planning outside the protected areas system. Hornbills are the only evergreen forest birds not specifically associated with rivers that are in clear decline even in remaining extensive habitat (Thewlis *et al*. 1998). The status of all species in north Lao PDR is particularly concerning; apart from Phou Dendin NBCA, there have been very few recent records in areas north of Vientiane (Table 11). They require large areas of habitat (e.g. see Wreathed Hornbill), are vulnerable to encroachment of forest (needing both an adequate supply of fruit trees and of trees with large nesting holes) and are susceptible to hunting, especially when in large groups at roosts and fruit sources. The networks of remaining habitat in the Nam Theun and Xe Kong basins offer the best chances of preserving large hornbills in the long term.
- Design and implementation of monitoring programmes for all species; even Oriental Pied Hornbill has become locally extinct and exists well below carrying capacity in most other areas.
- Public education programmes. Being charismatic and harmless to human interests, and suffering a variety of threats, hornbills are ideal for use in such work.

Upupidae: Hoopoes (1 species)

Upupa epops **Common Hoopoe** (= Hoopoe, ^K, ^T; = Eurasian Hoopoe, ^Sm). Resident, perhaps augmented by winter visitors; north[B8], centre[B16], south[B2]. Open wooded country and dry dipterocarp forest, up to at least 1080 m.

Trogonidae: Trogons (2 species)

Harpactes oreskios **Orange-breasted Trogon**. Resident; north[B1], centre, south[B2]. Evergreen forest and adjacent mature secondary growth, generally below 700 m, locally up to at least 1000 m.

Harpactes erythrocephalus **Red-headed Trogon**. Resident; north[B1], centre, south[B2]. Evergreen forest and adjacent mature secondary growth from plains (where generally scarce) to at least 1700 m.

Coraciidae: Rollers (2 species)

Coracias benghalensis **Indian Roller**. Resident; north, centre, south[B2]. Open country, including some deciduous forests and cultivation; chiefly lowlands and foothills.

Eurystomus orientalis **Dollarbird**. Mainly breeding visitor, arriving late dry-season; north, centre, south[B2]; some birds present in south during much of dry season. Open evergreen and deciduous forests, secondary growth, rocky savanna and riverine forest; chiefly lowlands and foothills.

Alcedinidae: River kingfishers (4 species)

• *Alcedo hercules* **Blyth's Kingfisher**. *Conservation Significance:* Globally Threatened - Vulnerable; Potentially At Risk in Lao PDR. *Documented Range and Habitat:* Resident; north, centre, south[B14]. Forested streams at 200-1200 m. Seems more tolerant of deforestation in the north, but everywhere occurs primarily on ever-flowing streams of 3-20 m width, shaded by bank-side vegetation. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). The few historical records came from a few areas of the north (Oustalet 1899-1903, Bangs and Van Tyne 1931, David-Beaulieu 1944). Recent observations have come from a much wider range, in total from 11 survey areas (Table 11), from the extreme north (Phou Dendin NBCA) south to the lowlands of Dong Hua Sao NBCA just south of the Bolaven Plateau. (Plate 1)

Alcedo atthis **Common Kingfisher**. Widespread winter visitor; north, centre, south[B2]. Breeds locally in the north (David-Beaulieu 1944). All types of wetland in forest and non-forest areas including towns.

Alcedo meninting **Blue-eared Kingfisher**. Resident; north[B1], centre, south[B2]. Streams and smaller rivers, mainly in forests, up to at least 630 m. Records prior to 1994 were reviewed by Thewlis *et al*. (1996).

Ceyx erithacus **Oriental Dwarf Kingfisher** (= Black-backed Kingfisher, ^K, ^Sm). Wet-season visitor, presumed breeder, also occasional records in dry season; north, centre, south[B2]. Evergreen forest well supplied with streams and pools; passage birds sometimes outside forest. Records prior to 1996 were reviewed by Duckworth *et al*. (1998a).

Dacelonidae: Dacelonid kingfishers (6 species)

Lacedo pulchella **Banded Kingfisher**. Resident; north[B1], centre, south[B2]. Evergreen forest below 700 m.

Halcyon capensis (= *Pelargopsis capensis*, ^K, ^Sm) **Stork-billed Kingfisher**. Resident; north[B1], centre, south[B2]. Usually along tree-lined streams and rivers, occasionally in more open country; generally below 500 m.

• *Halcyon coromanda* **Ruddy Kingfisher**. *Conservation Significance:* Little Known in Lao PDR. *Documented Range and Habitat:* Passage migrant, perhaps present during other seasons and may breed; north[B7], centre[B2]. Forested streams and rivers, up to at least 600 m. *Status Information:* The three records prior to 1997, and one in Nam Kan PNBCA in 1997 (Pasquet 1997), were in April and could all relate to migrants (Thewlis *et al*. 1998). Breeding birds might also occur: in late April - early May 1997 at two sites in Nam Theun Extension PNBCA, several birds were recorded on two and four consecutive days respectively, calling frequently and possibly establishing territories. The species was again seen in Nam Theun Extension PNBCA on 31 May 1998 (WGR). A record from Khonphapheng falls in Thewlis *et al*. (1996) was a typographical error.

Halcyon smyrnensis **White-throated Kingfisher**. Resident; north, centre, south[B2]. Large rivers, marshes and open areas, often near water; exceptionally in dense forest. Up to at least 1200 m.

Halcyon pileata **Black-capped Kingfisher**. Winter visitor; north, centre, south[B2]. Locally resident in north (David-Beaulieu 1944). Wooded and open streams and rivers, and open wetlands, up to at least 1100 m.

• *Todiramphus chloris* (= *Halcyon chloris*, ^K, ^T; = *Todirhamphus chloris*, ^Sm) **Collared Kingfisher**. *Conservation Significance:* Little Known in Lao PDR. *Documented Range and Habitat:* Seasonal status unclear: centre, south (historically[B22]). Large rivers. *Status Information:* No recent records, despite substantial survey effort. The species was recorded at several localities along the Mekong in Savannakhet and Champasak Provinces in the 1940s (David-Beaulieu 1949-1950). It may never have been particularly common in Lao PDR as Engelbach (1927, 1932) never recorded it in several years' residence in the south. The decline of other species of wide lowland rivers and the lack of records despite recent observational effort along the southern Mekong indicates that the species would be likely to be At Risk in Lao PDR. In the absence of clear evidence that it was ever anything other than a scarce migrant, it is classed as Little Known in Lao PDR.

Cerylidae: Cerylid kingfishers (2 species)

Megaceryle lugubris (= *Ceryle lugubris*, ^K) **Crested Kingfisher**. Resident subject to some seasonal altitudinal movements; north, centre[B14], south[B5]. Fast-flowing rocky rivers mainly in forested foothills, up to at least 960 m. Records prior to 1997 were reviewed by Thewlis *et al*. (1998). In view of the species's apparently secure status (recorded from six survey areas), it was dropped from the recommended list of key species. In 1997-1998 it was recorded in an additional five survey areas, confirming its wide distribution across the north.

• *Ceryle rudis* **Pied Kingfisher**. *Conservation Significance:* At Risk in Lao PDR. *Documented Range and Habitat:* Resident; north (Heath 1996), centre (historically[B22]), south[B14]. Wide slow-flowing rivers with exposed earth banks; histori-

cally may have shown wider habitat use. This is a very restricted habitat use compared with that in many other countries of the species's wide range. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). Pied Kingfishers have only recently been recorded regularly in southern Champasak Province, along parts of the Xe Kong and Mekong mainstream. Recent records from the Thai side of the Mekong opposite north Lao PDR (Heath 1996) suggest that small numbers may remain locally elsewhere in the country, but in comparison with the wide distribution of historical records (Engelbach 1932, Delacour and Greenway 1940a, David-Beaulieu 1949-1950), it is clear that a major range contraction has occurred. The reasons for this are obscure but might include nest robbing: a pair at Ban Hangkhon (Champasak Province) was robbed, but moved elsewhere and re-nested successfully (Cunningham 1998).

Conservation Management and Research Proposed for Kingfishers:

- Protection of adequate areas of riverine habitats, particularly for Blyth's, Pied, Crested and Ruddy Kingfishers.
- Field investigation of the reasons behind the decline of Pied and Collared Kingfishers. Kingfishers are near the top of the wetland food-chain and, given the nearly-extinct status of other, larger, piscivorous birds in Lao PDR, may be valuable ecosystem indicators. Alternatively, declines may merely be driven by nest robbery.

Meropidae: Bee-eaters (5 species)

Nyctyornis athertoni **Blue-bearded Bee-eater**. Resident; north[B1], centre, south[B2]. Forest, largely evergreen and generally below 1200 m.

Merops orientalis **Green Bee-eater** (= Little Green Bee-eater, ^Sm). Presumed resident, probably making local movements; north[B1], centre[B10], south[B2]. Dry dipterocarp forest, other lightly wooded and open areas with scrub and/or trees, up to at least 1600 m.

Merops viridis **Blue-throated Bee-eater**. Seasonal status unclear, but possibly occurs only as passage migrant; north[B7], centre[B10]. Habitat use unclear, but probably mainly open areas; migrants stop in small clearings and follow wider rivers and ridges in evergreen forest.

• *Merops philippinus* **Blue-tailed Bee-eater**. *Conservation Significance:* Potentially At Risk in Lao PDR. *Documented Range and Habitat:* Seasonal status unclear, but breeds during dry season; north[B1], centre (historically[B22]), south[B11]. Wide rivers with shrub-covered exposed sediment and adjacent broken wooded areas. *Status Information:* Records prior to 1997 were reviewed by Evans *et al*. (in prep. a). At least 100 were seen in the Seephandon area, with a few along the Mekong to a point a little upstream of Pakxe, in April - May 1996 (Evans *et al*. in prep. a). A few were seen near the Khonphapheng Falls in February 1993 (provisionally; Thewlis *et al*. 1996), around Paksang (Sangthong District) in March and June 1996 (Duckworth 1996a), around the mouth of the Xe Bang-Nouan in March - May 1997 (Evans in prep.), around Ban Hangkhon (Champasak Province) in spring 1997 (Cunningham 1998) and in Dong Khanthung PNBCA in spring 1998 (Round 1998). These are all likely breeding areas, but at least six birds in the upper Nam Cham valley (640 m; Nam Theun Extension PNBCA) on 17 May 1996 (Tizard 1996, RJTiz) were perhaps on passage. The only historical records are of about 15 presumed migrants in Xiangkhouang in April 1941, and occasional small numbers in Savannakhet Province (David-Beaulieu 1944, 1949-1950). The species occurs mainly along the Mekong and is common only in the south, a pattern shown by various other species at risk. None of the four recent survey areas with records (Table 11) is a declared NBCA. The species nests colonially in sand-cliffs along accessible lowland rivers and most or all suitable breeding areas are accessible to people, and may be harvested; around Ban Hangkhon (Champasak Province), Chestnut-headed Bee-eater nests were robbed (Cunningham 1998). Colonies may also be vulnerable to sediment flow changes. The species is clearly Potentially At Risk in Lao PDR.

Merops leschenaulti **Chestnut-headed Bee-eater**. Presumed resident; north[B9], centre, south[B2]. Open evergreen and deciduous forests and open areas with scrub and/or clumps of trees; often on and over dense scrub along river banks. Generally below 650 m.

Conservation Management and Research Proposed for Bee-eaters:

- Protection of adequate areas of habitat for Blue-tailed Bee-eater, which depends upon large sand banks in rivers for nesting areas (other species use smaller rivers, road banks, etc. and so are less vulnerable); as such habitat is vulnerable to changes in riverine sediment dynamics, site-specific activities are likely to be insufficient. Integrated basin-level planning is needed.
- Field investigation of reasons for the generally low numbers; eggs are presumably taken but it is unclear whether adults are harvested.

Cuculidae: Cuckoos (16 species)

Clamator coromandus **Chestnut-winged Cuckoo**. Wet-season breeding visitor, sporadic records during dry season; north, centre, south[B2]. Broken forest, secondary growth and other areas with a dense understorey, up to at least 650 m.

Hierococcyx sparverioides (= *Cuculus sparverioides*, ^K, ^Sm, ^T) **Large Hawk Cuckoo**. Breeder, at least locally, seasonal status unclear; north, centre[B2], south[B10]. Evergreen and deciduous forests, especially more open stands and secondary growth, up to at least 1700 m; at least in non-breeding season, occurs down to 80 m.

• *Hierococcyx vagans* (= *Cuculus vagans*, ^K, ^Sm, ^T) **Moustached Hawk Cuckoo**. *Conservation Significance:* Little Known in Lao PDR. *Documented Range and Habitat:* Presumed resident; south[B2]. Lowland semi-evergreen forest, bamboo and tall secondary growth. *Status Information:* Known in Lao PDR from three records: singles in Xe Pian NBCA in December 1992 and January 1993 (Thewlis *et al*. 1996, Duckworth 1996c) and (calling, perhaps suggesting breeding) in July 1998 in Dong Khanthung PNBCA (Round 1998). On current knowledge the species has a very limited range and is confined to a habitat that may contract substantially.

Hierococcyx fugax (= *Cuculus fugax*, ^K, ^Sm, ^T) **Hodgson's Hawk Cuckoo**. Presumed breeder, seasonal status unclear; north[B9], centre[B7], south[B2]. Evergreen and mixed deciduous forests, secondary growth, probably mainly at 500-1450 m; also down to 100 m. First recorded in 1993 (Thewlis *et al*. 1996).

Cuculus micropterus **Indian Cuckoo**. Breeder, seasonal status unclear; north, centre, south[B2]. Deciduous and evergreen forests and secondary growth; up to at least 1600 m.

Cuculus canorus **Eurasian Cuckoo** (= Common Cuckoo, ^K, ^Sm, ^T). Seasonal status unclear, presumed to breed; north (historically[B21]). Habitat use in Lao PDR unknown. Difficulties of field separation of silent birds from Oriental Cuckoo mean that the species may be overlooked; all Lao records traced by David-Beaulieu (1944) were during April and May, and all his personal encounters were with singing birds, which suggests that the species breeds in at least Xiangkhouang Province. A few silent individuals seen since 1991 have been suspected to be this species.

Cuculus saturatus **Oriental Cuckoo**. Seasonal status unclear, presumed to breed; north[B9], centre[B10]. Evergreen forest at 800-1800 m. First recorded in 1994 (Evans and Timmins 1998).

Cuculus poliocephalus **Lesser Cuckoo**. Seasonal status unclear, presumed to breed; north[B9]. Evergreen forests and secondary growth above 1450 m. First recorded for Lao PDR in 1995, in Phou Dendin NBCA (Duckworth *et al*. 1998a).

Cacomantis sonneratii **Banded Bay Cuckoo**. Presumed resident; north, centre, south[B2]. Evergreen and deciduous forests, scrub and secondary growth particularly along rivers; up to at least 1200 m.

Cacomantis merulinus **Plaintive Cuckoo**. Resident; north, centre, south[B2]. Secondary growth, scrub, cultivation, gardens; natural habitats occupied at high density are scrub in river channel islands and vegetated limestone karst. Occurs up to at least 1050 m.

Chrysococcyx maculatus **Asian Emerald Cuckoo**. Seasonal status unclear but probably breeds; north[B2], centre[B10], south[B2]. Evergreen forests, sometimes secondary growth and scrub; up to at least 1500 m.

Chrysococcyx xanthorhynchus **Violet Cuckoo**. Seasonal status unclear; north[B2], centre[B17], south[B2]. Evergreen forest, including degraded and edge areas; chiefly lowlands and hills. Records prior to 1994 were reviewed by Thewlis *et al*. (1996).

Surniculus lugubris **Drongo Cuckoo**. Breeder, seasonal status unclear; north, centre, south[B2]. Forests and tall dense secondary growth up to at least 1120 m.

Eudynamys scolopacea **Asian Koel** (= Common Koel, ^K, ^T). Breeder, seasonal status unclear; north, centre, south[B2]. Open deciduous forest and secondary growth at lower altitudes. It is a brood parasite upon Large-billed Crows and is doubtless limited by their low numbers.

Phaenicophaeus tristis **Green-billed Malkoha**. Resident; north[B1], centre, south[B2]. Forests (mainly evergreen) and tall dense secondary growth, up to at least 1350 m.

• *Carpococcyx renauldi* **Coral-billed Ground Cuckoo**. *Conservation Significance:* Globally Near-Threatened; endemic to Indochina and parts of Thailand. Not At Risk in Lao PDR. *Documented Range and Habitat:* Resident; north, centre, south[B14]. Mainly in evergreen forests and mature tall regrowth, mainly below 1000 m, exceptionally up to 1500 m. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). Historical records come widely from south and central Lao PDR, but are few. The species has been recorded in 11 recent survey areas (Table 11), and was assessed as common in several, notably the Nakai Plateau. Calling in the species is strongly seasonal and (resulting from its shy nature) detecting the species visually is difficult: thus, areas surveyed outside the main calling period may hold unsuspected large populations. Coral-billed Ground Cuckoos are caught in snares set for ground birds and are eaten (Thewlis *et al*. 1998). One captive was observed being transported to either Savannakhet or Vientiane from Salavan airport (Salter 1993a).

Conservation Management and Research Proposed for Cuckoos:

- Cessation of snaring in protected areas, to remove the major threat to Coral-billed Ground Cuckoo.

- Adequate protection of habitat in the far south for Moustached Hawk Cuckoo, notably including declaration of Dong Khanthung as an NBCA.

Centropodidae: Coucals (2 species)

Centropus sinensis **Greater Coucal**. Resident; north, centre, south[B2]. Forest edge, scrub, tall secondary growth and grassland, including around ponds and villages; locally within dense forest. Up to at least 1350 m.

Centropus bengalensis **Lesser Coucal**. Resident; north, centre, south[B2]. Grassland, marshes, scrubby secondary growth, often near water, up to at least 1200 m.

Psittacidae: Parrots (5 species)

Loriculus vernalis **Vernal Hanging Parrot**. Resident; north, centre, south[B2]. Evergreen and deciduous forests, secondary growth; mainly lowland; occasionally up to 1000 m. *Special Significance:* CITES Appendix II.

• *Psittacula eupatria* **Alexandrine Parakeet**. *Conservation Significance:* At Risk in Lao PDR; CITES Appendix II. *Documented Range and Habitat:* Resident; centre (historically[B22]); south[B14]. Open deciduous forests and adjacent riverine evergreen forest, mainly lowland. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). Historically the species was described as common in parts of south and central Lao PDR (Engelbach 1932, David-Beaulieu 1949-1950) and there is even a record from the Thai bank of the Mekong opposite north Lao PDR (Robinson and Kloss 1931). There are records from near Attapu and only two recent survey areas (Table 11): Xe Pian NBCA, where scattered pairs were seen in association with open forest, including the area around Ban Sompoy (five on 18 December 1997, Robichaud 1998e, and two in early 1998, RJTiz), and the Khonphapheng falls and Ban Hangkhon area (Champasak Province; TDE in Cunningham 1998). One was reported from a Vientiane market (Srikosamatara *et al*. 1992) but this should not be taken to suggest that it still occurs in north Lao PDR. There are many areas with apparently suitable habitat in which the species has not been recorded recently, including Dong Ampham, Xe Bang-Nouan and Phou Xiang Thong NBCAs, and Dong Khanthung and Phou Kathong PNBCAs. This indicates a considerable decline. All parakeets are harvested for the cage-bird trade. This species is reportedly favoured over others as it is the largest (Robichaud 1998e). Young are also apparently eaten (Cunningham 1998). The record from the north in Davidson (1998) was an editorial error.

Psittacula finschii **Grey-headed Parakeet**. Resident; north[B4], centre, south[B2]. Open forests, secondary growth from lowlands to hills and plateaux up to at least 900 m. As with other parakeets, numbers of this species are depressed but even so there remain several areas where flocks regularly exceed 50 birds (e.g. Nakai Plateau, Bolaven Plateau, Phou Xang He NBCA). The historical status of the species in the north is unclear but it seems now to be very scarce there. The species's conservation status should be reconsidered at regular intervals. *Special Significance:* CITES Appendix II.

• *Psittacula roseata* **Blossom-headed Parakeet**. *Conservation Significance:* Potentially At Risk in Lao PDR; CITES Appendix II. *Documented Range and Habitat:* Resident; north (R. Jelinek verbally 1999), centre (historically[B22]), south[B2]. Dry dipterocarp forest, including secondary areas, below 200 m. *Status Information:* Recent records come from only five survey areas (Table 11). Flocks of up to 40 were seen in the open areas of Xe Pian NBCA (including around Ban Sompoy) and on the nearby Xe Kong plains in 1992-1998 (Thewlis *et al*. 1996, Duckworth *et al*. 1998a; RJTiz), and in Dong Khanthung PNBCA in 1998 (Round 1998), with smaller numbers along the lower Xe Xou in February 1996 (provisionally; Evans *et al*. in prep. a), on the Attapu plain (including Phou Kathong PNBCA) in early 1997 (uncommon, biggest flock five; Davidson *et al*. 1997) and at Ban Hangkhon (Champasak Province; two in January 1997; Cunningham 1998). The only record from the north is of two over a Mekong island near Sangthong on 31 December 1998 (R. Jelinek verbally 1999). The species was formerly abundant in western Savannakhet Province, nesting in large colonies in open forest (David-Beaulieu 1949-1950). Engelbach (1927, 1932) recorded it from Pakxe, Attapu and Salavan, but considered it rare. Many features indicate that this species is Potentially At Risk in Lao PDR: the small flocks, limited altitudinal range, restricted distribution (many fewer sites than Red-breasted or Grey-headed Parakeets), apparent range contraction (no recent records from central Lao PDR), and the ongoing demand for parakeets as cage-birds.

Psittacula alexandri **Red-breasted Parakeet**. Resident; north[B1], centre, south[B2]. Deciduous forests and adjacent secondary growth below 400 m; sometimes seen over adjacent evergreen forest. Flocks exceeding 1000 still occur (e.g. around Ban Hangkhon, Champasak Province, in November 1997; Cunningham 1998) but in most areas they rarely number more than 20-30. This species has probably undergone a major decline in numbers and some range contraction. Its conservation status should be reconsidered at regular intervals. *Special Significance:* CITES Appendix II.

Conservation Management and Research Proposed for Parrots:

- Development and implementation of trade controls to

prevent over-exploitation in the pet trade, lest all species become as scarce as Alexandrine. Parakeets (notably Red-breasted) are among the birds most commonly kept as pets in Lao PDR and international trade occurs (e.g. La-Ong *et al*. 1997). Most wild flocks observed recently were relatively small, even in the most remote areas which presumably support the least harvested populations.
- Complete legal protection of Alexandrine and Blossom-headed Parakeets.
- Identification and protection of important nesting areas, particularly the parts of Champasak and Attapu Provinces supporting Alexandrine, Blossom-headed and Red-breasted Parakeet.
- Assessment of levels of parakeet-human conflict: parakeets are reported as crop pests in some rural areas, particularly in the south (Baird 1993, Table 2).
- Awareness-raising campaigns and consideration of use in eco-tourism of large parakeet flocks.

Apodidae: Swifts (8 species)

Collocalia brevirostris (= *Aerodramus brevirostris* ^T) **Himalayan Swiftlet** (separated as *C. rogersi* Indochinese Swiftlet by ^Sm). Breeding and seasonal status unclear; north[B13]. The Lao status of swiftlets is unclear: field identification to species is difficult and historical data are ambiguous (see Thewlis *et al*. 1996). Swiftlets occur in the north, centre and south (Thewlis *et al*. 1996), primarily in or near areas of limestone hills, often over open areas. Observations in different months in a given area reveal complex patterns of seasonal occurrence. Swiftlet nests are reportedly collected for human consumption from caves in Nam Et and Phou Louey NBCAs (A. Guillén *in litt*. 1998), although the species involved and season are not known. *C. b. innominata* may also occur, as a winter visitor (C. R. Robson *in litt*. 1999).

Collocalia germani **Germain's Swiftlet** (= German's Swiftlet, ^Sm); (included in *C. fuciphaga*, ^K; *Aerodramus fuciphaga* ^T Edible-nest Swiftlet). Presumed resident; centre[B17]. Confidently identified in the field in Hin Namno NBCA in early 1998 (PD in Walston in prep.). See also *C. brevirostris*.

Hirundapus caudacutus **White-throated Needletail**. Passage migrant; north[B2], centre (WCS 1996a). Over all habitats.

Hirundapus cochinchinensis **Silver-backed Needletail** (= White-vented Needletail, ^K, ^T). Seasonal status unclear, presumed breeder; north, centre, south[B2]. Over all habitats.

Hirundapus giganteus **Brown-backed Needletail** (= Brown Needletail, ^K, ^T). Presumed breeder, making local movements; north, centre, south[B2]. Over all habitats.

Cypsiurus balasiensis (= *C. batasiensis*, ^K) **Asian Palm Swift**. Resident; north, centre, south[B2]. Open scrub, villages and towns in the vicinity of mature palms, some dispersing to feed over mature forest; predominantly in lowlands, but up to at least 1250 m.

Apus pacificus **Fork-tailed Swift** (= Pacific Swift, ^T). Breeder, making complex local movements[B9]; north, centre, south[B2]. Over all habitats, probably commonest in regions with cliffs, caves and other roosting sites.

Apus affinis **House Swift** (separated as *A. nipalensis* House Swift by ^Sm). Breeder, making complex local movements; north, centre, south[B2]. Flocks usually over towns, water or limestone areas; birds occasionally turn up over any open areas. Occurs up to at least 1080 m.

Hemiprocnidae: Treeswifts (1 species)

Hemiprocne coronata **Crested Treeswift**. Resident; north[B1], centre (historically[B22]), south[B2]. Principally in open deciduous forest, locally in adjacent forest edge and secondary growth, usually below 500 m, occasionally up to 1000 m. Lao records prior to 1996 were reviewed in Duckworth (1996a).

Tytonidae: Barn owls (2 species)

• *Tyto alba* **Barn Owl**. *Conservation Significance:* Little Known in Lao PDR; CITES Appendix II. *Documented Range and Habitat:* Resident; north[B6], centre (Robinson and Webber 1998a), south[B11]. Cultivated areas, dry dipterocarp forest and limestone karst. No recent records from towns although these are occupied in adjacent countries. *Status Information:* There are very few recent field records (Table 11). One was found dead in a cave in Khammouan Limestone NBCA in early 1998 (Robinson and Webber 1998a). One was heard on two successive nights in Dong Khanthung PNBCA in 1998 (Round 1998). Other recent records are of captives: two (close to fledging) in the market at Ban Lak (52) in 1996; pet adults in a Louang-Namtha restaurant in 1997 and in Vientiane in 1996; and two unfledged young in Vientiane collected from 'somewhere outside Vientiane' in 1996 (Tizard *et al*. 1997; RJTiz, PD, RJTim). There is very little information available on origins of captive birds. Two in Vientiane were taken from a nest in a rocky crevice in Gnommolat, Khammouan Province in 1998 (C. Alton verbally 1999). A fledgling in a village house on the Xe Set Plateau in early 1999 was the only survivor of a family of 3-4 collected 1-2 months previously. The tree was felled to collect the young, after the adults were seen carrying food to it (KK). A captive was seen near the Khonphapheng Falls, Champasak Province in February 1998

(R. Jelinek verbally 1999). Historically, it was heard frequently around Xiangkhouang and Savannakhet towns (David-Beaulieu 1944, 1949-1950). The paucity of recent field records suggests that populations are not healthy. Nests are easily found and, judging by the numbers of captives, regularly plundered. The species is large enough to be persecuted opportunistically, but it can be difficult to detect. It should be regarded as Little Known in Lao PDR.

Phodilus badius **Oriental Bay Owl** (= Bay Owl, ^K, ^T). Resident; north[B9], centre[B10], south[B2]. Evergreen forest, including quite fragmented areas, from plains up to at least 890 m. *Special Significance:* CITES Appendix II.

Strigidae: Typical owls (14-15 species)

Otus spilocephalus **Mountain Scops Owl**. Resident; north[B1], centre, south[B2]. Evergreen forest and secondary growth, across a wide altitudinal range including the extreme lowlands. *Special Significance:* CITES Appendix II.

Otus sunia **Oriental Scops Owl** (included in *O. scops* Common Scops Owl by ^K, ^Sm[2]). Resident at least locally, probably augmented by winter visitors; north[B1], centre[B10], south[B2]. Open deciduous and, locally, evergreen forest, secondary growth; mainly lowlands and foothills. *Special Significance:* CITES Appendix II.

Otus bakkamoena **Collared Scops Owl** (= Indian Scops Owl, ^Sm[2]); (separated as *O. lempiji* Collared Scops Owl by ^Sm[1], ^T). Resident; north[B1], centre[B10], south[B2]. Forest, especially evergreen forest or riverine tall forest within open areas; up to at least 1700 m. *Special Significance:* CITES Appendix II.

• *Bubo nipalensis* **Spot-bellied Eagle Owl**. *Conservation Significance:* Globally Near-Threatened; Potentially At Risk in Lao PDR; CITES Appendix II. *Documented Range and Habitat:* Resident; north[B7], south[B5]. Forests, particularly near rivers; from lowlands to at least 1200 m. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). Historically, singles were recorded twice in Xiangkhouang Province (Delacour and Jabouille 1927, David-Beaulieu 1944). In 1992-1996, singles (provisionally identified) were heard in the Xe Namnoy catchment and Phou Khaokhoay NBCA. In 1997-1998, birds were seen in Dong Ampham NBCA, on the Dakchung Plateau and in Nam Ghong Provincial PA, and heard in Nam Theun Extension and Dong Khanthung PNBCAs (Davidson *et al*. 1997, Tobias 1997, Round 1998, Showler *et al*. 1998a; RJTiz). Nocturnal habits and presumed seasonal calling make large owls difficult to survey in Lao PDR. However, recent survey teams have included people familiar with this species's calls and the results suggest that while it is widespread (records from nine recent survey areas, including provisional identifications; Table 11), densities are probably low. It is the most numerous owl in captivity. Records around Vientiane include singles in a beer garden on the road to Ban Thadua (1995) and at Ban Keun zoo (1997), and three at the Vientiane Cultural Park in 1995 (RJTiz). A captive seen in Nam Et NBCA was reportedly caught locally (Davidson 1998). This recent information urges reclassification from Little Known in Lao PDR (as in Thewlis *et al*. 1998) to Potentially At Risk in Lao PDR.

• *Ketupa zeylonensis* **Brown Fish Owl**. *Conservation Significance:* Potentially At Risk in Lao PDR; CITES Appendix II. *Documented Range and Habitat:* Resident; north (historically[B21]), centre (historically[B22]), south[B2]. Forested streams and perhaps other shaded areas with surface water. *Status Information:* There are records from few recent survey areas (Table 11). Additionally, one thought to be this species was heard along the Xe Kong in Xekong Province in December 1997 (PD). Pending clarification of the vocal repertoire of all three species in *Ketupa*, only identifications based on plumage are accepted here; call-based records are regarded as provisional. This has involved some modification of identifications in survey reports. A captive was seen at a small zoo in Vientiane in early 1995 (RJTiz). Unidentified fish owls were found at various sites in 1994-1998 (Duckworth *et al*. 1998a, Round 1998), but never commonly. The few records doubtless partially reflect the difficulties of detecting and identifying fish-owls in Lao PDR. However, in Xiangkhouang and Savannakhet Provinces the species was formerly very common and was frequently flushed from roadside buffalo wallows at night (David-Beaulieu 1944, 1949-1950). It was also considered to be common along the Mekong of north Lao PDR (Delacour and Greenway 1940a) and was recorded at several sites in the south (Engelbach 1932). The paucity of recent records suggests that the species has declined and should be considered Potentially At Risk in Lao PDR.

• *Ketupa flavipes* **Tawny Fish Owl**. *Conservation Significance:* Globally Near-Threatened; Little Known in Lao PDR; CITES Appendix II. *Documented Range and Habitat:* Resident; north, centre[B9], south (provisionally[B14]). Forested streams and rivers and perhaps other shaded areas with surface water. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). Historically the species was recorded from two rivers in Xiangkhouang Province (David-Beaulieu 1944) and recently it has been confirmed from the Nam Theun Corridor PNBCA (feathers found), with provisional identifications from the Nakai Plateau and two parts of the Xe Kong basin. Feathers found in Nam Theun Extension PNBCA at 600 m and along the Nam Mon in Nakai-Nam Theun NBCA in 1997 were both confirmed as

this species (J. A. Tobias *in litt*. 1998). The species's nocturnal habits, presumed low density, close visual similarity to Buffy Fish Owl, and uncertainty over which calls may be shared with congeners make it difficult to identify, let alone survey.

[• *Ketupa ketupu* **Buffy Fish Owl**]. *Conservation Significance:* Little Known in Lao PDR; CITES Appendix II. *Documented Range and Habitat:* Resident; south (potentially[B2]; historically, provisionally[B19]). Forested streams and rivers and perhaps other shaded areas with surface water. *Status Information:* Fish owls either of this species or Tawny were recorded in Xe Pian NBCA in 1992-1993 (Thewlis *et al*. 1996) and in Nakai Plateau and Nakai-Nam Theun NBCA in 1994 (Evans and Timmins 1998). The only historical claim appears to be of a young bird taken at Ban Thateng (Bolaven Plateau) on 16 December 1931 (Engelbach 1932). Fish owls are difficult to identify to species (especially as young). The other irregular identifications of this author (e.g. Black-billed Malkoha, Blyth's Hawk Eagle) urge that this record be regarded as provisional unless the specimen can be traced. The lack of understanding of the species's status and the possibility that its habitat is under elevated threat suggest that it should be considered Little Known in Lao PDR.

• *Strix seloputo* **Spotted Wood Owl**. *Conservation Significance:* Little Known in Lao PDR; CITES Appendix II. *Documented Range and Habitat:* Resident; south (Robson 1997b). Recent Lao records came from open deciduous forest and isolated clumps of tall trees near major rivers, both in lowlands. *Status Information:* One heard (provisionally) on the Xe Kong plains (Xe Pian NBCA) on 3 March 1993 (Thewlis *et al*. 1996) and one heard near Ban Hangkhon (Champasak Province) in May 1997 (P. Davidson in Robson 1997b; PD). Although there is yet neither specimen nor sight record from Lao PDR, PD is familiar with the species's calls from Thailand. This species is likely to have a limited range in Lao PDR. Habitat use is unclear and so the species is best considered Little Known in Lao PDR.

Strix leptogrammica **Brown Wood Owl**. Resident; north (provisionally, WGR; historically[B21]), centre[B10], south[B2]. Evergreen forests and evergreen patches and riverine strips within deciduous forest. Altitudinal range in Lao PDR unclear; recorded up to at least 1600 m. With few recent records, the species's conservation status should be reconsidered at regular intervals. *Special Significance:* CITES Appendix II.

Glaucidium brodiei **Collared Owlet**. Resident; north[B1], centre, south[B2]. Evergreen forest across a wide altitudinal range, at least locally down to 150 m. *Special Significance:* CITES Appendix II.

Glaucidium cuculoides **Asian Barred Owlet**. Resident; north, centre, south[B2]. Forests (possibly commonest in mixed deciduous), secondary growth, scrub, up to at least 1200 m. *Special Significance:* CITES Appendix II.

Athene brama **Spotted Owlet**. Resident; centre, south[B2]. Dry dipterocarp and other open lowland forest. *Special Significance:* CITES Appendix II.

Ninox scutulata **Brown Hawk Owl**. Resident; north, centre, south[B2]. Fragmented forests, cultivation; often hunts in open areas and near water. Occurs up to at least 1050 m. *Special Significance:* CITES Appendix II.

Asio otus **Long-eared Owl**. Winter visitor; north (historically, David-Beaulieu 1948). Sole Lao record from a large garden in Xiangkhouang on 21 October 1946 (David-Beaulieu 1948). *Special Significance:* CITES Appendix II.

Asio flammeus **Short-eared Owl**. Winter visitor; north (historically[B21]). Habitat in Lao PDR unknown, probably open grasslands and wetlands. *Special Significance:* CITES Appendix II.

Conservation Management and Research Proposed for Owls:

- Conservation of forested wetlands both within and outside NBCAs, for fish owls and the large number of other species they support.
- Surveys of nocturnal birds, with a focus on large owls, to clarify which merit conservation intervention.
- National legal protection of all large owls from killing, capture, nest-robbery and being kept in captivity.
- Monitoring and control of trade and keeping of small owls.
- Investigation of international trade in owls; several species were imported into Japan in the 1980s under CITES documentation indicating Lao PDR as the point of origin or export (Annex 2). Their true origin is unknown.
- Public awareness campaigns. Attitudes to owls vary across the country and greater emphasis on the value of some species as predators of crop pests would be valuable. The existing WCS/CPAWM poster campaign to this effect should be continued.

Batrachostomidae: Asian frogmouths (2 species)

Batrachostomus hodgsoni **Hodgson's Frogmouth**. Resident north[B8], centre[B7], south[B12]. Evergreen forests, secondary growth, generally over 900 m.

Batrachostomus javensis **Javan Frogmouth** (separated as *B. affinis* Blyth's Frogmouth by ^Sm). Resident; north, centre (provisionally[B14]), south[B11]. Forests and secondary growth

(including heavily fragmented areas) largely below 650 m. Records prior to 1997 were reviewed by Thewlis *et al*. (1998). It was dropped from the recommended list of key species in view of its apparently secure status: birds were heard in most areas with substantial nocturnal survey work at suitable altitude. The species was first recorded for Lao PDR in 1993. All records are based on calls heard. Early records were provisional as no surveyor was experienced at identifying calls of frogmouths to species. In 1997 and 1998, two observers with considerable previous experience affirmed the identification (JAW, PDR).

Eurostopodidae: Eared nightjars (1 species)

Eurostopodus macrotis **Great Eared Nightjar**. Resident; north[B1], centre, south[B2]. Forests, secondary growth, scrub and cultivation below 600 m.

Caprimulgidae: Typical nightjars (4 species)

Caprimulgus indicus **Grey Nightjar**. Seasonal status unclear; north[B2], centre[B17], south[B5]. Open forest, scrub, across a wide altitudinal range. Records prior to 1997 were reviewed by Evans *et al*. (in prep. a). A bird in Hin Namno in late February 1998 was calling (DAS), suggesting the possibility of breeding; winter visitors are also likely to occur.

Caprimulgus macrurus **Large-tailed Nightjar**. Resident; north[B9], centre, south[B2]. Open wooded areas, scrub and cultivation, mostly below 650 m.

Caprimulgus asiaticus **Indian Nightjar**. Resident; north (Robson 1997b), south[B11]. Open deciduous forest, scrub and cultivation. Delacour and Jabouille (1940) indicate central Lao PDR within the range of the species, but we have not traced a primary record.

Caprimulgus affinis **Savanna Nightjar**. Resident; north (RJTiz), centre (historically[B22]), south[B2]. Open deciduous forest, rocky savanna. The record from Houay Nhang NR in 1995 listed as provisional in Duckworth *et al*. (1998a) has been confirmed (RJTiz). With few recent records, the species's conservation status should be reconsidered at regular intervals.

Columbidae: Pigeons, doves (19-21 species)

[*Columba livia* **Rock Pigeon**]. Introduced resident, viability of feral populations unclear; north[B2], centre (JWD), south[B2]. Towns and the neighbourhood of large villages. Domestic birds are common. There does not yet seem to be any documentation of feral populations or even any record of wild breeding. The level of harvesting of medium-sized birds in inhabited areas perhaps makes it unlikely that feral populations are established.

Columba hodgsonii **Speckled Wood Pigeon**. Presumed winter visitor; north[B6]. Sole Lao record was in evergreen forest at 1350 m, in February 1997 in Nam Ha NBCA (Tizard *et al*. 1997).

• *Columba pulchricollis* **Ashy Wood Pigeon**. *Conservation Significance:* Little Known in Lao PDR. *Documented Range and Habitat:* Presumed resident; north (TDE). Presumed to inhabit montane forest. *Status Information:* Sole Lao record was of a freshly-killed bird in Ban Phonsavan market (Xiangkhouang Province) in February 1999 (TDE). If the species is indeed resident, as a large edible bird in north Lao PDR it is likely to be hunted heavily and it is therefore categorised as Little Known in Lao PDR.

• *Columba punicea* **Pale-capped Pigeon**. *Conservation Significance:* Globally Threatened - Vulnerable; Little Known in Lao PDR. *Documented Range and Habitat:* Seasonal status unclear, but probably resident subject to local movements; north[B14], south[B14]. Forest including open deciduous areas and secondary growth; records from 300 to 850 m. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998); there are recent records of small flocks from two areas showing no obvious similarity (evergreen forest in Nam Kading NBCA and open bushy savanna on the Bolaven Plateau) and historical records from the Bolaven Plateau (Engelbach 1927, 1932).

Streptopelia orientalis **Oriental Turtle Dove**. Seasonal status unclear, breeds in at least north, with numbers augmented by winter visitors; north[B9], centre, south[B2]. Open deciduous and semi-evergreen forests, secondary growth, scrub, margins of cultivation, up to at least 1200 m.

Streptopelia chinensis **Spotted Dove**. Resident; north, centre, south[B2]. Open country, cultivation, open deciduous forest and secondary growth, up to at least 1450 m.

Streptopelia tranquebarica **Red Collared Dove** (= Red Turtle Dove, ^K, ^T). Seasonal status unclear, breeds in at least south; north (historically[B21]), centre (historically[B22]) south[B2]. Open deciduous forest and adjacent scrub and secondary growth of lowlands; non-breeding birds up to at least 1200 m (David-Beaulieu 1944). There have been no recent records of non-breeding flocks or of any birds in north or central Lao PDR, suggesting that the population may have declined (August and September flocks formerly exceeded 100 birds). The species's conservation status should be reconsidered at regular intervals.

Macropygia unchall **Barred Cuckoo Dove**. Resident; north, centre[B10], south[B2]. Evergreen forest, secondary growth; mainly in hills and mountains, rare in extreme lowlands.

• *Macropygia ruficeps* **Little Cuckoo Dove**. *Conservation Significance:* Potentially At Risk in Lao PDR. *Documented Range and Habitat:* Resident; north (historically[B21]). Montane areas, lower (down to 1200 m) during rainy season. *Status Information:* There are no recent records, although historically Little Cuckoo Dove was recorded widely in the north. It was sometimes noted as rare (David-Beaulieu 1944) but more often as common (Delacour and Jabouille 1927, Delacour and Greenway 1940a); records are also given by Delacour (1929b), Bangs and Van Tyne (1931) and Dickinson (1970a, 1970b). This contrast suggests that the species may have declined, although the lack of a plausible reason means it can only be considered Potentially At Risk in Lao PDR.

Chalcophaps indica **Emerald Dove** (= Green-winged Pigeon, ^K). Resident; north, centre, south[B2]. Evergreen and dense deciduous forests, and adjacent secondary growth up to at least 1400 m.

[*Geopelia striata* **Peaceful Dove** (= Zebra Dove, ^Sm, ^T)]. Potential introduced resident; north (TDE). Degraded areas. First recorded on 17 October 1998: a single over rice paddies on the outskirts of Vientiane (TDE). Twelve near Ban Thadua in late February 1999 included some singing birds, suggesting that breeding may be occurring (PD). Introduced populations occur in Thailand (King *et al*. 1975) and it seems possible that the species will become established in parts of Lao PDR. Peaceful Dove is not kept commonly, if at all, in Lao PDR and these birds are assumed to have dispersed from Thailand. The species is retained as provisional not because identification is in doubt, but because it is unclear if a population is already established.

• *Treron bicincta* **Orange-breasted Green Pigeon** (= Orange-breasted Pigeon, ^K, ^T). *Conservation Significance:* Potentially At Risk in Lao PDR. *Documented Range and Habitat:* Resident; south[B2]. Open lowland deciduous forest and adjacent evergreen riverine forest and secondary areas. *Status Information:* The only historical record of this species is from dense forest at the southern foot of the Bolaven Plateau (Engelbach 1932). Recently it has been recorded only from Champasak and Attapu Provinces (including five survey areas; Table 11), specifically from Xe Pian NBCA (locally frequent), the lower Xe Namnoy (flocks of up to 20), Ban Samkhang beside the southern Mekong, in Nam Ghong Provincial PA (one in a hunter's bag) and commonly (daily maximum 40) in Dong Khanthung PNBCA (Thewlis *et al*. 1996, Duckworth *et al*. 1998a, Round 1998; RJTim). In occurrence and habitat use it is similar to Yellow-footed Green Pigeon and, although no historical decline can be demonstrated, the species is likely to be at risk for similar reasons and so is best considered Potentially At Risk in Lao PDR.

• *Treron pompadora* **Pompadour Green Pigeon** (= Pompadour Pigeon, ^K, ^T). *Conservation Significance:* At Risk in Lao PDR. *Documented Range and Habitat:* Resident; north[B1], centre (historically; Robinson and Kloss 1931), south (historically[B19]). Habitat use unclear, but the species is now very local and may be restricted to some particular types of lowland forests and adjacent secondary growth. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). The only known recent site is Sangthong District (where presence was re-affirmed in April 1997; PD). Historically, records come from five widely-separated areas. All records, historical and recent, come from lowland areas; Salavan (Engelbach 1932) is the only site not close to the Mekong.

Treron curvirostra **Thick-billed Green Pigeon** (= Thick-billed Pigeon, ^K, ^T). Resident; north[B1], centre, south[B2]. Forests (mainly lowland and evergreen), sporadically in secondary growth, cultivation; up to at least 1000 m.

• *Treron phoenicoptera* **Yellow-footed Green Pigeon** (= Yellow-footed Pigeon, ^K, ^T). *Conservation Significance:* At Risk in Lao PDR. *Documented Range and Habitat:* Resident; centre (historically[B22]), south[B14]. Open lowland deciduous forest and adjacent evergreen riverine forest; formerly also cultivation, scrub and gardens (e.g. David-Beaulieu 1949-1950). *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). Recently, the species has only been found in four survey areas (Table 11), including the Xe Kong basin (centred upon Xe Pian NBCA), Ban Hangkhon (Champasak Province; Cunningham 1998) and Dong Khanthung PNBCA (Round 1998). Historically it was found widely in the south and centre. The Xe Pian area supports large numbers, but for reasons unclear Dong Khanthung PNBCA seems not to do so (Round 1998). The species has not been recorded in some potentially suitable areas such as Dong Ampham NBCA, Phou Kathong PNBCA (the record in Davidson *et al*. 1997 was far from both of these) and Nam Ghong Prov. PA. These largely hilly areas have only very little of the level lowland habitat apparently favoured by this species. Only Xe Pian NBCA and Dong Khanthung PNBCA have extensive areas of such habitat.

Treron apicauda **Pin-tailed Green Pigeon** (= Pin-tailed Pigeon, ^K, ^T). Resident, probably making local movements; north[B9], centre[B10], south[B2]. Evergreen and mixed deciduous forests, secondary growth at 200-1200 m.

• *Treron seimundi* **Yellow-vented Green Pigeon** (= Yellow-vented Pigeon, ^K, ^T). *Conservation Significance:* Globally Near-Threatened; endemic to South-east Asia. Not At Risk

in Lao PDR. *Documented Range and Habitat:* Resident, probably making local movements; north, centre[B14], south[B5]. Evergreen forest and adjacent secondary growth from 250 to at least 1000 m. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). First found in 1994, the species has been found in six survey areas along the Annamites from Nam Theun Extension PNBCA south to Dong Ampham NBCA (Table 11). The number and spread of recent records means that the species can no longer be considered as Little Known in Lao PDR.

Treron sphenura **Wedge-tailed Green Pigeon** (= Wedge-tailed Pigeon, ^K, ^T). Resident, subject to local movements; north[B6], centre[B9], south (historically[B19]). Evergreen forests and adjacent secondary growth, generally over 800 m. Records prior to 1996 were reviewed by Duckworth *et al*. (1998a). There are several subsequent sightings including an astonishing record of a single on a wooded Mekong sand bank in Vientiane (165 m) on 21 November 1998 (TDE). Green pigeons are not kept in cages in Lao PDR commonly, if at all, and this individual was presumably a natural wanderer. With few recent records, the species's conservation status should be reconsidered at regular intervals.

• *Treron sieboldii* (= *T. seiboldii*, ^K) **White-bellied Green Pigeon** (= White-bellied Pigeon, ^K, ^T). *Conservation Significance:* Globally Near-Threatened; Little Known in Lao PDR. *Documented Range and Habitat:* Status unclear; north (TDE), centre[B10]. All Lao records are from degraded forest at 400-520 m. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). First found in 1994, there remain only a few field observations of the species, all from around the Nam Theun catchment (Table 11). An unpublished record is of one in unencroached semi-evergreen forest just south of Nam Kading NBCA in February 1999 (TDE). Several birds seen for sale in the Ban Lak (20) market allowed in-the-hand confirmation of the species's identification.

• *Ducula aenea* **Green Imperial Pigeon**. *Conservation Significance:* At Risk in Lao PDR. *Documented Range and Habitat:* Resident; north (historically[B18]), centre, south[B14]. Lowland open semi-evergreen and deciduous forests with riverine evergreen strips; sometimes within mature semi-evergreen forest. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). Formerly widespread in Lao PDR (reported in almost all historical sources), and specifically described as common in many areas, Green Imperial Pigeon has recently been found in groups exceeding six only along the Xe Pian river and in Dong Khanthung (although numbers in the latter were lower in 1998; Round 1998). Small numbers were found in 12 survey areas, 11 in south Lao PDR (Table 11). The record from Nam Theun Extension PNBCA in Tobias (1997) has been withdrawn (J. A. Tobias *in litt*. 1999).

Ducula badia **Mountain Imperial Pigeon**. Resident; north[B10], centre, south[B2]. Evergreen forests and adjacent open areas; chiefly in hills and mountains, rare in extreme lowlands. Under local decline in areas where hunting is heavy (e.g. Phou Khaokhoay NBCA) but still too common and widespread to be considered a key species. Nonetheless, the species's conservation status should be reconsidered at regular intervals.

Conservation Management and Research Proposed for Pigeons and doves:

- Development and implementation of harvesting and trade controls, focussing on species at risk. Species are hunted and sold for food across the country (Baird 1993, Salter 1993a, Annex 1). Thick-billed Green Pigeon and Mountain Imperial Pigeon were among the most commonly sold wild birds at the That Luang fresh food market in Vientiane (Srikosamatara *et al*. 1992), reflecting their abundance in the wild. Other species are probably taken in proportion. Controls must recognise that field identification to species within the various genera is difficult. A nation-wide ban on the hunting of all green pigeons would prevent access to some important protein sources, while banning hunting only of the scarce species would be unenforceable. A better solution would be to focus on protected areas supporting the key species and enforce anti-hunting legislation applicable to all species within them. Some species may be nomadic, adding further complication to their conservation. Particularly important are the protected areas of the Xe Kong basin, Dong Khanthung PNBCA, Nakai-Nam Theun NBCA and the unprotected Sangthong District.
- Termination of large-scale clap-netting (especially at salt licks; Round 1998) in all conservation areas and in areas outside the protected area system supporting any key species of green pigeon.
- Field investigation of reasons behind the restricted distribution and general scarcity of Pompadour Green Pigeon and Pale-capped Pigeon, and the apparent declines in Little Cuckoo Dove and migratory populations of Red Collared Dove.

Gruidae: Cranes (1 species)

• *Grus antigone* **Sarus Crane**. *Conservation Significance:* Globally Near-Threatened; At Risk in Lao PDR; CITES Appendix II. The subspecies occurring in Lao PDR (*G. a. sharpei*; endemic to South-east Asia) is critically threatened (Maine and Archibald 1996). *Documented Range and Habitat:* Seasonal status unclear; centre (provisionally[B14]; historically[B22]), south[B14]. Marshes and pools in open deciduous forest, exceptionally paddy-fields. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998).

The species used to be widespread in south and central Lao PDR, but recent observations come only from Xe Pian NBCA and Dong Khanthung PNBCA, with villager reports from nearby Dong Hua Sao NBCA (Table 11). Evidence from captive birds suggested that small numbers still visited and even attempted breeding in the wetlands south and east of Savannakhet into the late 1980s. Two were reported near Ban Sompoy (Xe Pian NBCA) in November 1997 to Robichaud (1998e), but the only post-1996 record is of a single in Dong Khanthung PNBCA on 24 July 1998 (Round 1998).

Conservation Management and Research Proposed for Cranes:

- Enforcement of existing ban on hunting and trade, with special attention to nest robbing. Cranes are at higher risk from opportunistic theft of eggs and chicks than are other large waterbirds, as they nest on the ground. Thus effective protection of nesting areas may best involve regulation of entry or passage for any purpose.
- Protection of remaining nesting and feeding habitat (in Xe Pian NBCA, Dong Khanthung PNBCA and any other areas found to support the species) by drafting and enforcement of appropriate protective measures with stiff penalties for violators.
- Education campaigns in all areas still supporting the species.
- Investigation of wetlands in Savannakhet Province, to check if cranes remain.

Heliornithidae: Finfoots (1 species)

• *Heliopais personata* **Masked Finfoot**. *Conservation Significance:* Globally Threatened - Vulnerable; At Risk in Lao PDR. *Documented Range and Habitat:* Seasonal status unclear, but probable wet-season breeder; south[B14]. Lowland sluggish rivers and streams amid open forest. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). First recorded in 1993, finfoots have been found quite widely in the Xe Kong basin, including in two existing and two proposed NBCAs (Xe Pian, Dong Ampham, Phou Kathong and Bolaven Southwest) and in Dong Khanthung PNBCA (Davidson *et al*. 1997, Round 1998, Thewlis *et al*. 1998).

Conservation Management and Research Proposed for Finfoots:

- Complete year-round legal protection from hunting.
- Protection of remaining nesting and feeding habitat (in the Xe Kong basin, Dong Khanthung PNBCA and any other areas found to support the species) by drafting and enforcement of appropriate protective measures with stiff penalties for violators.
- Education campaigns throughout the species's Lao range.
- River catchment conservation measures as populations are likely to be spread along rivers, indicating that site-specific management is probably insufficient to conserve viable populations.
- Field investigation of major threats to the species, particularly the balance between direct persecution and indirect disturbance.

Rallidae: Rails, crakes, waterhens, coots (11-12 species)

[*Rallina fasciata* **Red-legged Crake**]. Seasonal status unclear; south (provisionally[B11]). Pools amid lowland deciduous forest. First recorded from Lao PDR in July 1998, when calling birds were heard at several localities in Dong Khanthung PNBCA (Round 1998). No birds were seen and the surveyor documented the records as provisional.

Rallina eurizonoides **Slaty-legged Crake**. Seasonal status unclear; south (Evans *et al*. 1996b). Sole observation in Lao PDR was of a bird in a wet runnel in closed-canopy dry evergreen forest at 400 m in 1996, in Dong Hua Sao NBCA (Evans *et al*. 1996b; TDE). An earlier reference to the species in Lao PDR (Wells and Medway 1976) was in error as the site (Ok Yam) is on the coastal Cambodia - Thai border (Robinson 1915: 720).

Gallirallus striatus (= *Rallus striatus*, ^K, ^T) **Slaty-breasted Rail**. Presumed resident; north (historically[B21]), centre (historically[B22]), south[B2]. Wetlands. With few recent records, the species's conservation status should be reconsidered at regular intervals.

Rallus aquaticus **Water Rail**. Winter visitor; north (historically[B21]). Wetlands. Lao records of this species were reviewed by David-Beaulieu (1944). Three specimens were reported from a Vientiane market by Srikosamatara *et al*. (1992) but their identification and origin are unclear (B. Siripholdej verbally 1999).

Amaurornis phoenicurus **White-breasted Waterhen**. Resident; north[B1], centre, south[B2]. Most types of wetlands with access to dense cover, although generally not on fast-flowing streams or small forest wetlands; up to at least 1100 m.

• *Porzana bicolor* (= *Amaurornis bicolor*, ^Sm) **Black-tailed Crake**. *Conservation Significance:* Little Known in Lao PDR. *Documented Range and Habitat:* Resident; north (historically[B21]). Dense marshy brushland at mid - high altitudes. *Status Information:* Recorded only in Xiangkhouang (David-Beaulieu 1944) and Phongsali Provinces (Bangs and Van Tyne 1931). The species is very skulking and difficult to record (David-Beaulieu 1944, Inskipp and Round 1989). The lack of recent records means little, as David-Beaulieu used a

specially trained dog to find the birds. The species should be treated as Little Known in Lao PDR.

Porzana pusilla **Baillon's Crake**. Seasonal status unclear, perhaps passage migrant; north (historically[B21]). Marshes.

Porzana fusca **Ruddy-breasted Crake**. Presumed resident; north (RJTiz), centre (provisionally[B10]), south[B2]. Marshes. There are very few recent field records of this species. Presence in the north and [centre] was based on market specimens. Delacour and Jabouille (1940) implied that this species occurred in central Lao PDR but we have not traced a primary reference. A bird from Ban Lak (20) market is listed here as provisionally in central Lao PDR, as it could have been harvested in a nearby part of north Lao PDR. With few recent records, the species's conservation status should be reconsidered at regular intervals.

• *Gallicrex cinerea* **Watercock**. *Conservation Significance:* At Risk in Lao PDR. *Documented Range and Habitat:* Seasonal status unclear; north[B9], centre (historically[B22]), south[B2]. Marshes, margins of lakes and large pools, and probably paddy-fields if persecution were controlled. *Status Information:* Recently, Watercock has been found at five survey areas scattered across the country (Table 11), with counts mostly of only single birds, at the following sites: Northern Zone wetlands of Xe Pian NBCA (December 1992 - January 1993), the degraded lowlands of Dong Hua Sao NBCA (May - July 1993), near Ban Nakhay (Phou Khaokhoay NBCA; April - May 1995), Nam Kan PNBCA in April 1997 and Dong Khanthung PNBCA in July 1998 (Thewlis *et al*. 1996, Pasquet 1997, Duckworth *et al*. 1998a, Round 1998). Historically, it was recorded by all resident ornithologists, in Xiangkhouang (uncommon passage migrant in May and August - October) and Savannakhet Provinces (small numbers in the wet season, apparently breeding) and, once only, at Salavan (Engelbach 1932, David-Beaulieu 1944, 1949-1950). Most wetlands sustain heavy extractive use, including trapping of rails and opportunistic shooting of birds. Taken together, these features suggest that the species is At Risk in Lao PDR.

• *Porphyrio porphyrio* **Purple Swamphen**. *Conservation Significance:* At Risk in Lao PDR. *Documented Range and Habitat:* Seasonal status unclear; north[B9], centre (historically[B22]), south[B2]. Shallow marshes with extensive emergent or fringing vegetation; less numerous in other wetlands. *Status Information:* January counts during 1989-1992 from wetlands around Vientiane were, respectively, 43, 19, 27 and 5 birds, at 2, 4, 5 and 3 sites (Scott and Rose 1989, Perennou *et al*. 1990, Perennou and Mundkur 1991, 1992). These sites have not been checked recently. The species has been found in three recent survey areas (Table 11), with up to three birds seen frequently in the Northern Zone of Xe Pian NBCA in winter 1992-1993 (Claridge 1996, Thewlis *et al*. 1996) and small numbers found at Ban Nakhay (Phou Khaokhoay NBCA) and on Nong Lom (Bolaven Plateau) in spring 1995 (Duckworth *et al*. 1998a). Small numbers (under 12) were seen regularly at Nong Lom during 1996-1998 (RJTiz). Historically, the species was found in the rainy and early dry seasons at 3-4 wetlands in Savannakhet Province (David-Beaulieu 1949-1950), and, rarely, at a small lake near Salavan (Engelbach 1932). Six were taken near Vientiane (Bangs and Van Tyne 1931). Numbers are currently low (in areas of Indochina where the species is not persecuted, loose groups of dozens, even hundreds, can be observed) and the species is presumably threatened by the same factors as Watercock and should also be considered At Risk in Lao PDR.

Gallinula chloropus **Common Moorhen**. Seasonal status unclear, certainly present in winter; north[B1], centre[B10], south[B2]. Marshes and other standing water, exceptionally in slow forest streams.

Fulica atra **Common Coot** (= Eurasian Coot, ^T). Presumed winter visitor; north (historically[B21]), south[B2]. Large shallow pools with extensive open water. There are only two Lao records (David-Beaulieu 1944, Thewlis *et al*. 1996).

Conservation Management and Research Proposed for Rails, crakes and coots:

- Specific surveys of wetlands to clarify the status of all species and allow the identification of important sites; wetlands have fallen largely outside the scope of recent general surveys. Resumption of winter counts (see Purple Swamphen) would focus activity.
- Management of extensive wetland areas, primarily in a multiple use context, to maintain suitable water regimes and vegetation cover. Wetlands of national importance include those in and around the complex of Xe Pian and Dong Hua Sao NBCAs and Xe Khampho and Bolaven Southwest PNBCAs, and Dong Khanthung PNBCA. Other areas may be of equivalent importance.
- Control of hunting and trade where necessary. White-breasted Waterhen was frequently observed for sale in the That Luang fresh food market in Vientiane (Annex 1) and elsewhere; its population remains healthy, but numbers of Watercock and Purple Swamphen seem to be well below carrying capacity.
- Field investigation of hunting and trapping practices.

Scolopacidae: Woodcocks, snipes, curlews, sandpipers, phalaropes (21-22 species)

Scolopax rusticola **Eurasian Woodcock**. Winter visitor; north[B2], centre[B10], south[B2]. Shady stream and river banks, especially within forest, occasionally damp forest areas and non-wooded but well vegetated ditches etc. Occurs up to 1700 m.

Plate 11:

Crested Argus, Ban Lak (20), Bolikhamxai Province, March 1997. Healthy populations remain of this Globally Threatened species in some areas but it faces several threats. *W. G. Robichaud / WCS.*

Male Siamese Fireback, Xe Pian NBCA, early 1997. Camera-trapped. Lao PDR probably holds the largest national population of this species. *WWF Thailand / FOMACOP.*

Green Peafowl, Phou Khaokhoay, March 1994. A specific project is now operating in the area to conserve the species. *T. D. Evans / WCS.*

Rufous-necked Hornbill casque, Xam-Nua, Houaphan Province, January 1998. This Globally Threatened species has a restricted distribution in Lao PDR. *P. Davidson / WCS.*

River Lapwing, Nam Theun catchment, mid 1996. Sandbar-nesting waders such as this are under widespread decline in Lao PDR. *C. A. Hills and V. Morris.*

Spot-billed Pelican, Pakxe, Champasak Province, January 1997. This Globally Threatened species is now apparently only an irregular visitor to Lao PDR. This one was found ailing near Dong Khanthung NBCA in 1996 and brought into captivity. *W. G. Robichaud / WCS.*

White-winged Duck, Dong Khanthung PNBCA, July 1998. One of three ducklings of this Globally Threatened species that were captured for pets. *B. L. Stuart / WCS.*

Lesser Adjutant, Pakxe, Champasak Province, November 1992. This Globally Threatened species has declined massively in Lao PDR. These two pets in a fish restaurant were reportedly taken from the nest. *T. D. Evans.*

• *Gallinago nemoricola* **Wood Snipe**. *Conservation Significance:* Globally Threatened - Vulnerable; Little Known in Lao PDR. *Documented Range and Habitat:* Winter visitor; north (historically[B21]); centre[B9]. Recent records from wide forest rivers at 520 m. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). Historical records come only from Xiangkhouang Province (David-Beaulieu 1944), recent observations only from the Nakai Plateau (four singles in 1995). Assessing this species's status is difficult, as it is a skulking bird, but it is sufficiently distinctive from other snipes to suggest that it would be only rarely overlooked. The listing in Table 7 of Srikosamatara *et al*. (1992) was an editorial error for Wood Sandpiper.

Gallinago stenura **Pintail Snipe**. Winter visitor; north[B2], centre[B9], south[B2]. Marshy areas, paddy-fields; occasionally along forest rivers. The species's similarity to Swinhoe's Snipe make it difficult to determine status, but previous specimen records indicate that most or all such birds observed recently are likely to be Pintail Snipe.

[*Gallinago megala* **Swinhoe's Snipe**]. Non-breeding visitor, perhaps vagrant; south (provisionally[B11]). Sole Lao record was from a sedge-bed. First recorded, albeit provisionally, for Lao PDR on 29 March 1997: two birds in Dong Khanthung PNBCA (JAW in Round 1998).

Gallinago gallinago **Common Snipe**. Winter visitor; north, centre, south[B2]. Marshes, paddy-fields, marshy stream and river banks.

Numenius arquata **Eurasian Curlew**. Non-breeding visitor; north (historically; see below). Wetlands. There are no published primary records, but two were seen by the Mekong 10 km west of Vientiane on 29 December 1962 by W. W. Thomas (*in litt*. to C. M. Poole 1999).

Tringa erythropus **Spotted Redshank**. Winter visitor; north[B9], centre[B10], south[B2]. Wide rivers, marshes, margins of pools, adjacent cultivation. Records prior to 1994 were detailed in Thewlis *et al*. (1996).

Tringa totanus **Common Redshank**. Winter visitor; north (Perennou and Mundkur 1991), centre[B9]. Habitat use in Lao PDR similar to congeners. Records prior to 1996 were reviewed in Duckworth *et al*. (1998a). Delacour and Jabouille (1940) listed the species for south Lao PDR but we have traced no individual records.

Tringa stagnatilis **Marsh Sandpiper**. Winter visitor; north[B10], centre[B9]. Marshy margins of pools, sand-bars in wide slow-flowing rivers. Delacour and Jabouille (1940) implied that the species occurred in south Lao PDR, but we have traced no individual records.

Tringa nebularia **Common Greenshank**. Winter visitor; north[B2], centre[B10], south[B2]. Marshes, pools, wide slow-flowing rivers.

Tringa ochropus **Green Sandpiper**. Winter visitor; north[B1], centre, south[B2]. Shady pools, slow forest rivers, occasionally around other surface water.

Tringa glareola **Wood Sandpiper**. Winter visitor; north[B2], centre[B10], south[B2]. Marshes, short flooded vegetation, including cultivated areas; sand-bars in wide slow-flowing rivers.

Xenus cinereus (= *Tringa cinerea*, ^Sm) **Terek Sandpiper**. Vagrant; north (historically[B21]). Sole Lao record was in rice paddies at 1150 m near Xiangkhouang (David-Beaulieu 1944).

Actitis hypoleucos (= *Tringa hypoleucos*, ^Sm) **Common Sandpiper**. Winter visitor; north, centre, south[B2]. Edge of all water-bodies.

Calidris alba (= *Crocethia alba*, ^K) **Sanderling**. Presumed passage migrant; south[B15]. Mekong sand-bars. First recorded in 1996 (Evans *et al*. in prep. a).

Calidris ruficollis **Red-necked Stint** (= Rufous-necked Stint, ^K, ^Sm, ^T). Presumed passage migrant; north (provisionally[B9]), centre[B16], south[B15]. Mekong sand-bars. After a provisional record in Vientiane on 21 November 1994 (RJTim), the first confirmed record for Lao PDR was in southern Champasak Province in May 1996 (Evans *et al*. in prep. a).

Calidris temminckii **Temminck's Stint**. Winter visitor; north[B2], centre[B16]; south[B15]. Margins of standing and slow-flowing water in and beside large rivers with much exposed sediment; likely also to use marshland but no records as yet from such habitat.

Calidris subminuta **Long-toed Stint**. Presumed passage migrant; north[B9], south[B15]. Mekong sand-bars. First recorded for Lao PDR in 1995 (Duckworth *et al*. 1998a).

Calidris alpina **Dunlin**. Non-breeding visitor; north[B9], south[B15]. The only Lao records were on Mekong sand-bars, in 1995, 1996 and 1998 (Duckworth *et al*. 1998a, Evans *et al*. in prep. a; J. N. Dymond per C. R. Robson *in litt*. 1999, TDE).

Calidris ferruginea **Curlew Sandpiper**. Presumed passage migrant; south[B15]. Mekong sand-bars. First recorded for Lao PDR in 1996 (Evans *et al*. in prep. a).

Philomachus pugnax **Ruff**. Presumed passage migrant; south[B15]. Mekong sand-bars. First recorded for Lao PDR in 1996 (Evans *et al*. in prep. a).

Phalaropus lobatus **Red-necked Phalarope**. Presumed passage migrant; south[B15]. Mekong sand-bars. First recorded for Lao PDR in 1996 (Evans *et al*. in prep. a).

Rostratulidae: Painted-snipes (1 species)

Rostratula benghalensis **Greater Painted-snipe**. Presumed resident; north (historically[B21]), centre (historically[B22]); south[B2]. Marshy areas and adjacent paddies and wet scrub. With few recent records, the species's conservation status should be reconsidered at regular intervals.

Jacanidae: Jacanas (2 species)

Hydrophasianus chirurgus **Pheasant-tailed Jacana**. Seasonal status unclear; north[B4], centre[B10], south[B2]. Marshes, pools with abundant floating, emergent or fringing vegetation.

Metopidius indicus **Bronze-winged Jacana**. Seasonal status unclear; north[B9], centre (historically[B22]), south[B2]. Marshes, pools with abundant floating, emergent or fringing vegetation.

Burhinidae: Thick-knees (2 species)

• *Burhinus oedicnemus* **Eurasian Thick-knee** (= Northern Thick-knee, ^T; = Stone-curlew, ^K). *Conservation Significance:* Little Known in Lao PDR. *Documented Range and Habitat:* Seasonal status unclear; south (RJTiz). Sole Lao record was in dry paddies and scrub at 80 m. *Recent Observations:* First recorded in February 1998: two at Ban Sompoy, Xe Pian NBCA (RJTiz). The species is listed as Little Known in Lao PDR because if it breeds, numbers may be very small, and large-bodied birds of open habitats are subject to high hunting pressure (see Thewlis *et al*. 1998).

• *Esacus recurvirostris* (= *Burhinus recurvirostris*, ^Sm) **Great Thick-knee** (included in *E. magnirostris* Great Thick-knee by ^K). *Conservation Significance:* At Risk in Lao PDR. *Documented Range and Habitat:* Presumed resident; north (Robson 1997b), centre (historically[B22]), south[B14]. Sedimentary features and rocks in very wide rivers. *Recent Observations:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). Formerly common on the Mekong and dispersing onto open plains in the wet season. Recent records are centred upon the Mekong in the far south, with records also of: five along the Xe Kong upstream of the inflow of the Xe Pian in April 1998 (JWKP), and, in the Mekong channel, singles at Paksang (Sangthong) on 31 May 1997 (RJTiz; note date is erroneous in Robson 1997b) and 31 December 1998 (R. Jelinek verbally 1999), and 2-3 on three March - May dates around the mouth of the Xe Bang-Nouan (Evans in prep.). At least around Ban Hangkhon (Champasak Province), fishing lines baited with worms are set at night to catch these birds (Cunningham 1998).

Charadriidae: Stilts, plovers, lapwings (12 species)

Himantopus himantopus **Black-winged Stilt**. Seasonal status unclear; north, centre[B2]. Mekong sand-bars, large shallow pools in open areas. Delacour and Jabouille (1940) implied that the species occurred in south Lao PDR but we have traced no primary record.

Pluvialis fulva **Pacific Golden Plover** (included in *P. dominica* Lesser Golden Plover by ^K). Passage migrant and winter visitor; north[B2], centre[B16], south (historically[B19]). Open areas, usually near water.

Pluvialis squatarola **Grey Plover**. Presumed passage migrant, perhaps only vagrant; north (TDE). Mekong sand-bars. The first Lao record was of two in Vientiane on 7 November 1998 (TDE).

• *Charadrius placidus* **Long-billed Plover**. *Conservation Significance:* Globally Near-Threatened; Little Known in Lao PDR. *Documented Range and Habitat:* Winter visitor; north[B9], centre (historically[B22]). Sedimentary features in rivers, perhaps favouring areas of gravel. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998) and there has been only one since, from Sangthong District on 31 December 1998 (R. Jelinek verbally 1999). There are only two other recent records (respectively from Nam Kading NBCA and the Mekong upstream of Vientiane); historically it was also only recorded sporadically. It was recorded for all Lao PDR by Delacour and Jabouille (1940) but we have traced no primary source for the south.

Charadrius dubius **Little Ringed Plover**. Presumed resident, with numbers augmented by winter visitors; north[B2], centre[B10], south[B2]. Sedimentary features in rivers, open parts of marshes, adjacent cultivation, airports.

Charadrius alexandrinus **Kentish Plover**. Winter visitor; north[B2], centre[B9], south (Evans *et al*. 1996a). Mekong sand-bars.

Charadrius mongolus **Lesser Sand Plover** (= Mongolian Plover, ^K, ^Sm). Non-breeding visitor; north (historically[B21]), centre (historically[B22]). Mekong sand-bars. Recent records of sand plovers (north[B2]; centre[B16]; south[B15]) were not identified to species. Records prior to 1994 were reviewed in Thewlis *et al*. (1996), who could trace no historical

source for the south, although the species is implied to occur there by Delacour and Jabouille (1940).

Charadrius leschenaultii **Greater Sand Plover**. Non-breeding visitor; centre (historically[B22]). Mekong sand-bars. Recent records of sand plovers were not identified to species. Records prior to 1994 were reviewed in Thewlis *et al*. (1996).

Vanellus vanellus **Northern Lapwing**. Winter visitor; north (Dymond 1995). Agricultural areas, open wetlands. First recorded for Lao PDR on 10 December 1995, when a flock of four was seen by the Mekong in Vientiane (Dymond 1995). On 25 December 1997, a flock of 15 flew over Vientiane (Robson 1998; PD).

• *Vanellus duvaucelii* **River Lapwing**. *Conservation Significance:* At Risk in Lao PDR. *Documented Range and Habitat:* Breeder, presumed resident with some seasonal dispersal; north, centre, south[B14]. Sedimentary features, in wide (over 20 m) slow rivers; occasionally river rocks. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998), and the species's conservation needs were considered in Duckworth *et al*. (1998b). River Lapwing was an abundant breeder on the many rivers with suitable habitat, but recently has disappeared from heavily settled areas. Numbers are depressed in areas with high numbers of villages and there are indications that breeding success is low in such areas (Duckworth 1996a, Cunningham 1998). Nonetheless, the species remains widespread in several catchments and along the Mekong itself, with records from 14 recent survey areas spread across the country (Table 11), and incidental sightings from various other sites. Concentrations occur on the Nakai Plateau (Plate 11), in parts of the Xe Kong basin and along various stretches of the Mekong. Most of these areas are unprotected. At least around Ban Hangkhon (Champasak Province), people reportedly do not eat the species as the taste is poor (Cunningham 1998); whether eggs are harvested is unclear. Cunningham's (1998) year-round observations at Ban Hangkhon found the species to be absent during July - mid November; how far the birds move and what habitats they use during the high flow season is unclear. The record in Showler *et al*. (1998a) was on the Xe Kong river well downstream of the Xe Sap.

• *Vanellus cinereus* **Grey-headed Lapwing**. *Conservation Significance:* Globally Near-Threatened; Potentially At Risk in Lao PDR. *Documented Range and Habitat:* Winter visitor; north, centre, south[B14]. Marshy areas with short vegetation and shallow water, short turf around pools, cultivation, sometimes river sand-bars from 80 to 1050 m. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). Historical sources recorded the bird only sporadically and in rather small numbers. Recently it has been found at many sites, with small numbers in or adjacent to several NBCAs, but the majority of the population probably lives in unprotected areas. As a non-breeding visitor which is likely to be mobile in response to various factors, specific locations cannot be pinpointed as of special importance, but the central Nakai Plateau, parts of the Xe Kong basin (particularly the Northern Zone of Xe Pian NBCA) and the Vientiane plain, and perhaps the extensive plains of Louang-Namtha Province are all of significance. Unpublished post-1996 records include two on the Mekong in central Vientiane on 7 February 1998 (JWD), 14 at Ban Sivilai (Vientiane Province) in October 1998 (JWKP), three by the Mekong 20 km upstream of Louangphabang in December 1998 (C. Poole verbally 1998) and 13 near Ban Nakhay (Phou Khaokhoay NBCA) in January 1999 (JWKP).

Vanellus indicus **Red-wattled Lapwing**. Resident; north (JWD), centre, south[B2]. Marshes, rivers, rice stubble, cultivation, open deciduous forest. This species is now scarce in some areas, e.g. there seems to be only one recent record from the north (a single at Nam Ngum reservoir on 6 December 1998; JWD), whereas David-Beaulieu (1944) found it very common throughout Xiangkhouang Province. There have been too few recent observations in suitable habitat in the north to allow strict comparison. While it remains too common and widespread to be considered even Potentially At Risk in Lao PDR today, the species's conservation status should be reconsidered at regular intervals.

Glareolidae: Pratincoles (2 species)

Glareola maldivarum **Oriental Pratincole**. Seasonal status unclear, probably primarily a passage migrant passing through in late dry season and late wet season, with no evidence of breeding; north[B2], centre[B16], south[B9]. Open country, marshy areas, dry-season river channels, up to at least 1200 m. Records prior to 1996 were reviewed by Duckworth *et al*. (1998a). Recent records are mostly of small groups, except for 500 on a Mekong sand-bar in Vientiane on 24 October 1998 (TDE).

• *Glareola lactea* **Small Pratincole**. *Conservation Significance:* Potentially At Risk in Lao PDR. *Documented Range and Habitat:* Breeder, presumed resident with local movements; north, centre, south[B14]. Wide rivers, especially stretches with many sand-bars and rocks. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). The species remains widespread and numerous in most areas of suitable habitat visited. Populations are much healthier than are those of most other waders tied to sand-bars. Nonetheless, numbers in some areas seem low, while historical sources were almost unanimous in considering that the bird was abundant. The Mekong supports by far the largest num-

bers, with the lower reaches of the Xe Kong and Nam Kading also providing regular records. The record listed in a report on Dong Ampham NBCA and Phou Kathong PNBCA (Davidson *et al*. 1997) was far from both, on the lower Xe Kong near Attapu.

Conservation Management and Research Proposed for Waders (Scolopacidae - Glareolidae):

- Innovative management of all breeding areas for Great Thick-knee, and major concentrations of breeding River Lapwings and Small Pratincoles, including (1) designation of no-use sand-bars and river islands to provide undisturbed nest sites, (2) major education campaigns, and (3) complete ban on hunting, egg collection and, in designated areas, incidental disturbance. Measures should be co-ordinated with those for terns.
- Complete habitat protection of any areas found to support (1) Wood Snipe regularly, or (2) breeding Northern Thick-knee; and rigorous enforcement of anti-hunting measures within them.
- Protection of key areas for Grey-headed Lapwing from habitat alteration and hunting.
- Field investigation of causal factors in the decline of sandbar nesters: with emphasis on Great Thick-knee and River Lapwing. Direct persecution of adults, collection of eggs, and incidental disturbance are all implicated. Design of appropriate recovery measures using this information.
- Comprehensive surveys for sandbar-nesting waders of all stretches of major rivers not surveyed by Duckworth *et al*. (1998b).
- Field surveys for (1) distribution of Wood Snipe, (2) seasonal status of Eurasian Thick-knee, (3) areas supporting Long-billed Plover and Grey-headed Lapwing regularly, (4) populations of sand-bar nesters during the wet season, when high water levels submerge the sand-bars, and (5) wetlands supporting nationally significant migrant or wintering populations of waders (level unclear, pending survey).
- Studies assessing (1) breeding success of River Lapwing in areas of contrasting human disturbance and (2) habitat use of Long-billed Plover and Grey-headed Lapwing.
- Studies of autumn harvests of migrating waders (particularly along the Mekong River) to develop appropriate control measures.

Laridae: Skimmers, gulls, terns (9 species)

• *Rynchops albicollis* **Indian Skimmer**. *Conservation Significance:* Globally Threatened - Vulnerable; At Risk in Lao PDR. *Documented Range and Habitat:* Seasonal status unclear; centre (historically, Harmand 1878-1879), south (historically[B19]). Formerly on wide rivers. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998); they overlooked the reference in Harmand (1878-1879) to groups of skimmers on the Mekong near Savannakhet in 1877. There are no recent records. Formerly small groups visited the southern Mekong in the dry season (Engelbach 1932). It is unclear whether they bred.

Larus ichthyaetus **Pallas's Gull** (= Great Black-headed Gull, ^K, ^Sm, ^T). Winter visitor; north[B9]. Sole Lao record was on the Mekong opposite Chiang Saen (Thailand) in December 1995 (not 1994, *contra* Duckworth *et al*. 1998a: 44).

Larus brunnicephalus **Brown-headed Gull**. Non-breeding visitor, mainly in the early dry season; north (RJTiz), centre (historically[B22]), south[B2]. Major rivers, feeding along sand banks.

Larus ridibundus **Black-headed Gull** (= Common Black-headed Gull, ^K, ^Sm, ^T). Non-breeding visitor; north (TDE). Major rivers. Singles were observed over the Mekong in Vientiane on 7 November 1998 (TDE) and from Chiang Saen (Thailand) on 26 November 1988 (C. Poole verbally 1998).

• *Sterna aurantia* **River Tern**. *Conservation Significance:* At Risk in Lao PDR. *Documented Range and Habitat:* Seasonal status unclear; north [B14], centre (historically[B22]), south[B14]. Wide rivers, mainly along little-disturbed stretches. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). Populations have collapsed in the last 50 years. Formerly it was common along much of the Mekong and on some larger tributaries. A few pairs still nest in the far south, and there are sporadic sightings of small numbers north to Xaignabouli Province, but the species is in grave danger of national extinction. Unpublished post-1996 records include a pair at Ban Sompoy (Xe Pian NBCA) on 17 December 1997 and 1-2 at Ban Namkong on 19 December 1997. Both sites are on the Xe Kong river in Attapu Province (Robichaud 1998e). Birds were still present at Ban Sompoy in early 1998 (RJTiz). The 3-4 pairs that breed around Ban Hangkhon (Champasak Province) are absent during June - October (Cunningham 1998). How far they move and what habitats they use during the high flow season is unclear.

• *Sterna albifrons* **Little Tern**. *Conservation Significance:* At Risk in Lao PDR. *Documented Range and Habitat:* Seasonal status unclear; south[B14]. Wide rivers, especially stretches with many sand-bars. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). In southern Lao PDR it was an abundant breeder along the Mekong (Engelbach 1932) but only one pair has been found recently and national extinction appears imminent.

• *Sterna acuticauda* **Black-bellied Tern**. *Conservation Significance:* Globally Threatened - Vulnerable; At Risk in Lao

PDR. *Documented Range and Habitat:* Seasonal status unclear; north (Round 1995), centre (historically[B22]), south (provisionally[B2]; historically[B19]). Formerly rivers, lakes, marshes and cultivation; now restricted to the least disturbed stretches of wide rivers, or extirpated. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). Black-bellied Terns formerly nested in large colonies along much of the Mekong. They dispersed during the rainy season to pools and flooded areas away from major rivers. Single birds were seen recently in the main Mekong channel at Chiang Saen (Thailand) and (provisionally) Khonphapheng falls (U. Treesucon in Round 1995, Thewlis *et al*. 1998).

Chlidonias hybridus (= *C. hybrida*, ^K) **Whiskered Tern**. Presumed passage migrant; north (historically[B20]), centre (historically[B22]), south (RJTiz). Wide rivers, marshes, lakes, flooded land. The only recent records are of 3-4 over a large pool on the Bolaven Plateau and dozens along the middle Xe Kong in September 1996 (RJTiz), and one on the Xe Kong in April 1998 (JWKP). There is no reason to assume a decline has occurred as even historically the species was scarce (e.g. David-Beaulieu 1949-1950).

Chlidonias leucopterus **White-winged Tern**. Presumed passage migrant; north (historically; see below), centre[B16], south[B15]. Wide rivers, likely also to visit other substantial wetlands. There are no published primary records from the north, but a single was observed from Chiang Khong (on the Thai bank of the Mekong) on 21 May 1966 by E. C. Dickinson (*in litt*. to T. P. Inskipp 1997).

Conservation Management and Research Proposed for Skimmers, gulls and terns:

- Identification and complete protection of all remaining nesting areas of terns and skimmers (see waders for detail). Breeding tern species are in imminent danger of national extinction. Indian Skimmer has already disappeared. As nesting areas are typically highly localised, protective activity needs to involve prohibition, or at least regulation, of access to individual sand-bars supporting colonies or pairs. Major changes in river use (e.g. prevention of access to entire stretches of river) are most unlikely to be needed.
- Understanding of wet-season movements of these species, in case they are threatened in non-breeding areas.

Accipitridae: Osprey, bazas, kites, vultures, harriers, hawks, buzzards, eagles (35-36 species)

Pandion haliaetus **Osprey**. Winter visitor, occasional summer records (David-Beaulieu 1944); north[B2], centre (historically[B22]), south[B2]. Around large water bodies. *Special Significance:* CITES Appendix II.

• *Aviceda jerdoni* **Jerdon's Baza**. *Conservation Significance:* Globally Near-Threatened; CITES Appendix II. Not At Risk in Lao PDR. *Documented Range and Habitat:* Seasonal status unclear, may breed; north, centre, south[B14]. Open or fragmented evergreen and mixed deciduous forest and regrowth up to at least 520 m. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). There are recent records of nine singles in four areas from Phou Khaokhoay NBCA south to the Cambodia border (Table 11). Historically, only one was recorded. A June record from Phou Khaokhoay NBCA (DAS) suggests that birds may breed in Lao PDR.

Aviceda leuphotes **Black Baza**. Resident, probably throughout (Duckworth *et al*. 1998a), numbers greatly augmented by passage migrants and perhaps winter visitors; north, centre, south[B2]. Open forest, secondary growth, trees within cultivated land and villages; chiefly lowlands and foothills. *Special Significance:* CITES Appendix II.

Pernis ptilorhyncus **Oriental Honey-buzzard** (= Crested Honey-buzzard, ^T); (included in *P. apivorus* Eurasian Honey-buzzard by ^K). Resident probably throughout, numbers greatly augmented by passage migrants and perhaps also winter visitors; north, centre, south[B2]. Open and forested areas. *Special Significance:* CITES Appendix II.

Elanus caeruleus **Black-shouldered Kite** (= Black-winged Kite, ^Sm). *Documented Range and Habitat:* Resident; north[B1], centre, south[B2]. Open country, including cultivation, from plains to 1200 m. Occurrence seems patchy and densities seem low, but there is no evidence of a decline. *Special Significance:* CITES Appendix II.

• *Milvus migrans* **Black Kite** (separated as *M. lineatus* Black-eared Kite by ^Sm). *Conservation Significance:* At Risk in Lao PDR; CITES Appendix II. *Documented Range and Habitat:* Passage migrant and scarce winter visitor; north, centre[B14], south (historically[B19]). Open areas, particularly near water; up to 1200 m. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). Three singles and a group of two were seen in three areas. One freshly-caught captive was seen in a Vientiane temple. The only subsequent records are of singles over the Mekong in Vientiane on 7 November 1998 (TDE) and 15 January 1999 (RJTiz) and over the Plain of Jars (Xiangkhouang Plateau) on 14 February 1999 (JWD). The resident form *M. m. govinda* occurs in adjacent Cambodia and Thailand, but seems not to have been recorded in Lao PDR (Thewlis *et al*. 1998). If *M. lineatus* is separated as a species, *govinda* remains with *migrans*. Recent records were not identified to race except for the captive and that over the Plain of Jars, both of which were *lineatus*. Dates of recent observations (except two in early 1999) fit with passage migrants; formerly the bird was abundant in winter (Thewlis *et al*. 1998).

• *Haliastur indus* **Brahminy Kite**. *Conservation Significance:* At Risk in Lao PDR; CITES Appendix II. *Documented Range and Habitat:* Resident; north (historically[B12]), centre (historically[B22]), south[B14]. Major rivers and adjacent open land; formerly any open country, usually at low altitude. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). This species is still seen frequently south of Pakxe along the Mekong and some of its tributaries (e.g. the Nam Lepou, Dong Khanthung PNBCA; Round 1998), but the Lao population has collapsed. Only a few decades ago it abounded across lowland south and central Lao PDR, with occasional records from the north. Around Ban Hangkhon (Champasak Province), the species is resident (Cunningham 1998), in contrast to various other river-channel bird species.

• *Haliaeetus leucogaster* **White-bellied Sea Eagle** (= White-bellied Fish Eagle, ^Sm). *Conservation Significance:* At Risk in Lao PDR; CITES Appendix II. *Documented Range and Habitat:* Seasonal status unclear; south (historically[B19]). Large wetlands. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). There are no recent records. Formerly it was not rare along the southern Mekong (Engelbach 1932). Delacour and Jabouille (1940) listed the species for the whole of Lao PDR but we have traced no primary sources for the north and centre.

• *Ichthyophaga humilis* (= *Icthyophaga nana*, ^K) **Lesser Fish Eagle**. *Conservation Significance:* Globally Near-Threatened; At Risk in Lao PDR; CITES Appendix II. *Documented Range and Habitat:* Resident; north, centre, south[B14]. Forested wetlands, particularly larger rivers. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). Small numbers persist in several major catchments (in 13 recent survey areas; Table 11). Each group of birds may be isolated from the others, and each, by nature of the few birds it contains, is vulnerable to direct persecution, habitat change and incidental disturbance. Important sites include Phou Dendin, Dong Ampham and Xe Pian NBCAs and the Nakai Plateau. The historical distribution is unclear; past observers may have confused the two fish eagle species (see Thewlis *et al*. 1998).

• *Ichthyophaga ichthyaetus* (= *Icthyophaga ichthyaetus*, ^K) **Grey-headed Fish Eagle**. *Conservation Significance:* Globally Near-Threatened; At Risk in Lao PDR; CITES Appendix II. *Documented Range and Habitat:* Resident; north (provisionally, Salter 1992a; historically, Oustalet 1899-1903), centre (provisionally[B14]), south[B14]. Forested wetlands, as Lesser. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). There are confirmed records only from Xe Pian NBCA and Dong Khanthung PNBCA (Round 1998, Thewlis *et al*. 1998), with provisional identifications from two other areas important for Lesser Fish Eagle: Phou Dendin NBCA and the Nakai Plateau. An unidentified fish eagle was seen at Ban Hangkhon (Champasak Province) in November 1997 (Cunningham 1998) and one was reported from a Vientiane market (Srikosamatara *et al*. 1992; B. Siripholdej verbally 1999). As with Lesser Fish Eagle, historical information is difficult to interpret. Delacour and Jabouille (1940) recorded the species throughout Lao PDR but we have traced no primary record for the centre.

• *Gyps bengalensis* **White-rumped Vulture**. *Conservation Significance:* Globally Near-Threatened; At Risk in Lao PDR; CITES Appendix II. *Documented Range and Habitat:* Resident; north (historically[B21]), centre (historically[B22]), south[B14]. Open and lightly wooded country. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). This species was historically widespread and common, but recent records come only from southern Champasak and Attapu Provinces. Numbers are small (the largest flock seen recently comprised at least 11 birds). Most records are from within or adjacent to proposed or existing NBCAs (Table 11), but the species has also been seen recently near Ban Hangkhon (Champasak Province; Cunningham 1998) and between Senamsai and Ban Sompoy (Xe Pian NBCA), Attapu Province (6-17 in December 1997; Robichaud 1998e).

• *Gyps indicus* **Long-billed Vulture**. *Conservation Significance:* Globally Near-Threatened; At Risk in Lao PDR; CITES Appendix II. *Documented Range and Habitat:* Resident; north (historically[B21]), centre (historically[B22]), south[B14]. Open and lightly wooded country. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). This species was historically widespread and common but recent records come only from southern Champasak and Attapu Provinces. Numbers are small (the largest flock seen recently contained at least ten). Most records are from within or adjacent to proposed or existing NBCAs (Table 11), but the species has also been seen recently near Ban Hangkhon (Champasak Province; Cunningham 1998) and between Senamsai and Ban Sompoy (Xe Pian NBCA), Attapu Province (8-19 in December 1997; Robichaud 1998e).

[• *Aegypius monachus* **Cinereous Vulture**]. *Conservation Significance:* Globally Near-Threatened; At Risk in Lao PDR; CITES Appendix II. *Documented Range and Habitat:* Presumed vagrant or scarce migrant; centre (provisionally, see below). Open habitats. *Status Information:* There are no field records, but one in Ban Keun Zoo reportedly came from Savannakhet (N. Krathintong per RJTiz). The species may be a sporadic visitor (there is a recent record from Cambodia; O'Sullivan 1994), but it is clearly not common. Any visiting birds are clearly At Risk in Lao PDR.

• *Sarcogyps calvus* **Red-headed Vulture**. *Conservation Significance:* Globally Near-Threatened; At Risk in Lao PDR;

CITES Appendix II. *Documented Range and Habitat:* Resident; north (historically[B21]), centre (historically[B22]), south[B14]. Open and lightly wooded country. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). This species was historically widespread and common but recent records come only from southern Champasak and Attapu Provinces. Numbers are small (the largest flock seen recently comprised at least ten birds). Most records are from within or adjacent to proposed or existing NBCAs (Table 11), but the species has also been seen recently near Ban Hangkhon (Champasak Province; Cunningham 1998) and between Senamsai and Ban Sompoy (Xe Pian NBCA), Attapu Province (1-13 in December 1997; Robichaud 1998e).

Circaetus gallicus **Short-toed Snake Eagle** (= Short-toed Eagle, ^K, ^T). Winter visitor; north[B9], south[B2]. Potentially over most open habitats. First recorded for Lao PDR in 1993 (Thewlis *et al*. 1996); two subsequent records (Duckworth *et al*. 1998a, Round 1998). *Special Significance:* CITES Appendix II.

Spilornis cheela **Crested Serpent Eagle**. Resident, making local movements; north, centre, south[B2]. Evergreen and deciduous forests, including degraded and fragmented areas; up to at least 1800 m. *S. bassus* was separated as a species by Stepanjan (1992). Although no records were given from Lao PDR, the distribution elsewhere indicates that it would occur. However, further details are needed to assess the validity of this separation. *Special Significance:* CITES Appendix II.

Circus aeruginosus **Eurasian Marsh Harrier** (named as a subspecies *C. a. spilonotus* Eastern Marsh Harrier by ^K; separated as *C. spilonotus* Eastern Marsh Harrier by ^Sm, ^T). Winter visitor; north[B9], centre[B10], south[B2]. Open country, overwhelmingly wetlands. All Lao records are of *C. a. spilonotus*; *C. a. aeruginosus* might also occur as a rare visitor. The two forms are often regarded as separate species (see Inskipp *et al*. 1996). *Special Significance:* CITES Appendix II.

Circus cyaneus **Hen Harrier** (= Northern Harrier, ^K, ^Sm, ^T). Winter visitor; north (Salter 1989a), centre[B9]. Open country, especially wetlands. Records prior to 1996 were reviewed by Duckworth *et al*. (1998a). *Special Significance:* CITES Appendix II.

Circus melanoleucos **Pied Harrier**. Winter visitor; north[B2], centre (provisionally[B10]; historically[B22]), south[B2]. Open country, especially wetlands. *Special Significance:* CITES Appendix II.

Accipiter trivirgatus **Crested Goshawk**. Resident; north, centre, south[B2]. Evergreen forests, even quite encroached areas, up to at least 1750 m. *Special Significance:* CITES Appendix II.

Accipiter badius **Shikra**. Resident; north, centre, south[B2]. Open wooded areas, often near cultivation and villages; among natural habitats, it seems to be commonest in open mixed deciduous forest. Generally low-mid altitudes. *Special Significance:* CITES Appendix II.

Accipiter soloensis **Chinese Sparrowhawk** (= Chinese Goshawk, ^K, ^Sm, ^T). Passage migrant and local winter visitor; north, centre, south[B9]. May be seen over any habitat. Records prior to 1996 were reviewed by Duckworth *et al*. (1998a). *Special Significance:* CITES Appendix II.

Accipiter gularis **Japanese Sparrowhawk**. Presumed passage migrant; north[B7], south[B2]. Any habitat, including towns. Status assessment is handicapped by difficulties of identification, particularly from Besra. Delacour and Jabouille (1940) implied that the species occurs in central Lao PDR, but we have not traced a primary source. *Special Significance:* CITES Appendix II.

Accipiter virgatus **Besra**. Seasonal status unclear, but presumed resident; north[B9], centre[B7], south[B2]. Forested and wooded areas from 200 to at least 1240 m. Status assessment is handicapped by difficulties of identification. *Special Significance:* CITES Appendix II.

Accipiter nisus **Eurasian Sparrowhawk** (= Northern Sparrowhawk, ^K, ^T). Winter visitor; north (provisionally[B9]; historically[B21]), centre (provisionally[B9]; historically[B22]). Habitat use in Lao PDR unclear. Status assessment is handicapped by difficulties of identification. South Lao PDR was included in the species's range by Delacour and Jabouille (1940), but we have not traced a primary record. *Special Significance:* CITES Appendix II.

• *Butastur liventer* **Rufous-winged Buzzard**. *Conservation Significance:* Globally Near-Threatened; CITES Appendix II. Not At Risk in Lao PDR. *Documented Range and Habitat:* Resident; north, centre, south[B14]. Open deciduous wooded areas (particularly dry dipterocarp forest) and open secondary growth, chiefly of lowlands and lower hills. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). Small numbers remain widespread (there are records from 11 recent survey areas; Table 11), both within and outside NBCAs. Phou Xang He, Xe Bang-Nouan and Xe Pian NBCAs and Dong Khanthung PNBCA all support large populations. Historically it was relatively common in suitable habitats. This is still so and as the species occupies degraded habitats, it should be considered Not At Risk in Lao PDR.

Butastur indicus **Grey-faced Buzzard**. Winter visitor and passage migrant; north[B2], centre[B10], south[B2]. Wooded areas and open country. Many live migrants are sold in Vientiane each spring. Effects on the population are unknown. *Special Significance:* CITES Appendix II.

Buteo buteo **Common Buzzard**. Winter visitor; north[B9], centre[B10]. Open country, particularly near water. Delacour and Jabouille (1940) listed the species from south Lao PDR, but we have not traced a primary source. *Special Significance:* CITES Appendix II.

Ictinaetus malayensis **Black Eagle**. Resident; north, centre[B10], south[B9]. Evergreen forest, particularly in hills and mountains. *Special Significance:* CITES Appendix II.

• *Aquila clanga* **Greater Spotted Eagle**. *Conservation Significance*: Globally Threatened - Vulnerable; Little Known in Lao PDR; CITES Appendix II. *Documented Range and Habitat:* Winter visitor; north[B7], centre (provisionally[B10]; historically[B22]). Open country, particularly near water. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). Subsequently, on 1 April 1997 one flew over Phou Chomvoy, Nam Theun Extension PNBCA. Four *Aquila* sp. over Ban Lak (20) on 19 March 1997 may also have been this species (Tobias 1997). An adult in Ban Keun zoo had reportedly been captured by a local villager (RJTiz).

• *Aquila heliaca* **Imperial Eagle**. *Conservation Significance:* Globally Threatened - Vulnerable; Little Known in Lao PDR; CITES Appendix I. *Documented Range and Habitat:* Winter visitor; north (provisionally, Dymond 1995; historically[B21]), centre (provisionally[B9]), south[B11]. Open country. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). Single *Aquila* sp. flying over the Nakai Plateau in March 1995 and in Louang-Namtha in December 1995 may have been this species (Dymond 1995, Thewlis *et al*. 1998). A single was seen in Dong Khanthung PNBCA on 28 March 1997 (JAW in Round 1998). Imperial Eagle was formerly a common winter visitor to Xiangkhouang Province (David-Beaulieu 1944). The lack of records elsewhere historically may merely reflect the difficulties of field identification. There has been too few recent winter observations in Xiangkhouang Province to assess this species's current status, but it seems unlikely that it is still common there.

Hieraaetus fasciatus **Bonelli's Eagle**. Seasonal status unclear, perhaps vagrant; north (historically[B21]). Sole Lao record was in open hilly woodland near a lake. A single was shot on 25 December 1939 after living for some days on Phou Chong Vong, near Xiangkhouang town (David-Beaulieu 1944). *Special Significance:* CITES Appendix II.

Hieraaetus pennatus **Booted Eagle**. Winter visitor, perhaps vagrant; south[B2]. Open and lightly wooded areas. There is only one Lao record: a single over Xe Pian NBCA in January 1993 (Duckworth 1996c). *Special Significance:* CITES Appendix II.

Hieraaetus kienerii **Rufous-bellied Eagle**. Resident; north[B7], centre[B10], south[B2]. Forests and their margins, mainly evergreen, but also in some predominantly deciduous areas; up to at least 850 m. First recorded in 1993 (Thewlis *et al*. 1996). *Special Significance:* CITES Appendix II.

Spizaetus cirrhatus **Changeable Hawk Eagle**. Presumed resident; north[B7], centre[B17], south[B5]. Evergreen and deciduous forests, including open and degraded areas, to at least 1350 m. *Special Significance:* CITES Appendix II.

Spizaetus nipalensis **Mountain Hawk Eagle**. Seasonal status unclear; north[B9], centre[B10], south (Evans *et al*. 1996b). Forests, mainly in hills and mountains, but locally as low as 280 m. *Special Significance:* CITES Appendix II.

Falconidae: Falcons, falconets (10 species)

• *Polihierax insignis* **White-rumped Falcon**. *Conservation Significance*: Globally Near-Threatened; Potentially At Risk in Lao PDR; CITES Appendix II; endemic to Indochina, Myanmar and Thailand. *Documented Range and Habitat:* Resident; centre (historically[B22]), south[B14]. Lowland open deciduous forest (especially some dry dipterocarp forest types). *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). Historically it was common and/or widespread in south and central Lao PDR (Engelbach 1932, David-Beaulieu 1949-1950). This description could not be applied to today's situation, in which small numbers have been found locally in six recent survey areas (Table 11): Xe Bang-Nouan and Xe Pian NBCAs and Phou Kathong and Dong Khanthung PNBCAs, once at Don Khong and once near the inflow of the Xe Namnoy to the Xe Kong in 1997 (Davidson *et al*. 1997, Round 1998, Thewlis *et al*. 1998, PD).

Microhierax caerulescens **Collared Falconet**. Resident; north[B1], centre (historically[B22]), south[B2]. Open forest, forest edge and adjacent secondary growth in lowlands and foothills. Lao records prior to 1996 were reviewed in Duckworth (1996a). The species's conservation status should be reconsidered at regular intervals as it is known from rather few sites over a restricted geographical and altitudinal range. *Special Significance:* CITES Appendix II.

• *Microhierax melanoleucos* (= *M. melanoleucus*, ^Sm) **Pied Falconet**. *Conservation Significance:* Globally Near-Threatened; Little Known in Lao PDR; CITES Appendix II. *Documented Range and Habitat:* Resident; north[B8], centre[B14].

Evergreen forest edge and clearings, particularly along streams and in areas with dead emergent trees; from 260 to at least 1080 m. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). Small numbers have been found in six survey areas (Table 11), all of which are NBCAs or PNBCAs in the east, from Phou Louey in the north, south down the Annamites to Hin Namno. In each, distribution seems patchy and numbers seem low. For example, the first record for Nakai-Nam Theun NBCA (excluding the parts on the Nakai Plateau, treated here as a separate survey area) was in January 1999 (M. Hedemark verbally 1999) and the first for Nam Ha NBCA in August 1998 (A. Johnson verbally 1999). The intensive surveys of the previous years had produced no records.

• *Falco naumanni* **Lesser Kestrel**. *Conservation Significance:* Globally Threatened - Vulnerable; Little Known in Lao PDR; CITES Appendix II. *Documented Range and Habitat:* Winter visitor; north (historically[B21]). Upland plateau grassland (e.g. Plain of Jars). *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). Historically, the species was abundant in Xiangkhouang Province (David-Beaulieu 1944), but was never taken elsewhere. There are no recent records and it is likely that a substantial decline has occurred.

Falco tinnunculus **Common Kestrel** (= Eurasian Kestrel, ^K, ^T). Widespread winter visitor, perhaps resident locally; north[B9], centre[B10], south[B12]. Very open country, particularly near cliffs. *Special Significance:* CITES Appendix II.

Falco amurensis **Amur Falcon**. Passage migrant; north[B2]. Probably over all habitats. *Special Significance:* CITES Appendix II.

Falco columbarius **Merlin**. Vagrant; north (historically[B21]). Probably open country. *Special Significance:* CITES Appendix II.

Falco subbuteo **Eurasian Hobby** (= Northern Hobby, ^K, ^T). Passage migrant; north[B2]. Open areas. The few Lao records were all in October (David-Beaulieu 1944, Thewlis *et al*. 1996). *Special Significance:* CITES Appendix II.

Falco severus **Oriental Hobby**. Presumed resident; north, centre[B9], south[B2]. Evergreen forest, also in deciduous areas. Records prior to 1994 are summarised in Thewlis *et al*. (1996). *Special Significance:* CITES Appendix II.

Falco peregrinus **Peregrine Falcon**. Winter visitor and possibly local resident; north[B9], centre, south[B2]. Open country, forest, limestone karst. In SE Asia, wintering birds (*F. p. japonicus*) and residents (*F. p. ernesti* and *F. p. peregrinator*) are distinguishable in the field. Most recent records appear to be of migrants, but a pair showing plumage features consistent with one of the resident races was seen near Savannakhet town (JAW), and there is a June record of the species from Ban Hangkhon (Champasak Province; Cunningham 1998), suggesting resident birds may occur there. *Special Significance:* CITES Appendix I.

Conservation Management and Research Proposed for Accipitridae and Falconidae:

- Protection of large remaining evergreen forest blocks from fragmentation: difficulty of human access and hunting has allowed raptors to persist in such habitats, albeit at low densities.
- Enforced legal protection of all raptors from hunting and poisoning: although raptors do take small livestock (Table 2), this was not reported to be a major problem.
- Structured management programme for fish eagles and vultures in areas important for them (Xe Pian NBCA, Dong Khanthung PNBCA for all, and Phou Dendin NBCA, Dong Ampham NBCA and the Nakai Plateau for fish eagles). This should involve: (1) enforced legal protection from shooting and nest robbing; (2) stiff penalties for violators; (3) maintenance of adequate food sources for vultures, specifically that as long as wild ungulate population levels remain at current low levels, provision of domestic water buffaloes may be needed, as may specific action to prevent shooting of vultures at such carcases; (4) prevention of degradation of riverine forest strips; (5) use of media in Champasak and Attapu Provinces to enhance public perception of vultures - a Thai television film of them at a dead dog near Ban Hangkhon, Champasak Province has already been made (Cunningham 1998); and (6) general awareness raising of the value and needs of conserving these species.
- Identification of nest sites, if any, of vultures in Lao PDR.
- Identification of key nest and roost sites (if any) of Brahminy Kite in Dong Khanthung PNBCA and along the southern Mekong.
- Conservation management of any area found to support Lesser Kestrel regularly, unless it is clear that the species's pace of decline is determined by events in its breeding areas; these lie outside Lao PDR.
- Continuation for several years of the nation-wide CPAWM/WCS poster campaign emphasising the role of raptors as consumers of crop pests.
- Winter surveys of the Xiangkhouang Plateau, which formerly supported a rich community of wintering raptors (David-Beaulieu 1944). Several of these species are now considered Globally Threatened. Substantial numbers of raptors still occur in winter, but recent observation has been insufficient to tell whether any of the Globally Threatened species persist.
- Understanding of precise habitat needs of White-rumped Falcon and Pied Falconet. Within broad habitat-types,

both are patchily distributed, suggesting that large areas of habitat will need protection.
- Investigation of (1) international trade, as several species imported to Japan in the 1980s under CITES documentation had Lao PDR indicated as the point of origin or export (Annex 2), although they did not necessarily originate here; and (2) domestic trade in raptors with formulation of control measures if necessary. Various species are hunted, primarily for food, and both dead and live specimens are traded in urban markets (Baird 1993, Annex 1). The claws of raptors are used in traditional medicine (Martin 1992). Live-caught animals are often kept as pets (Baird 1993; WGR).

Podicepedidae: Grebes (1 species)

Tachybaptus ruficollis (= *Podiceps ruficollis*, ^K) **Little Grebe**. Resident; north[B9], centre[B10], south[B2]. Marshes, pools, lakes and slow streams up to at least 1200 m.

Anhingidae: Darters (1 species)

• *Anhinga melanogaster* **Darter** (separated as *A. melanogaster* Oriental Darter by ^K, ^Sm, ^T). *Conservation Significance:* Globally Near-Threatened (as *A. melanogaster, s.s.*); At Risk in Lao PDR. *Documented Range and Habitat:* Seasonal status unclear; north[B14], centre (historically[B22]), south[B14]. Rivers, marshes, pools; recent records from lowlands, but historical records from up to 1200 m. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). Historically, Darters were widespread and numerous. Numbers have plummetted and recently there have been only sporadic records from southern Champasak Province and two sightings, presumably of a wandering bird, in Nam Kading NBCA. Small numbers (under ten) were seen regularly in May - July around Ban Hangkhon (Champasak Province) in 1997, but not in other months (Cunningham 1998; RJT). All recent sightings are during the wet season or very late dry season (e.g. two at the mouth of the Xe Pian in April 1998; JWKP). Robichaud (1998e) received reports in December 1997 of two on the Xe Kong near Ban Sompoy (Xe Pian NBCA) "two days ago", suggesting at least occasional mid dry season occurrence.

Phalacrocoracidae: Cormorants (2 species)

• *Phalacrocorax niger* **Little Cormorant**. *Conservation Significance:* At Risk in Lao PDR. *Documented Range and Habitat:* Seasonal status unclear; north (historically, Oustalet 1898), centre (historically[B22]), south[B14]. Mekong, major tributaries and adjacent marshes, now only of the extreme lowlands, but formerly to at least 1000 m. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). The species seems to be in long-term decline. A century ago it was common even in north Lao PDR (Oustalet 1898). Fifty years ago it was recorded occasionally in south and central Lao PDR (Engelbach 1932, David-Beaulieu 1949-1950). Recently it has been recorded only in southern Champasak Province. The Mekong south of Ban Hangkhon has provided the bulk of recent records, with at least 28 positively identified as this species there in May 1996. Flocks sometimes totalling over 100 small cormorants (mainly this species but perhaps including some *P. fuscicollis* Indian Cormorant) were observed flying upstream from Cambodia during March - May 1997 (Cunningham 1998).

• *Phalacrocorax carbo* **Great Cormorant**. *Conservation Significance:* At Risk in Lao PDR. *Documented Range and Habitat:* Seasonal status unclear; north (historically[B21]). Mekong River. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). The species may be in long-term decline; there were numerous past records from north Lao PDR (Oustalet 1898, Delacour and Greenway 1940a, David-Beaulieu 1944), but there are no recent records from anywhere in the country. Delacour and Jabouille (1940) recorded it throughout Lao PDR but we have traced no primary records from the centre or south.

Conservation Management and Research Proposed for Cormorants and darters:
- Identification and protection of any remaining key habitat areas, including their fish stocks; conservation of mainstream Mekong and other large river fisheries may need to be addressed.
- Legal protection of all species from hunting.
- Complete protection of any nesting areas from unregulated human access during the breeding season.
- Education campaigns, including continuation for several years of the nation-wide CPAWM/WCS poster campaign depicting Darter and other large waterbirds.
- Collaboration with Cambodian authorities in the fishery conservation work which has been occurring since 1993 in the main area supporting these species (the southern Mekong).

Ardeidae: Herons, egrets, bitterns (15 species)

Egretta garzetta **Little Egret**. Small numbers possibly present all year, but much less scarce in winter and, especially, on passage; north[B9], centre[B10] and south[B2]. Marshes, paddyfields, lakes, river banks; up to at least 800 m. The complex patterns of seasonality of occurrence were discussed by Duckworth *et al*. (1998a), but more information is needed. Subsequently, Cunningham's (1998) year-round observations

at Ban Hangkhon (Champasak Province) found the species absent in July - August, but small numbers have been seen all year at Ban Sivilai, Vientiane Province (JWKP).

• *Ardea cinerea* **Grey Heron**. *Conservation Significance:* Potentially At Risk in Lao PDR. *Documented Range and Habitat:* Winter visitor; north, centre, south[B14]. Lakes, pools, marshes, rivers and exceptionally paddy-fields, up to at least 800 m. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). Small numbers (under a dozen) have been widely recorded in both protected and unprotected areas across the country, including 11 recent survey areas (Table 11). Historically it was often described as common and it is likely that a decline has occurred. A count of 38 along the Mekong at Savannakhet town in late January 1997 (JAW) is the highest recent count in Lao PDR, and flocks of at least 25 have been seen around Vientiane (T. Hansel verbally 1998). The listing of the species as At Risk in Lao PDR in Thewlis *et al*. (1998: Table 3) was a typographical error: Appendix 2 gave the correct category.

• *Ardea purpurea* **Purple Heron**. *Conservation Significance:* Potentially At Risk in Lao PDR. *Documented Range and Habitat:* Mainly winter visitor, possibly local breeder; north, centre, south[B14]. Marshes, well-vegetated pools, exceptionally paddy-fields, up to at least 800 m. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). Small numbers (under a dozen) have been widely recorded in both protected and unprotected areas across the country, including 11 recent survey areas (Table 11). Historically it was often described as common and it is likely that a decline has occurred. Juveniles were seen in Dong Khanthung PNBCA in July 1998, raising the possibility of local breeding (Round 1998). One was seen in a market in southern Champasak Province (Cunningham 1998). Unpublished records include single birds at Ban Sivilai and near Phou Khaokhoay NBCA (JWKP). The listing of the species as At Risk in Lao PDR in Thewlis *et al*. (1998: Table 3) was a typographical error: Appendix 2 gave the correct category.

Casmerodius albus (= *Egretta alba*, ^K, ^T) **Great Egret**. Passage migrant and winter visitor; north[B9], centre[B16], south[B2]. Paddy-fields, lakes, rivers, marshes.

Mesophoyx intermedia (= *Egretta intermedia*, ^K, ^T) **Intermediate Egret** (= Plumed Egret, ^K). Passage migrant and winter visitor; north[B9], centre[B16], south[B2]. Paddy-fields, lakes, marshes, river banks.

Bubulcus ibis **Cattle Egret**. Passage migrant and winter visitor; north[B9], centre[B16], south[B2]. Paddy-fields, pasture, marshes, rivers; often near livestock. Records prior to 1996 were summarised in Duckworth *et al*. (1998a).

Ardeola bacchus **Chinese Pond Heron**. Mainly winter visitor and passage migrant; north, centre, south[B2]. No evidence of breeding, although birds oversummer in the north (David-Beaulieu 1944) and even perhaps the south[B2]. Ponds, marshes, river and stream banks, paddy-fields. Records prior to 1996 were summarised in Duckworth *et al*. (1998a).

Butorides striatus **Little Heron** (= Striated Heron, ^Sm). Probably mainly winter visitor, also at least local breeder; north[B1], centre, south[B2]. Rivers, streams and pools, often in or near forests; up to 1220 m. Breeding behaviour was seen at Khonphapheng falls (Champasak Province) in February 1993.

• *Nycticorax nycticorax* **Black-crowned Night Heron**. *Conservation Significance:* Potentially At Risk in Lao PDR. *Documented Range and Habitat:* Seasonal status unclear; north (Parr and Parr 1998), centre (historically, Robinson and Kloss 1931), south[B2]. Marshes in vicinity of stands of trees. *Status Information:* The few recent records are: up to four in the Northern Zone wetlands of Xe Pian in winter 1992-1993 (Claridge 1996, Thewlis *et al*. 1996); one near Ban Hangkhon (Champasak Province; Cunningham 1998); regular sightings of up to ten at Ban Sivilai, Vientiane Province (Parr and Parr 1998; PD); occasional birds heard over Vientiane by night (JWKP); and singles in markets at Ban Lak (52) and (twice) southern Champasak Province (Cunningham 1998; RJTiz). Historically, the species was seen along the Mekong (two localities between Vientiane and Savannakhet; Robinson and Kloss 1931), the lower Xe Don and the Xe Kong, and at Salavan (Engelbach 1927, 1932). It was common in Xiangkhouang Province during September - December (David-Beaulieu 1944). This species is vulnerable to disturbance and persecution in the generally small groves of trees within wetlands where it concentrates to roost and nest. Furthermore, these are often felled, and the open areas used by the species are often chosen for human settlement. These negative factors doubtless limit the numbers and distribution of the species, thus it should be considered Potentially At Risk in Lao PDR.

Gorsachius melanolophus **Malayan Night Heron**. Seasonal status unclear, presumed to breed; north[B14], centre[B16], south[B14]. Streams, rivers and forest floor in evergreen and mixed deciduous forest, secondary growth and bamboo; probably mainly lowland but up to at least 830 m. Records prior to 1997 were reviewed by Thewlis *et al*. (1998) who classified the species as Little Known in Lao PDR. They omitted records of calling birds from the Nam Theun Extension PNBCA in Tizard (1996). There are post-1996 records from Nam Theun Extension PNBCA (same area), Dong Khanthung PNBCA, Dong Nathat Conservation Area (Savannakhet Province) and Dong Ampham NBCA (Tobias 1997, Davidson *et al*. 1997, Round 1998, Evans in prep.) indicating that the species can

no longer be considered Little Known in Lao PDR. It may be even more widespread than these records suggest as it is partially nocturnal, shy and difficult to detect; notably, visits to some of the presumed breeding areas outside the calling season failed to detect it. There is no reason to consider it as overly persecuted or at special risk of habitat loss.

Ixobrychus sinensis **Yellow Bittern**. Seasonal status unclear; north (PD), south[B2]. Densely vegetated wetlands, including wet paddies. Delacour and Jabouille (1940) also listed central Lao PDR in the species's range but we have not traced a primary source.

• *Ixobrychus eurythmus* **Von Schrenck's Bittern** (= Schrenck's Bittern, ^K, ^Sm, ^T). *Conservation Significance:* Globally Near-Threatened; Little Known in Lao PDR. *Documented Range and Habitat:* Passage migrant, one winter record; north[B14], south[B14]. Densely vegetated wetlands, pools within forest, and wet paddies adjacent to forest. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). There is one historical record, from Xiangkhouang Province (David-Beaulieu 1944), and six recent sightings: four singles in the Nam Theun Extension PNBCA (Tobias 1997) and singles from Houay Nhang NR and Xe Pian NBCA.

Ixobrychus cinnamomeus **Cinnamon Bittern**. Seasonal status unclear; probably mainly wet-season visitor, but some records even in mid-winter; north[B1], centre, south[B2]. Well-vegetated river and stream banks, lakes, marshes, paddy-fields.

Dupetor flavicollis (= *Ixobrychus flavicollis*, ^Sm[1]) **Black Bittern**. Passage migrant, potentially wet-season visitor[B9]; north (historically[B21]), south[B2]. Marshes and paddy-fields. Records prior to 1996 were reviewed by Duckworth *et al*. (1998a). Delacour and Jabouille (1940) also listed central Lao PDR in the species's range but we have not traced a primary source.

• *Botaurus stellaris* **Great Bittern**. *Conservation Significance:* At Risk in Lao PDR. *Documented Range and Habitat:* Winter visitor; north (TDE), south[B2]. Large well-vegetated marshes from Mekong plains to 1150 m. *Status Information:* There are only three Lao records, from Latsen (Xiangkhouang Province) in 1940 and 1999 (David-Beaulieu 1944; TDE) and Xe Pian NBCA in 1992 (Thewlis *et al*. 1996). It is unclear if the species occurs regularly in the country, but any individuals that do are under extreme risk of being shot, occupying as they do non-forested wetlands.

Conservation Management and Research Proposed for Herons, egrets and bitterns: There are few heronries in Lao PDR. Wintering herons also seem to be below carrying capacity. Doubtless this results from direct persecution and disturbance at feeding areas. Skulking and forest species (e.g. Von Schrenck's Bittern, Malayan Night Heron) are probably less affected than are open country species (e.g. egrets, *Ardea* herons, Great Bittern). Re-establishment of populations across Lao PDR is of lower priority than for other large waterbirds as Lao numbers are of little relevance regionally. Activities should be concentrated where there is a realistic chance of benefit to storks, ibises, cormorants, darters, cranes and/or pelicans; these species are likely to be attracted to areas with many herons and egrets.

- Management of extensive wetlands, primarily in a multiple use context, to maintain suitable water regimes and vegetation cover for these species.
- Identification and protection of breeding colonies.
- Designation of disturbance-free key feeding areas for all species.
- Investigation of factors that permit the Ban Sivilai herons (Vientiane Province) to thrive (Parr and Parr 1998) to guide management of other areas.
- Widespread education programmes.
- Consolidation of gun collection campaigns in all areas with extensive open wetlands.

Threskiornithidae: Ibises (3 species)

• *Threskiornis melanocephalus* **Black-headed Ibis**. *Conservation Significance:* Globally Near-Threatened; At Risk in Lao PDR. *Documented Range and Habitat:* Seasonal status unclear; centre, south (historically[B22]). Wetlands. *Status Information:* The only Lao record is of a single flying down the Xe Banghiang river (the border of central and southern Lao PDR) prior to 1950 (David-Beaulieu 1949-1950).

• *Pseudibis papillosa* **Black Ibis** (separated as *P. davisoni* White-shouldered Ibis by ^K, ^Sm, ^T). *Conservation Significance:* Globally Threatened - Endangered (as *P. davisoni*; Collar *et al*. 1994); At Risk in Lao PDR. *Documented Range and Habitat:* Presumed resident, although doubtless undertakes local movements; north (historically[B20]), centre (historically[B22]), south[B14]. Pools, seasonal streams and river banks within open lowland forest. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). This species's population decline is among the most dramatic of any bird in Lao PDR. Past visitors to lowland areas with suitable habitat universally described it as common. A few birds persist in Xe Pian NBCA and perhaps elsewhere in the south. Post-1996 records are only of two near Ban Sompoy (Xe Pian NBCA) on 19 December 1997 (Robichaud 1998e), one on the banks of the Xe Pian 1 km upstream of its confluence with the Xe Kong (JWKP) in April 1998, and one possible heard in Dong Khanthung PNBCA in early 1998 (Round 1998). Local reports from the latter site suggest that

the species occurs, but Round (1998) stressed the need for restraint by those who would identify ibises to species using local names and descriptions.

• *Pseudibis gigantea* **Giant Ibis**. *Conservation Significance:* Globally Threatened - Critical; At Risk in Lao PDR; endemic to parts of Thailand and southern Indochina, but extirpated over much of this range. *Documented Range and Habitat:* Seasonal status unclear; centre (historically[B22]), south[B14]. Pools, seasonal streams and river banks within open lowland forest. *Status Information:* Records prior to 1997 were reviewed by Thewlis and Timmins (1996) and Thewlis *et al*. (1998). The few historical records are outnumbered by recent sightings, from both Xe Pian NBCA and Dong Khanthung PNBCA. However, the great effort made to locate the species since 1992 indicates that populations have surely decreased in the last few decades. Post-1996 records come from Dong Khanthung PNBCA (Round 1998). A claim from the Houay Kaliang (Xe Pian NBCA) of a flock of five (Baird 1997) lacks any substantiating description.

Pelecanidae: Pelicans (1 species)

• *Pelecanus philippensis* **Spot-billed Pelican**. *Conservation Significance:* Globally Threatened - Vulnerable; At Risk in Lao PDR. *Documented Range and Habitat:* Presumed wet season non-breeding visitor; centre[B17], south[B14]. Mekong and major tributaries, large pools and lakes. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). Historically the species visited the south regularly, and unidentified pelicans were recorded occasionally in central Lao PDR. There are few recent records: an injured bird found in Dong Khanthung PNBCA in August 1996 was reportedly one of two, and a captive observed in Pakxe in mid 1997 (Robson 1997b; Plate 11) was probably one of the 1996 birds. A bill of a bird shot near Hin Namno NBCA in November 1997 was seen there in early 1998 (Walston in prep.). This latter area, in the Annamite foothills, is away from the major lowland wetlands used by the species. The record is a remarkable parallel to a bill in a hunter's possession on the other side of the Annamites, near Vu Quang Nature Reserve, Vietnam (Eames *et al*. 1994a). These records suggest that the Annamites are used as a dispersal route. Reference to occurrence in north Lao PDR by King *et al*. (1975) reflects Delacour and Jabouille's (1940) statement of the species's range as 'Mekong and tributaries in Cambodia and Laos'(E. C. Dickinson *in litt*. 1999); we have traced no primary record from the north.

Ciconiidae: Storks (7 species)

• *Mycteria leucocephala* (= *Ibis leucocephalus*, ^K) **Painted Stork**. *Conservation Significance:* Globally Near-Threatened; At Risk in Lao PDR. *Documented Range and Habitat:* Seasonal status unclear; north[B14], centre (historically[B22]), south (historically[B19]; provisionally, Cunningham 1998). Large wetlands. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). Formerly small flocks occurred throughout the country but the only recent record is of a wandering group in northern Vientiane Province in June 1996. One was provisionally identified in December 1996 near Ban Hangkhon (Champasak Province; Cunningham 1998). It is clear that numbers have plummetted.

• *Anastomus oscitans* **Asian Openbill**. *Conservation Significance:* Globally Near-Threatened; At Risk in Lao PDR. *Documented Range and Habitat:* Non-breeding visitor; south[B14]. Not yet recorded east of the Mekong. Wetlands. *Status Information:* The first records for Lao PDR came from Dong Khanthung PNBCA in August 1996 and July 1998 (Round 1998, Thewlis *et al*. 1998). They are presumed to relate to birds dispersing from Cambodian breeding colonies.

• *Ciconia nigra* **Black Stork**. *Conservation Significance:* At Risk in Lao PDR; CITES Appendix II. *Documented Range and Habitat:* Winter visitor; north (PDR), centre[B10]. Wetlands, probably mainly in and near forest. *Status Information:* Records prior to 1996 were reviewed by Duckworth *et al*. (1998a). Historical and recent records all indicate that the species is of infrequent occurrence. Records come from, historically, various sites in the north (Delacour and Greenway 1940a, David-Beaulieu 1944) but recently only from the Nakai Plateau (Evans and Timmins 1998, Duckworth *et al*. 1998a) with one record of a single flying from Myanmar to Lao PDR over the Mekong upstream of Chiang Saen (Thailand) on 25 December 1983 (PDR). The eastern population of this species was estimated recently to number only 2000 birds and to be in decline (Perennou *et al*. 1994). All large waterbirds are persecuted and this species should be considered At Risk in Lao PDR.

• *Ciconia episcopus* **Woolly-necked Stork**. *Conservation Significance:* At Risk in Lao PDR. *Documented Range and Habitat:* Resident; north (historically[B21]), centre (historically[B22]), south[B2]. River banks, pools including those within open and dense forest and grassland. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). The decline of this species is among the most dramatic of all Lao birds. Formerly, Engelbach (1932) dealt with its status in southern Lao PDR in one word: 'common', and it was recorded widely elsewhere, although it was clearly much less common in the north. Today, it is only known in Lao PDR from a few sites in the south (Table 11). Dong Khanthung PNBCA and Xe Pian NBCA support most of this species's Lao population, although birds are seen elsewhere (e.g. Cunningham 1998). A breeding colony was reported in

the eastern part of Xe Pian NBCA to Dobias (1992a); it is conceivable that this referred to the Attapu Lesser Adjutant colony but this has not been investigated.

• *Ephippiorhynchus asiaticus* (= *Xenorhynchus asiaticus*, ^K) **Black-necked Stork**. *Conservation Significance:* At Risk in Lao PDR. *Documented Range and Habitat:* Seasonal status unclear; north (historically[B20]), centre (historically[B22]), south[B14]. Pools and marshes within dry dipterocarp forest; formerly on a wider variety of wetlands among other habitat-types. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). Historically it was a widespread but scarce non-breeding visitor. Recent records come only from Dong Khanthung PNBCA: two singles in wet season 1996 (Thewlis *et al*. 1998), a pair in April 1997 and, in the same area, in February 1998, plus a single in a different sector in February 1998 (Round 1998).

• *Leptoptilos javanicus* **Lesser Adjutant**. *Conservation Significance:* Globally Threatened - Vulnerable; At Risk in Lao PDR. *Documented Range and Habitat:* Resident; centre (historically[B22]), south[B14]. Marshes and pools within open forest, and in some areas flooded paddies. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). The species was formerly abundant in the south and centre; today, small numbers remain only in parts of Champasak and Attapu Provinces. Dong Khanthung PNBCA is particularly important as birds breed (advanced nestlings were seen in February 1998) and numbers are larger than elsewhere, e.g. a flock of 15 was seen in July 1998 (Round 1998). A full-grown young was seen on one of two nests near Ban Sompoy (Xe Pian NBCA) in February 1998 (RJTiz). Adjutants were reported to have nested until recently in the Ban Hangkhon area (Champasak Province; Cunningham 1998). The species is still taken for captivity. Two were observed at a Pakxe fish garden (Plate 11), one was seen in Savannakhet, and one captive (offered for sale) in Vientiane in 1992 was reported to have come from the south (Salter 1993a). Two are held at the Vientiane Cultural Park (RJTiz). A further threat is direct harvesting; although some people do not eat adjutants, others certainly do (Round 1998). Although Delacour and Jabouille (1940) recorded this species throughout Lao PDR, we have traced no primary record from the north. The reference to flocks of 'marabous' along the Mekong between Pakxan and Vientiane in Bassenne (1912) may, however, refer to this species.

• *Leptoptilos dubius* **Greater Adjutant**. *Conservation Significance:* Globally Threatened - Endangered; At Risk in Lao PDR. *Documented Range and Habitat:* Formerly presumed resident; south (historically[B19]). Mainly pools in open forest. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). Historically, the species was common in at least the far south. Assessing the status today is difficult, as confusion with Lesser Adjutant is not infrequent. There remains one unconfirmed sight record: at Nong Houay Soymong (Bolaven Southwest PNBCA) in March 1992 (Salter 1992b). Other recent claims (including of breeding), from Dong Khanthung PNBCA in 1996, have been withdrawn by the observers (see Round 1998, Thewlis *et al*. 1998).

Conservation Management and Research Proposed for Ibises, pelicans and storks: The precarious global status of Giant Ibis and Black Ibis of the race *P. p. davisoni* means that their occurrence in Lao PDR is of exceptional international conservation significance. Most stork species are concentrated in two southern sites, Dong Khanthung PNBCA and Xe Pian NBCA, both of which are priorities for conservation activity for ibises as well. Work on Black Stork is a lower priority as it is a long-distance migrant non-breeding visitor and may not use sites regularly.

- Total protection of all remaining ibis populations and their habitats. Dong Khanthung PNBCA and Xe Pian NBCA are the only known sites.
- Legal declaration of Dong Khanthung PNBCA and establishment of management activities.
- High level of international donor support to Xe Pian NBCA and Dong Khanthung PNBCA in view of their global significance.
- Identification of important feeding wetlands (river margins and small pools), particularly in the late dry season when resources are most spartan.
- Specific protection within these areas of sites with regular ibis and stork usage from hunting (the main factor implicated in the population declines), intensive livestock grazing (of which the overall effects are unclear) and agricultural conversion. Certain sites may best have all human access strongly regulated.
- Identification and protection of trees used for breeding and roosting. Further investigation of adjutant breeding in Dong Khanthung PNBCA to resolve anomalies in information (Round 1998).
- Legal protection of all ibis, pelican and stork species from hunting and from capture for trade and display purposes.
- Educational campaigns across Champasak and Attapu Provinces. Round (1998) reported that storks are still sometimes shot 'for fun'.
- Understanding of habitat use, seasonal movements and basic ecology and breeding biology of all species, particularly Giant and Black Ibises, to allow design of conservation strategies. This includes both year-round work in known sites and coverage of other possible sites.
- Consideration of the potential role of captive breeding for Giant and Black Ibises.

Pittidae: Pittas (8 species)

Pitta phayrei **Eared Pitta**. Resident; north[B9], centre (Timmins

and Khounboline 1996), south[B2]. Evergreen forest and tall secondary growth particularly in areas with abundant bamboo, up to at least 1040 m.

• *Pitta nipalensis* **Blue-naped Pitta**. *Conservation Significance:* Globally Near-Threatened; Little Known in Lao PDR. *Documented Range and Habitat:* Resident; north[B9]. Evergreen forest and secondary growth, including bamboo and bananas, in hills up to at least 980 m. Records prior to 1997 were reviewed by Thewlis *et al*. (1998). Historical and recent records (the latter from only four survey areas; Table 11) are scattered across the north of the country. It has only once been described as common, at Ban Namkeung-Kao, Bokeo Province (Delacour and Greenway 1940a).

• *Pitta soror* **Blue-rumped Pitta**. *Conservation Significance:* Globally Near-Threatened; Potentially At Risk in Lao PDR; endemic to Indochina, south-east Thailand and south China. *Documented Range and Habitat:* Resident; north, centre, south[B14]. Evergreen forest and tall secondary growth, mostly in lowlands, but locally up to 850 m. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). The species is widespread in south and central Lao PDR (Table 11) and is common in at least some areas, notably Xe Pian NBCA.

Pitta oatesi **Rusty-naped Pitta**. Resident; north[B9], centre[B7], south[B2]. Evergreen forests and secondary growth, invariably above 800 m.

Pitta cyanea **Blue Pitta**. Resident; north[B9], centre[B10], south[B2]. Evergreen forests and secondary growth, particularly in hills and on plateaux.

• *Pitta elliotii* (= *P. ellioti*, ^K, ^T) **Bar-bellied Pitta**. *Conservation Significance:* Globally Near-Threatened; Potentially At Risk in Lao PDR; endemic to Indochina and east Thailand. *Documented Range and Habitat:* Resident; north, centre, south[B2]. Evergreen and, locally, dense mixed deciduous forest and secondary growth (including very degraded areas basically classifiable as scrub), mostly below 500 m in areas of gentle relief; occasionally recorded up to at least 680 m. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). The species is common in lowland south and central Lao PDR, with scattered records in the north; records come from ten recent survey areas (Table 11). As with other pittas, it is susceptible to capture in snares set for ground-dwelling birds. (Plate 12)

Pitta sordida **Hooded Pitta**. Wet season breeding visitor; north[B9], south[B5]. Evergreen forest and secondary growth up to at least 870 m. Records prior to 1996 were reviewed by Duckworth *et al*. (1998a).

Pitta moluccensis **Blue-winged Pitta**. Wet season breeding visitor; north[B1], centre[B16], south[B2]. Evergreen and deciduous forests, secondary growth, mature scrub; often in areas with extensive bamboo and many streams. Generally in lowlands and foothills.

Conservation Management and Research Proposed for Pittas:

- Protection of adequate habitat areas from excessive hunting (including snaring); see Phasianidae.

Eurylaimidae: Broadbills (5 species)

Corydon sumatranus **Dusky Broadbill**. Resident; north[B9], centre, south[B2]. Evergreen forests, often along streams; up to at least 900 m.

Cymbirhynchus macrorhynchus (= *C. macrorhynchos*, ^K) **Black-and-red Broadbill**. Resident; south[B2]. Lowland wooded areas and tall, thick scrub, especially near watercourses; exceptionally within dense forest. All records from below 300 m. Records prior to 1997 were reviewed by Thewlis *et al*. (1998). In view of the species's apparently secure status (common in several areas of degraded habitat in Champasak Province), it was dropped from the recommended list of key species. It was first recorded for Lao PDR in 1992 (Thewlis *et al*. 1996).

Eurylaimus javanicus **Banded Broadbill**. Resident; north, centre, south[B2]. Evergreen forests and mature secondary growth mainly below 600 m, occasionally to 800 m.

Serilophus lunatus **Silver-breasted Broadbill**. Resident; north[B1], centre, south[B2]. Evergreen forest and mature secondary growth, up to at least 1100 m.

Psarisomus dalhousiae **Long-tailed Broadbill**. Resident; north[B1], centre, south[B2]. Evergreen forest including encroached areas from lowlands to at least 1700 m; mainly hills.

Irenidae: Fairy bluebirds, leafbirds (4 species)

Irena puella **Asian Fairy Bluebird**. Resident; north, centre, south[B2]. Forests (both evergreen and mixed deciduous) and adjacent tall secondary growth, up to at least 1300 m.

Chloropsis cochinchinensis **Blue-winged Leafbird**. Resident; north, centre, south[B2]. Evergreen and mixed deciduous forests and tall secondary growth to at least 1200 m.

Chloropsis aurifrons **Golden-fronted Leafbird**. Resident; north (historically[B18]), centre, south[B2]. Mostly in mixed

deciduous forest, dry dipterocarp forest and open degraded habitats; lowlands and foothills.

Chloropsis hardwickii **Orange-bellied Leafbird**. Resident; north, centre[B10], south[B5]. Hill evergreen forest and forest edge, generally above 600 m; locally down to 400 m.

Laniidae: Shrikes (5 species)

Lanius tigrinus **Tiger Shrike**. Passage migrant; north (historically, Delacour and Jabouille 1940). Secondary growth, open forests and edge. Although Delacour and Jabouille (1940) is primarily a secondary source, they specifically note that H. G. Deignan obtained this species near the Mekong in north Lao PDR.

Lanius cristatus **Brown Shrike**. Winter visitor; north, centre, south[B2]. Scrub and bushes amid open country, forest edge, secondary growth, gardens. Mainly lowlands and foothills, on plateaux to at least 1200 m.

Lanius collurioides **Burmese Shrike**. Resident, perhaps also migrant; north[B1], centre[B9], south[B2]. Open deciduous forest, including dry dipterocarp forest, pine forest, cultivation; up to 1250 m.

Lanius schach **Long-tailed Shrike**. Resident; north[B2], centre[B10], south[B2]. Scrub and bushes amid open country, secondary growth and cultivation, up to at least 1600 m.

Lanius tephronotus **Grey-backed Shrike**. Winter visitor; north[B1], centre[B10], south[B5]. Scrub, bushes amid cultivation and other open secondary habitats, up to at least 1600 m.

Corvidae: Whistlers, jays, magpies, crows, woodswallows, orioles, cuckooshrikes, minivets, flycatcher-shrikes, fantails, drongos, monarchs, paradise-flycatchers, ioras, woodshrikes (47 species)

Pachycephala grisola (= *P. cinerea*, ^K) **Mangrove Whistler**. Resident; south[B11]. Low-moderate stature dry evergreen forest of extreme lowlands. First recorded in Lao PDR in 1998, in Dong Khanthung PNBCA (Round 1998).

Garrulus glandarius **Eurasian Jay**. Resident; centre, south[B2]. Dry dipterocarp, open deciduous and pine forests, of lowlands, foothills and plateaux.

Urocissa erythrorhyncha **Red-billed Blue Magpie** (= Blue Magpie, ^K, ^Sm, ^T). Resident; north[B9], centre, south[B2]. Forests, especially open mixed deciduous, and secondary growth; mostly below 600 m.

• *Urocissa whiteheadi* **White-winged Magpie**. *Conservation Significance:* Globally Near-Threatened; Potentially At Risk in Lao PDR; endemic to Lao PDR, Vietnam and southern China. *Documented Range and Habitat:* Resident; north, centre[B14]. Broad-leaved evergreen, pine and mixed deciduous forests, particularly at streamsides and other gaps, and secondary growth; from 200 m up to at least 1080 m. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). The species is very local in Lao PDR. Records come from only four recent survey areas (Table 11), all in the north and central Annamites. (Plate 12)

Cissa chinensis **Common Green Magpie** (= Green Magpie, ^K, ^Sm, ^T). Resident; north[B1], centre, south[B2]. Evergreen forests and tall secondary regrowth, occasionally mixed deciduous forest; lowlands to at least 1700 m.

• *Cissa hypoleuca* **Indochinese Green Magpie** (= Yellow-breasted Magpie, ^Sm[2]; = Eastern Green Magpie, ^T); (included in *Cissa thalassina* Short-tailed Magpie by ^K, ^Sm[1]). *Conservation Significance:* Globally Near-Threatened; Potentially At Risk in Lao PDR; endemic to Indochina, south-east Thailand and southern China. *Documented Range and Habitat:* Resident; north, centre[B7], south[B2]. Evergreen and occasionally mixed deciduous forest, largely restricted to semi-evergreen forest with localised bamboo patches in the extreme lowlands in south, but occurring in evergreen forest up to at least 750 m in the Annamites. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). The sole historical record comes from the slopes of the Bolaven Plateau (Engelbach 1932). All records prior to 1997 came from lowland Champasak and Attapu Provinces. It has since been discovered in three survey areas in central and north Lao PDR (Nam Theun Extension PNBCA, Nakai-Nam Theun and Hin Namno NBCAs), although at lower densities than in Xe Pian NBCA. In at least Nam Theun Extension PNBCA, it occurs in the same forests as *C. chinensis*.

Dendrocitta vagabunda **Rufous Treepie**. Resident; centre (historically[B22]), south[B2]. Open deciduous forests, especially dry dipterocarp; lowlands.

Dendrocitta formosae **Grey Treepie**. Resident; north[B4], centre[B10]. Evergreen forest and adjacent secondary growth in a mosaic with more open areas, generally above 700 m, locally down to 520 m.

Crypsirina temia **Racket-tailed Treepie**. Resident; north[B1], centre, south[B2]. Open country, scrub, secondary growth, cultivation, streamsides through dry dipterocarp forest, also open mixed deciduous and semi-evergreen forest; usually below 750 m.

Temnurus temnurus **Ratchet-tailed Treepie**. Resident; north, centre[B14]. Evergreen forest at 200-1200 m. Records prior to

1997 were reviewed by Thewlis *et al*. (1998). In view of the species's apparently secure status (widespread and locally common in five survey areas, and recorded from a further two), it was dropped from the list of key species. However, it has only been found subsequently in one further survey area, Nam Xam NBCA (Showler *et al*. 1998b) and it appears to be restricted in Lao PDR to eastern parts. The species's conservation status should be reconsidered at regular intervals. *Special Significance:* Endemic to Lao PDR, Vietnam and Hainan (south China) with outlying populations in southern Thai/Myanmar border area.

• *Pica pica* **Black-billed Magpie**. *Conservation Significance:* Little Known in Lao PDR. *Documented Range and Habitat:* Presumed resident; north (historically[B18]), south (provisionally, historically, Engelbach 1927). Habitat unknown in Lao PDR. *Status Information:* There is only one confirmed record from Lao PDR: a male at Phongsali on 26 April 1929 (Bangs and Van Tyne 1931). Engelbach (1927) considered the species 'very common' in south Lao PDR, yet later when summing up his observations in the area (Engelbach 1932), he did not mention it. It beggars belief that a mistake could have been made in the earlier identification, yet Delacour and Jabouille (1940) also make no reference to the 1927 record. Thus, the magnitude of decline in Lao PDR is unclear. The species has declined drastically in Vietnam. Delacour *et al*. (1928) noted that the species was 'very common' in Vietnam, but did not occur south of Cap Varela (about 13ºN). It is now extremely rare (J. C. Eames verbally 1998). The factors which have driven its decline in Vietnam are likely also to have operated in Lao PDR, if the species was formerly widespread here. It should therefore be considered Little Known in Lao PDR.

Corvus macrorhynchos **Large-billed Crow**. Resident; north[B2], centre[B10], south[B2]. Open country, secondary growth, especially near large slow-flowing rivers and other extensive water bodies. Sibley and Monroe (1990) separated *C. levaillanti* Jungle Crow as a separate species. Both races of crow known to inhabit Lao PDR, *C. m. macrorhynchos* and *C. m. colonorum,* belong under *C. macrorhynchos (s.s.)*, but *levaillanti* might also occur, as its distribution includes northern Thailand and Myanmar. Crows are scarce in most of Lao PDR, tending to be less scarce in areas away from large human settlements. As a large bird of non-forest areas, it is vulnerable to human pressure in various forms. The species's conservation status should be reconsidered at regular intervals.

Artamus fuscus **Ashy Woodswallow**. Resident; north[B9], centre[B10], south[B2]. Open wooded areas predominantly of secondary regrowth and cultivation from 150 m up to 1400 m. Records prior to 1996 were reviewed by Duckworth *et al*. (1998a).

Oriolus chinensis **Black-naped Oriole**. Largely winter visitor; north, centre, south[B2], breeding in the north[B21]. Most habitats with trees, from evergreen forest to stands of trees amid cultivation; lowlands to at least 1000 m.

Oriolus tenuirostris **Slender-billed Oriole**. Seasonal status unclear, breeds in some areas; north[B8], south[B9]. Open forest, at one site with pines, up to at least 1150 m; probably rare in lowlands. Records prior to 1996 were reviewed by Duckworth *et al*. (1998a). Difficulties of separation from Black-naped Oriole hamper status assessment of this species.

Oriolus xanthornus **Black-hooded Oriole**. Resident; north (Pasquet 1997), centre, south[B2]. Forests, mainly open, deciduous and below 800 m.

Oriolus traillii **Maroon Oriole**. Resident (*O. t. traillii*) and winter visitor (*O. t. nigellicauda*); north[B1], centre[B10], south[B2]. Forests, mainly evergreen and above 500 m, but dispersing as low as 150 m in winter.

Coracina macei **Large Cuckooshrike** (included in *C. novaehollandiae* Large Cuckooshrike by ^K). Resident; north[B10], centre, south[B2]. Open evergreen and mixed deciduous forest, forest edge, glades in heavy forest and ridges in montane forest, up to at least 2000 m.

Coracina polioptera **Indochinese Cuckooshrike**. Resident; north (historically[B21]), centre (historically[B22]), south[B2]. Open deciduous forest and secondary growth, chiefly of lowlands, foothills and plateaux, up to 850 m. Separation from *C. melaschistos* can be difficult; it is possible that this is responsible for the lack of recent records of this species over most of the country. *Special Significance:* Endemic to Indochina, Thailand and Myanmar.

Coracina melaschistos (= *C. melaschista*, ^K, ^T) **Black-winged Cuckooshrike**. Mainly winter visitor; north, centre, south[B2], also resident in north[B21]. Forests, tall dense secondary growth; migrants appear in even heavily fragmented areas and town gardens. Occurs up to at least 1480 m.

Pericrocotus roseus **Rosy Minivet**. Passage migrant and perhaps winter visitor; north[B2], south[B2]. Forests, tall dense secondary growth.

• *Pericrocotus cantonensis* **Swinhoe's Minivet** (= Brown-rumped Minivet, ^Sm); (included in *P. roseus* Rosy Minivet by ^K, ^T). *Conservation Significance:* Globally Near-Threatened. Not At Risk in Lao PDR. *Documented Range and Habitat:* Winter visitor; north, centre, south[B14]. Open deciduous forests and secondary growth, occasionally in evergreen forest, up to at least 870 m. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). Small numbers

have been recorded from 11 widely-scattered recent survey areas (Table 11). Post-1996 records include a small flock in Nam Kading NBCA in January 1999 (TDE).

Pericrocotus divaricatus **Ashy Minivet**. Winter visitor; north[B2], centre[B9], south[B2]. Forests, secondary growth and trees amid cultivation; generally lowlands and foothills.

Pericrocotus cinnamomeus **Small Minivet**. Resident; north[B7], centre[B10], south[B2]. Dry dipterocarp and other open deciduous forests, up to 550 m.

Pericrocotus solaris **Grey-chinned Minivet**. Resident; north[B10], centre[B7], south[B2]. Evergreen forest, occasionally in pines; above 500 m.

Pericrocotus ethologus **Long-tailed Minivet**. Seasonal status unclear; north[B8], centre (historically, see below), south (provisionally[B3]). Evergreen forest including pine forest and secondary growth, generally above 1000 m, some moving lower in winter. Skins collected by David-Beaulieu in Savannakhet Province, but apparently not recorded by him as any species in David-Beaulieu (1949-1950), were re-examined by B. F. King and found to be Long-tailed Minivet. Furthermore, the listings in King *et al*. (1975) for this species in north and south Lao PDR were apparently erroneous (E. C. Dickinson *in litt*. to T. P. Inskipp 1997). Field separation of Long-tailed and Short-billed Minivets can be difficult.

Pericrocotus brevirostris **Short-billed Minivet**. Resident; north[B7], centre[B10], south (provisionally[B3]). Evergreen forest above 1080 m. Records of this species in Davidson *et al*. (1997) and Showler *et al*. (1998a) should refer to Short-billed / Long-tailed Minivet.

Pericrocotus flammeus **Scarlet Minivet**. Resident; north[B1], centre, south[B2]. Evergreen and deciduous forest, and adjacent wooded areas and secondary growth, up to at least 1600 m.

Hemipus picatus **Bar-winged Flycatcher-shrike**. Resident; north, centre, south[B2]. Evergreen forest, forest edge and tall regrowth; rare in open deciduous forest except where bordering evergreen streamside forest. Occurs up to at least 1350 m.

Rhipidura hypoxantha **Yellow-bellied Fantail**. Resident, north[B8]. Montane evergreen forest; probably breeds above 2000 m. The only records are from two sites in Xiangkhouang Province (David-Beaulieu 1944) and the summit of Phou Louey mountain, Phou Louey NBCA, where the species was common in May 1998 (Davidson 1998). Thewlis *et al*. (1998) considered the bird Little Known in Lao PDR. This is no longer appropriate as there is no clear threat to the species or its habitats.

Rhipidura albicollis **White-throated Fantail**. Resident; north, centre[B10], south[B2]. Evergreen forest, secondary growth, bamboo; mainly in hills and mountains, but locally down to 200 m.

Rhipidura aureola **White-browed Fantail**. Resident; centre (historically[B22]), south[B2]. Dry dipterocarp forest of lowlands and foothills, but apparently absent from some large areas of this habitat. Records from prior to 1994 were summarised in Thewlis *et al*. (1996).

Rhipidura javanica **Pied Fantail**. Presumed resident; north (Robson 1997b). Dense scrub and vegetation in disturbed areas, often near water, e.g. gardens, cultivation. Duckworth *et al*. (1998a) hypothesised that the Mekong represented a dispersal barrier to this species. There seems no other clear explanation for the difference in status on the Thai bank (at Nong Khai, where it is abundant) and in Lao PDR (Vientiane area), where the species was first recorded in 1997 (Robson 1997b) and it remains very local.

Dicrurus macrocercus **Black Drongo**. Locally resident, more widespread in winter; north, centre, south[B2]. Open country including towns and cultivation; generally lowlands.

Dicrurus leucophaeus **Ashy Drongo**. Locally resident, augmented by winter visitors; north, centre, south[B2]. Forests, scrub, agricultural land, towns, from lowlands to at least 1800 m.

Dicrurus annectans **Crow-billed Drongo**. Wet-season breeding visitor and probable passage migrant; north[B9], centre[B2], south[B9]. Evergreen forests and tall regrowth from lowlands to at least 960 m. Breeders were found in Dong Ampham NBCA in the late dry - early wet season 1997 (Davidson *et al*. 1997). Records from prior to 1994 were summarised in Thewlis *et al*. (1996).

Dicrurus aeneus **Bronzed Drongo**. Resident; north, centre, south[B2]. Evergreen forests and tall secondary growth up to at least 1800 m.

Dicrurus remifer **Lesser Racket-tailed Drongo**. Resident, some dispersing to lower altitudes in winter; north, centre, south[B2]. Evergreen forests, generally above 500 m in breeding season; outside this season, often in tall secondary growth and down to plains.

Dicrurus hottentottus **Spangled Drongo** (= Hair-crested Drongo, ^Sm, ^T). Resident, undertaking at least local movements; north, centre, south[B2]. Forests, secondary growth, flowering trees amid cultivation; up to at least 1700 m.

Dicrurus paradiseus **Greater Racket-tailed Drongo**. Resident; north, centre, south[B2]. Evergreen and mixed deciduous forests and tall secondary growth, generally below 1000 m.

Hypothymis azurea **Black-naped Monarch**. Resident; north, centre, south[B2]. Evergreen and mixed deciduous forest and other thick vegetation types; up to at least 1200 m, although generally lower.

Terpsiphone paradisi **Asian Paradise-flycatcher**. Seasonal status unclear; north, centre, south[B2]. Evergreen forest, tall secondary growth, mainly lowlands but up to at least 1450 m.

• *Terpsiphone atrocaudata* **Japanese Paradise-flycatcher**. *Conservation Significance:* Globally Near-Threatened; Little Known in Lao PDR. *Documented Range and Habitat:* Passage migrant; centre[B10], south (historically[B19]). Evergreen forests. *Status Information:* Recorded only on the Bolaven Plateau in 1930 (Engelbach 1932) and in Nakai-Nam Theun NBCA in 1994 (Thewlis *et al*. 1998), both in April.

Aegithina tiphia **Common Iora**. Resident; north, centre, south[B2]. Open forest and forest edge, gardens, secondary growth and wooded areas; among natural habitats, dry dipterocarp forest supports the highest densities. Occurs to at least 1050 m.

Aegithina lafresnayei **Great Iora**. Resident; north, centre, south[B2]. Evergreen forest and adjacent secondary growth, generally below 750 m.

Tephrodornis gularis (= *T. virgatus*, ^K, ^T) **Large Woodshrike**. Resident; north[B1], centre, south[B2]. Forests and well wooded country up to 1500 m.

Tephrodornis pondicerianus **Common Woodshrike**. Resident; centre[B10], south[B2]. Mixed deciduous and dry dipterocarp forest, sometimes in other open areas with scattered trees; generally below 700 m. The record for Nam Et / Phou Louey NBCAs in Davidson (1998) was an editorial error.

Conservation Management and Research Proposed for Corvidae:

- Conservation of adequate habitat.
- Hunting controls on larger species (magpies and jays), notably White-winged Magpie and Indochinese Green Magpie; both are restricted in range and the former is particularly conspicuous to hunters.
- Field investigation of reasons why Large-billed Crow and perhaps Black-billed Magpie have declined; nest disturbance may be a major factor.
- Field investigation of the use of the various types of dry dipterocarp forest by White-browed Fantail.

Cinclidae: Dippers (1 species)

• *Cinclus pallasii* **Brown Dipper**. *Conservation Significance:* Potentially At Risk in Lao PDR. *Documented Range and Habitat:* Resident; north, centre[B10]. Upland streams and rivers in both forested and cleared areas; generally above 600 m. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). Historical and recent records both come from scattered montane areas of the north and down the Annamites into central Lao PDR. The species is known from six recent survey areas (Table 11). It was only considered to be common, and only locally so, in two. It has not been found in various other areas of superficially suitable habitat within its Lao range. There may be specific microhabitat requirements. In the absence of any understanding of these, and given the ecological fragility of upland river systems in Lao PDR, the species is retained as Potentially At Risk in Lao PDR.

Conservation Management and Research Proposed for Dippers:

- Conservation of adequate habitat.
- Research into factors leading to the patchy distribution of the species.

Muscicapidae: Thrushes, shortwings, true flycatchers, robins, redstarts, forktails, cochoas, chats (70 species)

Monticola gularis **White-throated Rock Thrush**. Winter visitor; north[B9], centre[B16], south[B2]. Forests, mainly evergreen; generally below 700 m.

Monticola rufiventris **Chestnut-bellied Rock Thrush**. Resident; north[B13]. Open evergreen forests and cleared areas above 1500 m.

Monticola solitarius **Blue Rock Thrush**. Winter visitor; north, centre, south[B2]. Open forest with rocky areas, limestone karst, open stream and river banks, secondary growth with bare areas, towns and villages; up to at least 1500 m.

Myophonus caeruleus (= *Myiophoneus caeruleus*, ^T; = *Myiophonus caeruleus*, ^Sm) **Blue Whistling Thrush**. Winter visitor and local resident; north[B1], centre, south[B2]. Forested streams (especially in rocky areas) and dry karst valleys, from lowlands to highest altitudes.

Zoothera citrina **Orange-headed Thrush**. Seasonal status unclear; north[B9], centre[B10], south[B2]. Evergreen forest, particularly in gullies, and mature secondary growth, including on limestone, to at least 1165 m.

Zoothera sibirica **Siberian Thrush**. Passage migrant and perhaps uncommon winter visitor; north[B9], centre[B2]. Evergreen forest, secondary growth, thickets; most records from hills and mountains. Records from prior to 1994 were summarised in Thewlis *et al*. (1996).

Zoothera dixoni **Long-tailed Thrush**. Seasonal status unclear; north[B6]. Sole Lao record came from montane evergreen forest at 1750 m. First recorded in Lao PDR in Nam Ha NBCA in March 1997 (Tizard *et al*. 1997; RJTiz).

Zoothera dauma **Scaly Thrush**. Winter visitor, also local resident[B21]; north[B1], centre, south[B2]. Wooded areas at 200-1650 m; high numbers along stream banks in mid-altitude evergreen forest.

Zoothera marginata **Dark-sided Thrush**. Resident; north[B9], centre[B2], south (historically[B19]). Evergreen forest, particularly near shady streams; generally above 600 m but occasionally lower.

• *Turdus dissimilis* **Black-breasted Thrush**. *Conservation Significance:* Globally Near-Threatened; Little Known in Lao PDR. *Documented Range and Habitat:* Winter visitor; north, centre[B14]. Stream banks within forest, areas with fruiting trees; above 500 m. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). The species has been seen recently only in evergreen forest near Louang-Namtha and on the Nakai Plateau, and, in late 1998, provisionally in the Southern Mountains of Nakai-Nam Theun NBCA (Robichaud 1999). In January 1997 about eight were seen dead in Louang-Namtha market (RJTiz) and in February 1999 a male was seen in Ban Phonsavan market, Xiangkhouang Province (TDE).

Turdus cardis **Japanese Thrush**. Winter visitor; north[B10], centre[B9], south[B15]. Forest and other dense vegetation, probably mainly in hills and mountains.

• *Turdus boulboul* **Grey-winged Blackbird**. *Conservation Significance:* Little Known in Lao PDR. *Documented Range and Habitat:* Resident; north (TDE). Breeds in high mountains, descending a little in winter. *Status Information:* Historically, in Xiangkhouang Province it was fairly rare (David-Beaulieu 1944) and a female was taken in Lo Tiao, Bokeo Province (Delacour and Greenway 1940a). A male was seen in Ban Phonsavan market, Xiangkhouang Province, in February 1999 (TDE). The species is probably a local higher montane breeder and until a population is found is best considered Little Known in Lao PDR.

Turdus merula **Eurasian Blackbird** (= Common Blackbird, ^K, ^T). Winter visitor; north[B9], centre[B10], south[B2]. Secondary growth, vegetated stream and river banks through forest and areas with fruit trees; mainly in hills and mountains, also in extreme lowlands.

Turdus rubrocanus **Chestnut Thrush**. Winter visitor; north[B6], centre[B17]. There are two Lao records: at least three birds in evergreen forest at about 900 m and one in riparian evergreen forest amid open deciduous forest at 200 m. First recorded for Lao PDR in March 1997 in Nam Ha NBCA (Tizard *et al*. 1997).

• *Turdus feae* **Grey-sided Thrush**. *Conservation Significance:* Globally Threatened - Vulnerable; Little Known in Lao PDR. *Documented Range and Habitat:* Winter visitor; centre[B9]. Both recent Lao records came from river banks through evergreen forest at about 520 m. *Status Information:* The species is known in Lao PDR only from two singles observed on the Nakai Plateau in February 1995 (Thewlis *et al*. 1998, Duckworth *et al*. 1998a).

Turdus obscurus **Eyebrowed Thrush**. Winter visitor; north[B2], centre[B10], south[B2]. Well-wooded areas at all altitudes.

Brachypteryx leucophrys **Lesser Shortwing**. Resident; north, centre[B7], south[B2]. Evergreen forest above 1000 m, some birds moving lower in winter.

Brachypteryx montana **White-browed Shortwing**. Resident; north[B8]. Evergreen forest; only above 2000 m at the only known recent site, Phou Louey NBCA (Davidson 1998). Thewlis *et al*. (1998) reviewed past records and considered the bird Little Known in Lao PDR. This is no longer appropriate as there is no clear threat to the species or its habitats.

Muscicapa sibirica **Dark-sided Flycatcher**. Passage migrant, overwintering locally in the south; north[B10], centre[B2], south[B9]. Forest gaps, open wooded country, villages. Records prior to 1996 were reviewed by Duckworth *et al*. (1998a).

Muscicapa dauurica (= *M. latirostris*, ^K) **Asian Brown Flycatcher**. Passage migrant, wintering locally in south and lowlands; north, centre, south[B2]. Forest gaps and edges, stream and river sides, open wooded country, villages and even towns. It is possible that the race *M. d. siamensis*, resident in areas peripheral to Lao PDR such as south Annam (Vietnam) and north-west Thailand, may occur locally in Lao PDR.

Muscicapa ferruginea **Ferruginous Flycatcher**. Passage migrant, overwintering locally; north[B9], centre[B17]. Evergreen forest, particularly tree-fall sites. Records prior to 1996 were reviewed by Duckworth *et al*. (1998a).

Ficedula zanthopygia **Yellow-rumped Flycatcher**. Passage migrant; north[B2]. Wooded areas, scrub, villages.

Ficedula mugimaki **Mugimaki Flycatcher**. Winter visitor and passage migrant; north[B9], centre[B10], south[B9]. Evergreen and mixed deciduous forests, wooded areas, tree-falls and

other gaps within forest, berry-bearing scrub, from 200 up to at least 1600 m.

Ficedula hodgsonii **Slaty-backed Flycatcher**. Winter visitor; north[B8], centre (JWD). Evergreen forest edge and secondary growth; recent records from over 520 m.

Ficedula strophiata **Rufous-gorgeted Flycatcher**. Winter visitor, also resident in at least south-east Lao PDR; north[B13], south[B3]. Evergreen forest, forest edge; generally over 1500 m, some down to 900 m in winter.

Ficedula parva **Red-throated Flycatcher** (= Red-breasted Flycatcher, ^Sm). Winter visitor; north, centre, south[B2]. Open wooded areas, forest edge especially flanking watercourses, trees and bushes within cultivation, gardens; on passage may occur within dense forest.

Ficedula monileger **White-gorgeted Flycatcher**. Resident; north, centre[B10], south[B9]. Evergreen forest, mature regrowth, bamboo; above 800 m. Birds in parts of the Bolaven Plateau show morphological variation perhaps indicating intergradation with Rufous-browed Flycatcher (Thewlis *et al*. 1996).

Ficedula solitaris (= *F. solitaria*, ^K) **Rufous-browed Flycatcher**. Presumed resident; south (PD). Sole Lao record is from evergreen forest at 1140 m during December 1997 on the Dakchung Plateau. Rufous-browed Flycatcher may have a very limited range in Lao PDR as birds along the southern border of Xe Sap NBCA and on Phou Ahyon are the closely-related *F. monileger*. The latter was not found in the area supporting *F. solitaris*. See also *F. monileger*.

Ficedula hyperythra **Snowy-browed Flycatcher**. Resident; north[B9], centre[B10], south[B2]. Evergreen forest, especially in thick undergrowth and near shady streams, generally above 1000 m, although some move lower (exceptionally to 400 m) in winter.

Ficedula westermanni **Little Pied Flycatcher**. Resident; north[B2], centre[B10], south[B2]. Forest and forest edge, breeding in mountains but some disperse down to plains (200 m) in winter.

Ficedula tricolor **Slaty-blue Flycatcher**. Seasonal status unclear, possibly both resident and winter visitor; north[B6]. Evergreen secondary growth, thickets, grass and scrub above 1000 m.

Ficedula sapphira **Sapphire Flycatcher**. Seasonal status unclear, possibly both resident and winter visitor; north (historically[B20]), centre[B7]. Evergreen forests generally over 1200 m; birds thought perhaps to be breeding in central Lao PDR were at 1520 m.

Cyanoptila cyanomelana **Blue-and-white Flycatcher**. Passage migrant; north, centre, south[B2]. Wooded areas, forest edge, berry-bearing scrub. Records from prior to 1994 were summarised in Thewlis *et al*. (1996).

Eumyias thalassina (= *Muscicapa thalassina*, ^K) **Verditer Flycatcher**. Local resident and widespread winter visitor; north[B2], centre[B10], south[B2]. Forests, forest clearings, streamsides, from lowlands to at least 1950 m.

Niltava grandis **Large Niltava**. Resident; north[B13], centre[B10], south[B2]. Evergreen forest and adjacent regrowth, generally above 1000 m.

Niltava macgrigoriae **Small Niltava**. Resident; north, centre[B10], south[B2]. Hill and montane evergreen forest and secondary growth, some moving lower in winter, exceptionally down to 400 m.

• *Niltava davidi* **Fujian Niltava** (= Fukien Niltava, ^K, ^T). *Conservation Significance:* Globally Near-Threatened; Potentially At Risk in Lao PDR; endemic to Lao PDR, Vietnam and parts of southern China, with one record from Thailand. *Documented Range and Habitat:* Winter visitor; north[B9], centre[B7], south (historically[B19]). Gullies and streams in mid-altitude evergreen forests. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). Status assessment is clouded by the difficulties of separation from Rufous-bellied Niltava (Plate 12), and the conflicting treatments of the historical Lao records in various sources (Dickinson 1973, King *et al*. 1975). It seems likely that the species occurs fairly widely in hills throughout eastern Lao PDR. There are records from up to six recent survey areas (Table 11).

Niltava sundara **Rufous-bellied Niltava**. Seasonal status unclear, but probably resident in north at least, augmented by winter visitors; north[B8], centre[B7]. Evergreen forests, generally above 1000 m. See also *N. davidi*.

Niltava vivida **Vivid Niltava**. Seasonal status unclear; north[B6]. Evergreen forest above 1650 m.

Cyornis concretus (= *C. concreta*, ^K, ^T) **White-tailed Flycatcher** (= White-tailed Blue Flycatcher, ^Sm[1]). Resident; north[B10], centre[B2], south[B5]. Evergreen forest from 200 to at least 1360 m. Records prior to 1996 were reviewed by Duckworth *et al*. (1998a).

Cyornis hainanus (= *C. hainana*, ^K, ^T) **Hainan Blue Flycatcher**. Winter visitor, breeding locally (probably mainly in hills); north[B2], centre[B10], south[B2]. Wooded areas, both evergreen and mixed deciduous; up to at least 1020 m. *Special Significance:* Endemic to Indochina, Thailand, south China and Myanmar.

Cyornis unicolor **Pale Blue Flycatcher**. Resident; north[B9], centre[B10], south[B2]. Evergreen and mixed deciduous forest including on limestone, also pines, from foothills to at least 1500 m; often near streams, landslides, ridge crests and other areas of more open forest.

Cyornis rubeculoides **Blue-throated Flycatcher**. Resident and passage migrant; centre, south[B2]. Forests and mature secondary growth, at 300-1200 m. The resident form *C. r. klossi* has a small range in the south of the country. There is one recent record of the migrant race *C.* (*r.*) *glaucicomans* (Thewlis *et al*. 1996), which is sometimes considered a separate species, Chinese Blue Flycatcher (see Inskipp *et al*. 1996). There is also one recent record of a bird with a throat largely or entirely blue, and thus neither of the foregoing races: from Hin Namno NBCA in February 1998 (PD).

Cyornis banyumas **Hill Blue Flycatcher**. Resident; north[B7], centre[B7], south (potentially[B2]). Evergreen and deciduous forest and tall secondary growth, up to at least 1000 m. Status is obscured by the difficulties of separation from Tickell's Blue Flycatcher; in particular, many birds in the south were identified only to Hill/Tickell's Blue Flycatcher. Birds, of one, other or both these two species, are common across much or all of Lao PDR. The record of this species for south Lao PDR in Showler *et al*. (1998a) was an editorial error.

Cyornis tickelliae **Tickell's Blue Flycatcher**. Resident; centre (provisionally[B10]; historically, Delacour 1929a), south[B5]. Wooded areas, especially bamboo-dominated areas including streamsides through deciduous forest, up to at least 650 m. Status is somewhat obscured, due to difficulties of separating from Hill Blue Flycatcher.

Muscicapella hodgsoni **Pygmy Blue Flycatcher**. Resident; north[B8], centre[B10], south[B2]. Evergreen forest, including encroached areas, from 1100 to at least 2000 m. First recorded in 1993 (Thewlis *et al*. 1996).

Culicicapa ceylonensis **Grey-headed Canary Flycatcher** (= Grey-headed Flycatcher, ^K, ^T). Resident, subject to local movements, breeding generally above 600 m, with many dispersing to plains in winter; north, centre, south[B2]. Evergreen and deciduous forests, tall secondary growth, and, on passage, other habitats including town gardens.

Erithacus akahige **Japanese Robin** Winter visitor; centre (Robichaud 1999). The only Lao record is of a male in Nakai-Nam Theun NBCA at 1450 m on Phou Vang in December 1998 - January 1999, possibly accompanied by a female (Robichaud 1999).

Luscinia sibilans (= *Erithacus sibilans*, ^K) **Rufous-tailed Robin**. Winter visitor; north[B2], centre[B10], south[B2]. Dense understorey of evergreen forest and secondary growth up to at least 1200 m.

Luscinia calliope (= *Erithacus calliope*, ^K) **Siberian Rubythroat**. Winter visitor; north[B2], centre, south[B9]. Dense thickets and scrub, particularly over abandoned cultivation and near water, including some town gardens; mainly plains and foothills.

Luscinia svecica (= *Erithacus svecicus*, ^K) **Bluethroat**. Winter visitor; north[B2], centre[B16], south[B11]. Dense cover in otherwise open areas, reeds, grass, brush, almost invariably near water; mainly plains, foothills and plateaux.

Luscinia cyane (= *Erithacus cyane*, ^K) **Siberian Blue Robin**. Winter visitor; north, centre, south[B2]. Understorey of evergreen forest, secondary growth; less attached to impenetrable tangles than are congeners. Mainly below 900 m.

Tarsiger cyanurus **Orange-flanked Bush Robin**. Winter visitor; north[B9], centre[B10], south[B2]. Evergreen forest, secondary growth, often along streams; generally over 800 m, but locally as low as 150 m.

Copsychus saularis **Oriental Magpie Robin** (= Magpie Robin, ^K). Resident; north, centre, south[B2]. Gardens, cultivated areas, secondary growth, open wooded areas, towns; generally lowlands but up to at least 1000 m.

Copsychus malabaricus **White-rumped Shama**. Resident; north, centre, south[B2]. Degraded forests, dense secondary growth, bamboo areas within primary forest; up to at least 1000 m.

Phoenicurus auroreus **Daurian Redstart**. Winter visitor; north[B6], centre (historically, Delacour 1929a), south[B9]. Forest edge, montane thickets, undergrowth, generally at higher altitudes. Records prior to 1996 were reviewed by Duckworth *et al*. (1998a).

Phoenicurus frontalis **Blue-fronted Redstart**. Winter visitor; north (historically[B21]). Montane open country, grass, scrub, also forest edge (in south-west China and Thailand; likely to be similar in Lao PDR).

Chaimarrornis leucocephalus (= *Thamnolaea leucocephala*, ^K) **White-capped Water Redstart** (= River Chat, ^K, ^T). Resident, subject to some local movements; north, centre[B10]. Rocky streams and rivers, largely in hills and mountains; down to 240 m in winter.

Rhyacornis fuliginosus **Plumbeous Water Redstart** (= Plumbeous Redstart, ^K, ^T). Resident, subject to some local movements; north, centre[B10], south[B9]. Rocky streams, largely in hills and mountains; down to 240 m in winter.

Hodgsonius phaenicuroides **White-bellied Redstart**. Resident; north[B6]. Dense grass and scrub in open country, secondary growth and forest edge, above 1200 m.

Myiomela leucura (= *Cinclidium leucurum*, ^K, ^Sm, ^T) **White-tailed Robin**. Resident; north, centre[B10], south[B2]. Evergreen forest and bamboo, mostly above 1000 m but dispersing locally lower in winter (rarely to 150 m).

• *Cinclidium frontale* **Blue-fronted Robin**. *Conservation Significance:* Globally Near-Threatened; Little Known in Lao PDR. *Documented Range and Habitat:* Seasonal status unclear (probably resident); north (historically, Delacour and Jabouille 1927). Habitat unknown in Lao PDR, but presumably montane; elsewhere uses densely vegetated, damp shady gullies within or adjacent to evergreen forest (Redman 1992). *Status Information:* There is only one Lao record: from Xiangkhouang Province in January 1926 (Delacour and Jabouille 1927).

Enicurus schistaceus **Slaty-backed Forktail**. Resident; north, centre[B10], south[B2]. Rocky streams and rivers through evergreen forest, damp gullies, from lowlands to highest altitudes.

Enicurus leschenaulti **White-crowned Forktail**. Resident; north[B10], centre, south[B2]. Rocky streams and damp areas through evergreen forest, damp gullies, from lowlands to at least 1650 m.

• *Cochoa purpurea* **Purple Cochoa**. *Conservation Significance:* Globally Near-Threatened; Little Known in Lao PDR. *Documented Range and Habitat:* Resident; north (TDE). Presumed to use montane evergreen forest. *Status Information:* Nine were seen for sale in Ban Phonsavan market (Xiangkhouang Province) on 12 February 1999 (JWD). A provisional field record from Nam Theun Extension PNBCA was withdrawn by Evans and Timmins (1998). If the species is as heavily harvested as is Green Cochoa, but has a more limited range, it is likely to be more vulnerable.

• *Cochoa viridis* **Green Cochoa**. *Conservation Significance:* Globally Near-Threatened. Not At Risk in Lao PDR. *Documented Range and Habitat:* Resident; north, centre, south[B14]. Evergreen forest and adjacent degraded forest; generally above 750 m, occasionally lower. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). Green Cochoa inhabits most montane areas surveyed across the country, in the north-west, the Annamites and on the Bolaven Plateau (Table 11). Four were seen for sale in Xam-Nua market in January 1998 (Showler *et al*. 1998b) and a single was seen in Ban Phonsavan market (Xiangkhouang Province) on 12 February 1999 (JWD). Feathers from plucked hunted birds were found in Nam Xam NBCA (Showler *et al*. 1998b). Harvesting pressure is unlikely to eradicate the species from the large expanses of remaining habitat, but would become a greater threat with fragmentation of forest.

Saxicola torquata **Common Stonechat** (= Stonechat, ^K, ^T); (separated as *S. maura* Siberian Stonechat by ^Sm[1]). Local resident, winter visitor throughout; north, centre, south[B2]. Open areas with secondary growth, grass, cultivation, bushes amid paddies; passage birds may appear within small breaks (e.g. logging roads, grassy pools) in dense forest. Resident birds on Bolaven Plateau are usually found above 1000 m, wintering birds occur across a wide altitudinal range.

Saxicola caprata **Pied Bushchat**. Resident; north[B1], centre[B10], south[B2]. Open areas, secondary growth, cultivation, mostly lowlands; natural habitats are dry dipterocarp forest and island scrub in river channels.

• *Saxicola jerdoni* **Jerdon's Bushchat**. *Conservation Significance:* Globally Near-Threatened. Not At Risk in Lao PDR. *Documented Range and Habitat:* Resident, lowland populations making seasonal dispersal; north[B1]. Upland tall grassland (especially stands of *Imperata* and *Saccharum* spp.) and scrub subject to annual burning in hills to at least 1650 m, and natural scrub on lowland river-channel islands. Wintering birds by the Mekong in north Thailand, and presumably on the Lao side, use tall grass on river banks. *Status Information:* Records prior to 1997 were reviewed by Duckworth (1997b) and Thewlis *et al*. (1998). The species breeds in both hill grassland, where occurrence is patchy, and on Mekong islands. Survey of the latter has been too patchy to define the distribution in north Lao PDR, but the species is absent from such habitat in the south. A male in the Mekong channel between Vientiane and Sangthong at Ban Thanasanghin on 15 November 1998 (TDE) represents the current known downstream limit of occurrence. Records in upland areas are scattered across the north, including four recent survey areas (Table 11). Small numbers were seen near Nam Xam NBCA in January 1998, but suitable habitat was not found in the protected area (PD). The occurrence in various areas of secondary grassland generated by prolonged cultivation and over-burning suggests that the species should be considered Not At Risk in Lao PDR.

Saxicola ferrea **Grey Bushchat**. Winter visitor; north[B2], centre[B10], south[B2]. Open pine and broad-leaved evergreen forest, secondary growth and scrub, including cultivation; to at least 1650 m.

Conservation Management and Research Proposed for Muscicapidae:

- Conservation of adequate areas of habitat, particularly for key species with a restricted distribution, notably Grey-winged Blackbird, Fujian Niltava, Purple Cochoa

and Blue-fronted Robin. Various non-key species currently known only from one or a few sites would also need consideration if these sites became threatened, and the species were not found elsewhere: Long-tailed Thrush, White-browed Shortwing, Rufous-browed Flycatcher, Sapphire Flycatcher, Rufous-bellied Niltava, Vivid Niltava and Blue-throated Flycatcher. The erratic nature of occurrence of wintering thrushes limits the possibilities of location-specific action.

- Attention to stream complexes within protected areas; forest stream banks are important for thrushes, and shady gullies and streamsides for flycatchers, yet are susceptible to damage by a variety of subsistence / commercial activities.
- Hunting controls for the larger species. Bundles of passerines are widely sold in markets as food (Plates 1, 4, 12). *Turdus* spp., *Zoothera* spp. and *Cochoa* spp. are all traded. Fuller documentation of hunting would allow measures to be honed.
- Field investigation of the wet season location of riverine populations of Jerdon's Bushchat.

Sturnidae: Starlings, mynas (11 species)

Sturnus malabaricus **Chestnut-tailed Starling**. Seasonal status unclear, at least locally resident; north[B2], centre[B10], south[B2]. Open deciduous forest, secondary growth, scrub, cultivation, parts of towns with many mature trees (e.g. temple gardens); generally lowlands and foothills.

Sturnus sturninus **Purple-backed Starling**. Passage migrant; north (historically[B21]). Riverside trees, town parks and probably other types of open country with trees.

Sturnus sinensis **White-shouldered Starling**. Winter visitor; north[B6], centre[B10], south[B2]. Wide variety of open country from marshes through dry dipterocarp forest to limestone karst.

• *Sturnus contra* **Asian Pied Starling**. *Conservation Significance:* Little Known in Lao PDR. *Documented Range and Habitat:* Resident; north (historically[B20]). Habitat not known in Lao PDR. *Status Information:* No recent records; there are previous records only from the north-west (Bokeo - Phongsali Provinces). The species was common around Ban Muangyo in 1929 (Bangs and Van Tyne 1931), and around Ban Houayxai and Ban Namkeung-Kao it was fairly common, but shy and not easy to collect (Delacour and Greenway 1940a). Elsewhere in its range it is a popular cage-bird and the level of this threat in Lao PDR is unknown. It should therefore be regarded as Little Known in Lao PDR.

Sturnus nigricollis **Black-collared Starling**. Resident; north, centre, south[B2]. Open country, cultivation, scrub, paddy-fields, mainly in degraded country but also in semi-natural marshland and in dry dipterocarp forest; plains to at least 1200 m.

Sturnus burmannicus **Vinous-breasted Starling**. Resident; centre (historically[B22]), south[B2]. Mainly in open deciduous forest, tolerant of degradation and fragmentation, but rather local; occurs from lowlands to at least 900 m. The species's conservation status should be reconsidered at regular intervals as it is known from rather few sites over a restricted geographical range.

Acridotheres tristis **Common Myna**. Resident; north, centre, south[B2]. Open country, cultivation, villages, towns.

Acridotheres cinereus (= *A. javanicus*, ^K, ^T) **White-vented Myna** (separated as *A. grandis* White-vented Myna by ^Sm). Resident; north, centre, south[B2]. Open country, scrub, paddy-fields; especially near domestic buffaloes and/or water. Up to at least 1200 m.

Acridotheres cristatellus **Crested Myna**. Resident; centre[B2], south[B5]. Cultivation and other open country, including abandoned cultivation. Recorded only in the east of the country.

• *Ampeliceps coronatus* **Golden-crested Myna**. *Conservation Significance:* Potentially At Risk in Lao PDR. *Documented Range and Habitat:* Resident; north[B7], centre, south[B2]. Open parts of evergreen and deciduous forests and forest edge, including river-sides, below 600 m. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). Small numbers have been found in 10 recent survey areas (Table 11); most large areas of broken forest below 500 m in south and central Lao PDR may be found to support the species. Densities seem naturally low, meaning that large areas such as NBCAs are needed to support populations. Some apparently suitable survey areas lack records, notably Dong Khanthung PNBCA, Phou Xiang Thong NBCA and Nam Ghong Provincial PA. It has not been observed in markets or otherwise in captivity in Lao PDR, although there is no obvious reason why it would not be trapped for the cage-bird trade, and young have been seen for sale on the Thai - Lao border (La-Ong *et al*. 1997).

Gracula religiosa **Hill Myna**. Resident; north, centre, south[B14]. Wide habitat range; scarce in closed-canopy forest, treeless areas, heavily settled areas and above 600 m; recorded locally to 1000 m. Records prior to 1997 were reviewed by Thewlis *et al*. (1998), and the species was dropped from the list of key species. Although there is evidence of local declines, the species remains widespread and was recorded from almost all recent survey areas. The species's conservation

status should be reconsidered at regular intervals. *Special Significance:* CITES Appendix II.

Conservation Management and Research Proposed for Starlings and mynas:

- Development of adequate controls on the pet trade in Hill Mynas: nestlings are captured for use as pets (Baird 1993, Salter 1993a, Thewlis *et al*. 1998), of which some are kept locally and some traded to Thailand and Vietnam (Baird 1993, La-Ong *et al*. 1997, Compton in prep. b). Trade to Thailand reportedly involves at least 50 birds per year and that to Vietnam may be of the same order of magnitude (Baird 1993).
- Clearer understanding of the habitat use of Golden-crested Myna (of which nestlings are also traded to Thailand; La-Ong *et al*. 1997) and Vinous-breasted Starling.
- Field investigation of the current status of Asian Pied Starling and threats to it.

Sittidae: Nuthatches (6 species)

• *Sitta nagaensis* **Chestnut-vented Nuthatch**. *Conservation Significance:* Little Known in Lao PDR. *Documented Range and Habitat:* Resident; south[B9]. The one known Lao site is an area of pine forest at 1000 m[B9]. *Status Information:* First recorded in 1995, on the Bolaven Plateau (Duckworth *et al*. 1998a); no subsequent records. The site is not within the protected area system and is threatened by development. If subsequent work fails to find the species at other sites, it should be re-classified as At Risk in Lao PDR.

Sitta castanea **Chestnut-bellied Nuthatch**. Resident; north[B9], centre, south[B2]. Two forms occur: *S. c. neglecta* (with relatively pale rufous underparts) is typical of lowland dry dipterocarp forest of the Mekong plain and inhabits some other natural open formations, while *S. c. tonkinensis* (with deep chestnut underparts) has been recorded in mixed deciduous and dense evergreen forest from 250 to 1700 m. The ecological and taxonomic relationships between these forms are unclear in Lao PDR, as they are elsewhere (Harrap and Quinn 1996).

• *Sitta himalayensis* **White-tailed Nuthatch**. *Conservation Significance:* Little Known in Lao PDR. *Documented Range and Habitat:* Presumed resident; north (historically[B21]). Montane evergreen forest. *Status Information:* The only Lao record is of a small flock on Phou Kabo (Xiangkhouang Province) on 29 May 1939 (David-Beaulieu 1944). The lack of recent records indicate that the species should be considered Little Known in Lao PDR.

Sitta frontalis **Velvet-fronted Nuthatch**. Resident; north, centre, south[B2]. Evergreen forest, but patchy in occurrence, locally in deciduous forests and pine forests, and occasionally in other habitats such as mature secondary growth, freshly-cleared land for cultivation retaining relict trunks; up to 1650 m.

• *Sitta solangiae* **Yellow-billed Nuthatch**. *Conservation Significance:* Globally Threatened - Vulnerable; Potentially At Risk in Lao PDR; endemic to Lao PDR, Vietnam and Hainan (south China). *Documented Range and Habitat:* Resident; south[B14]. Evergreen forest at 900-1400 m. *Status Information:* The species was first found in Lao PDR in 1996, in the Phou Ahyon area and two sites on the Dakchung Plateau. This remains the only region with records. It appears to be common (Showler *et al*. 1998a, Thewlis *et al*. 1998) and occurs sympatrically with Velvet-fronted Nuthatch. *S. solangiae* was found in broad-leaved evergreen forest, with *S. frontalis* in adjacent pine woodland, on the Dakchung Plateau (Showler *et al*. 1998a). Thewlis *et al*. (1998) classified this species as Little Known in Lao PDR. The region of occurrence is under pressure from forest clearance. Until the species is found to be more widespread, it should be regarded as Potentially At Risk in Lao PDR.

• *Sitta formosa* **Beautiful Nuthatch**. *Conservation Significance:* Globally Threatened - Vulnerable; Potentially At Risk in Lao PDR. *Documented Range and Habitat:* Resident; north[B13], centre[B14]. Evergreen forests, usually above 1500 m, down to 950 m. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). Recent records come from only three survey areas (Table 11), extending south to Nakai-Nam Theun NBCA. Most birds were in or near areas of *Fokienia* forest.

Conservation Management and Research Proposed for Nuthatches:

- Conservation of adequate habitat areas for localised species (Chestnut-vented, White-tailed, Yellow-billed and Beautiful Nuthatches).
- Preservation of stands of *Fokienia* in areas supporting Beautiful Nuthatch. In view of its global threat level, this species is the nuthatch most in need of attention.

Certhiidae: Northern treecreepers (1 species)

• *Certhia discolor* **Brown-throated Treecreeper**. *Conservation Significance:* Little Known in Lao PDR. *Documented Range and Habitat:* Resident; north[B13]. Evergreen forest above 1460 m. *Status Information:* Historically, the species was common in the mountains of Xiangkhouang Province (David-Beaulieu 1944). This area has been barely visited recently, and the only recent records are from Nam Xam NBCA where it occurs in *Fokienia* forest at 1400-1700 m (Showler *et al*. 1998b). It was not found in other areas within or

marginal to its range, even those retaining tall forest at 1500 m or more (e.g. Phou Louey, Nam Ha and Phou Dendin NBCAs). It may have specific habitat requirements. It is thus retained as Little Known in Lao PDR.

Conservation Management and Research Proposed for Treecreepers:
- Conservation of adequate habitat areas.
- Clearer understanding of the species's habitat needs.

Paridae: Penduline tits, true tits (6 species)

Cephalopyrus flammiceps **Fire-capped Tit**. Winter visitor; north (historically[B20]). Habitat use unclear. The record in Robichaud and Sounthala (1995) was withdrawn by the observer. There remain only two Lao records: several birds at Lo-Tiao (Bokeo Province) on 9 January 1939 (Delacour and Greenway 1940a) and four on a Mekong sand-bar upstream of Chiang Saen (Thailand) on 25 December 1983 (PDR).

Parus major **Great Tit**. Resident; north (RJTim), centre (historically[B22]), south[B2]. Dry dipterocarp forest and open secondary growth with pines; chiefly lowlands and plateaux and unrecorded from many apparently suitable regions.

Parus monticolus **Green-backed Tit**. Resident; centre[B17]. Semi-evergreen and mixed deciduous forest on limestone at 220-500 m. First recorded for Lao PDR in 1996 in Hin Namno NBCA, where its presence was reconfirmed in 1998 (Walston in prep.). Although known only from one site, there is no reason to think the species at risk in Lao PDR, even potentially. Its habitat is barely accessible and the species is too small for market-led hunting. Plumage differences between the birds in Lao PDR and other populations of this rather variable species may warrant taxonomic investigation.

Parus spilonotus **Yellow-cheeked Tit**. Resident; north[B7], centre[B10], south[B2]. Evergreen forest and tall secondary growth over 800 m.

Sylviparus modestus **Yellow-browed Tit**. Resident; north[B8], south[B14]. Evergreen forest above 1500 m. Records prior to 1997 were reviewed by Thewlis *et al*. (1998). In view of the low likelihood that the species is under any specific threat, it was dropped from the recommended list of key species.

Melanochlora sultanea **Sultan Tit**. Resident; north, centre[B10], south[B7]. Evergreen and mixed deciduous forests and mature secondary growth at 200-1500 m.

Aegithalidae: Long-tailed tits (1 species)

Aegithalos concinnus **Black-throated Tit**. Resident; north, centre, south[B14]. Evergreen forest and secondary growth over 800 m, down to 490 m in winter. Records prior to 1997 were reviewed by Thewlis *et al*. (1998). In view of the species's apparently secure status and the low likelihood that it is under elevated threat, it was dropped from the recommended list of key species.

Hirundinidae: Swallows, martins (10 species)

Riparia riparia **Sand Martin**. Winter visitor; north (PD), centre (potentially[B9]; historically[B22]), south (potentially[B15]). Marshes, wide rivers. The difficulties of distinguishing this species from *R. diluta* Pale Martin (see Table 9) mean that most of the recent records are identified only to the species-pair. Sightings could involve either species. Records prior to 1997 were reviewed by Evans *et al*. (in prep. a). Historical records (as *R. r. ijimae*) come from Xiangkhouang and Savannakhet Provinces (David-Beaulieu 1944, 1949-1950).

• *Riparia paludicola* **Plain Martin**. *Conservation Significance:* At Risk in Lao PDR. *Documented Range and Habitat:* Resident; north[B14], centre (historically[B22]), south[B14]. Wide rivers, especially near sand banks, marshes. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). Historically the species was widespread and common (e.g. Engelbach 1932, Delacour and Greenway 1940a, David-Beaulieu 1944). Recently it has only been found commonly at one site, Sangthong District (1996: Duckworth 1996a, 1997: PD), with a few at scattered northern localities. There are two outlying records in the south: at Xe Pian NBCA in December 1992 (Thewlis *et al*. 1998), and over the Mekong near Champasak ferry in September 1997 (RJTiz). Two small breeding colonies, several kilometers apart, were found on the Mekong between Louangphabang and Pakou in December 1998 (L. Watson and C. Poole verbally 1998).

Hirundo concolor **Dusky Crag Martin**. Resident; north[B9], centre (WGR), south[B5]. Rugged country with exposed cliffs in both limestone and non-calcareous regions over at least 200-1700 m. Records prior to 1996 were reviewed by Duckworth *et al*. (1998a).

Hirundo rustica **Barn Swallow**. Resident and winter visitor; north, centre, south[B2]. Only known to breed south to Louangphabang (RJTiz) but small numbers over summer even in south Lao PDR (PDR). Breeding birds live around open areas (often near water and/or livestock), towns, villages; non-breeders occur over any habitat.

• *Hirundo smithii* **Wire-tailed Swallow**. *Conservation Significance:* Potentially At Risk in Lao PDR. *Documented Range and Habitat:* Resident; north[B1], centre[B16], south[B2]. Wide rivers with rocky outcrops or man-made structures, dispersing to a small extent over adjacent cultivation to feed.

Plate 12:

Male niltava, probably (on the basis of measurements) Fujian Niltava, Nakai-Nam Theun NBCA, December 1998. The possibility that the bird may have been the very similar Rufous-bellied Niltava is difficult to rule out. *W. G. Robichaud / WCS and IUCN.*

Male Bar-bellied Pitta, Dong Ampham NBCA, January 1997. A Globally Near-Threatened species with a world range almost restricted to lowland evergreen forest east of the Mekong. *P. Davidson / WCS.*

Dead passerines for sale, Xam-Nua market, January 1998. *P. Davidson / WCS.*

Red-tailed Laughingthrush, Nakai-Nam Theun NBCA, spring 1997. A widespread species of middle and higher altitude evergreen forest in Lao PDR. *J. A. Tobias / WCS and IUCN.*

Grey Laughingthrush. Nakai-Nam Theun NBCA, December 1998. The chestnut head-markings are characteristic of race *Garrulax maesi castanotis* of this Globally Near-Threatened species, which has a very small world range. *W. G. Robichaud / WCS and IUCN.*

Coral-billed Scimitar Babbler, Nakai-Nam Theun NBCA, April 1994. A species typical of hill and montane evergreen forest in Lao PDR. *T. D. Evans / WCS.*

Silver-eared Mesia, Nakai-Nam Theun NBCA, spring 1997. This red-throated race *Leiothrix argentauris ricketti* is restricted to evergreen forest of central and northern Indochina and to adjacent southern China. *J. A. Tobias / WCS and IUCN.*

White-winged Magpie. Nakai-Nam Theun NBCA, December 1998. This Globally Near-Threatened species has a small world range, occurring only in parts of Indochina and southern China. *W. G. Robichaud / WCS and IUCN.*

Status Information: Records prior to 1997 were reviewed by Thewlis *et al*. (1998). It is unclear whether there has been a major decline. Observations come from ten recent survey areas (Table 11) and other incidental sites. These come nowhere near matching one past count, of thousands along the Xe Banghiang (David-Beaulieu 1949-1950). There is probably a complex pattern of seasonal occurrence at individual sites. The record in Showler *et al*. (1998b) was on the Xe Kong west of Phou Ahyon and the Dakchung Plateau and 20 km south of Xe Sap NBCA.

Hirundo daurica **Red-rumped Swallow**. Winter visitor; north[B2], centre[B9], south[B2]. Largely in open country, especially near wide rivers. Records from prior to 1994 were reviewed by Thewlis *et al*. (1996).

Hirundo striolata **Striated Swallow** (included in *H. daurica* Red-rumped Swallow by ^K, ^T). Resident; north, centre, south[B2]. Rugged country with exposed cliffs in both limestone and non-calcareous regions. Records from prior to 1994 were reviewed by Thewlis *et al*. (1996).

Delichon urbica **Northern House Martin** (= Common House Martin, ^K, ^T). Winter visitor; north (historically[B21]), centre[B9], south (historically[B19]). The few recent records were of small numbers in flocks of mixed hirundines over pools and agricultural land on the Nakai Plateau. Records prior to 1996 were reviewed by Duckworth *et al*. (1998a). The absence of historical records of Asian House Martin, which recent records show to be much commoner than Northern, suggests that re-examination of any historical house martin specimens (which were all identified as Northern) that can be traced would be desirable.

Delichon dasypus **Asian House Martin**. Winter visitor; north[B1], centre[B10], south[B5]. Forests, open wooded country, around villages, especially in hilly and mountainous areas, but locally over the Mekong plain. First recorded for Lao PDR in 1994 (Evans and Timmins 1998). Field characters of birds in Lao PDR were discussed by Duckworth *et al*. (1998a).

Delichon nipalensis **Nepal House Martin**. Presumed resident; north[B9], south[B2]. Escarpments and limestone karst, feeding over adjacent flatlands. First recorded in 1993 (Thewlis *et al*. 1996). Records prior to 1996 were reviewed by Duckworth *et al*. (1998a). Subsequently the species has been seen around limestone karst near Vangviang, a substantial northward extension of its known distribution in Lao PDR (RJTim).

Conservation Management and Research Proposed for Swallows and martins:

- Habitat conservation, with special attention to Plain Martin and Wire-tailed Swallow.
- Field investigation of causes behind the undoubted decline in Plain Martin; egg collecting from colonies could perhaps be a contributory cause, although there is no direct evidence (but see Pied Kingfisher and Blue-tailed Bee-eater).
- Location and monitoring of breeding colonies of Plain Martin. These are currently known only from the Mekong in Louangphabang Province and in Sangthong District.

Pycnonotidae: Bulbuls (17 species)

Spizixos canifrons **Crested Finchbill**. Resident; north[B6]. Forest edge, scrub, grass and secondary growth above 1200 m.

Pycnonotus striatus **Striated Bulbul**. Resident; north[B13], centre (WCS 1996a). Evergreen forests and secondary growth above 1200 m.

Pycnonotus atriceps **Black-headed Bulbul**. Resident; north, centre, south[B2]. Evergreen forest, secondary growth, riverine forest, generally below 800 m.

Pycnonotus melanicterus **Black-crested Bulbul**. Resident; north, centre, south[B2]. Evergreen forest and forest edge, mature secondary growth, dense scrub up to at least 1250 m.

Pycnonotus jocosus **Red-whiskered Bulbul**. Resident; north, centre, south[B2]. Cultivation, villages, towns, secondary growth, forest edge up to at least 1600 m. Often rather locally distributed in natural habitats but abundant in degraded ones.

Pycnonotus sinensis **Light-vented Bulbul** (= Chinese Bulbul, ^T). Presumed winter migrant; north (TDE). Sole Lao record came from lowland limestone scrub. First recorded for Lao PDR in 1999 near the southern tip of Nam Kading NBCA (TDE), when one bird of race *P. s. sinensis* was seen.

Pycnonotus xanthorrhous **Brown-breasted Bulbul**. Resident; north[B8]. Scrub, secondary growth and rank grassland above 1020 m. Records prior to 1996 were reviewed by Duckworth *et al*. (1998a).

Pycnonotus aurigaster **Sooty-headed Bulbul**. Resident; north[B9], centre[B10], south[B2]. Dry dipterocarp and other open forest, its secondary derivatives, scrub and tall grass; up to at least 1560 m.

Pycnonotus finlaysoni **Stripe-throated Bulbul**. Resident; north, centre, south[B2]. Degraded forest, secondary growth, scrub, chiefly in lowlands and foothills.

Pycnonotus flavescens **Flavescent Bulbul**. Resident; north[B7], south[B2]. Open evergreen forest, forest edge, scrub and grass amid secondary growth, generally above 1000 m.

Pycnonotus goiavier **Yellow-vented Bulbul**. Resident; south[B15]. Riverine secondary growth and scrub of lowlands. First recorded in 1996 (Evans *et al*. in prep. a); perhaps a recent colonist.

Pycnonotus blanfordi **Streak-eared Bulbul**. Resident; north, centre, south[B2]. Secondary growth, gardens, cultivation; generally lowlands. Only natural habitat supporting high densities seems to be seasonally inundated scrub on river channel islands.

Alophoixus pallidus (= *Criniger pallidus*, ^K, ^T) **Puff-throated Bulbul**. Resident; north, centre, south[B2]. Evergreen forest and secondary growth generally below 1000 m (but up to 1400 m), sometimes in adjacent scrub.

Iole propinqua (= *Hypsipetes propinquus*, ^K, ^T) **Grey-eyed Bulbul**. Resident; north[B1], centre, south[B2]. Evergreen forest and mature scrub up to at least 1100 m.

Hemixos flavala (= *Hypsipetes flavala*, ^K, ^T) **Ashy Bulbul**. Resident; north, centre[B10], south[B2]. Evergreen forests and tall secondary growth, mostly over 500 m, locally down to 350 m.

Hypsipetes mcclellandii **Mountain Bulbul**. Resident; north[B4], centre[B10], south[B2]. Evergreen forests and tall secondary growth above 800 m.

Hypsipetes leucocephalus **Black Bulbul** (included in *H. madagascariensis* Black Bulbul by ^K, ^T). Locally resident (a black headed race) with winter visitors (both black and, mainly, white headed races) widespread; north[B1], centre[B10], south[B2]. Forests, secondary growth, scrub and cultivation; breeders mainly in hills and plateaux above 600 m, but in winter birds occur down to 120 m.

Cisticolidae: Cisticolas, prinias (8 species)

Cisticola juncidis **Zitting Cisticola**. Resident; north[B2], centre[B10], south[B2]. Paddy-fields, grass and scrub in otherwise open areas up to at least 1200 m.

Cisticola exilis **Bright-headed Cisticola** (= Bright-capped Cisticola, ^K, ^T; = Golden-headed Cisticola, ^Sm). Resident; north[B2], centre[B16], south[B11]. Tall grass, scrub and other thickly-vegetated areas amid cultivation, up to at least 1200 m; usually near water. Most localities are on the Mekong plain, but it occurs on the Dakchung Plateau (Showler *et al*. 1998a). First recorded for Lao PDR in 1993, in Vientiane (Thewlis *et al*. 1996).

Prinia polychroa **Brown Prinia**. Resident; centre (historically[B22]), south[B2]. Primarily dry dipterocarp forest, also rocky savanna; generally lowlands.

Prinia atrogularis **Hill Prinia**. Resident; north[B9], centre[B7], south[B2]. Clearings in evergreen forest, secondary growth, grass and dense low scrub, often in tussocks amid cultivation; generally above 900 m. The records for this species from Vientiane, Vangviang (Vientiane Province) and the Ban Paam area (Attapu Province) in Duckworth *et al*. (1998a) were typographical errors.

Prinia rufescens **Rufescent Prinia**. Resident; north[B2], centre, south[B2]. Grass, scrub, secondary growth, understorey of open deciduous and semi-evergreen forest up to at least 1200 m.

Prinia hodgsonii **Grey-breasted Prinia**. Resident; north[B2], centre[B10], south[B2]. Coarse rank herbs, often admixed with many woody shrubs, secondary growth and grass up to at least 980 m.

Prinia flaviventris **Yellow-bellied Prinia**. Resident; north[B2], centre[B10], south[B2]. Grass, reeds, scrub, with highest densities in seasonally-inundated scrub on river channel islands; up to at least 1000 m.

Prinia inornata **Plain Prinia** (included in *P. subflava* Tawny-flanked Prinia by ^K). Resident; north[B2], centre[B10], south[B2]. Wet areas in reeds, grass, secondary growth, paddy-fields, dense vegetated pools within deciduous forest; generally lowlands and foothills but up to at least 1200 m.

Zosteropidae: White-eyes (3 species)

Zosterops erythropleurus (= *Z. erythropleura*, ^K) **Chestnut-flanked White-eye**. Irruptive winter visitor; north[B6], centre[B16]. Evergreen forest, generally above 800 m; once in secondary growth at about 150 m (TDE). First recorded in December 1995, near Louang-Namtha (Dymond 1995).

Zosterops palpebrosus (= *Z. palpebrosa*, ^K) **Oriental White-eye**. Seasonal status unclear, but at least locally resident; north, centre[B7], south[B5]. Forest, secondary growth, villages and towns up to at least 1000 m. Status obscure, due to identification difficulties with congeners.

Zosterops japonicus (= *Z. japonica*, ^K) **Japanese White-eye**. Seasonal status unclear, probably mainly or solely a winter visitor; north, centre[B7], south[B5]. Open evergreen

forest, secondary growth, villages and towns up to at least 1500 m. Status obscure, due to identification difficulties with congeners.

Sylviidae: Tesias, old-world warblers, tailorbirds, grassbirds, laughingthrushes, babblers, parrotbills (123-126 species)

Tesia castaneocoronata **Chestnut-headed Tesia**. Resident; north[B6]. Undergrowth of evergreen forest and secondary growth, especially near streams; above 1400 m. First recorded for Lao PDR in March 1996, in Phou Dendin NBCA (RJTiz).

Tesia olivea **Slaty-bellied Tesia**. Resident; north, centre[B10]. Undergrowth of evergreen forest and regrowth, especially near streams, generally above 900 m, locally down to 700 m. See cautionary note concerning historical records under Grey-bellied Tesia.

Tesia cyaniventer **Grey-bellied Tesia**. Resident; north[B6], centre (historically, provisionally, Delacour 1929a), south[B14]. Undergrowth of evergreen forest and regrowth, especially near streams, above 1140 m. Records prior to 1997 were reviewed by Thewlis *et al*. (1998). In view of the species's apparently secure status at its then only known site (common in the Phou Ahyon area and adjacent Dakchung Plateau) and the lack of apparent threats, it was dropped from the recommended list of key species. Historical records require careful interpretation, as *T. olivea* was formerly considered conspecific with Grey-bellied Tesia under the name *T. cyaniventer* (Ludlow and Kinnear 1937, Thewlis *et al*. 1998).

Urosphena squameiceps (= *Cettia squameiceps*, ^K, ^T) **Asian Stubtail** (= Stub-tailed Bush Warbler, ^K, ^T). Winter visitor; north, centre, south[B2]. Understorey of evergreen forests and mature regenerating scrub over abandoned cultivation, often near streams; up to at least 1500 m.

Cettia pallidipes **Pale-footed Bush Warbler**. Resident; north[B9], centre (historically, Delacour 1929a). Open semi-evergreen and mixed deciduous forest, grass and scrub from 550 to at least 1640 m. Records prior to 1996 were reviewed by Duckworth *et al*. (1998a).

Cettia diphone **Japanese Bush Warbler** (separated as *C. canturians* Manchurian Bush Warbler by ^K, ^Sm, ^T). Winter visitor; north[B2], centre[B10]. Dense scrub and fringes of cultivation, often near water, at low - mid altitudes.

Cettia fortipes **Brownish-flanked Bush Warbler**. Resident; north (historically[B21]). Probably forest edge, scrub and grass at higher altitudes. Four males and six females were collected in Phongsali in April 1929 (Bangs and Van Tyne 1931). While some of these appear to be the birds re-identified by Delacour and Greenway (1941) as *C. flavolivacea*, P. Rasmussen (*in litt*. 1999) has confirmed that some are indeed *C. fortipes davidiana*. David-Beaulieu (1944) recorded one as this species from Xiangkhouang Province in December 1938, but in view of other warbler misidentifications in this collection (see *Bradypterus tacsanowskius* and *B. luteoventris*) the identification should be regarded as provisional. A taxonomic reassessment of this group is needed to evaluate whether *davidiana* truly belongs within *C. fortipes* (P. Rasmussen *in litt*. 1999).

Cettia flavolivacea (= *C. flavolivaceus*, ^K) **Aberrant Bush Warbler**. Resident; north (historically, Delacour and Greenway 1941). Probably thick scrub, tall grass at higher altitudes. Delacour and Greenway (1941) stated that previously this form was confounded with *C. fortipes davidiana*, and specifically mention Phongsali as a location for *C. flavolivacea*. P. Rasmussen (*in litt*. 1999) has confirmed that some of the Bangs and Van Tyne (1931) specimens are indeed *C. flavolivacea oblitus*, although it is unclear whether this form should continue to be regarded as a race of *C. flavolivacea*.

Bradypterus thoracicus **Spotted Bush Warbler**. Winter visitor; north (historically, Dickinson 1970b). Probably rank dense herbage and scrub especially in wet areas. Robichaud and Sounthala's (1995) record was modified to *Bradypterus* sp. in Duckworth *et al*. (1998a). Future records should be checked carefully as *B. 't.' davidi* and allied races are probably better considered to form a separate species, David's Bush Warbler (Round and Loskot 1995). The sole Lao record was probably *B. t. przevalskii* (D. Goodwin in Dickinson 1970b), which falls with the *thoracicus* group.

Bradypterus tacsanowskius **Chinese Bush Warbler**. Non-breeding migrant; north (historically[B20]). Probably brush, thickets, paddy-fields and other dense undergrowth. The species was also recorded in north Lao PDR by David-Beaulieu (1944), who stated that this species was a fairly common winter visitor to Xiangkhouang Province. However, the only one of his specimens available for re-examination is *B. thoracicus* (Dickinson 1970b).

[*Bradypterus luteoventris* **Brown Bush Warbler**]. Seasonal status unclear; north (provisionally, historically[B21]), centre (provisionally, WCS 1996b). Dense weeds and grass, generally (in neighbouring countries) at higher altitudes. A sight record of a single bird in scrubby herbaceous growth at about 500 m on the Nakai Plateau in early 1996 (JAW) is the only recent record, albeit provisional. A record from Nam Theun Extension PNBCA (Tobias 1997) has been withdrawn (J. A. Tobias *in litt*. 1998). David-Beaulieu (1944) recorded the species as rare in Xiangkhouang in winter, but the sole

surviving known specimen of his (actually from Savannakhet Province) was in fact a Blunt-winged Warbler (Dickinson 1970b). The only extant specimen from north Lao PDR (listed in Bangs and Van Tyne 1931) was also re-examined and found to be *B. seebohmi* (Dickinson *et al*. in press). Field identification of birds in this genus is very difficult.

Bradypterus seebohmi **Russet Bush Warbler**. Presumed resident subject to local altitudinal movements; north[B8]. Grass and scrub above 1200 m, probably lower in winter. The species has recently been recorded from two survey areas, Nam Ha and Phou Louey NBCAs (Tizard *et al*. 1997, Davidson 1998), and is known from one historical specimen published as *B. luteoventris* (see that species).

Locustella lanceolata **Lanceolated Warbler**. Winter visitor; north, centre, south[B2]. Reeds, paddy-fields, scrub and grass, especially near water; also sometimes abundant in undergrowth of dry dipterocarp forest and occasionally in forest edge and secondary growth. Up to at least 1200 m.

Locustella certhiola **Rusty-rumped Warbler** (= Pallas's Grasshopper Warbler, ^Sm[2], ^T; = Pallas's Warbler ^K, ^Sm[1]). Winter visitor; north[B9], south[B2]. Reed, grass and dense herbs, especially near water; lowlands. Because of morphological similarities with *L. ochotensis* Middendorff's Warbler, some recent field records were considered provisional; however this latter species has yet to be recorded anywhere in South-east Asia.

Acrocephalus bistrigiceps **Black-browed Reed Warbler**. Winter visitor; north[B2], centre[B16], south[B2]. Reeds and grass, wet paddies and riverine scrub; usually near water.

• *Acrocephalus agricola* **Paddyfield Warbler** (includes *A. tangorum* Manchurian Reed Warbler as separated by ^Sm[1]). *Conservation Significance:* Little Known in Lao PDR. *Documented Range and Habitat:* Winter visitor: north (Robson 1996), south[B11]; rank wetland vegetation. *Status Information:* At least one *A. (a.) tangorum* in marsh vegetation in Dong Khanthung PNBCA on 11 February 1998 (Round 1998) constituted the first record of this form for Lao PDR, which is better regarded as a full species (Leisler *et al*. 1997). One in Vientiane (Mekong channel) in December 1995 (Dymond 1995) was the first record of *A. a. agricola*. Great care is needed to separate these two forms (Leader and Lewthwaite 1996, Round 1998). The species is best considered Little Known in Lao PDR. Clarification of the seasonal status of *tangorum* is needed. If the two forms were separated as species, *A. a. agricola* would not merit treatment as a key species, being only a winter visitor of marginal occurrence and no global conservation concern. By contrast, there is only one currently known wintering site of *A. (a.) tangorum* (in south-west Thailand) and it is probably Globally Threatened (Round 1994).

Acrocephalus concinens **Blunt-winged Warbler**. Winter visitor; north (provisionally[B9]), centre (historically, Dickinson 1970b), south (provisionally[B9]). Reeds and grass, usually in wetlands; 180-1120 m. Records prior to 1996 were reviewed by Duckworth *et al*. (1998a). This species is difficult to identify in the field and so recent records are retained as provisional, including that in Dong Ampham NBCA initially reported by Davidson *et al*. (1997) as confirmed.

Acrocephalus orientalis **Oriental Reed Warbler** (included in *A. arundinaceus* Great Reed Warbler by ^K, ^Sm[2], ^T). Winter visitor; north (provisionally[B2]; historically, David-Beaulieu 1948), centre (historically[B22]), south[B11]. Reed beds and other dense growth, usually near water. Field separation from Clamorous Reed Warbler is difficult and most records are therefore retained as provisional. Historical specimens suggest that Oriental Reed Warbler is likely to be much more common than is Clamorous, but there is some ambiguity (see Thewlis *et al*. 1996).

Acrocephalus stentoreus **Clamorous Reed Warbler**. Seasonal status unclear: north (historically, David-Beaulieu 1948). Habitat use probably similar to that of *A. orientalis*. Birds of this species could have been overlooked as Oriental Reed Warbler, recently and historically (e.g. David-Beaulieu 1949-1950). Records from prior to 1994 were reviewed in Thewlis *et al*. (1996).

Acrocephalus aedon (= *Phragamaticola aedon*, ^K) **Thick-billed Warbler**. Winter visitor; north, centre, south[B2]. Dense grass and other thickets, often near water; also in undergrowth and edge of broken forest. Occurs up to at least 1120 m

Orthotomus cuculatus **Mountain Tailorbird**. Resident; north[B7], centre[B10], south[B2]. Evergreen forest, bamboo, secondary growth, scrub; invariably above 1000 m.

Orthotomus sutorius **Common Tailorbird**. Resident; north, centre, south[B2]. Scrub, bamboo, open secondary growth, towns, villages; up to at least 1200 m.

Orthotomus atrogularis **Dark-necked Tailorbird**. Resident; north, centre, south[B2]. Forests and dense regrowth, up to at least 1000 m.

Phylloscopus fuscatus **Dusky Warbler**. Winter visitor; north, centre, south[B2]. Dense undergrowth, usually near rivers or ponds; also town and village gardens. Winters generally in lowlands but passage birds occur at higher altitudes.

Phylloscopus subaffinis **Buff-throated Warbler**. Winter visitor; north[B6]. Open scrub, understorey of open pine forest, grass and upland cultivation above 1200 m.

Phylloscopus armandii **Yellow-streaked Warbler**. Winter visitor; north[B2]. Thickets in open areas, undergrowth in and near forest, scrub and fringes of upland cultivation; generally below 1150 m. Records from prior to 1994 were reviewed in Thewlis *et al*. (1996).

Phylloscopus schwarzi **Radde's Warbler**. Winter visitor; north, centre, south[B2]. Dense understorey of forest and scrub, rank grass and cultivation, also town gardens; up to at least 1540 m.

Phylloscopus pulcher **Buff-barred Warbler** (= Orange-barred Leaf Warbler, ^T). Presumed resident; north[B6]. Evergreen forest above 1500 m.

Phylloscopus maculipennis **Ashy-throated Warbler**. Resident; north[B6], south[B14]. Evergreen forest and adjacent regrowth provided at least some medium-stature trees are present; above 1700 m. Records prior to 1997 were reviewed by Thewlis *et al*. (1998). In view of the unlikelihood that the species, tolerant of degradation, would be at risk, it was dropped from the recommended list of key species.

Phylloscopus proregulus **Pallas's Leaf Warbler** (= Lemon-rumped Warbler, ^Sm[2]); (included with *P. proregulus* Lemon-rumped Warbler by ^K, ^Sm[1], ^T). Winter visitor; north[B13]. Evergreen forest and secondary growth above 1000 m. Understanding this species's status is hampered by the difficulties of separating it from Lemon-rumped and Chinese Leaf Warblers in the field. It is probably a locally common winter visitor to montane north Lao PDR. Historical specimens were listed for Lao PDR only in the north-west by Delacour and Jabouille (1940). Although King *et al*. (1975) implied that this species-group may breed in north Lao PDR (probably based on David-Beaulieu 1944), recent surveys have found no evidence of this. The form *kansuensis*, treated as a subspecies of *P. proregulus* by Inskipp *et al*. (1996) but perhaps better considered a separate species, has not been recorded from Lao PDR. Its field characters and winter range are poorly understood and it should not be assumed not to occur in Lao PDR.

Phylloscopus sichuanensis **Chinese Leaf Warbler** (not distinguished from *P. chloronotus* Lemon-rumped Warbler in most references). Winter visitor; north (historically, C. R. Robson *in litt*. 1998; potentially[B6]), centre (potentially[B10]), south (potentially[B5]). Evergreen forest, secondary growth above 1000 m. At least one Lao specimen at NHM, Tring (from Lo Tiao, Bokeo Province), is of this species (C. R. Robson *in litt*. 1998). It has only recently been recognised as a species (Alström *et al*. 1994) and is barely possible to separate from Lemon-rumped Warbler in the field unless it calls; even then identification is not simple. Specimen records from Lao PDR of *P. chloronotus* (e.g. David-Beaulieu 1944) may well refer to *P. sichuanensis* and cannot be accepted as either unless re-examined. Recent field observations indicate that birds of *P. chloronotus* / *P. sichuanensis* are probably much commoner in Lao PDR than is *P. proregulus*. Re-examination of Thai specimens labelled as *P. chloronotus* suggests that in Lao PDR most birds are likely to be *P. sichuanensis* (PDR).

Phylloscopus inornatus **Yellow-browed Warbler** (included in *P. inornatus* Inornate Warbler by ^K, ^Sm, ^T). Winter visitor; north, centre, south[B2]. Forest, secondary growth, villages, towns, riverine scrub, parks and gardens from extreme lowlands to high altitudes. Historical specimens confirm that this is the commonest species of the *P. inornatus* / *P. h. mandelli* pair across the country (e.g. Delacour and Jabouille 1940).

Phylloscopus humei **Hume's Warbler** (included, as *P. i. mandelli*, with *P. inornatus* Inornate Warbler by ^K, ^Sm, ^T). Winter visitor; north[B8]. Evergreen forest, secondary growth and scrub over 1000 m. Understanding this species's status is hampered by the difficulties of separating it from Yellow-browed Warbler in the field. Recent field observations suggest that it is scarce, and there may be only one specimen record (from Lo-Tiao, Bokeo Province, in 1939; Delacour and Jabouille 1940). On the basis of these records and those from elsewhere in South-east Asia, it probably occurs in Lao PDR largely or entirely in the north above 1000 m.

Phylloscopus borealis **Arctic Warbler**. Passage migrant, exceptionally in winter[B9]; north[B2], south[B2]. Forest and mature regrowth, stands of trees amid open areas. Delacour and Jabouille (1940) listed the species from central Lao PDR, but we have not traced a primary record.

Phylloscopus trochiloides **Greenish Warbler** (includes *P. plumbeitarsus* Two-barred Warbler as separated by ^Sm[1], ^T). Winter visitor; north, centre, south[B2]. Evergreen forest, tall secondary growth and other wooded areas; occasionally towns. Recent records are largely or solely of the race *P. (t.) plumbeitarsus* (often considered a separate species, see Inskipp *et al*. 1996) and are largely from below 750 m. Historically birds of *P. trochiloides (s.s.)* were recorded from Xiangkhouang Province (*P. t. trochiloides*) and north-west Lao PDR (*P. t. obscuratus*) and specimens of *plumbeitarsus* were taken across Lao PDR (Delacour and Jabouille 1940).

Phylloscopus tenellipes **Pale-legged Leaf Warbler**. Winter visitor; north, centre, south[B2]. Evergreen forest and other wooded areas especially near shaded pools and streams;

generally below 1000 m. Some records could conceivably refer to the extremely similar *P. borealoides* Sakhalin Leaf Warbler. The latter's winter distribution and field characters are not well known (see Inskipp *et al*. 1996; C. R. Robson verbally 1998).

Phylloscopus coronatus **Eastern Crowned Warbler**. Passage migrant, overwintering at least sporadically in the south; north[B2], centre[B9], south (historically[B19]). Forests and other areas with mature trees. Records prior to 1996 were reviewed by Duckworth *et al*. (1998a).

Phylloscopus reguloides **Blyth's Leaf Warbler**. Winter visitor, locally resident in south[B3]; north, centre, south[B2]. Evergreen forest and adjacent tall regrowth, commonest in hills and mountains but occurs down to Mekong plains.

Phylloscopus davisoni **White-tailed Leaf Warbler**. Resident; north[B4], centre[B10], south[B2]. Evergreen forest and tall secondary growth above 900 m, perhaps lower in winter.

• *Phylloscopus cantator* **Yellow-vented Warbler**. *Conservation Significance:* Globally Near-Threatened. Not At Risk in Lao PDR. *Documented Range and Habitat:* Winter visitor, perhaps local breeder; north, centre[B10]. Evergreen and mixed deciduous forests, often beside rivers; usually at 500-1000 m. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). The species is relatively widespread, usually at low density, in northern and hilly central Lao PDR. Records come from seven recent survey areas (Table 11). Post-1996 records include several in song in Phou Louey NBCA, which were still present on 13 May 1998 in suitable breeding habitat (Davidson 1998). Similar behaviour was observed in similar habitats in Nam Ha NBCA in March 1997 (Tizard *et al*. 1997).

Phylloscopus ricketti **Sulphur-breasted Warbler**. Winter visitor to south, passage migrant throughout; north[B2], centre[B7], south[B2]. Evergreen forests and regrowth, up to at least 1520 m on passage. Until the taxonomic status of the 'Limestone Leaf Warbler' is resolved, records of this species in parts of central Lao PDR may be best left unidentified; but birds in late March in Nakai-Nam Theun NBCA were clearly long-distance migrants (PD).

[*Phylloscopus* sp. 'Limestone Leaf Warbler']. Breeding resident; north, centre[B9]. Evergreen forest on limestone karst, dispersing to adjacent wooded non-calcareous formations outside the breeding season. This form of *Phylloscopus* resembles *P. ricketti* in external appearance but vocalisations suggest it belongs to an un-named taxon, possibly distinct at the species level (P. Alström *in litt*. 1997).

Seicercus burkii **Golden-spectacled Warbler**. Winter visitor, probably breeding in south[B3]; north, centre, south[B2]. Evergreen forest, bamboo, streamside thickets, up to at least 1650 m. Birds breeding in the Phou Ahyon area were presumed to be *S. burkii* rather than *S. affinis* on the basis of their yellow eye-rings. They differed clearly in vocalisations and plumage from the common wintering form across Lao PDR (RJTim). The taxonomic status of '*S. burkii*' has recently been re-assessed (Alström and Olsson in press), and it is likely that three forms recognisable as full species occur in Lao PDR.

[*Seicercus affinis* **White-spectacled Warbler**]. Seasonal status unclear; north (provisionally[B6]). Habitat in Lao PDR unclear. Some recent birds in Lao PDR were left unidentified beyond *S. affinis* / *S. poliogenys* pending further experience (e.g. WCS 1995a, Tizard 1996). Birds in Nam Ha NBCA were given in Tizard *et al*. (1997) as *S. affinis*, but until the details of the various forms currently included within *S. burkii* are clarified, these Nam Ha birds should be considered as provisional *S. affinis* (RJTiz). The only historical records are from Xiangkhouang Province (David-Beaulieu 1944). Here the species was noted as a winter visitor, mainly to the low valleys (perhaps about 500 m). Elsewhere in its range it is montane and so these records are also best considered provisional until any extant specimens can be re-examined.

Seicercus poliogenys **Grey-cheeked Warbler**. Resident; north[B13], centre[B10], south[B2]. Evergreen forest and secondary growth, generally above 900 m, perhaps lower in the winter.

Seicercus castaniceps **Chestnut-crowned Warbler**. Resident; north[B4], centre[B10], south[B2]. Evergreen forest above 1000 m.

Abroscopus albogularis **Rufous-faced Warbler**. Resident; north, centre[B10]. Evergreen forest, bamboo and secondary growth above 600 m. Records prior to 1997 were reviewed by Thewlis *et al*. (1998). The species is common or abundant in higher hill and montane areas in and around the Nam Theun catchment, and not uncommon, or at least present, in several other survey areas. It is unlikely to be under elevated threat. Thus it was dropped from the recommended list of key species. In 1997 and 1998 it was recorded from several further areas.

Abroscopus superciliaris **Yellow-bellied Warbler**. Resident; north, centre, south[B2]. Bamboo and secondary growth within and near evergreen forest, up to at least 1450 m.

Megalurus palustris **Striated Grassbird** (= Striated Warbler, ^K, ^T). Resident; north[B2]. Reed beds, marshes, extensive tall grassland; all known localities are near water and on flat terrain, up to 1200 m.

Garrulax leucolophus **White-crested Laughingthrush**. Resident; north[B1], centre, south[B2]. Evergreen and mixed

deciduous forest and tall secondary growth, riverine areas within dry dipterocarp forest, up to at least 1200 m.

Garrulax monileger **Lesser Necklaced Laughingthrush**. Resident; north[B7], centre, south[B2]. Forest, tall secondary growth and bamboo, especially mixed deciduous forest and riverine forest through dry dipterocarp forest; up to at least 1000 m.

Garrulax pectoralis **Greater Necklaced Laughingthrush**. Resident; north, centre[B10]. Evergreen and mixed deciduous forests and tall secondary growth, from foothills up to at least 1800 m.

Garrulax strepitans **White-necked Laughingthrush**. Resident; north[B6]. Evergreen forest at 600-1100 m (probably higher); uses mixed oak - pine forest in north-west Thailand.

• *Garrulax milleti* **Black-hooded Laughingthrush**. *Conservation Significance:* Globally Threatened - Vulnerable; Potentially At Risk in Lao PDR; endemic to south Lao PDR and central and southern Vietnam. *Documented Range and Habitat:* Resident: south[B14]. Evergreen forest at 980-1550 m. *Status Information:* The species was first found in Lao PDR in 1996, in the Phou Ahyon area (Thewlis *et al*. 1998). Since then it has been found in only one other area, Dong Ampham NBCA (Davidson *et al*. 1997).

• *Garrulax maesi* **Grey Laughingthrush**. *Conservation Significance:* Globally Near-Threatened; endemic to Lao PDR, Vietnam and southern China. Not At Risk in Lao PDR. *Documented Range and Habitat:* Resident; north, centre[B10]. Evergreen forest at 600-1700 m. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). The species is common in six recent survey areas in the north and central Annamites south to Nakai-Nam Theun NBCA, and in north-eastern Lao PDR (Table 11). The race concerned (*varennei*; Plate 12), together with *castanotis* may best be grouped as a full species, *G. castanotis* Rufous-cheeked Laughingthrush (Inskipp *et al*. 1996; C. R. Robson verbally 1998). This proposed species is endemic to Hainan (south China), north and central Lao PDR and north and central Vietnam.

Garrulax chinensis **Black-throated Laughingthrush**. Resident; north, centre[B10], south[B9]. Evergreen and mixed deciduous forest, dense rank growth, streamside thickets within dry dipterocarp forest, bamboo; up to at least 1350 m.

Garrulax vassali **White-cheeked Laughingthrush**. Resident; south[B2]. Evergreen forest, forest edge and adjacent dense tall scrub and grass at 800-1200 m. Records prior to 1997 were reviewed by Thewlis *et al*. (1998). As the species is widespread on the Bolaven Plateau and recorded in the Phou Ahyon area, and tolerant of habitat degradation, it was dropped from the recommended list of key species. Large flocks have subsequently been recorded on the Dakchung Plateau and in Dong Ampham NBCA (Davidson *et al*. 1997, Showler *et al*. 1998a). Although sometimes stated to inhabit central Lao PDR (e.g. King *et al*. 1975), this appears to be based on David-Beaulieu's (1949-1950) records from Muang Somoy, which was one of his few observation sites falling within south Lao PDR. *Special Significance:* Endemic to south Lao PDR, east Cambodia and central and south Vietnam.

• *Garrulax gularis* **Rufous-vented Laughingthrush** (included in *G. delesserti* Rufous-vented Laughingthrush by ^K). *Conservation Significance:* Little Known in Lao PDR. *Documented Range and Habitat:* Resident; north[B8], centre (historically, Delacour and Jabouille 1940). Secondary growth, scrub, bamboo and evergreen forest in hills and mountains. *Status Information:* The only recent record is from Nam Et NBCA where a presumed pair was seen in secondary scrub with much bamboo at 1000 m in May 1998 (Davidson 1998; DAS). The few documented historical records all came from Xiangkhouang Province: a small series was collected in the mountains (Delacour and Jabouille 1927) and, while David-Beaulieu (1944) never saw the bird in the field, he once found a villager carrying one. Nape is given as a locality by Delacour and Jabouille (1940), although we have traced no primary reference to the species there. The lack of recent records indicates that the species should be considered Little Known in Lao PDR. *G. delesserti* Wynaad Laughingthrush, within which this species is sometimes included (e.g. King *et al*. 1975), was considered to be Globally Near-Threatened by Collar *et al*. (1994), but this designation does not include *gularis*.

• *Garrulax* sp. A. **Laughingthrush sp. A**. *Conservation Significance:* Little Known in Lao PDR; perhaps endemic to south-east Lao PDR and probably adjacent Vietnam. *Documented Range and Habitat:* Resident; south[B3]. Forest undergrowth, including at the edge of degraded areas, at 1350-1450 m. *Status Information:* A laughingthrush seen several times in the Phou Ahyon area in May 1996 fitted no described form. Although birds showed some similarities to *G. rufogularis* Rufous-chinned Laughingthrush (recorded from Indochina only in west Tonkin, Vietnam; C. R. Robson *in litt*. 1998), the number of plumage differences indicates the form should be left unidentified pending further taxonomic investigation. It is likely to have a restricted range and may be at risk, so is classed as Little Known in Lao PDR.

• *Garrulax merulinus* **Spot-breasted Laughingthrush**. *Conservation Significance:* Globally Near-Threatened; Little Known in Lao PDR. *Documented Range and Habitat:* Resident; north[B13]. Dense thickets within evergreen forest, including bamboo tangles, forest edge and secondary growth from

1100 to 1600 m. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). Historically it was known only from Xiangkhouang Province (Delacour and Jabouille 1927, David-Beaulieu 1944). The only recent records are from Phou Louey and Nam Xam NBCAs in early 1998 (Davidson 1998, Showler *et al*. 1998b).

Garrulax canorus **Hwamei**. Resident; north[B8], south (historically[B22]). Undergrowth of open forests, secondary thickets and scrub, at 500-1200 m. There are recent records from only a few areas: Nam Theun Extension PNBCA, Phou Dendin NBCA, the border between Nam Et and Phou Louey NBCAs, and in scrub near Xiangkhouang town in July 1996 (Tobias 1997, Davidson 1998; RJTiz, RJTim). As the usual habitats of the species lie largely outside selected survey areas, the scarcity of recent records in Lao PDR may reflect little more than the distribution of survey effort. Nonetheless, the species's Lao conservation status should be reconsidered at regular intervals as there is heavy pressure on it in adjacent Vietnam for the cage-bird trade (JWD, RJTim). Although sometimes stated to inhabit central Lao PDR (e.g. King *et al*. 1975), this appears to be based on David-Beaulieu's (1949-1950) records from Muang Somoy, which was one of his few observation sites falling within south Lao PDR.

Garrulax sannio **White-browed Laughingthrush**. Resident; north[B8]. Scrub, grass, secondary growth, generally above 1000 m, locally down to 600 m.

Garrulax erythrocephalus **Chestnut-crowned Laughingthrush**. Resident in north[B8], centre[B10]. Evergreen forest, secondary growth and bamboo; above 1250 m.

• *Garrulax milnei* **Red-tailed Laughingthrush**. *Conservation Significance:* Globally Near-Threatened; endemic to parts of Lao PDR, Vietnam, Thailand, Myanmar and south China. Not At Risk in Lao PDR. *Documented Range and Habitat:* Resident; north[B7], centre, south[B14]. Evergreen forest, secondary growth, bamboo and occasionally dense scrub; above 800 m. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). Recent records come from six survey areas (Table 11) and indicate that it is locally fairly common from north-east Lao PDR along the Annamite chain (Plate 12) and on the Bolaven Plateau.

Liocichla phoenicea **Red-faced Liocichla**. Resident; north[B13]. Evergreen forest, secondary growth, grass and scrub above 1400 m.

Malacocincla abbotti (= *Trichastoma abbotti*, ^K, ^T) **Abbott's Babbler**. Resident; north, centre, south[B2]. Evergreen forest (especially degraded areas), forest edge, secondary growth and scrub, generally below 800 m. Records from prior to 1994 were reviewed in Thewlis *et al*. (1996).

Pellorneum tickelli (= *Trichastoma tickelli*, ^K, ^T) **Buff-breasted Babbler**. Resident; north, centre, south[B2]. Evergreen forest, secondary growth and bamboo, up to at least 1300 m.

Pellorneum albiventre **Spot-throated Babbler**. Resident; north[B6], centre[B17], south[B2]. Dense scrub and grass, secondary growth and open forest understorey, generally above 500 m, but occasionally down to 280 m.

Pellorneum ruficeps **Puff-throated Babbler**. Resident; north, centre, south[B2]. Evergreen and deciduous forests, dense secondary growth, scrub, bamboo; mainly lowlands and foothills but up to at least 1350 m.

Malacopteron cinereum **Scaly-crowned Babbler**. Resident; north[B9], centre, south[B2]. Evergreen forest, mature secondary growth; mainly below 500 m, but up to 830 m. Records from prior to 1994 were reviewed in Thewlis *et al*. (1996).

Pomatorhinus hypoleucos **Large Scimitar Babbler**. Resident; north[B1], centre, south[B2]. Evergreen and mixed deciduous forest, dense secondary growth, bamboo; generally below 800 m but up to at least 1550 m.

Pomatorhinus erythrocnemis **Spot-breasted Scimitar Babbler**. Resident; north[B8]. Scrub and grass, open forest, secondary growth, at 1000-1650 m.

Pomatorhinus schisticeps **White-browed Scimitar Babbler**. Resident; north[B1], centre, south[B2]. Evergreen and deciduous forest, secondary growth, bamboo, scrub, grass; up to at least 1700 m.

Pomatorhinus ruficollis **Streak-breasted Scimitar Babbler**. Resident; north[B9], centre (potentially[B10]; historically, Delacour and Greenway 1940b). Evergreen forest and dense secondary growth up to at least 1400 m. Duckworth *et al*. (1998a) reviewed records of the species prior to 1996. Birds show high plumage variation (perhaps intergrading with White-browed Scimitar Babbler) in and around the Nam Theun catchment (Duckworth *et al*. 1998a; PD).

Pomatorhinus ochraciceps **Red-billed Scimitar Babbler**. Resident; north, centre[B10], south[B2]. Evergreen forest, bamboo, dense secondary growth at 600-1400 m, occasionally down to 440 m and up to 1800 m.

Pomatorhinus ferruginosus **Coral-billed Scimitar Babbler**. Resident; north[B9], centre[B10], south[B2]. Evergreen forest and dense secondary growth at 900-1800 m. (Plate 12)

• *Jabouilleia danjoui* **Short-tailed Scimitar Babbler**. *Conservation Significance:* Globally Threatened - Vulnerable; Potentially At Risk in Lao PDR; endemic to Lao PDR and

Vietnam. *Documented Range and Habitat:* Resident; north, centre[B14]. Evergreen forest, often in climatically wet areas, from 500 to 1650 m. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). The species was first recorded in 1994, in the Nam Theun Extension PNBCA, and has subsequently been found in the Nakai-Nam Theun NBCA; within the latter it is common on the Phou Vang massif (Robichaud 1999).

Napothera crispifrons **Limestone Wren Babbler**. Resident; north[B9]. Forest and scrub on limestone karst up to 900 m. Records prior to 1996 were reviewed by Duckworth *et al*. (1998a). *Special Significance:* Endemic to northern Indochina, Thailand and extreme eastern Myanmar.

Napothera brevicaudata **Streaked Wren Babbler**. Resident; north, centre[B10], south[B2]. Evergreen forest, especially damp ravines and stream valleys with bare rocks in areas of steep topography, including areas on limestone; at 210-1620 m.

Napothera epilepidota **Eyebrowed Wren Babbler**. Resident; north, centre[B10], south[B5]. Understorey of evergreen forest, particularly on steep topography; above 280 m. Records from Houay Nhang NR in October 1992 (Thewlis *et al*. 1996) are here retracted.

Pnoepyga pusilla **Pygmy Wren Babbler**. Resident; north[B13], centre[B10], south[B12]. Evergreen forest, moist secondary growth and scrub, often near water; generally above 750 m.

• *Spelaeornis formosus* **Spotted Wren Babbler**. *Conservation Significance:* Globally Near-Threatened. Not At Risk in Lao PDR. *Documented Range and Habitat:* Resident; north[B10]. Evergreen forest and dense secondary growth, especially in damp gullies; at 600-1400 m. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). The species was first recorded in 1994, in the Nam Theun Extension PNBCA, and has since been recorded in Nam Et and Phou Louey NBCAs (Davidson 1998). In the latter two areas it was recorded in heavily degraded vegetation and as no specific threats to the species seem likely, it is best considered Not At Risk in Lao PDR.

Stachyris rufifrons **Rufous-fronted Babbler** (separated as *Stachyris ambigua* Buff-chested Babbler by ^K, ^Sm). Resident; north, centre[B7], south[B2]. Secondary growth, bamboo, forest edge and, rarely, forest undergrowth; up to at least 1450 m.

Stachyris ruficeps **Rufous-capped Babbler**. Resident; north[B6], south[B12]. Evergreen forest, scrub, bamboo, generally at 950-1600 m.

Stachyris chrysaea **Golden Babbler**. Resident; north, centre[B10], south[B2]. Hill and montane evergreen forest and edge, dense secondary growth; generally above 800 m, but locally down to 400 m.

• *Stachyris herberti* **Sooty Babbler**. *Conservation Significance:* Globally Threatened - Vulnerable; endemic to central Indochina. Not At Risk in Lao PDR. *Documented Range and Habitat:* Resident; north (TDE), centre[B9]. Evergreen forest on limestone karst and adjacent bare rock, at 230-610 m. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). After the collection of the type series in 1920 from the area now known as Khammouan Limestone NBCA, the species was not subsequently recorded in Lao PDR until being found nearby in 1995. It has subsequently been found widely in Hin Namno NBCA, in Sayphou Loyang, and on unprotected karsts near Ban Lak (20) and near the southern tip of Nam Kading NBCA; at the latter a group of five was seen in February 1999 (Thewlis *et al*. 1998; TDE). The low likelihood of karst being modified across wide areas and the relatively large number of sites with sightings makes it reasonable to assume that Sooty Babbler is Not At Risk in Lao PDR.

Stachyris nigriceps **Grey-throated Babbler**. Resident; north[B1], centre, south[B2]. Evergreen forest and mature regrowth, up to at least 1570 m.

Stachyris striolata **Spot-necked Babbler**. Resident; north[B1], centre[B10]. Evergreen forest and mature regrowth, more frequent in hills than in lowlands, but generally below 1000 m.

Macronous gularis **Striped Tit Babbler**. Resident; north, centre, south[B2]. Evergreen and deciduous forest, riverine forest within open deciduous areas, thickets, bamboo, secondary growth and scrub up to at least 1320 m.

• *Macronous kelleyi* **Grey-faced Tit Babbler**. *Conservation Significance:* Globally Near-Threatened; endemic to central and south Lao PDR, east Cambodia and Vietnam, east of the Mekong. Not At Risk in Lao PDR. *Documented Range and Habitat:* Resident; centre, south[B2]. Evergreen and, locally, deciduous forests, markedly scarcer in heavily degraded areas; mostly below 400 m, but occurs to at least 960 m. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). The species is abundant in Champasak and Attapu Provinces, including Dong Hua Sao, Xe Pian and Dong Ampham NBCAs, Bolaven Southwest and Phou Kathong PNBCAs, and Nam Ghong Provincial PA, but north of this has been found only in Phou Xiang Thong and Phou Xang He NBCAs, in both of which it seems rather local. It occurs on the east bank of the Mekong channel at Ban Hangkhon (Champasak Province; PD), but has not been found in Dong Khanthung PNBCA (west of the Mekong) despite considerable recent effort.

Timalia pileata **Chestnut-capped Babbler**. Resident; north[B9], centre, south[B2]. Dense tall grass, scrub, bamboo, thickets and secondary growth; up to at least 1480 m.

Chrysomma sinense **Yellow-eyed Babbler**. Resident; north[B9], centre (historically[B22]), south (historically[B19]). Dense stands of grass, scrub and other vegetation up to at least 1200 m. Records prior to 1996 were reviewed by Duckworth *et al*. (1998a). The few recent records may largely reflect restricted survey effort in the species's usual habitats.

Leiothrix argentauris **Silver-eared Mesia**. Resident; north, centre[B10], south[B2]. Evergreen forest, mature secondary growth and forest edge, generally above 900 m. *Special Significance:* CITES Appendix II. (Plate 12)

Cutia nipalensis **Cutia**. Resident; north (historically[B21]), centre[B10], south[B3]. Evergreen forest above 1500 m.

Pteruthius flaviscapis **White-browed Shrike Babbler**. Resident; north, centre[B10], south[B2]. Evergreen and mixed deciduous forest, usually above 900 m, locally down to 700 m.

Pteruthius melanotis **Black-eared Shrike Babbler**. Resident; north[B4], centre[B10], south[B9]. Evergreen forest and forest edge above 1050 m.

Pteruthius aenobarbus **Chestnut-fronted Shrike Babbler**. Resident; north, centre[B10], south[B2]. Evergreen forest and forest edge above 900 m, locally down to 700 m.

Gampsorhynchus rufulus **White-hooded Babbler**. Resident; north[B1], centre[B10], south[B2]. Evergreen forest, bamboo stands and dense secondary growth at 500-1350 m, locally down to 200 m.

Actinodura ramsayi **Spectacled Barwing**. Resident; north[B13], centre[B10]. Montane evergreen forest, scrub, secondary growth; above 1200 m.

• *Actinodura sodangorum* **Black-crowned Barwing**. *Conservation Significance:* Little Known in Lao PDR; endemic to a small area of south-east Lao PDR and central Vietnam. *Documented Range and Habitat:* Resident; south[B12]. At the only known Lao site, birds live in damp tall dense grass and scrub at 1140 m. *Status Information:* A small population of this newly discovered species (Eames *et al*. 1999) was found on the Dakchung Plateau in late 1997 (Showler *et al*. 1998a). Pending further information on range and habitat use, this species should be considered Little Known in Lao PDR.

Minla cyanouroptera **Blue-winged Minla**. Resident; north, centre[B10], south[B2]. Evergreen forest and tall secondary growth, usually above 900 m.

Minla strigula **Chestnut-tailed Minla**. Resident; north[B8], centre[B10]. Evergreen forest and adjacent scrub above 1750 m. Records prior to 1997 were reviewed by Thewlis *et al*. (1998). In view of the species's apparently secure status (common in Nakai-Nam Theun NBCA above 1750 m) and the low likelihood of it being at elevated risk, it was dropped from the recommended list of key species. It has subsequently been found to be common above 1900 m in Phou Louey NBCA (Davidson 1998).

Minla ignotincta **Red-tailed Minla**. Resident; north[B8], centre[B10], south[B3]. Evergreen forest and secondary growth above 1100 m. First recorded for Lao PDR in 1994 (Evans and Timmins 1998).

• *Alcippe cinerea* **Yellow-throated Fulvetta**. *Conservation Significance:* Globally Near-Threatened; Little Known in Lao PDR. *Documented Range and Habitat:* Resident; north (historically[B21]). Understorey of montane evergreen forest. *Status Information:* The species is known in Lao PDR from only two sites in Xiangkhouang Province, at one of which it was abundant (David-Beaulieu 1944). Since the text for Thewlis *et al*. (1998) was finalised, several areas of potentially suitable montane forest in north Lao PDR have been surveyed and the species has still not been found.

Alcippe castaneceps **Rufous-winged Fulvetta**. Resident; north[B4], centre[B10], south[B2]. Evergreen forest and secondary growth above 1100 m.

• *Alcippe ruficapilla* **Spectacled Fulvetta**. *Conservation Significance:* Globally Near-Threatened; endemic to south-west China, Lao PDR and Vietnam. Not At Risk in Lao PDR. *Documented Range and Habitat:* Resident; north (historically[B21]), centre, south[B14]. Evergreen forest above 1800 m. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). Historical records come from two sites in Xiangkhouang Province (David-Beaulieu 1944), and recently the species was found to be common on Phou Ahyon and to occur in Nakai-Nam Theun NBCA. The form concerned is probably better regarded as a separate species, *A. danisi* Indochinese Fulvetta (C. R. Robson *in litt*. 1998) which is endemic to Lao PDR and Vietnam and includes the recently described race *A. r. bidoupensis* Eames, Robson and Nguyen Cu, 1994.

• *Alcippe rufogularis* **Rufous-throated Fulvetta**. *Conservation Significance:* Globally Near-Threatened. Not At Risk in Lao PDR. *Documented Range and Habitat:* Resident; north, centre[B14]. Damp gullies and ravines in little-degraded evergreen forest at 200-800 m in central Lao PDR; wide variety of forest types and secondary growth in the north up to at least 1000 m. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). The species has been found

in 12 recent survey areas (Table 11) in several of which it is locally common. In central Lao PDR it appears to have narrow habitat requirements, suggesting sensitivity to encroachment of forest, but in the north this is not so. The reason for this difference is not clear.

Alcippe dubia **Rusty-capped Fulvetta** (included in *A. brunnea* Brown-capped Fulvetta by ^K, ^T). Resident; north[B8], centre[B10], south[B3]. Understorey of evergreen forest and secondary growth, occasionally scrub; mainly above 1500 m.

Alcippe poioicephala **Brown-cheeked Fulvetta**. Resident; north[B1], centre[B16]. Evergreen forest, secondary growth, dense scrub, bamboo and, locally, thick grass; lowlands to at least 1050 m. Records prior to 1996 were reviewed by Duckworth *et al*. (1998a).

Alcippe peracensis **Mountain Fulvetta**. Resident; centre, south[B2]. Evergreen forest and adjacent secondary growth over a wide altitudinal range. Two forms occur and are widely geographically sympatric although they are separated by altitude; one (*A. p. grotei*) occurs primarily below 400 m but locally to at least 800 m, the other (*A. p. annamensis*) occurs primarily above 900 m, but perhaps locally lower. Records prior to 1997 were reviewed by Thewlis *et al*. (1998). In view of the species's apparently secure status, it was dropped from the recommended list of key species. Differences in habitat use between the two forms are discussed in Thewlis *et al*. (1996). Both forms are widespread. *A. (p.) grotei* occurs south from Hin Namno and Phou Xang He NBCAs to Xe Pian and Dong Ampham NBCAs. *A. p. annamensis* occurs at high densities in both the southern Annamites and on the Bolaven Plateau. The forms are best considered as separate species, *A. peracensis* Mountain Fulvetta and *A. grotei* Black-browed Fulvetta (C. R. Robson verbally 1998). They differ in morphology and vocalisations, and are separated altitudinally in both Lao PDR and Vietnam. *Special Significance:* Endemic to Indochina, south-east Thailand and montane parts of the Malay Peninsula.

Alcippe morrisonia **Grey-cheeked Fulvetta**. Resident; north, centre[B10]. Evergreen forest and tall secondary growth, also mature scrub above 600 m.

Heterophasia annectans (= *H. annectens*, ^K, ^Sm, ^T) **Rufous-backed Sibia**. Resident; north[B7], south[B3]. Evergreen forest and secondary growth above 1000 m.

Heterophasia melanoleuca **Black-headed Sibia**. Resident; north[B6], south[B3]. Evergreen forest and secondary growth above 800 m. One in Nam Ha NBCA, in bamboo and rattan at 1800 m, in March 1997 (Tizard *et al*. 1997; RJTiz) is the first sight record for Lao PDR (and indeed east of the Mekong) of *H. melanoleuca* (*s. s*.) 'Black-backed Sibia'. The form was heard widely in evergreen forest and secondary growth from 1,300 m to at least 1,800 m in February and March 1997 (PD). Records from the Bolaven Plateau (Engelbach 1932) relate to *engelbachi*, which falls within *H. desgodinsi* 'Black-headed Sibia', probably better regarded as a separate species (Inskipp *et al*. 1996; C. R. Robson verbally 1998). Those from the Phou Ahyon area (Timmins and Vongkhamheng 1996a) were not collected but may represent an undescribed race allied to *H*. (*m*.) *desgodinsi*. *Special Significance: H. melanoleuca* (*s.s.*) is endemic to Myanmar, north and west Thailand and north Lao PDR; *H.* (*m*.) *desgodinsi* extends from south Lao PDR and southern Vietnam north into central China.

Heterophasia picaoides **Long-tailed Sibia**. Resident; north[B13], centre[B10], south[B3]. Evergreen forest and occasionally mixed deciduous forest above 950 m.

Yuhina castaniceps **Striated Yuhina**. Resident; north[B10], centre[B7], south[B12]. Evergreen and mixed deciduous forest, secondary growth and scrub; above 910 m, exceptionally down to 400 m.

Yuhina flavicollis **Whiskered Yuhina**. Resident; north, centre[B14]. Evergreen forest and secondary growth, generally above 1500 m, occasionally down to 1000 m. Records prior to 1997 were reviewed by Thewlis *et al*. (1998). In view of the species's apparently secure status, it was dropped from the recommended list of key species.

• *Yuhina gularis* **Stripe-throated Yuhina**. *Conservation Significance:* Little Known in Lao PDR. *Documented Range and Habitat:* Resident; north (historically[B21]). Evergreen forest above 2500 m. *Status Information:* The only records are from Phou Bia (Xiangkhouang Province) where it was very common over its limited altitudinal range (David-Beaulieu 1944). The lack of recent records indicates that the species should be regarded as Little Known in Lao PDR.

Yuhina nigrimenta **Black-chinned Yuhina**. Resident; north[B10], centre[B7]. Evergreen forest and secondary growth at 700-1450 m.

Yuhina zantholeuca **White-bellied Yuhina**. Resident; north, centre, south[B2]. Evergreen forest and mature secondary growth up to at least 1350 m; the only yuhina widespread in the lowlands.

Paradoxornis gularis **Grey-headed Parrotbill**. Resident; north[B9], centre[B10], south[B3]. Evergreen forest and adjacent mature secondary growth at 800-1600 m.

Paradoxornis guttaticollis **Spot-breasted Parrotbill**. Resident; north[B14]. Scrub, dense tall grass and fringes of cultivation; over 1050 m. Records prior to 1997 were reviewed by Thewlis *et al*. (1998), who considered the species to be Little Known in Lao PDR. Further records have come from various degraded areas across north Lao PDR. The species seems unlikely to be either rare or declining and it should not be considered a key species.

Paradoxornis nipalensis **Black-throated Parrotbill**. Resident; north (historically[B21]), centre[B7], south[B3]. Bamboo, evergreen forest and dense tall grass, mostly above 1500 m. *P. n. beaulieui* inhabits central Lao PDR (Nakai-Nam Theun NBCA) and a different form, as yet undescribed, occurs in the south (Phou Ahyon area).

Paradoxornis verreauxi **Golden Parrotbill** (included in *P. nipalensis* Black-throated Parrotbill by ^K). Resident; north[B8]. Bamboo and other understorey vegetation in evergreen forest above 1500 m. All birds appear to belong to *P. v. craddocki*. The records of this species from Nakai-Nam Theun NBCA in Evans and Timmins (1998) were intended to refer to Black-throated Parrotbill. This species was first recorded for Lao PDR in Nam Ha NBCA in 1997 (Tizard *et al*. 1997).

• *Paradoxornis davidianus* **Short-tailed Parrotbill**. *Conservation Significance:* Globally Threatened - Vulnerable; endemic to northern Indochina, north Thailand and southern China. Not At Risk in Lao PDR. *Documented Range and Habitat:* Resident; north[B1]. Bamboo and adjacent vegetation, also occasionally scrub and grass; at 250-1200 m. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). It has subsequently been found locally in Nam Kan PNBCA (Robson 1997b, Pasquet 1997), Nam Ha NBCA (Tizard *et al*. 1997) and Nam Xam NBCA (Showler *et al*. 1998b). This surge of records in northern Lao PDR and the sightings in degraded areas indicate that the species should currently be considered Not At Risk in Lao PDR.

• *Paradoxornis atrosuperciliaris* **Lesser Rufous-headed Parrotbill** (= Black-browed Parrotbill, ^Sm). *Conservation Significance:* Globally Near-Threatened; Little Known in Lao PDR. *Documented Range and Habitat:* Resident; north[B13], centre[B7]. Naturally disturbed areas within evergreen forest and bamboo, generally above 1000 m, locally down to 750 m. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). There is one old record, of a small flock in Xiangkhouang Province (David-Beaulieu 1948), and recently the species has been recorded just twice, in Nakai-Nam Theun and Nam Xam NBCAs (Tobias 1997, Showler *et al*. 1998b).

• *Paradoxornis ruficeps* **Greater Rufous-headed Parrotbill** (= Rufous-headed Parrotbill, ^Sm). *Conservation Significance:* Globally Near-Threatened; Little Known in Lao PDR. *Documented Range and Habitat:* Resident; north[B13]. Evergreen forest including areas dominated by *Fokienia*, bamboo and scrub, at 960-1850 m. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). Subsequently, there have been several records, generally of small flocks, from Nam Xam and Phou Louey NBCAs (Davidson 1998, Showler *et al*. 1998b) and one was seen for sale at Xam-Nua airport in January 1998 (Showler *et al*. 1998b).

Conservation Management and Research Proposed for Sylviidae:

- Conservation of adequate areas of habitat, focussing on resident species suspected to be under decline or otherwise at risk which show restricted geographical and/or altitudinal range and/or habitat use, namely: Sooty Babbler, Black-hooded, Rufous-vented, Spot-breasted and Grey Laughingthrushes, the undetermined laughingthrush from the south, Short-tailed Scimitar Babbler, Yellow-throated and Spectacled Fulvettas, Black-crowned Barwing and Grey-faced Tit Babbler.
- Protection of the habitats and specific sites of Paddyfield Warbler of the race *A. (a.) tangorum*, if the form is found to occur regularly.
- Investigation of international trade in laughingthrushes, which are very popular cage-birds in Vietnam and Indonesia. Trade levels out of Lao PDR, if any, remain unknown. A few Black-throated Laughingthrushes have been seen in cages in Vientiane, but numbers are insignificant compared with those in Vietnam.
- Clarification of the distribution of all parrotbill species; most seem to survive in degraded areas and it is unlikely they are under elevated threat from habitat loss.
- Clearer understanding of the range and status of each warbler form currently under taxonomic reassessment (notably some complexes within the genus *Phylloscopus*); wintering taxa (e.g. the several in the *P. proregulus* complex) are not listed here as key species as it is unlikely that any are threatened by activities in Lao PDR.
- Monitoring of trade levels in dead birds with control if necessary. Passerines, especially of bulbul size and bigger, are hunted throughout Lao PDR. Bundles of mixed passerines are widely sold in markets for food (Plates 1, 4, 12). Trade includes several Globally Threatened and Near-Threatened sylviids, e.g. parrotbills at Xam-Nua airport in 1998 (Showler *et al*. 1998b). Current trading levels are unlikely to threaten any sylviids, but this could change if habitat is substantially reduced and/or fragmented.

Alaudidae: Larks (3 species)

Mirafra javanica **Australasian Bushlark** (= Singing Bushlark, ^K, ^T; = Australasian Lark, ^Sm). Seasonal status unclear; north[B9], centre (historically[B22]). Open country. Records prior to 1996 were reviewed by Duckworth *et al*. (1998a). David-Beaulieu (1944, 1949-1950) considered that the species was a passage migrant at the sites he knew. He collected and observed large numbers, and as he habitually hunted open-country birds with dogs it is unlikely that a spurious pattern of occurrence would arise through differential detectability with season. The distance moved remains unclear.

Mirafra assamica **Rufous-winged Bushlark** (= Rufous-winged Lark, ^Sm). Resident; north (J. Tobias *in litt*. 1998), centre (historically[B22]), south[B2]. Dry dipterocarp forest, rocky savanna, dry cultivation and sometimes other open country; mostly below 350 m, but up to 900 m. The recent record from the north involved three birds displaying at Pakxan in 1997 (J. Tobias *in litt*. 1998). Alström (1998) re-examined this species complex and concluded that birds in Indochina belong to the species *M. marionae* Indochinese Bushlark, a species endemic to Indochina, Thailand and, marginally, Myanmar.

Alauda gulgula **Oriental Skylark**. Seasonal status unclear; north (Parr and Parr 1998). Dry paddies of level lowlands at 200 m. First recorded in December 1997, near Vientiane (Robson 1998) and subsequently recorded at several other sites around Vientiane. Many birds were singing, suggesting that they breed locally.

Nectariniidae: Flowerpeckers, sunbirds, spiderhunters (19 species)

Dicaeum agile **Thick-billed Flowerpecker**. Resident; north, centre, south[B2]. Evergreen and mixed deciduous forests and secondary growth, up to at least 850 m.

Dicaeum chrysorrheum **Yellow-vented Flowerpecker**. Resident; north[B2], centre[B10], south[B2]. Secondary growth, scrub, evergreen and deciduous forest up to 980 m.

• *Dicaeum melanoxanthum* **Yellow-bellied Flowerpecker**. *Conservation Significance:* Little Known in Lao PDR. *Documented Range and Habitat:* Seasonal status unclear (may breed); north[B8]. Evergreen forests and forest edge, formerly in towns; above 1200 m. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). Although formerly described as common in Xiangkhouang town (David-Beaulieu 1948), the only recent record is of a single male at 2010 m on Phou Louey, Phou Louey NBCA, in May 1998 (Davidson 1998).

Dicaeum concolor **Plain Flowerpecker**. Resident; north, centre, south[B2]. Forests, secondary growth; mainly lowlands and foothills.

Dicaeum ignipectus **Fire-breasted Flowerpecker** (= Buff-bellied Flowerpecker, ^K, ^T). Resident; north[B4], centre[B10], south[B2]. Evergreen forests and mature secondary growth; generally above 850 m.

Dicaeum cruentatum **Scarlet-backed Flowerpecker**. Resident; north, centre, south[B2]. Dry dipterocarp forest, secondary growth, scrub, cultivation, gardens, villages, towns; chiefly in lowlands and foothills.

Anthreptes malacensis **Brown-throated Sunbird** (= Plain-throated Sunbird, ^Sm). Resident; north[B2], south (JAW). Town gardens and other heavily disturbed areas with flowering or fruiting trees, secondary growth and forest edge; predominantly lowlands. Records from prior to 1994 were reviewed in Thewlis *et al*. (1996).

Anthreptes singalensis **Ruby-cheeked Sunbird**. Resident; north, centre, south[B2]. Evergreen and deciduous forests, mature secondary growth, mainly lowlands but up to at least 1150 m.

Hypogramma hypogrammicum **Purple-naped Sunbird**. Resident; north, centre, south[B2]. Under- and mid-storey of evergreen forests, mature secondary growth; chiefly lowlands and foothills, occasionally up to 800 m.

Nectarinia sperata **Purple-throated Sunbird**. Resident; south[B2]. Scrub, secondary growth, open parts of semi-evergreen forest; records come only from the level lowlands.

Nectarinia jugularis **Olive-backed Sunbird**. Resident; north, centre, south[B2]. Dry dipterocarp forest, gaps in evergreen forest, scrub, secondary growth, gardens including those in towns; mainly lowlands.

Nectarinia asiatica **Purple Sunbird**. Resident; north, centre, south[B2]. Open forests, especially dry dipterocarp forest, also gardens and cultivation; mainly lowlands.

Aethopyga gouldiae **Mrs Gould's Sunbird** (= Gould's Sunbird, ^K, ^Sm, ^T). Resident; north[B4], centre[B10], south[B2]. Montane evergreen forest and secondary growth, generally above 1400 m, locally down to 1000 m.

Aethopyga nipalensis **Green-tailed Sunbird**. Resident; north[B6], centre, south[B14]. Montane evergreen forest and mature scrub, generally above 1400 m, locally down to 1140 m in winter. Records prior to 1997 were reviewed by Thewlis *et al*. (1998). In view of the species's apparently secure

status, it was dropped from the recommended list of key species.

Aethopyga christinae **Fork-tailed Sunbird**. Resident; north, centre[B10], south[B12]. Evergreen forests and mature secondary growth from 300 to 1400 m. First recorded in 1994 (Evans and Timmins 1998). *Special Significance:* Endemic to south China, Vietnam and Lao PDR.

Aethopyga saturata **Black-throated Sunbird**. Resident; north[B1], centre[B10], south[B2]. Evergreen forest, secondary growth, scrub; especially in hills and mountains, up to at least 1600 m.

Aethopyga siparaja **Crimson Sunbird**. Resident; north, centre, south[B2]. Secondary growth, gaps in evergreen and deciduous forests, non-intensive cultivation; mostly below 1000 m.

Arachnothera longirostra **Little Spiderhunter**. Resident; north, centre, south[B2]. Evergreen forest, tall secondary growth, bamboo, bananas; mainly lowlands but up to at least 1150 m.

Arachnothera magna **Streaked Spiderhunter**. Resident; north[B10], centre, south[B2]. Evergreen and tall closed-canopy deciduous forest, mature secondary growth, bananas; at 250-1700 m, usually scarcer at lower altitudes.

Passeridae: Sparrows, wagtails, pipits, weavers, parrotfinches, munias (19 species)

Passer domesticus **House Sparrow**. Resident; north (Robson 1997a), south (PDR). So far recorded only in two towns. The first record was in Vientiane in December 1995 (JAW). The population has grown steadily in the intervening three years. A male was seen in Pakxe on 5 February 1998 (PDR) and one was carrying nest material there in early 1999 (A. J. Stones *in litt*. 1999).

Passer rutilans **Russet Sparrow**. Seasonal status unclear; north[B6]. Forest edge, cultivation and open pine forest, above 1100 m.

Passer flaveolus **Plain-backed Sparrow**. Resident; north[B9], centre[B10], south[B2]. Dry dipterocarp forest and riverside scrub, occasionally other open forests; locally in cultivated areas with trees, and towns. Mainly lowlands. Records prior to 1996 were reviewed by Duckworth *et al*. (1998a). *Special Significance:* Endemic to South-east Asia.

Passer montanus **Eurasian Tree Sparrow**. Resident; north, centre, south[B2]. Villages, towns, gardens, cultivation; not yet in many of the smaller and/or more remote settlements. Up to at least 1350 m.

Dendronanthus indicus **Forest Wagtail**. Passage migrant, wintering locally in southern lowlands; north, centre, south[B2]. Open forests, secondary growth, open areas with mature trees, and road- and track-side vegetation. Records prior to 1996 were reviewed by Duckworth *et al*. (1998a).

Motacilla alba **White Wagtail** (some races separated as *M. lugens* Black-backed Wagtail by ^Sm). Winter visitor and local breeding resident; north[B2], centre[B10], south[B2]. Open country, often near water; paddy-fields, roadsides, sedimentary features in rivers. Races of both *M. alba (s.s.)* and those sometimes placed in the *lugens*-group occur; *M. a. (l.) leucopsis* is the most widespread winter visitor; *M. a. (l.) alboides* is an uncommon resident breeder in the north (Duckworth *et al*. 1998a); and *M. a. (a.) ocularis* is also a non-breeding visitor. *M. a. baicalensis* might also occur but we have traced no records. Birds (probably *alboides*) also breed in southern Lao PDR on the wide lowland rivers, e.g. at Ban Hangkhon (Champasak Province; PD).

Motacilla citreola **Citrine Wagtail** (= Yellow-hooded Wagtail, ^K, ^Sm[1]). Winter visitor; north[B2]. Recorded frequently beside pools and in beds of ephemerals on sand-bars in the Mekong river at Vientiane, where first found in 1992 (Thewlis *et al*. 1996). One record from the Xiangkhouang Plateau at 1200 m (TDE).

Motacilla flava **Yellow Wagtail**. Winter visitor; north[B2], centre[B10], south[B2]. Marshes, open damp cultivation, beds of ephemerals and bare ground on river sand-bars. The taxonomy of this 'species' is complex and in future several forms may be recognised as distinct species. The forms occurring in Lao PDR are: *M. f. macronyx*, widespread and locally common, and *M. f. taivana*, recorded once in Salavan (Engelbach 1932). It is likely that *M. f. angarensis* and *M. f. simillima* also occur, although we have traced no records.

Motacilla cinerea **Grey Wagtail**. Winter visitor; north, centre, south[B2]. Forest openings, secondary growth, open country, cultivation; usually near running water. Up to at least 1650 m.

Anthus richardi **Richard's Pipit** (included in *A. novaeseelandiae* Richard's Pipit by ^K, ^T). Winter visitor; north, centre, south[B2]. Open country, paddy-fields and cultivation.

Anthus rufulus **Paddyfield Pipit** (included in *A. novaeseelandiae* Richard's Pipit by ^K, ^T). Resident; north[B2], centre[B10], south[B2]. Sand-bars in rivers, open marshy

areas, bare areas within open deciduous forest, locally in adjacent paddies and other cultivation; up to 1200 m.

Anthus hodgsoni **Olive-backed Pipit** (= Olive Tree Pipit, ^K). Winter visitor; north, centre, south[B2]. Forest openings, secondary growth, wooded areas, especially evergreen and pine-dominated areas, upland cultivation; lowlands to highest altitudes.

Anthus cervinus **Red-throated Pipit**. Winter visitor; north, centre, south[B2]. Cultivation, paddy-fields, usually near water, mostly in lowlands but up to 1200 m. Records from prior to 1994 are discussed in Thewlis *et al*. (1996).

• *Ploceus philippinus* **Baya Weaver**. *Conservation Significance:* Potentially At Risk in Lao PDR. *Documented Range and Habitat:* Resident; north[B2], centre (historically, potentially, David-Beaulieu 1949-1950), south[B2]. Dense waterside vegetation with adjacent trees; lowlands. *Status Information:* Records prior to 1994 were reviewed by Thewlis *et al*. (1996). A prominent breeding colony in Pakxan (David-Beaulieu 1949-1950) is the only firm historical record. The lack of others probably reflects the difficulties of identifying birds in non-breeding plumage (see, e.g., David-Beaulieu 1949-1950). Recent records are of small colonies in Xe Pian NBCA, Vangviang and several sites along the southern Mekong (Thewlis *et al*. 1996, Evans *et al*. in prep. a) and of birds in Dong Khanthung PNBCA (up to 30 per day; Round 1998), near Ban Thadua (Vientiane Municipality; small numbers in 1997-1998; RJTiz), and Nam Ghong Provincial PA (several small flocks; RJTiz). None was seen in several visits to the Pakxan wetlands. The few localities and low numbers of birds may reflect ongoing loss of natural waterside shrubs and marshland, trapping / persecution, and maybe other factors. Nests are frequently seen in markets and as ornaments in restaurants. Whether nest collection is problematical for the birds is unknown. The species is best considered Potentially At Risk in Lao PDR.

• *Ploceus hypoxanthus* **Asian Golden Weaver**. *Conservation Significance:* Globally Near-Threatened; At Risk in Lao PDR. *Documented Range and Habitat:* Resident; south[B14]. Well-vegetated pools in open woodland; lowlands. *Status Information:* Records prior to 1997 were reviewed by Thewlis *et al*. (1998). The species was first found (albeit provisionally) in March 1993 in Xe Pian NBCA, and breeding was confirmed in 1996 in Dong Khanthung PNBCA; these remain the only areas with records. The Dong Khanthung population is clearly of high national significance: Round (1998) had a minimum of 30 breeding pairs at 12 different pools. Birds were associated with sedge beds around the less disturbed or larger pools, but distribution was very patchy, and birds were absent from many apparently suitable sites.

Erythrura prasina **Pin-tailed Parrotfinch**. Resident but semi-nomadic; north, centre[B14]. Evergreen forest and mature regrowth, particularly areas with extensive flowering bamboo; rank streamside herbs within forest, up to at least 1100 m. Records prior to 1997 were reviewed by Thewlis *et al*. (1998). In view of the species's apparently secure status (large flocks found in two survey areas, smaller numbers in two others) and lack of apparent threats, it was dropped from the recommended list of key species. Subsequently, a flock of over 60 was seen in Nam Xam NBCA (Showler *et al*. 1998b). The species is sometimes seen in temples for release (see Introduction): dozens were seen at Vangviang (Vientiane Province) in 1997 and at That Luang (Vientiane town) in 1997 and 1998 (TDE, WGR).

Lonchura striata **White-rumped Munia**. Resident; north, centre, south[B2]. Open forest, secondary growth, scrub, cultivation, open parts of towns; up to at least 1580 m.

Lonchura punctulata **Scaly-breasted Munia**. Resident; north, centre, south[B2]. Cultivation, secondary growth, scrub, grass, paddy-fields, river sediments exposed during dry season; up to at least 1200 m.

• *Lonchura malacca* **Black-headed Munia** (= Chestnut Munia, ^K, ^T). *Conservation Significance:* Little Known in Lao PDR. *Documented Range and Habitat:* Presumed resident; north (historically[B18]), south (historically, provisionally, Engelbach 1927). Habitat use unknown in Lao PDR, but likely to be non-forest lowlands in vicinity of wet areas. *Status Information:* Historically the species was found near Ban Muangyo, Phongsali Province (one male collected 17 May; Bangs and Van Tyne 1931) and perhaps in the Muang Taoy region of Xekong Province (Engelbach 1927). As the latter record is not included in Engelbach's (1932) final synthesis of his southern Lao observations it is treated here as provisional. The lack of recent records suggests that the species has declined, but the reasons for this are not obvious; it should be regarded as Little Known in Lao PDR.

Conservation Management and Research Proposed for Weavers and munias:

- Conservation of adequate areas of vegetated wetland habitat, specifically for Asian Golden Weaver in Xe Pian NBCA and Dong Khanthung PNBCA.
- Control over capture and trade in weavers and parrotfinches.
- Identification of key breeding areas (especially weaver colonies) and instigation of locally-organised protective measures.
- Local awareness raising activities in weaver breeding areas.
- Field investigation and possibly control of levels of

chemical seed-dressing around areas supporting concentrations of birds.
- Investigation into the status of Black-headed Munia.

Fringillidae: Finches, buntings (13 species)

Carduelis ambigua **Black-headed Greenfinch**. Resident; north (JWD). Pine forest at 1100-1300 m, rarely in high mountains. The only records come from Xiangkhouang Province prior to 1950 and in 1999 (David-Beaulieu 1944; JWD).

Carpodacus erythrinus **Common Rosefinch**. Winter visitor; north[B8]. Forest edge, secondary growth, upland cultivation (especially poppy fields) and grassy areas; generally above 1000 m, but recorded as low as 730 m.

Haematospiza sipahi **Scarlet Finch**. Seasonal status unclear; north (historically[B21]). Sole Lao record was from leafless forest on steep terrain at almost 2000 m in February 1939 (David-Beaulieu 1944).

Eophona migratoria (= *Coccothraustes migratorius*, ^K) **Yellow-billed Grosbeak**. Winter visitor; north (RJTiz). The only recent record is from mixed deciduous forest at approximately 600 m, along the banks of the Nam Ou in Phou Dendin NBCA on 19 March 1996 (RJTiz).

Mycerobas melanozanthos **Spot-winged Grosbeak**. Seasonal status unclear, but probably breeds; north[B9]. Evergreen, mixed deciduous, and mixed coniferous forests and secondary growth, usually above 1150 m, once at 570 m. Records prior to 1996 were reviewed by Duckworth *et al*. (1998a).

Melophus lathami **Crested Bunting**. Resident; north[B8], centre (historically, Delacour 1929a). Cultivation, grass and scrub, generally in hills and mountains. King *et al*. (1975) suggested that Crested Bunting is resident throughout Lao PDR, but this is not supported by the historical literature and recent observations confirm that it is a locally numerous breeding species largely restricted to the north of the country.

Emberiza tristrami **Tristram's Bunting**. Winter visitor; north (historically[B21]). Habitat use in Lao PDR unclear; likely to be evergreen forest and secondary growth above 1200 m.

Emberiza fucata **Chestnut-eared Bunting**. Winter visitor; north[B9], centre[B10], south[B2]. Open areas including paddy-fields and marshes, up to at least 800 m. Records from prior to 1994 were reviewed in Thewlis *et al*. (1996).

Emberiza pusilla **Little Bunting**. Winter visitor; north[B9], centre[B10]. Scrub, cultivation, open grass, open rocky areas within forest and secondary growth, up to at least 1250 m.

Emberiza aureola **Yellow-breasted Bunting**. Winter visitor; north[B7], centre, south[B2]. Open areas, especially marshes, also grassy areas, scrub and cultivation; generally in lowlands.

Emberiza rutila **Chestnut Bunting**. Winter visitor; north[B1], centre[B10]. Evergreen forest, forest edge, secondary growth, cultivation, especially in areas with bamboo; up to at least 1650 m.

Emberiza melanocephala **Black-headed Bunting**. Vagrant; north[B9]. The sole Lao record (indeed, the sole field record from mainland South-east Asia), from Vangviang (Vientiane Province), was in a lowland dry harvested paddy-field in late November 1994 (Thewlis 1995).

Emberiza spodocephala **Black-faced Bunting**. Winter visitor; north[B13]. Open areas, forest edge, scrub, weed patches, cultivation; generally in lower-lying areas.

Appendix: Species Omitted from the Foregoing List

Species listed below have been published somewhere as occurring, or being likely to do so, in Lao PDR. For the reasons given, their occurrence is considered inadequately documented even for listing as provisional records. Some are otherwise plausible and may be added to the known Lao avifauna with further field work and documented observations. Several further species listed recently as occurring in Lao PDR are on lists with other highly implausible records. These records are therefore not included here.

Lophura leucomelanos (= *L. leucomelana*, ^K, ^T) **Kalij Pheasant**. A total of eight birds was seen for sale in That Luang market, Vientiane over four days in 1991 (Srikosamatara *et al*. 1992). Plumage variation in this species and Silver Pheasant is highly complex (McGowan and Panchen 1994). Several races of Silver Pheasant differing strongly in appearance from each other occur in Lao PDR (see species account). Kalij Pheasant is found largely west of the Irrawaddy river, with a small area occupied to the east of the river around Bhamo district, northern Myanmar (C. R. Robson *in litt*. 1999, *contra* Lekagul and Round 1991 and McGowan and Panchen 1994). Occurrence in Lao PDR is highly unlikely.

Lophura imperialis **Imperial Pheasant**. Historical discussion of the possibility of Imperial Pheasant occurring in Lao PDR stems from local reports. Recent work indicates the great difficulties of interpreting such information about dark pheasants (Thewlis *et al*. 1998). Imperial Pheasant may be a hybrid between Silver Pheasant and Edwards's Pheasant *L. edwardsi* or Vietnamese Pheasant *L. hatinhensis* (Rasmussen 1998). Neither of the latter two species has been recorded in Lao PDR.

Phasianus colchicus **Common Pheasant**. Salter (1993b) stated that this species "possibly occurs in north", based on a pencil-amended photocopy of the unpublished distribution table of King *et al*. (1975). We have traced no primary source of even a provisional record, and E. C. Dickinson (*in litt*. 1999), the original compiler of the table, confirmed that he knows of none. (Plate 5)

Polyplectron germaini **Germain's Peacock Pheasant**. Previous claims of this species in Lao PDR apparently stem from local reports and lack sufficient detail for listing even as provisional records (Thewlis *et al*. 1998).

Argusianus argus **Great Argus**. Ogilvie-Grant (1893) apparently listed this species from Lao PDR but there has been no subsequent evidence and occurrence is most unlikely.

Anas clypeata **Northern Shoveler** An individual reported from a market in Vientiane in 1991 (Srikosamatara *et al*. 1992) may or may not have been caught in Lao PDR. No identification details are now available, even to sex (B. Siripholdej verbally 1999). Occasional winter visitors would be expected to occur (Table 9).

Aythya fuligula **Tufted Duck**. Although recorded in King *et al*. (1975) as a migrant in the north, the basis for this is not now traceable (E. C. Dickinson *in litt*. to T. P. Inskipp 1997). Occasional winter visitors would be expected to occur, as indeed they would of several other congeners (Table 9).

Dendrocopos hyperythrus (= *Picoides hyperythrus*, ^K, ^T) **Rufous-bellied Woodpecker**. Reference to this species in Lao PDR relates to one collected by Harmand in the untraced locality of 'Kouys' (= the land of the Kouy people) in 1875. Kouys was stated clearly to be in Laos by Oustalet (1899-1903: 259). The map of Indochina in Garnier (1869-1885) placed the 'Siam' (in this sense, Lao PDR and Thailand) - Cambodia boundary just north of Stung Treng (i.e. about 150 km south of the present position), and Kouys fell partly in Cambodia and partly in 'Siam'. None is within modern Lao PDR. Although Harmand could conceivably have used 'Kouys' for a wider area than did Garnier, this seems an insufficient reason to maintain the species on a list of birds recorded from Lao PDR, even provisionally. E. C. Dickinson (*in litt*. 1999) has confirmed that in the preparation of King *et al*. (1975), the issue of 'Kouys' was not investigated, nor was it by Thewlis *et al*. (1998). Recent records from Vietnam (Le Xuan Canh *et al*. 1997), and the known Lao habitats of other species collected at 'Kouys', suggest that this species, if resident in Lao PDR, will be found in dry dipterocarp forest. Additionally, winter migrants might visit high altitude pine and evergreen broad-leaved forests in north Lao PDR.

Picus viridianus **Streak-breasted Woodpecker**. The record in Evans *et al*. (1996b) for Dong Hua Sao NBCA was an editorial error (Evans *et al*. in prep. a); the species is most unlikely to occur in Lao PDR.

Aceros subruficollis (= *Rhyticeros subruficollis*, ^T) **Plain-pouched Hornbill** (included in *Rhyticeros plicatus* Blyth's Hornbill by ^K). Claridge (1996) listed this species for the Nakai Plateau area but the original trip report lacks detail and the record was not included in Thewlis *et al*. (1998). There has been no further evidence and occurrence of this species seems very unlikely.

Phaenicophaeus diardi **Black-bellied Malkoha**. A young male malkoha taken along the lower Xe Don on 16 August 1929 was identified as this species on the basis of size (Engelbach 1932). But for a claim from Cochinchina (Tirant 1879), this species is otherwise known only from the Sundaic subregion (King *et al*. 1975). The species can easily be confused with Green-billed Malkoha, and C. R. Robson (*in litt*. 1999) pointed out that Engelbach's wing measurement fits neither Black-bellied nor Green-billed (suggesting the bird was but partly-grown and thus even more difficult to identify conclusively). These factors and the general difficulties of making identifications in Indochina over half a century ago (see some re-identifications in Dickinson 1970b), make it preferable to reject this record unless further evidence is forthcoming.

Grus grus **Common Crane**. Sources including this as a member of the Lao avifauna are apparently based on the predictive report in McNeely (1975). Occasional occurrence is indeed likely.

Porzana paykulli **Band-bellied Crake**. Sources including this as a member of the Lao avifauna are apparently based on the predictive report in McNeely (1975). Occasional occurrence is not unlikely.

Sterna caspia (= *Hydroprogne caspia*, ^K) **Caspian Tern**. Several groups of terns identified as this species were recorded by Engelbach (1929) in a mid-May voyage up the Mekong. The species was not listed by subsequent authors, including Engelbach (1932) when discussing the same region of Lao PDR. This suggests that the identification had been revised.

Aquila rapax **Tawny Eagle** (separated as *A. vindhiana* Eurasian Tawny Eagle by ^Sm[1]). Sources including this as a member of the Lao avifauna are apparently based on the predictive report in McNeely (1975). Occasional occurrence is not unlikely.

Spizaetus alboniger **Blyth's Hawk Eagle**. Except for a report from Lao PDR, this species is limited to the Sundaic subregion (King *et al*. 1975). The Lao report refers to a bird

captive in a village on the Xe Don plains in 1925. It was retrospectively identified provisionally as this species from features noted at the time; it could not be purchased (Engelbach 1932). The published description is inadequate to confirm such an astounding record. C. R. Robson (*in litt*. 1998) concurs with this assessment.

Phylloscopus chloronotus **Lemon-rumped Warbler** (= Pale-rumped Warbler, ^Sm[2]); (included in *P. proregulus* Lemon-rumped Warbler by ^K, ^Sm[1], ^T); (not distinguished from *P. sichuanensis* Chinese Leaf Warbler in most references). This species's close similarity to Chinese Leaf Warbler (see that species) means that historical records cannot now be accepted. We have traced no historical specimens from Lao PDR (but many possible ones have not yet been re-examined) and therefore remove the species from the Lao list following PDR's re-examination of Thai specimens, which revealed that *P. chloronotus* is very rare in Thailand.

Tickellia hodgsoni (= *Abroscopus hodgsoni*, ^K) **Broad-billed Warbler**. A single individual was recorded from Xiangkhouang Province in February 1940 by David-Beaulieu (1944). This record was cited in Thewlis *et al*. (1998) as the only one for Lao PDR. However, Dickinson (1970b) had already re-identified the specimen as a Chestnut-crowned Warbler. Although he then stated that "[Broad-billed Warbler is] already known from Northern Laos", this appears to have been an error and no other record from Lao PDR is known (E. C. Dickinson *in litt*. 1999). This species's occurrence in Lao PDR is, however, certainly possible.

Garrulax perspicillatus **Masked Laughingthrush**. This species was recorded for Lao PDR in Oustalet (1899-1903) on the basis of a specimen collected by Harmand in 1877. Harmand's record was referred to by Delacour and Jabouille (1931, 1940), but the species is not listed for Lao PDR in King *et al*. (1975). It seems likely that some other species was being referred to by Oustalet (1899-1903) as he also listed *perspicillatus* for Cochinchina and Thailand, two other areas with no subsequent records.

Alcippe cinereiceps **Streak-throated Fulvetta**. The statement that the species inhabits north-east Lao PDR in King *et al*. (1975) resulted from confusion over a specimen of *A. ruficapilla danisi* from Phou Kabo (Xiangkhouang Province). There is thus no evidence that *cinereiceps* occurs in Lao PDR, although occurrence in the north is possible (C. R. Robson *in litt*. 1998) and it has recently been found in Vietnam at the latitude of south Lao PDR (J. C. Eames verbally 1999).

Nectarinia calcostetha **Copper-throated Sunbird**. Sources including this as a member of the Lao avifauna are apparently based on the predictive report in McNeely (1975). Occurrence is unlikely as the species lives mainly in mangroves and other coastal vegetation (Wells 1985).

Amandava amandava **Red Avadavat**. Sources including this as a member of the Lao avifauna are apparently based on the predictive report in McNeely (1975). Occurrence is very likely.

Carpodacus nipalensis **Dark-breasted Rosefinch**. Sources including this as a member of the Lao avifauna are apparently based on the predictive report in McNeely (1975). Occurrence, at least occasionally, seems very likely.

LARGE MAMMALS

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INTRODUCTION

Species Included

The following list includes all species of large mammal recorded (in some cases, provisionally) from Lao PDR, or believed likely to occur. 'Large mammals' are taken as those identifiable under typical field conditions (see Dorst and Dandelot 1970), with some modification to keep related species together. For example, most squirrels can be identified in the field, so even though species of *Hylopetes* are difficult to separate, all squirrels are treated in this chapter. Conversely, while some insectivores, bats and rats are readily identifiable under field conditions, most are not, so all species in these groups are considered in subsequent chapters.

Species are listed as confirmed in Lao PDR only where a documented record has been traced. Portrayal of parts of Lao PDR in generalised range maps (e.g. Lekagul and McNeely 1977, Corbet and Hill 1992) is not sufficient, as most maps extrapolate to some degree. Compared with birds, recent recording of mammals in Lao PDR has been less complete, and documentation of historical specimens less thorough. There seem to be no confirmed Lao records yet for several species likely to occur (or formerly to have done so), some of which are of high conservation concern (e.g. Wild Water Buffalo). Species likely to occur in Lao PDR are included in the following list (in square brackets). To place them in an appendix of hypothetical species would deflect attention from them, yet many merit high priority in conservation planning. Some of the species listed recently and/or widely for Lao PDR for which no acceptable evidence has been traced, and which seem unlikely to occur, are relegated to an appendix at the back of this list. Other species have been claimed from Lao PDR but inclusion in the appendix is restricted to those listed in otherwise authoritative sources or other cases where genuine confusion may result. Domestic species are not discussed at all if there is little likelihood of the establishment of feral populations, based on known behaviour and habitat requirements (e.g. horse, donkey). The four domestic species listed (dog, cat, cattle and water buffalo) are square-bracketed as there is no recent evidence of feral populations in Lao PDR. There is reasonable historical evidence and/or good behavioural or ecological reasons to expect that feral populations of all four could exist, or may once have done so, within Lao PDR.

Well over a hundred species defined here as large mammals are likely to occur in Lao PDR. A precise total of species so far confirmed from the country would mean little. The pace at which further species are being confirmed to occur, and the ongoing investigation of groups of uncertain taxonomy (notably lorises, langurs, pigs, muntjacs and squirrels) would make any calculated figure obsolete within months of publication.

Taxonomy and Scientific Nomenclature

Sequence, species limits and scientific names follow *Mammals of the Indomalayan Region* (Corbet and Hill 1992), with, in addition to the incorporation of species discovered subsequently, two exceptions:

1. the gibbon taxon *siki* is regarded as a race of *Hylobates leucogenys*, not of *H. gabriellae* (Geissmann 1995);
2. the pig taxon *bucculentus* is considered a full species, not questionably synonymous with *Sus verrucosus* (Groves *et al*. 1997).

Alternative species limits or scientific names in selected works are given: [M1]Prater (1971), [M2]Lekagul and McNeely (1977), [M3]Payne *et al*. (1985), [M4]Corbet and Hill (1991), [M5]Corbet and Hill (1992), [M6]Wilson and Reeder (1993) and [M7]IUCN (1996).

World species totals for families are taken from Wilson and Reeder (1993), adjusted to reflect differing family limits in Corbet and Hill (1992). For example, Corbet and Hill separated flying squirrels Pteromyidae from non-flying squirrels Sciuridae, while Wilson and Reeder placed all species within Sciuridae.

English Names

No single source lists English-language names for all Lao large mammals. While careful consideration about the role and desirable characters of common names has been given to the region's birds (e.g. King *et al*. 1975, Sibley and Monroe 1990, Inskipp *et al*. 1996), this subject has received little attention for mammals, despite its high conservation importance (see Pine 1993). Thus, an English name has been selected for each species, using the principles (of non-ambiguity, stability of usage, accuracy and brevity) of King *et al*. (1975) and Inskipp *et al*. (1996). Comprehensive listing of all alternatives to the selected name would be impracticable and of limited value, but a selection is given, including all those in the following sources: [M1]Prater (1971), [M2]Lekagul and McNeely (1977), [M3]Payne *et al*. (1985), [M4]Corbet and Hill (1991), [M5]Corbet and Hill (1992) and [M7]IUCN (1996). These include all of the books in wide use in Lao PDR containing English names of mammals. A separate document explaining the choice of individual names is under preparation.

Distribution and Habitat

National distribution for each species is indicated according to the three-way split of Lao PDR into north, central and south (see Introduction). A primary source is cited for each region, with a focus on recent (post-1988) information in refereed journals rather than data in internal survey reports

or other grey literature. The former have generally been checked more carefully prior to final printing. References frequently cited for distribution are abbreviated thus (recent): [M8]Duckworth *et al*. (1994), [M14]Bergmans (1995), [M15]WCS (1995b), [M9]Duckworth (1996a), [M10]Timmins and Evans (1996), [M11]Davidson *et al*. (1997), [M12]Duckworth (1997a), [M13]Duckworth (1998), [M16]Showler *et al*. (1998b), [M17]Robinson and Webber (1998a), and (historical) [M18]Osgood (1932).

Distribution maps would be of limited use for most species of large mammal at this stage. Confirmed records of most species are positioned essentially randomly across their range. There is no indication that the survey areas with records represent those in which the species is most common. Similarly, it is so difficult to see or otherwise find, say, Marbled Cats, that there is no reason to believe them absent from those survey areas with no records. Recent village-interview data are not amenable to mapping in the semi-quantitative style of the first edition of this work (Salter 1993b, repeated here as Annex 5). Maps of predictive distribution would be entirely inappropriate in a work of this nature.

Habitats are assigned from personal experience of the authors, using a loose classification (see Introduction). As habitat use often varies across a species's range, every attempt is made to present information specific to Lao PDR, or derived from adjacent parts of Thailand, Cambodia and Vietnam. If there is no information from Lao PDR, this is stated.

Key Species of Special Conservation Significance

Key species (those of special conservation significance) are bulletted (•). Global status information is from the *1996 IUCN Red List of threatened animals* (IUCN 1996). Globally Threatened species are listed (in increasing order of threat) as Vulnerable, Endangered or Critical. Globally Near-Threatened species are not yet believed to be Globally Threatened, but may soon be so if current trends continue. Data Deficient species are too poorly known for their conservation status to be assessed (see Conventions).

National risk status categories have been assigned specifically for this report, the evaluations having been made by the authors in discussion with a number of experienced observers (R. J. Tizard, R. Steinmetz, S. Sawathvong, W. G. Robichaud and T. D. Evans). Species of large mammal confirmed or assumed to be still extant in Lao PDR are categorised as *At Risk in Lao PDR*, *Potentially At Risk in Lao PDR*, *Little Known in Lao PDR* or *Not At Risk in Lao PDR* (see Conventions). Assessments were made, following the guidelines of Thewlis *et al*. (1998), on the basis of observed and perceived threats to the species or its habitat together with perception of the species's population level relative to the apparent carrying capacity of the habitat.

Species *Conditionally At Risk in Lao PDR* are those which are not confirmed to occur in Lao PDR in the late 1990s but which, if present, are clearly at risk, e.g. rhinoceroses, Hog Deer and Hairy-nosed Otter. They cannot logically be categorised as at risk, as this term would imply their presence in Lao PDR. If there is no clear rationale for a species with no confirmed Lao records to be considered at risk in Lao PDR, it is not assigned a national risk category, even if it is currently considered Globally Threatened (e.g. Red Panda).

All species of large mammal with confirmed records for Lao PDR and not assigned a risk category are considered to be Not At Risk in Lao PDR at the current time. If any species unconfirmed to occur in Lao PDR is recorded in the future, its national risk category would need to be established. Most such species would be likely to qualify for at least Little Known in Lao PDR.

Four species listed as of special conservation concern in the first edition (Salter 1993b) were not retained as key species in this edition. Recent surveys show that Leopard Cat, Variable Squirrel and Cambodian Striped Squirrel are clearly not at risk. There is neither evidence that Intermediate Loris inhabits Lao PDR, nor grounds for assuming that if it does, it is at risk. The supposition that Grey Wolf occurred in Lao PDR may have been an error.

A recommended list of key species of mammals for use in future work in Lao PDR is given in Annex 6. National species conservation priorities are presented in Table 6. Key species occurrence in each recent survey area is given in Table 12. A status summary, usually with detail for less widely available records, has been included under each key species account.

Proposed Conservation Management and Research Measures

A synopsis of proposed conservation measures is provided for key species, usually presented by group. As well as the specific recommendations, there is a general need for further information on the distribution, abundance and particularly the habitat-use and altitudinal range of many species, and for active management of Lao PDR's protected area system to maintain viable populations of mammals.

CITES-listed and Restricted-range Species

CITES information is from the *Checklist of CITES species* (WCMC 1998). Except for Northern Treeshrew and Leopard Cat, all CITES-listed species occurring in Lao PDR (Annex 3) are key species and so receive a status review. Species with restricted ranges (local or regional endemics) are highlighted, to indicate the significance of the Lao range to the conservation of the species. Extralimital ranges are not given for other, more widespread, species.

Historical Sources

There is little historical information on mammals of Lao PDR. Osgood (1932) summarised the then available material and several subsequent reviews of taxonomic groups include Lao material (e.g. diurnal squirrels: Moore and Tate

1965), but no detailed fauna has yet been written. Delacour (1940) wrote an interim list, as he was concerned that various mammal-related publications included fantasy. His own important collection of 1938-1939 was not then fully documented, and we have not traced any subsequent published overview of it. There are other post-Osgood collections which have never been written up. Examination of the accounts for 'big game' species in Osgood (1932) indicates how scientific collectors ignored them in favour of the smaller ones, the assumption being that the 'sportsmen' would take care of knowledge concerning them. There are indeed various hunting books on Indochina, some including Lao PDR, but nobody has yet produced a modern analysis of the faunistic information that they contain, or its reliability. Information as available has been incorporated here.

The more recent *Les mammifères du Laos* (the mammals of Lao PDR; Deuve 1972) built on a series of papers in the former Lao national scientific journal (Deuve 1961a, 1961b, Deuve and Deuve 1962a-1964d). However, the validity of this work is compromised as methodology (how much fieldwork was undertaken and where, how much use was made of secondary reports, how identifications were confirmed, etc.) was not discussed. Deuve's earlier papers show that some species were listed for Lao PDR simply because they were implied to be there in sources such as Tate's (1947) *Mammals of eastern Asia*. Furthermore, Deuve largely ignored previous major works on the mammals of Indochina, e.g. he stated that no otters had been identified to species in north and south Lao PDR, but Osgood (1932) and Delacour (1940) listed various specimens from these regions. Even where Deuve's work appears to have been original, trenchant errors with conspicuous species (for example those concerning the distribution, subspecies and Lao name of Douc Langur; Timmins and Duckworth in press) urge consideration of these records as unconfirmed.

Recent Information

Field surveys of large mammals for periods exceeding a week took place in 32 areas during 1991-1998 (Table 12, Fig. 7). The types of methodology used on these surveys and the balance between them varied widely between sites, depending on factors such as season, duration and goals of the survey, characteristics of the survey area, and previous experience and personal inclination of the surveyor(s). In few areas could it be considered that a wide enough range of methods was used in sufficient depth to give a balanced overall view of the large mammal community. In many areas the backbone of mammal survey has been incidental opportunistic observation by day. Little direct nocturnal observation was undertaken at sites north of Phou Khaokhoay National Biodiversity Conservation Area (NBCA). Intensive sign searching was patchy. Camera-trapping (Plates 1, 14) was used at only a few sites. Mammal remains in village houses were examined extensively in relatively few areas.

This list seeks to lay a reliable baseline for future work. Thus if there is any reasonable doubt over a piece of information, it is better left out. This situation is very different from that faced by the author of a management-oriented survey report, where any plausible information on key species should be included. If it is not, the species's needs are unlikely to be incorporated into future management activities. Many indirect methods are used to record mammals, some of which do not give information of absolute reliability. Authors therefore phrase their findings appropriately. For example, Boonratana (1998a) wrote for Fishing Cat in Dong Hua Sao NBCA that "scats found on boulders close to streams ... *suggest* that they belong to this species". This indicates clearly that management of the NBCA should cater for the needs of Fishing Cat, even though the presence of the species remains to be confirmed. By contrast, defining the national range (geographical, altitudinal, habitat) of Fishing Cat can use only reliable records. What constitutes acceptable information varies between species, and depends also on the experience of the surveyor.

Below follows some information about the two chief methods of indirect recording, local information and signs. Assessing local information about mammals has never been experimentally validated in Indochina. Some problems could be reduced by interviewers noting (in Lao script) the name used locally for the animal under discussion, rather than merely their assessment of which species they believe is under discussion. Even so, a given name may mean different animals in different areas. Furthermore, even with an unambiguous name, not all informants will know perfectly the identification characteristics of the animals about which they are speaking. Conceptual differences between scientifically based surveyors rooted in concepts such as gene-pools and diagnosable morphological characteristics, and rural hunters unconcerned by such things, are widespread. Considerable further work is necessary to understand the assumptions involved in using local information. The reliability of basic information concerning high profile species (those valuable in trade, as food sources, dangerous to people and/or damaging to crops etc.) seems to be relatively high, especially if they are also visually distinctive (Annex 5). Reliability is low for species of little direct relevance to local informants, or where there are several closely-similar species, even when the species are economically important (e.g. muntjacs; Timmins *et al*. 1998).

Various recent incidents in Lao PDR exemplify the dangers of uncritical acceptance of local information, including: a charred gibbon skeleton (Plate 5) claimed to be that of a Douc Langur; the investigation at one site of recent Saola sightings by two people independently, which produced two lists of specific records (related to time and locality) with little congruence; claims several years apart from the same area that a certain event happened 'recently, for the first time'; and others. These deliberately elementary examples (clearly,

Figure 7. Areas where large mammals were surveyed for periods exceeding one week during 1992-1998 inclusive.

no hunter could confuse a gibbon, even hairless, with a Douc Langur) underscore the overall problem that no assumptions should be made during interviews and that errors often lie with the surveyor's interpretation of local information, and in particular a widespread failure by surveyors to understand that as villagers do not use a Linnaean classification, it is not always possible to fit their information into one.

Village interview data gathered during 1988-1993 (see Information sources) came mostly from interviews conducted in or adjacent to large blocks of forest. Extrapolating findings to the whole nation would overestimate abundance in Lao PDR. These data were collected 5-11 years prior to this revision and distributions have doubtless changed for some species. The original maps are reproduced in Annex 5 to facilitate comparison with the field survey results (Table 12) which come largely from 1993-1998.

There are problems with the treatment of signs as confirmed records. In Lao PDR, many taxonomic groups contain similar species (bears; deer; muntjacs; otters; cats; dogs; etc.). Within each group, the various species leave rather similar signs, and individual species can leave signs widely varying in size. Kanchanasakha *et al*. (1998) documented the wide size ranges shown by Tiger footprints. Similarly wide ranges are likely for other species in the region. The discussion of big cat faeces and scrapes in Kanchanasakha *et al*. (1998: 229) also cautions against attempting species identifications. Kruuk *et al*. (1993) gave field-validated guidelines for separating otter signs to species, but there appear to be few comparable studies of other groups. Many mammal species vary in size across their geographic ranges. Thus it is unwise to claim firm identifications in Lao PDR based upon size guidelines derived elsewhere, e.g. van Strien (1983), which was written for use in Indonesia, not Indochina. Except with people who have been active in the region using sign-based survey techniques for many years, a cautious approach has been taken to the inclusion of sign-based records in the following list.

ANNOTATED LIST OF SPECIES

Key species distribution across recent survey areas is given in Table 12.

Manidae: Pangolins (2 species in Lao PDR; 7 worldwide)

• *Manis pentadactyla* **Chinese Pangolin**. *Conservation Significance:* Globally Near-Threatened; At Risk in Lao PDR; CITES Appendix II. *Documented Range and Habitat:* North[M13], centre[M10]. There are too few locality records to determine this species's geographical distribution and altitudinal range in Lao PDR. Corbet and Hill (1992) mapped the two pangolin species in Lao PDR as showing a simple latitudinal replacement, with this species north of about 19ºN, and *M. javanica* south of this. It seems more likely that there is a wide latitudinal overlap between the species, with *pentadactyla* primarily in hills and mountains and *javanica* in the lowlands and lower hills. Habitat use is unclear in Lao PDR. *Status Information:* See below. The only recent field sighting is of a single individual in Nam Theun Extension PNBCA (Duckworth 1998); another was seen in a village in Nakai-Nam Theun NBCA (Evans *et al*. in prep. b). Animals (collected by villagers) were seen around Nam Phoun NBCA in 1997 (Boonratana 1997, RB). The only historical record may be of two individuals from Phongsali (Osgood 1932), although Deuve (1972) mentioned occurrence in Bokeo Province.

• *Manis javanica* **Sunda Pangolin** (= Malayan Pangolin[M2, M4, M7]; = Pangolin[M3]). *Conservation Significance:* Globally Near-Threatened; At Risk in Lao PDR; CITES Appendix II. *Documented Range and Habitat:* North[M15], centre[M10], south[M8]. Wide variety of forest types and secondary growth; probably mainly lowlands and lower hills. *Status Information:* See below. Recent records from a wide distribution of areas below 600 m, from Xe Pian NBCA in the south, north at least to Nam Kading NBCA (Table 12); records from Nam Phoun NBCA are based on local reports (RB). Most records are of captured animals; in no area have field sightings been common, nor were tracks found particularly frequently. Hunters report that animals still occur widely, but numbers seem low. The only historical record may be from Ban Thateng (Bolaven Plateau) at 900 m (Osgood 1932; but see his cautions on the altitudes of individual records, p. 197). Deuve (1972) considered that the species inhabited the length of the Mekong valley, from Pakxe north to Louangphabang.

Status Information on Pangolins: Pangolins were reported during 99% of 1988-1993 village interviews (n = 328), suggesting that they remained widespread, despite intensive collecting for food and scales. They are eaten in rural Lao PDR (Table 1) and are widely available in urban food markets and restaurants (Annex 1), being one of the most commonly sold mammals in the That Luang fresh food market in Vientiane (Srikosamatara *et al*. 1992). Whole animals are exported to Thailand (Srikosamatara *et al*. 1992) and Vietnam (Nash 1997, Compton in prep. b; RJTim). Pangolin claws and scales are used in traditional medicine (Martin 1992). Parts are mixed with other ingredients in many medicines (Baird 1995b) and this non-specific use presumably elevates demand for pangolins.

Pangolins are the most heavily traded animal in Lao PDR, at least through Ban Lak (20), with *javanica* outnumbering *pentadactyla* (Compton in prep. b). Pangolin scales generate a large trade from Lao PDR. Skins for leather goods can only be used from a proportion of animals (those still fresh at the tannery), but even so they are exported in quantity: 4020 in

Table 12. Records of key species of large mammals in survey areas across Lao PDR as of 28 February 1999.
(a) North Lao PDR

Species	Phou Dendin NBCA	Nam Et NBCA	Phou Louey NBCA	Nam Ha NBCA	Nam Xam NBCA	Nam Phoun NBCA	Phou Khaokhoay NBCA	Sangthong District	Houay Nhang NR	Nam Kading NBCA	Nam Theun Extension PNBCA
Survey effort: signs	low	mid	mid	mid	mid	high	low	low	low	mid	high
Survey effort: daytime observation	low	mid	mid	mid	mid	low	low	high	high	mid	high
Survey effort: night-time observation	low	low	low	low	low	low	mid	low	mid	high	mid
Chinese Pangolin						?					X
Sunda Pangolin						?				X	X
Pangolin sp(p).		?	X	?	?	X	X	?			
Sunda Colugo		?	?		?		?				
Mainland Slender-tailed Treeshrew											
Large loris sp(p).						X	X			X	X
Small loris sp(p).							X			X	X
Loris sp(p).			?	?	?			?			
Pig-tailed Macaque				?		X	X	X		X	
Assamese Macaque			?	X		X				X	X
Rhesus Macaque	X	?		?			X	X		X	X
Long-tailed Macaque											
Bear Macaque		X	?	?	?	?	?			X	X
Francois's Langur										X	
Silvered Langur						?					
Phayre's Langur	X				?	?	X	?		X	
Douc Langur										X	X
White-handed Gibbon						X					
Pileated Gibbon											
Black-cheeked Crested Gibbon											
White-cheeked / Yellow-cheeked Crested Gibbon		X	X		X		X	X		X	X
Gibbon sp(p).				†							
Golden Jackal				?		?	?				
Dhole		?	?	?	?	?	X	?		X	X
Asiatic Black Bear		?	?	?	?	?	?				?
Sun Bear		?	?	?	?	?	?				?
Bear sp(p).	X	X	X			X	X	?		X	X
Yellow-bellied Weasel					X						
Siberian Weasel											
Back-striped Weasel				X						X	
Weasel sp(p).											
Hog Badger		?	?	?	?	?	X			X	X
Large-toothed Ferret Badger											
Small-toothed Ferret Badger											
Ferret badger sp(p).		?	?	?				X			
Eurasian Otter											
Smooth-coated Otter											
Oriental Small-clawed Otter										X	X
Otter sp(p).		X	X	X	X	X	X	?		X	
Large-spotted Civet											
Spotted Linsang											
Binturong		?	?			?	?	?		X	
Owston's Civet											?

Species	Phou Dendin NBCA	Nam Et NBCA	Phou Louey NBCA	Nam Ha NBCA	Nam Xam NBCA	Nam Phoun NBCA	Phou Khaokhoay NBCA	Sangthong District	Houay Nhang NR	Nam Kading NBCA	Nam Theun Extension PNBCA
Jungle Cat											
Fishing Cat		?									X
Asian Golden Cat		?	X	?	?	?		X		X	
Marbled Cat				X	X		?				
Clouded Leopard				?	?	?	X				
Medium-sized cat sp(p).						X					X
Leopard		?	?	?	?	?					
Tiger		X	X	X	?	X	?			?	X
Big cat sp(p).							X				
Irrawaddy Dolphin											
Asian Elephant	X	X	†	X*	X	X	X	X		X	
Lesser One-horned Rhinoceros											
Asian Two-horned Rhinoceros											
Rhinoceros sp(p).		†	†	†		†	†				
Pig spp.	X	X	X	X	X	X	X	X		X	X
Heude's Pig											X
Eld's Deer											
Sambar	?	X	X	X	X	X	X	X		X	X
Hog Deer							†				
Large-antlered Muntjac										X	X
Roosevelts' Muntjac											
Annamite Muntjac											
Small muntjac spp.		?	?	?	?						X
Kouprey											
Gaur		?	X	X	X	X	?			X	
Banteng		?	?	?		?					
Wild cow sp(p).							?	X			
[Wild Water Buffalo]											
[Long-tailed Goral]		?	?	?							
Southern Serow		X	X	X	X	X	?			?	X
Saola											X
Black Giant Squirrel		?	?	X	X	X	?	?		X	X
Inornate Squirrel	X	X	X		X			X	X	X	X
Hairy-footed Flying Squirrel											
Red-cheeked Flying Squirrel				?							
Particolored Flying Squirrel					?	?					
Phayre's Flying Squirrel						?					
Small flying squirrel sp(p).				X	X	X	X				
East Asian Porcupine	X	X	X	X	?	X	X	X		X	X
Annamite Striped Rabbit											?

Note: *Only in Nam Kong Provincial Protected Area; not recorded recently in Nam Ha NBCA.

(b) Centre Lao PDR

Species	Nakai - Nam Theun NBCA	Nakai Plateau	Nam Theun Corridor PNBCA	Khammouan Limestone NBCA	Hin Namno NBCA	Phou Xang He NBCA	Dong Phou Vieng NBCA
Survey effort: signs	high	high	mid	mid	mid	mid	mid
Survey effort: daytime observation	high	high	mid	mid	mid	mid	low
Survey effort: night-time observation	high	high	low	mid	low	high	low
Chinese Pangolin	X						
Sunda Pangolin	X	X	?				
Pangolin sp(p).					X		
Sunda Colugo	X						
Mainland Slender-tailed Treeshrew					X		
Large loris sp(p).	X	X	X	X		X	
Small loris sp(p).	X			X	?	X	
Loris sp(p).							
Pig-tailed Macaque	X	X	X	X	X	X	X
Assamese Macaque	X			X	X	?	
Rhesus Macaque		X	X		X		
Long-tailed Macaque							
Bear Macaque	X				X	X	
Francois's Langur	X			X	X	X	
Silvered Langur						?	?
Phayre's Langur	?				?		
Douc Langur	X	?		?	X	X	X
White-handed Gibbon							
Pileated Gibbon							
Black-cheeked Crested Gibbon							
White-cheeked / Yellow-cheeked Crested Gibbon	X	X	X	X	X	X	X
Gibbon sp(p).							
Golden Jackal							?
Dhole	X	?	?	?	?	X	?
Asiatic Black Bear	X	?	?	?		?	
Sun Bear	X	?	?			?	
Bear sp(p).	X	X	X	X	X	X	X
Yellow-bellied Weasel							
Siberian Weasel	X			?			
Back-striped Weasel	X						
Weasel sp(p).		X					
Hog Badger	X	X	?		X	?	?
Large-toothed Ferret Badger				X			
Small-toothed Ferret Badger							
Ferret badger sp(p).							
Eurasian Otter							
Smooth-coated Otter							
Oriental Small-clawed Otter	X	X			?	?	
Otter sp(p).		X	X		X	X	X
Large-spotted Civet						X	
Spotted Linsang	X						
Binturong		?	?		X	?	

Species	Nakai - Nam Theun NBCA	Nakai Plateau	Nam Theun Corridor PNBCA	Khammouan Limestone NBCA	Hin Namno NBCA	Phou Xang He NBCA	Dong Phou Vieng NBCA
Owston's Civet					**?**		
Jungle Cat		?					
Fishing Cat		?					
Asian Golden Cat	X	?		?	?	?	
Marbled Cat	X	?			?		
Clouded Leopard	X	?			?		
Medium-sized cat sp(p).	X	X		X	X	X	X
Leopard	X	?		?	?		
Tiger	X	X	X		X	X	
Big cat sp(p).	X	X	X	X	X	X	?
Irrawaddy Dolphin							
Asian Elephant	X	X	X	X	?~	X	X
Lesser One-horned Rhinoceros							
Asian Two-horned Rhinoceros							
Rhinoceros sp(p).	?					†	
Pig spp.	X	X	X	X	X	X	X
Heude's Pig	?						
Eld's Deer		†				†	
Sambar	X	X	X	X	X	X	X
Hog Deer							
Large-antlered Muntjac	X	X			X	X	X
Roosevelts' Muntjac							
Annamite Muntjac							
Small muntjac spp.	X						
Kouprey							
Gaur	X	X	X	X	X	X	X
Banteng		?				†	†
Wild cow sp(p).							
[Wild Water Buffalo]							
[Long-tailed Goral]							
Southern Serow	X			X	X	X	
Saola	X				?^	?	
Black Giant Squirrel	X	X	X	X	X	X	
Inornate Squirrel	X	X			X		
Hairy-footed Flying Squirrel				X			
Red-cheeked Flying Squirrel				X			
Particolored Flying Squirrel							
Phayre's Flying Squirrel				X			
Small flying squirrel sp(p).	X					X	
East Asian Porcupine	X	X	?	X	X	?	X
Annamite Striped Rabbit	?						

Notes: *excluding that part of the NBCA lying on the Nakai Plateau; **including that part of the plateau within the boundaries of Nakai-Nam Theun NBCA. The Nam Theun Corridor PNBCA also includes a section of the Nakai Plateau and it has not been possible to separate all records according to site, to produce an assessment for the non-Plateau parts of the Corridor. Some species listed under Hin Namno NBCA were found only some distance to the south, in the headwaters of the Xe Bangfai (^), or about 15 km to the west in an area of forest on non-calcareous rock (˜). Part of Dong Phou Vieng NBCA lies in south Lao PDR.

(c) South Lao PDR.

Species	Xe Bang-Nouan NBCA	Xe Sap NBCA	Phou Ahyon	Dakchung Plateau	Phou Xiang Thong NBCA	Phou Kathong PNBCA	Dong Ampham NBCA	Nam Ghong Provincial PA	Bolaven Northeast PNBCA	Dong Hua Sao NBCA	Bolaven Southwest PNBCA	Xe Pian NBCA	Southern Mekong	Dong Khanthung PNBCA
Survey effort: signs	mid	low	low	mid	high	mid	high	high	low	high	low	mid	low	high
Survey effort: daytime observation	mid	low	low	low	mid	mid	high	mid	mid	high	low	high	mid	high
Survey effort: night-time observation	low	low	low	low	mid	low	low	low	mid	low	low	mid	low	low
Chinese Pangolin														
Sunda Pangolin			X	?	X	X				X		X		X
Pangolin sp(p).	X	?					?	X	X					
Sunda Colugo														
Mainland Slender-tailed Treeshrew			X					X						
Large loris sp(p).		?			X	X			X	X		X		
Small loris sp(p).			?	X					X					
Loris sp(p).														
Pig-tailed Macaque	X		?		X		X	X	X	X	X	X		X
Assamese Macaque			?							X				
Rhesus Macaque	X	?	?			?			X					
Long-tailed Macaque					X		?			X	X	X		X
Bear Macaque			X		?		?			?				
Francois's Langur														
Silvered Langur	X	?		?			?	X		X	X	X		X
Phayre's Langur														
Douc Langur	X	?	X	?	?		X	X		X				
White-handed Gibbon														
Pileated Gibbon														X
Black-cheeked Crested Gibbon														
White-cheeked / Yellow-cheeked Crested Gibbon	X	X	X		X	X	X	X	X	X	X	X		
Gibbon sp(p).														
Golden Jackal			?	?								X		X
Dhole		?		?	?		?	?		X		X		X
Asiatic Black Bear		X	?	?	?		?	?				?		
Sun Bear		?	X		?	?	X	X		X		X		
Bear sp(p).	X	X			X				X	X	X	X		X
Yellow-bellied Weasel														
Siberian Weasel														
Back-striped Weasel														
Weasel sp(p).														
Hog Badger		?					X	?				?		
Large-toothed Ferret Badger														
Small-toothed Ferret Badger														
Ferret badger sp(p).														
Eurasian Otter														
Smooth-coated Otter								X				X		
Oriental Small-clawed Otter				?		X	X		X					
Otter sp(p).		?		X						X	X			X
Large-spotted Civet												X		
Spotted Linsang				X										
Binturong														
Owston's Civet														
Jungle Cat														
Fishing Cat					?		X			?				?
Asian Golden Cat					?	?	?			?		X		

Species	Xe Bang-Nouan NBCA	Xe Sap NBCA	Phou Ahyon	Dakchung Plateau	Phou Xiang Thong NBCA	Phou Kathong PNBCA	Dong Ampham NBCA	Nam Ghong Provincial PA	Bolaven Northeast PNBCA	Dong Hua Sao NBCA	Bolaven Southwest PNBCA	Xe Pian NBCA	Southern Mekong	Dong Khanthung PNBCA
Marbled Cat														
Clouded Leopard		?					X							
Medium-sized cat sp(p).								X						X
Leopard		?		?	?	?	?	X		?		?		?
Tiger	X	?		X	X	?	X	X	?	X		X		X
Big cat sp(p).			?		X	?	X	X				X		X
Irrawaddy Dolphin						†	†					X	X	
Asian Elephant	X	?		X	X	X	X	X	X	†	X	X		X
Lesser One-horned Rhinoceros														
Asian Two-horned Rhinoceros														
Rhinoceros sp(p).		†		†		†	†					†		†
Pig spp.	X	X		X	X	X	X	X	X	X	X	X		X
Heude's Pig														
Eld's Deer										?		†		X
Sambar	X	X		X	X	X	X	X	?	X	?	X		X
Hog Deer												†		
Large-antlered Muntjac	X	X	X	X			X							
Roosevelts' Muntjac														
Annamite Muntjac			X											
Small muntjac spp.		?	X				X							
Kouprey							†					?		†
Gaur		?		?	?	?	X	X		X		X		X
Banteng					X		?	?				X		X
Wild cow sp(p).	X													
[Wild Water Buffalo]														
[Long-tailed Goral]														
Southern Serow	X	X	X	X	X		X	X	X	X				
Saola				?										
Black Giant Squirrel	X		X		X		X		X	X	X	X		X
Inornate Squirrel														
Hairy-footed Flying Squirrel														
Red-cheeked Flying Squirrel														
Particolored Flying Squirrel														
Phayre's Flying Squirrel							?							
Small flying squirrel sp(p).					X		X		X			X		
East Asian Porcupine	X		X	X	X	X	X		X	X		X		X
Annamite Striped Rabbit														

Status information:

X, present in the survey area; ?, record for the survey area is provisional; † species appears to have occurred formerly, but to be now extinct. Survey areas are shown in Fig. 7. Some modifications in the interests of caution have been made to some of the primary information.

Records listed under individual NBCAs do not necessarily come from within present-day boundaries of the NBCA. Most surveys are designed to influence the location of boundaries and it would be impracticable, and of limited biological use (given current survey effort) to classify retrospectively all records from each survey as within or outside the NBCA boundary.

With two exceptions, species are only included on this table if they are confirmed to occur (at least formerly) in Lao PDR. The exceptions are Long-tailed Goral (for which there is recent provisional information) and Wild Water Buffalo (for which there is over-

whelming historical evidence). Species in **bold face** are listed in IUCN (1996) as of global conservation concern: either Globally Threatened, Globally Near-Threatened, or Data Deficient. Other key species are those defined in Annex 6 as (Potentially) At Risk in Lao PDR or Little Known in Lao PDR.

This table should not be used for comparing survey areas in their importance for key species of large mammals. Firstly, widely varying survey efforts (both in terms of time and the prior experience of the surveyors) prevent comparison of like with like. Secondly, survey reports from 1992-1996 were markedly more selective in their inclusion of local information than were reports of surveys in 1997 and 1998. As many of the provisional records (marked with '?') relate to local information, sites surveyed only in 1992-1996 would be undervalued relative to those worked in 1997 or 1998.

References: **North**: Phou Dendin NBCA: Evans *et al.* (in prep. b); Nam Et NBCA: Davidson (1998); Phou Louey NBCA: Davidson (1998); Nam Ha NBCA: Phiapalath (1996), Tizard *et al.* (1997); Nam Xam NBCA: Showler *et al.* (1998b); Nam Phoun NBCA: Boonratana (1997, 1998b); Phou Khaokhoay NBCA: Payne *et al.* (1995), Evans *et al.* (in prep. b), JWKP (verbally 1998), Golden Jackal see text; Sangthong District: Duckworth (1996a), ferret badger see text; Houay Nhang NR: Duckworth *et al.* (1994); Nam Kading NBCA: Evans *et al.* (in prep. b); Nam Theun Extension PNBCA, Schaller (1995), Tizard (1996), Groves *et al.* (1997), Tobias (1997), Robichaud (1998a, 1998b), Duckworth (1998), Evans *et al.* (in prep. b). **Centre**: Nakai-Nam Theun NBCA: Tizard (1996), Tobias (1997), Duckworth (1998), Robichaud (1999), Evans *et al.* (in prep. b); Nakai Plateau: WCS (1996b), Tobias (1997), Evans *et al.* (in prep. b), RB *in litt.* (1998); Nam Theun Corridor: WCS (1996b), Timmins (1997), Steinmetz (1998b), Evans *et al.* (in prep. b); Khammouan Limestone NBCA: Timmins (1997), Steinmetz (1998b), Robinson and Webber (1998a), Evans *et al.* (in prep. b), BLS (verbally 1998; loris); Hin Namno NBCA: Timmins and Khounboline (1996), Walston (in prep.); Phou Xang He NBCA: Duckworth *et al.* (1994), Boonratana (1998b); Dong Phou Vieng NBCA: Steinmetz (1998a). **South**: Xe Bang-Nouan NBCA: Evans *et al.* (in prep. b); Xe Sap NBCA: Bergmans (1995), Schaller and Boonsou (1996), Timmins and Vongkhamheng (1996b), Showler *et al.* (1998a); Phou Ahyon: Bergmans (1995), Timmins and Vongkhamheng (1996b), Showler *et al.* (1998a); Dakchung Plateau: Bergmans (1995), Timmins and Vongkhamheng (1996b), Showler *et al.* (1998a); Phou Xiang Thong NBCA: Evans *et al.* (1996a), Boonratana (1998a); Phou Kathong PNBCA: Davidson *et al.* (1997); Dong Ampham NBCA: Davidson *et al.* (1997), Schaller (1997); Bolaven Northeast PNBCA: Evans *et al.* (in prep. b); Dong Hua Sao NBCA: Duckworth *et al.* (1994), Evans *et al.* (1996b), Boonratana (1998a); Bolaven Southwest PNBCA: Evans *et al.* (in prep. b); Xe Pian NBCA: Cox *et al.* (1992), Duckworth *et al.* (1994), Baird and Mounsouphom (1994), Steinmetz (in prep.); Southern Mekong: Duckworth *et al.* (1994), Baird and Mounsouphom (1994); Nam Ghong Provincial PA: Schaller (1997), Davidson *et al.* (1997), Fernando (in prep.), RJTiz verbally (1998); Dong Khanthung PNBCA: Berkmüller and Vilawong (1996), ICF (1996), Timmins and Vongkhamheng (1996b), Round (1998). **General**: Ruggeri and Timmins (1996), Duckworth (1997a), Timmins *et al.* (1998), Duckworth *et al.* (1998c), Duckworth and Hedges (1998a), Timmins and Duckworth (in press).

1987, 4600 in 1988 (WCMC/IUCN 1992), and an estimated 6100 during 1990-1991 (Srikosamatara *et al.* 1992). These are collected widely across the country; Vientiane, Savannakhet and Pakxe seem to be trading centres. At least some were tanned in-country (Srikosamatara *et al.* 1992). Large quantities go to Thailand (Baird 1995b). Despite various attempts at control, major shipments (e.g. 92 kg of skins intercepted by U.S. Customs) continued as of mid-1992 (Salter 1993a), and Pakxe traders were still buying skins in bulk as of mid-1993 (Baird 1993).

Trade levels were still high as of 1998. From one village in Dong Khanthung PNBCA alone, over 100 animals (total weight 200-300 kg) were estimated to be taken over a period of 4-5 months. A single man realised over a million kip in the 1997/1998 dry season (then, about US$ 250), allowing him to buy three buffaloes (Round 1998). There is no obvious reason to think that these figures are exceptional. Villagers in three disjunct areas of the range of *M. javanica* (Xe Pian, Dong Phou Vieng and Khammouan Limestone NBCAs) stated that pangolins have declined, in some areas to as little as 1% of their population 30 years ago (RS).

Some 500 kg of pangolins were confiscated in and around Ban Lak (20) in less than eight months in 1997-1998 (Compton in prep. b). The irregular distribution of figures, and occasional enormous hauls (e.g. over 200 kg in three days in late 1997) strongly suggest that this figure is merely the tip of an extremely large iceberg, with the full potential to sink pangolins in Lao PDR. As support for this, more detailed investigation in Khamkeut District, Bolikhamxai Province, revealed that in two months of 1998, 570 kg of pangolins were confiscated, and even these apparently represent only a fraction of the actual trade (IUCN 1998).

Numbers have been so reduced that field sightings are exceptionally rare: in many survey areas, no pangolins were seen, even when there is substantial work by night (e.g. Duckworth *et al.* 1994).

Both species are clearly At Risk in Lao PDR.

Conservation Management and Research Proposed for Pangolins:

- Development and enforcement of effective hunting and trade controls for both species, specifically targetting key border areas (some of which are not official border crossings).
- Ban on harvesting in NBCAs and provincial protected areas, coupled with active enforcement and punishment of offenders.
- Development of status survey and monitoring methodology for pangolins, which are not well covered in general wildlife surveys.

- Specific surveys to gain clearer understanding of each species's distribution and status, to identify key areas and habitats for each species.
- Research on trade routes and the end markets of pangolins both within and outside Lao PDR.

Insectivora (families Erinaceidae, Talpidae and Soricidae): see separate chapter

Tupaiidae: Treeshrews (2 species in Lao PDR; 19 worldwide)

Tupaia belangeri **Northern Treeshrew** (included in *T. glis* Common Treeshrew[M2, M3], *T. glis* Malay Treeshrew[M1]). North[M9], centre[M8], south[M8]. Widespread and common over a wide altitudinal range in tall forest including degraded, fragmented and deciduous areas and in dry dipterocarp forest. *Special Significance:* CITES Appendix II. *Taxonomic issues:* See *T. glis* (appendix).

• *Dendrogale murina* **Mainland Slender-tailed Treeshrew** (= Northern Smooth-tailed Treeshrew[M2, M4, M5]). *Conservation Significance:* Little Known in Lao PDR; CITES Appendix II. Endemic to Cambodia and adjacent Thailand, Lao PDR and Vietnam (Lekagul and McNeely 1977). Occurrence seems patchy within this area. *Documented Range and Habitat:* Centre (Timmins and Khounboline 1996), south (Timmins and Vongkhamheng 1996a). The three known Lao sites, in degraded evergreen forest, secondary vegetation and ridge forest at 300-1400 m all contain bamboo, in which most of the animals were seen. *Status Information:* This species was first recorded for Lao PDR in 1996 at Hin Namno NBCA in January and Phou Ahyon in May (Timmins and Khounboline 1996, Timmins and Vongkhamheng 1996a). Subsequently it has been found in Nam Ghong Provincial PA (RJTiz) and again in Hin Namno NBCA (Walston in prep.). There are few historical specimens from across the species's range (Osgood 1932) and little is known of habitat use or distributional limits. Thus, the species is categorised as Little Known in Lao PDR.

Conservation Management and Research Proposed for Treeshrews:

- Clearer understanding of the range and habitat use of Mainland Slender-tailed Treeshrew, and assessment of threats to its habitat.
- The CITES listing of treeshrews is part of a blanket listing of all primates and reflects their former inclusion within the order primates. It does not reflect a need for any special attention to conservation needs of *T. belangeri* in Lao PDR.

Cynocephalidae: Colugos (1 species in Lao PDR; 2 worldwide)

• *Cynocephalus variegatus* **Sunda Colugo** (= Colugo[M2, M3]; = Malayan Flying-lemur[M4, M5]). *Conservation Significance:* Little Known in Lao PDR. *Documented Range and Habitat:* North[M16], centre (Robichaud 1999). Sole field observation in Lao PDR was in dry evergreen forest at 730 m. *Status Information:* First found in Lao PDR in 1995, as market specimens in Ban Lak (20) (Ruggeri and Etterson 1998). Subsequently observed nearby in Nakai-Nam Theun NBCA in December 1998 (Robichaud 1999). There are further market specimens from Xam-Nua (Showler *et al*. 1998b) and convincing local reports from Phou Khaokhoay NBCA (JWKP). A claim of bones being used for traditional medicine (Baird 1995b) awaits confirmation; the report is from Champasak Province, well outside the known Lao range of the species. *Taxonomic issues:* Consideration as to whether the Lao population is separable as a new subspecies needs further specimens (L. R. Heaney *in litt*. to WGR 1997).

Conservation Management and Research Proposed for Sunda Colugo:

- Clearer understanding of the range and habitat use of the species and assessment of threats to it both through habitat alteration and from direct harvesting.

Chiroptera (seven families of bats): see separate chapter

Loridae: Lorises (at least 3 species in Lao PDR; 6 worldwide)

[• *Nycticebus coucang* **Slow Loris**]. *Conservation Significance:* Little Known in Lao PDR; CITES Appendix II. *Documented Range and Habitat:* North[M13], centre[M8], south[M8]; all provisional. Evergreen and deciduous forests, bamboo groves, and other heavily degraded areas, especially below 500 m. *Status Information:* One or more form of large loris is still well distributed and at least locally common in Lao PDR, at least below 500 m, with records from most survey areas with adequate nocturnal survey work (Table 12). Historical specimens cover a wide area: Xiangkhouang, Vientiane, Pakxe and Ban Thateng (Delacour 1940). *Taxonomic issues:* The large lorises of Indochina were placed in *N. bengalensis* by Groves (1998). Research in Bolikhamxai Province indicates that at least three species of loris inhabit Lao PDR (Alterman and Freed 1997). To which of these, if any, the name *coucang* is applicable is not yet clear (L. Alterman *in litt*. 1998). Until the issue is clarified, it is probably best to continue to use *N. coucang*, in square brackets, to refer to large lorises, and to consider the named species *N. coucang* as Little Known in Lao PDR, while accepting that it may turn out to be common and widespread and of no immediate conservation concern.

Plate 13:

Captive loris, Xaignabouli, early 1998. The site of capture of this animal is unknown. The number of species of loris in Lao PDR and the conservation status of each are still unclear.
R. Boonratana / IUCN.

Douc Langur, Nam Kading NBCA, early 1997. A fine example of the red-shanked form, *P. n. nemaeus*, this animal was at the north-western limit of the species's known world range.
C. W. Marsh / IUCN.

Infant *Nomascus* gibbon, Ban Lak (20), Bolikhamxai Province, July 1998. Gibbons of this sub-genus are difficult to identify to species.
W. G. Robichaud / WCS.

Juvenile *Nomascus* gibbon, Ban Lak (20), January 1999. This is believed to be the same individual as that in the preceding image. Gibbons of this sub-genus have a complex series of sex-specific age-related coat colour changes (see Delacour 1951b).
W. G. Robichaud / WCS.

Young White-handed Gibbon, Xaignabouli, early 1998. This gibbon has a small range in Lao PDR as it occurs only west of the Mekong. It is widespread elsewhere in South-east Asia. *R. Boonratana / IUCN*

Young Long-tailed Macaque, Dong Khanthung PNBCA, July 1998. Young macaques are commonly kept as pets. The mother was reportedly shot to obtain this one. *B. L. Stuart / WCS.*

Phayre's Langur, Phongsali Province, March 1996. No large population of this langur is currently known in Lao PDR. It may be the most threatened monkey in the country. *W. G. Robichaud / WCS.*

Sleeping cliff of Francois's Langur, Phou Xang He NBCA, early 1998. Faecal deposits and stains such as these are valuable indicators of the species's presence in areas where hunting has made the monkeys shy. *R. Boonratana / IUCN.*

[• *Nycticebus pygmaeus* **Pygmy Loris** (= Lesser Slow Loris[M5]; = Pygmy Slow Loris[M4])]. *Conservation Significance:* Globally Threatened - Vulnerable; Little Known in Lao PDR; CITES Appendix II. Endemic to parts of Lao PDR, southern Yunnan (China), Vietnam and Cambodia; occurs only east of the Mekong (Corbet and Hill 1992). *Documented Range and Habitat:* North[M13], centre[M8], south[M14]; all provisional. Evergreen forest in the Annamites and other hilly areas. *Status Information:* Field records of small lorises from a variety of areas (Table 12); not yet found commonly anywhere above 500 m. Although described as 'common' throughout Lao PDR (Delacour 1940), there are few specific historical records: Phongsali, Ban Thateng on the Bolaven Plateau (Osgood 1932) and Savannakhet (Bourret 1944). *Taxonomic issues:* Recent research in Bolikhamxai Province indicates that at least three species of loris inhabit Lao PDR (Alterman and Freed 1997). To which, if any, the name *pygmaeus* is applicable is unclear (L. Alterman *in litt*. 1998). The publication of sightings as *N. pygmaeus* by Duckworth (1994b) was premature, in omitting any comparative examination with the type specimen of *pygmaeus*. Nonetheless, the general conclusion holds, that two lorises of different sizes are ecologically sympatric in Phou Xang He NBCA. Similar patterns have been found widely elsewhere, from Bolaven Northeast PNBCA in the south, to Nam Kading NBCA in the north (Evans *et al*. in prep. b). Until the issue is clarified, it is best to consider the named species *N. pygmaeus* as Little Known in Lao PDR, while accepting that it may turn out to be common and widespread and of no immediate conservation concern.

[*Nycticebus intermedius* **Intermediate Loris** (= Intermediate Slow Loris[M5])]. *Context:* May occur in north-east Lao PDR, but apparently known only from the type from Vietnam and various specimens from Yunnan, China (Corbet and Hill 1992). *Special Significance:* CITES Appendix II. Speculated to be endemic to a small area around the Lao-Vietnam-Yunnan (China) border (Corbet and Hill 1992). *Taxonomic issues:* The type was collected in northern Vietnam (Dao Van Tien 1960). *N. intermedius* has been considered synonymous with *N. pygmaeus* on grounds of both morphology and genetics (Groves 1971, Zhang *et al*. 1993). There are more than two species of loris in Lao PDR (Alterman and Freed 1997; L. Alterman *in litt*. 1998), but whether *intermedius* is a valid name, and whether any of the forms in Lao PDR belong to it, are not yet clear.

Status Information on Lorises: Lorises are not favoured as food in Lao PDR (e.g. Duckworth 1994b) but some people are not averse to eating them (e.g. Davidson 1998). They are kept as pets (Salter 1993a; Plate 13) and used in medicinal preparations (Baird 1995b). The latter may be the most significant threat. Such harvesting goes on at high levels in neighbouring Cambodia (Timmins and Men Soriyun 1998) and Vietnam (Ratajszczak 1988). KK has received reports of the export to Vietnam of large numbers from Bolikhamxai and Khammouan Provinces. Animals are caught in various ways; the most damaging is when trees are cut down so that the loris can be captured, which occurs at least in Bolikhamxai Province (I. Johnson verbally 1999).

Conservation Management and Research Proposed for Lorises:

- Clarification of the number of forms present and their geographical and ecological distributions, to allow identification of taxa in need of specific action, and the actions themselves.
- Pending this, collection of detailed notes on appearance of animals (supported whenever possible with photographs and measurements) seen on field surveys or in markets or villages to allow possible retrospective identification.
- Investigation of trade threat, with due attention to international issues.
- Enactment and enforcement of a nocturnal hunting ban in NBCAs within the range of forms identified as threatened in Lao PDR; immediate enactment of such a ban in core zones of all NBCAs.

Cercopithecidae: Old-world monkeys (9 species in Lao PDR; 81 worldwide)

• *Macaca nemestrina* **Pig-tailed Macaque** (= Pigtail Macaque[M4]). *Conservation Significance:* Globally Threatened - Vulnerable; Potentially At Risk in Lao PDR; CITES Appendix II. *Documented Range and Habitat:* North[M9], centre[M8], south[M8]. Evergreen forest, and also in mosaic with more open habitats such as pine and dry dipterocarp forest; lowlands and lower hills, and locally in mountains. *Status Information:* See below. Recorded in many survey areas (Table 12), in several of which it was relatively common, including some highly degraded regions. Estimated group sizes in Lao PDR rarely exceeded 20-30. In some areas of other countries (e.g. Khao Yai National Park, Thailand; rural Dak Lak Province, Vietnam), probably those relatively undisturbed by opportunistic shooting, Pig-tailed Macaque groups number 50-150 animals (Le Xuan Canh *et al*. 1997; A. R. Nettelbeck verbally 1996). Only one recent record in Lao PDR specifically noted a group of such size (over 100 in Dong Phou Vieng NBCA; Steinmetz 1998a).

• *Macaca assamensis* **Assamese Macaque** (= Assam Macaque[M4]). *Conservation Significance:* Globally Threatened - Vulnerable; Potentially At Risk in Lao PDR; CITES Appendix II. *Documented Range and Habitat:* North[M15], centre[M13], south[M8]. Evergreen forests. Usually the commonest macaque in hills and mountains, occurring down to 300

m in limestone karst. *Status Information:* See below. Field records come from many survey areas (Table 12). The superficial visual similarity of this species to *M. mulatta* complicates field identification, especially in southern Lao PDR where intergrades of Rhesus and Long-tailed Macaque may have medium-length tails but reduced or absent rusty tones on the hindquarters (Fooden 1996, 1997). Thus, recent Lao records of Assamese Macaque are being reassessed and the information in Table 12 supersedes that in internal reports. Records from Dong Hua Sao NBCA (Duckworth *et al*. 1994, subsequently re-affirmed by RJTim) are the most southerly in Lao PDR. Although identities of specimens from the south (Ban Thateng, Bolaven Plateau) were validated by Fooden (1982), they came from markets and there is no information on their place of capture.

• *Macaca mulatta* **Rhesus Macaque** (= Rhesus Monkey). *Conservation Significance:* Globally Near-Threatened; Potentially At Risk in Lao PDR; CITES Appendix II. *Documented Range and Habitat:* North[M9], centre[M10], south (Timmins and Bleisch 1995). Evergreen forest and directly adjacent cultivation, particularly beside watercourses. Most records come from below 600 m, although the species was observed at 850 m in Nam Et NBCA. *Status Information:* See below. Field records from many survey areas, south from the far north to the Bolaven Plateau (Table 12). *Taxonomic issues:* This species's range abuts that of *M. fascicularis* in south Lao PDR. An animal basically intermediate between the two is known from a 1932 collection of trade animals from Ban Thateng, Bolaven Plateau. The zone of overlap seems to run south-east across southern Lao PDR, from about latitude 16º40'N at the western national boundary (Fooden 1997). Hybrids may thus occur over a large area, but most animals are identifiable as either *M. fascicularis* or *M. mulatta*; there does not appear to be a true intergrade zone. However, Rhesus Macaques observed in Xe Bang-Nouan NBCA and the Xe Namnoy basin were noticeably less rufous on the hindquarters than were those to the north (Evans *et al*. in prep. b).

• *Macaca fascicularis* **Long-tailed Macaque** (= Crab-eating Macaque[M2, M4, M5, M7]). *Conservation Significance:* Globally Near-Threatened; Potentially At Risk in Lao PDR; CITES Appendix II. *Documented Range and Habitat:* South[M8]. Various degraded forest types and riverine forest, including that through dry dipterocarp forest. *Status Information:* See below. Still relatively common locally in Xe Pian NBCA, with a few records from other sites (Table 12), it is probably widespread in forested areas of the Xe Kong and lower Mekong drainages. A report from Dong Phou Vieng NBCA (Steinmetz 1998a) has been withdrawn (RS). While its small range places Long-tailed Macaque at some national risk, its use of degraded areas under at least moderate hunting levels suggests that the species is not imminently threatened. *Taxonomic issues:* See note under *M. mulatta*. (Plate 13)

• *Macaca arctoides* (= *M. speciosa*[M1]) **Bear Macaque** (= Stumptail Macaque[M7]; = Stump-tailed Macaque[M1, M2]). *Conservation Significance:* Globally Threatened - Vulnerable; Potentially At Risk in Lao PDR; CITES Appendix II. *Documented Range and Habitat:* North[M15], centre[M13], south (Timmins and Vongkhamheng 1996a). Evergreen forests and adjacent degraded areas up to at least 1650 m; no records from extreme lowlands. *Status Information:* See below. Recent records come from a wide distribution of sites (Table 12) but the species was common at few (locally in Nakai-Nam Theun and Hin Namno NBCAs) and it has not yet been confirmed at several areas within its presumed range. It usually lives in large bands and under current hunting pressures social stability may be difficult. As a more terrestrial species, it is more affected by snaring than are other macaques. It is disproportionately frequent in captivity compared with the number of field sightings. The significance of this to the species's conservation needs is not yet clear.

• *Semnopithecus francoisi* (= *Trachypithecus francoisi*[M6, M7]; = *Presbytis francoisi*[M4]) **Francois's Langur** (= Francois's Leaf Monkey[M5, M7]; = Francois's Monkey[M4]). *Conservation Significance:* Globally Threatened - Vulnerable as *T. francoisi* (includes *hatinhensis*), and Data Deficient (Global) as *T. laotum*; Potentially At Risk in Lao PDR; CITES Appendix II. Endemic to small parts of Lao PDR, northern Vietnam and southern China; occurs only east of the Mekong (Brandon-Jones 1995). *Documented Range and Habitat:* North[M15], centre[M15]. Forest associated with major rock outcrops, particularly limestone but sometimes non-calcareous formations. *Status Information:* See below. *S. f. laotum* is known only from central and, marginally, north Lao PDR, specifically Khammouan Limestone and Nam Kading NBCAs and their environs. There are recent records from both NBCAs (Thomas 1921, Deuve 1972, Evans *et al*. in prep. b). This form has not been recorded in Vietnam (*contra* IUCN 1996). A black-headed form occurs in the southern extremity of Khammouan Limestone NBCA (M. F. Robinson *in litt*. 1999). During a 1998 survey, when the species was adjudged to be abundant, all identifiable sightings were of typical *S. f. laotum* (Steinmetz 1998b). In Hin Namno NBCA, some individuals showed features of the head pelage tending towards *S. f. hatinhensis* (known from adjacent Vietnam; Brandon-Jones 1995), but most appeared black-headed (Timmins and Khounboline 1996, Walston in prep.). A troop of at least 15 *S. f. hatinhensis* was seen at a small non-limestone cliff at 1150 m in the Phou Vang area of Nakai-Nam Theun NBCA in December 1998 (Robichaud 1999). Francois's Langurs (form not stated) were observed in one area of Phou Xang He NBCA in 1998 (Boonratana 1998b) and a sleeping cave with signs of recent usage was found in

another (RB; Plate 13). The supposition that *S. f. delacouri* could possibly also extend into north-east Lao PDR from adjacent Vietnam has not been confirmed by field work. Black-coloured langurs are reported from several areas within which there has been no recent fieldwork, e.g. near Nam Chouan PNBCA (Robichaud 1998d); limestone areas south and west of Hin Namno NBCA; and the limestone north-east of Nam Theun north of Ban Lak (20), and between Nakai-Nam Theun NBCA, Nam Kading NBCA and Nam Chouan PNBCA (RJTim). Detailed villagers' descriptions from some of these areas suggest that as yet undocumented forms may exist. The general distribution of positive responses during 1988-1993 village interviews accords closely with the above information (Annex 5). Although Francois's Langurs are shot opportunistically for food, the inaccessibility of their habitat and the sheer size of these rugged areas means that most populations may still be healthy. In neighbouring Vietnam, however, several forms face imminent extinction (Nadler 1996a, Duckworth and Walston in prep.) indicating that there is no room for complacency in Lao PDR. *Taxonomic issues:* This nominal species comprises seven phenotypically distinct forms and there is little consensus on the relationships between them and on how many should be viewed as full species (contrast Corbet and Hill 1992, Brandon-Jones 1995 and Rowe 1996). For conservation planning purposes, however, two forms occurring in Lao PDR (*laotum* and *hatinhensis*) should be treated as separate units (see Eudey 1987). The taxonomic status of the black-headed form is unclear. A black-headed skin of unknown provenance was named by Brandon-Jones (1995) as (*S. f.*) *ebenus*, and Nadler (1996b) hypothesised that this form also occurred in Lao PDR. It is unclear whether the black-headed animals in Lao PDR are the same as (*S. f.*) *ebenus*, and whether, if so, the latter is a discrete taxon. Were it confirmed to occur, *S. f. delacouri* would also constitute an individual unit, as would any as-yet undescribed form.

• *Semnopithecus cristatus* (= *Presbytis cristata*[M2, M3, M4]; = *Trachypithecus cristatus*[M6, M7]) **Silvered Langur** (= Silvered Leaf Monkey[M4, M5]). *Conservation Significance:* Globally Near-Threatened; At Risk in Lao PDR; CITES Appendix II. *Documented Range and Habitat:* Centre (potentially, Boonratana 1998b), south[M8]. Evergreen forest, particularly along watercourses, including in areas otherwise dominated by deciduous forest. *Status Information:* See below. Silvered Langur is widespread in south Lao PDR, where it has been found in at least seven survey areas (Table 12). Recent villager reports of grey langurs from two sites north of the confirmed range, Dong Phou Vieng and Phou Xang He NBCAs (Steinmetz 1998a, Boonratana 1998b; RS, RB) are perhaps more likely to be this species than Phayre's. Silvered Langurs provisionally identified in 1998 in Nam Phoun NBCA (Boonratana 1998b; RB) would represent a large northward extension of known range, as the outlying populations mapped in the Assam / Myanmar area for this species in Corbet and Hill (1992) are both mistakes (D. Brandon-Jones *in litt*. 1999). Historical specimens come from Ban Phone on the Bolaven Plateau and Xe Don (the former as *Pithecus pyrrhus argenteus*; Osgood 1932, Fooden 1976). *Taxonomic issues:* The taxonomic contents of *S. cristatus* and *S. phayrei* are unclear (Lekagul and McNeely 1977: 276; D. Brandon-Jones verbally 1998). The arrangement here, of a largely southern form (assigned to *S. cristatus*) separated by a large area (where no form of this group is common) from a largely northern one (assigned to *S. phayrei*), is provisional. C. P. Groves (*in litt.* 1999) assigns all the Indochinese animals of the southern form to *S. germaini*, reserving *S. cristatus* for Sundaic animals. Dao Van Tien (1977) described *Presbytis cristata caudalis* from two zoo specimens. Their origin is unknown, but it could have been Lao PDR.

• *Semnopithecus phayrei* (= *Presbytis phayrei*[M2, M4]; = *Trachypithecus phayrei*[M6, M7]) **Phayre's Langur** (= Phayre's Leaf Monkey[M4, M5]). *Conservation Significance:* Data Deficient (Global); At Risk in Lao PDR; CITES Appendix II. *Documented Range and Habitat:* North[M15], centre (provisionally[M13]). Various forest types, including degraded areas; sometimes on limestone. Occurs from the Mekong valley up to at least 800 m. *Status Information:* See below. There are recent records from only three survey areas. In five others, grey langurs seen and/or reported by villagers were assigned to this species on the basis of range (Table 12). These are fewer confirmed records than of any other monkey species in Lao PDR, despite its wide range. Furthermore, several areas surveyed within the species's range lack even provisional records. In marked contrast to Douc and Francois's Langurs, Phayre's has not been found commonly in any single area, although it may be locally numerous in Phou Dendin NBCA (Plate 13). Historically the species was found in Khet Dong Hieng (Vientiane Province), Xiangkhouang, Muang Mo, Ban Muangyo and Louangphabang (Delacour 1940, Fooden 1976); Osgood (1932) referred to some of these (as well as some from southern Indochina now considered as *S. cristatus*) as *Pithecus pyrrhus argenteus* (now taken as a synonym of *S. p. crepusculus*). *Taxonomic issues:* See note under *S. cristatus*.

• *Pygathrix nemaeus* **Douc Langur** (= Douc Monkey[M7]); (separated as *Pygathrix nemaeus* Red-shanked Douc Langur by various sources). *Conservation Significance:* Globally Threatened - Endangered; At Risk in Lao PDR; CITES Appendix I. Endemic to parts of Lao PDR, Vietnam and Cambodia; occurs only east of the Mekong (Corbet and Hill 1992, Nadler 1997). *Documented Range and Habitat:* North (Timmins and Duckworth in press), centre[M8], south[M8]. Evergreen forest from the Mekong valley to at least 1200 m, including on limestone. Absent from most areas which are degraded, fragmented and/or largely deciduous (Timmins and

Duckworth in press). *Status Information:* See below. Field records and village reports show a similar distribution: ubiquitous in suitable habitat in the eastern parts of Lao PDR south of about 18º45' N, but absent or extremely rare northwest of Nam Kading NBCA (Plate 13), and in Xe Pian NBCA and further to the south and west (Timmins and Duckworth in press; Table 12, Annex 5). The species remains common in some remote areas, but in fragmented areas has declined rapidly. Hunted for meat by villagers (Table 1), sometimes extensively (Dobias 1992b) and, assiduously, for trade to Vietnam and perhaps Thailand (Dobias 1992b, Srikosamatara *et al*. 1992, Baird 1993, Timmins and Duckworth in press). The Nam Theun catchment and adjacent Hin Namno NBCA together support the largest population remaining in the world of the red-shanked form *P. n. nemaeus*. *Taxonomic issues:* Douc langurs were little studied, taxonomically, until recently. Genetic divergence levels between the black-shanked *P. (n.) nigripes*, red-shanked *P. (n.) nemaeus* and grey-shanked *P. (n.) cinerea* forms suggests that treatment as separate species might be more appropriate (Nadler 1997, C. Roos in Feiler and Nadler 1997a; see Brandon-Jones in Timmins and Duckworth in press for use of '*cinerea*' rather than '*cinereus*'). In any case, each form constitutes a separate unit for conservation planning purposes. Despite the assertion in Deuve and Deuve (1963b) and some subsequent authors that Lao Douc Langurs were *nigripes*, most or all are red-shanked *nemaeus (s.s.)*, although in the south-east some show reduced red, suggesting some intergradation with another form (Davidson *et al*. 1997, Timmins and Duckworth in press).

Status Information on Old-world monkeys: Macaques are significant crop pests and are themselves eaten by villagers in rural Lao PDR (Tables 1, 2), used and traded for medicine (especially bones; Baird 1995b), and kept as pets in both rural and urban areas. Adults are usually killed for food rather than retained as pets (Nash 1997). Many live macaques are reportedly smuggled from Lao PDR to Thailand and Vietnam, to be sold as pets (Srikosamatara *et al*. 1992, Baird 1993, La-Ong *et al*. 1997, Nash 1997, Compton in prep. b). Langurs are eaten (Table 1) and their bones, internal organs, excrement and other parts are used in traditional medicine (Martin 1992, Baird 1995b). Trade levels to Vietnam of, especially, Douc Langur may be very high (Timmins and Duckworth in press, Compton in prep. b). Across Lao PDR, langurs are reputed to be more easily hunted than are macaques, and Douc Langur has a reputation of being particularly confiding. Large populations persist of all macaques and Francois's Langur but all are considered to be Potentially At Risk in Lao PDR because they have been eradicated from or reduced across areas where people have settled. Phayre's and Silvered Langur both occur in several areas but no large continuous areas are confirmed to hold high populations and both are best considered At Risk in Lao PDR. Several large populations of Douc Langur remain, but the species seems particularly vulnerable to wildlife trade pressures, and so is classed as At Risk in Lao PDR.

Conservation Management and Research Proposed for Old-world monkeys:

- Immediate and complete prohibition on killing or capturing Douc and Francois's Langurs, the Lao populations of which are of outstanding global importance.
- Specific consideration to Douc and Francois's Langurs in management plans of protected areas supporting important populations (Khammouan Limestone NBCA for *S. f. laotum*; Hin Namno NBCA for *S. francoisi* ssp.; Nakai-Nam Theun NBCA for *S. f. hatinhensis*; Nakai-Nam Theun, Hin Namno, Dong Ampham and Phou Xang He NBCAs for Douc Langur.
- Development of measures to limit hunting of Silvered and Phayre's Langurs, which are patchily distributed and probably not very numerous.
- Clarification of the number of forms of Francois's Langur and of grey *Semnopithecus* langur present in Lao PDR and their geographical and ecological distributions, to allow identification of taxa in need of specific action, and the actions themselves.
- Pending this, collection of detailed notes on appearance of *Semnopithecus* langurs (supported whenever possible with photographs) seen on field surveys or in markets to allow possible retrospective identification.
- Specific consideration to Bear Macaque (perhaps the most threatened macaque in Lao PDR) in management plans of protected areas containing large populations, notably Nakai-Nam Theun and Hin Namno NBCAs.
- Monitoring status of Pig-tailed and Assamese Macaques, both of which remain widely distributed and relatively numerous.
- Study and protection of three zones of hybridisation between related forms: (1) Douc Langurs in south-east Lao PDR, (2) Francois's Langurs between Nam Kading and Hin Namno NBCAs and adjacent Vietnam, and (3) Rhesus / Long-tailed Macaques in much of the south.

Hylobatidae: Gibbons (4-5 species in Lao PDR; 11 worldwide)

• *Hylobates lar* **White-handed Gibbon** (= Common Gibbon[M4]; = Lar Gibbon). *Conservation Significance:* Globally Near-Threatened; At Risk in Lao PDR; CITES Appendix I. *Documented Range and Habitat:* North (Boonratana 1997); occurs only west of the Mekong (Geissmann 1995). No information on habitat in Lao PDR, but presumably tall forest. *Status Information:* Recorded only from Nam Phoun NBCA, where in 1997 animals were distributed patchily and the species was considered to be "possibly rare" (Boonratana 1997). Single captives were seen in

Louangphabang in mid 1996 (RJTim) and at a petrol station in Xaignabouli town in 1998 (RB; Plate 13). A widely-cited historical specimen from Louangphabang lacks information on origin and indeed, no previous locality records from Lao PDR are known (T. Geissmann *in litt*. 1998). Although its limited distribution puts the species at risk in a Lao context, this is the most widespread and numerous gibbon in continental Asia. Its conservation interest in Lao PDR arises because it naturally extends only marginally into the country. *Taxonomic issues:* Formerly *H. pileatus* was included within *H. lar*, meaning that some earlier documents (e.g. Deuve 1972) listed *H. lar* for southern Lao PDR.

• *Hylobates pileatus* **Pileated Gibbon**. *Conservation Significance:* Globally Threatened - Vulnerable; At Risk in Lao PDR; CITES Appendix I. Endemic to south-west Lao PDR, Cambodia and south-east Thailand; occurs only west of the Mekong (Geissmann 1995). *Documented Range and Habitat:* South (Round 1998). Evergreen forests, mostly within 300 m of streams (Round 1998). *Status Information:* Recently recorded only from Dong Khanthung PNBCA, where occurrence is patchy, suggesting past or current high hunting intensity (Timmins and Vongkhamheng 1996b, Round 1998). Although the geographical range of the species extends only marginally into Lao PDR, its small world range means that each site supporting it is potentially important. Historically, one specimen was procured in the neighbourhood of Pakxe (Delacour 1940). Deuve and Deuve's (1963a) suggestion that the species might be found in Savannakhet Province was without foundation; at least since Delacour (1951b) it has been known to occur only west of the Mekong. *Taxonomic issues:* See *H. lar*.

• *Hylobates concolor* **Black-cheeked Crested Gibbon** (= Black Gibbon[M5, M7]; = Crested Gibbon; = Concolor Gibbon); (included in *H. concolor* Crested Gibbon[M4]). *Conservation Significance:* Globally Threatened - Endangered; At Risk in Lao PDR; CITES Appendix I. Now endemic to southern China (including Hainan), north Vietnam and a tiny part of north Lao PDR; occurs only east of the Mekong except in the far north of its range (Geissmann 1995). *Documented Range and Habitat:* North (J.-F. Reumaux verbally 1998); known only from Bokeo Province. Although the species has also been stated to inhabit north-east Lao PDR (e.g. Xam-Nua; Deuve 1972), Geissmann (1995) considered that (except for the outlying Bokeo population) it occurs only north-east of Vietnam's Black River, and thus north-east of the Vietnam-Lao boundary. Evergreen forest. *Status Information:* Recently recorded only from Nam Kan PNBCA, where some animals were videotaped in mid 1998; 12 family groups are estimated to remain (J.-F. Reumaux verbally 1998). There is apparently a local taboo against hunting the species, but the area is in a region of human in-migration and the new settlers are unlikely to share the residents' beliefs. The only historical record seems to be the type series of *H. c. lu* (four males and six females) collected at Ban Namkeung-Kao (Bokeo Province) in January 1939 (Delacour 1951b). The listing of this species for Phou Xang He NBCA by Boonratana (1998b) was in error. The Lao population is a biogeographic anomaly and is currently assigned subspecific rank (as *H. c. lu*; but see below). The small and shrinking global range of the species, together with its gravely threatened status in Vietnam (T. Nadler verbally 1998) means that the Bokeo population is of the highest international conservation importance. The potentially very small Lao population puts the species nationally at risk. *Taxonomic issues:* Gibbons of Indochina (the 'concolor' group, subgenus *Nomascus*) are one of the most challenging taxonomic issues of South-east Asian large mammals, with little consensus on their relationships and how many species are involved. The form of *concolor* inhabiting north-west Lao PDR, '*lu*', is separated from the other dark-cheeked *Nomascus* gibbons (to the north and east) by a broad swathe of light-cheeked animals. *H. c. lu* may not be a valid taxon, as the supposed morphological differences may reflect other sources of variation (Geissmann 1989). Pale-cheeked animals, which occupy Lao PDR east of the Mekong except in the range of '*lu*', were all formerly treated as races of *concolor* (and indeed still sometimes are; e.g. Lernould 1993). This has lead to some confusion in secondary compilations drawing data from disparate sources. Some imply that two taxa (*concolor (s.s.)* and either *leucogenys* or *gabriellae*) are sympatric. This has not been shown to be so, and nor is it likely except perhaps in north-west Lao PDR at the margins of the range of *H. c. 'lu'*.

• *Hylobates leucogenys* **White-cheeked Crested Gibbon** (= White-cheeked Gibbon[M5]); (included in *H. concolor* Crested Gibbon[M4]; includes one form treated as a race of *H. gabriellae*[M5]). *Conservation Significance:* Data Deficient (Global); Potentially At Risk in Lao PDR; CITES Appendix I. Endemic to southern Yunnan (China) and northern Indochina; occurs only east of the Mekong (Geissmann 1995). *Documented Range and Habitat:* North and central Lao PDR, perhaps south almost to the Bolaven Plateau, but information is conflicting (Geissmann 1995) and field records currently cannot be confirmed (see below). Deuve's (1972) claim from west of the Mekong (Xaignabouli Province) lacks detail and is best dismissed. Evergreen forest at a wide variety of altitudes. *Status Information:* See below. *Taxonomic issues:* See note under *H. concolor*. Among the pale-cheeked *Nomascus* gibbons are three forms, *leucogenys*, *siki* and *gabriellae*. Corbet and Hill regarded *siki* as a race of *H. gabriellae*, but re-examination of evidence indicates that *siki* is closer to *leucogenys* (Geissmann 1995). Mitochondrial DNA work suggests that *siki* may better be regarded as a full species (Zhang Yaping 1997), and black-coated animals (i.e. males and juvenile females) are visually distinguishable from congeners (C. P. Groves *in litt*. 1999). Criteria for field identification of the three pale-cheeked forms are unclear.

[• *Hylobates gabriellae* **Yellow-cheeked Crested Gibbon** (= Buff-cheeked Gibbon; = Yellow-cheeked Gibbon; = Red-cheeked Gibbon; = Golden-cheeked Gibbon); (included in *H. concolor* Crested Gibbon[M4]; one form treated as a race of this species[M5] is classified here under *H. leucogenys*)]. *Conservation Significance:* Data Deficient (Global); Little Known in Lao PDR; CITES Appendix I. Endemic to far southern Lao PDR(?), southern Vietnam and eastern Cambodia; occurs only east of the Mekong (Geissmann 1995). *Context:* The species may occur in Lao PDR south from the Bolaven Plateau to the Cambodian border (Geissmann 1995), but information is conflicting. Tape-recordings from Xe Pian NBCA in 1993 showed some characters of *siki*, even though museum specimens from the Bolaven Plateau, to the north, look like *H. gabriellae* (Geissmann 1995). Recently-taped songs from the Bolaven Plateau also show features of *H. l. siki* (T. Geissmann *in litt*. 1999). Male gibbons observed in Nam Ghong Provincial PA and Dong Ampham NBCA in 1997-1998 resembled *H. gabriellae* in pelage (RJTiz, JAW) but cannot be considered certainly identified. Males from Xe Bang-Nouan NBCA, well north of the Xe Pian / Bolaven Plateau population, also show features of *H. gabriellae* (RJTim). Pure *H. gabriellae* are only likely to occur in the far south, if they occur in Lao PDR at all, and should only be identified by song. Deuve's (1972) claim of sympatry with Pileated Gibbon in Champasak Province is insupportable. The presentation of information in Duckworth *et al*. (1994, 1995) as referring to *H. gabriellae* ssp. was based on Corbet and Hill's (1992) taxonomy, taking *siki* as a subspecies of *gabriellae*. *Taxonomic issues:* See notes under *H. concolor* and *H. leucogenys*.

Status Information on Pale-cheeked Nomascus *gibbons:* Identification criteria for field use between the three forms *leucogenys*, *siki* and *gabriellae* are evolving. Under typical viewing conditions in Lao PDR, visual field identification is likely to be possible only rarely. The main technique will remain sonographic analysis of tape-recorded calls (Geissmann 1995). Few calls have yet been analysed fully, thus the status of individual pale-cheeked gibbon taxa in Lao PDR remains unclear (Plate 13).

Gibbons were reported in 89% of 1988-1993 village interviews (n = 328), from across Lao PDR (Annex 5). All those east of the Mekong are likely to be *Nomascus*, and all those outside a limited area of the north-west are likely to be pale-cheeked forms. The few direct sightings of gibbons in the north make it difficult to define the area occupied by pale-cheeked forms, but Nam Xam, Nam Et and Phou Louey NBCAs are all known to support them.

Gibbons have been found widely (Table 12), from the Mekong plains up to at least 1550 m in the Phou Ahyon area, 1650 m in Phou Louey NBCA, and 1800 m in Nakai-Nam Theun NBCA (Timmins and Vongkhamheng 1996a, Davidson 1998, Evans *et al*. in prep. b). Davidson *et al*. (1997) and Showler *et al*. (1998a) discussed the possibility of close co-occurrence of white-cheeked and buff-cheeked animals in south-east Lao PDR, re-emphasising the need for caution in field identification of pale-cheeked forms using morphological criteria. Currently at no site has the intra-population variation in male cheek pelage features and song characteristics been documented.

Gibbons are hunted and eaten avidly in the central Annamites (WGR; Plate 5), but other villagers reportedly avoid hunting them. They were not reported as a major food species during 1988-1993 interviews (Table 1). Gibbons are kept as pets in Lao PDR (Bergmans 1995, Duckworth *et al*. 1995; Plate 13), and Lao gibbons reportedly can be ordered from wildlife dealers operating in Thailand (Srikosamatara *et al*. 1992, Baird 1993). There is some market hunting, in which females are shot to collect their young for sale to foreign and perhaps Lao buyers. Gibbons are heavily traded with Vietnam (e.g. Davidson *et al*. 1997, Compton in prep. b).

In many areas, e.g. Phou Xang He and Dong Hua Sao NBCAs, gibbons are patchily distributed and seem to be absent across logged or fragmented forest, either as a result of habitat destruction or hunting and other forms of human disturbance (Duckworth *et al*. 1995). These factors are probably reducing numbers in all encroached forest in Lao PDR. Although Evans *et al*. (1996b) found small numbers in some areas of Dong Hua Sao NBCA where Duckworth *et al*. (1995) had predicted them (on the basis of habitat) to be absent, the general conclusion, that numbers were severely depressed in encroached areas, was supported. Where protection from hunting is having some effect (e.g. Sangthong District), gibbons can persist in heavily degraded areas, suggesting that decreases in the other areas reflect primarily hunting pressure rather than the habitat being totally unsuitable (Duckworth 1996a).

In Xe Pian NBCA gibbons occur at high densities in primary semi-evergreen forest, in both flat and hilly areas. The large Xe Pian-Dong Hua Sao NBCAs population is of major global significance for gibbon conservation, particularly as it may lie along a zone of contact between *H. l. siki* and *H. gabriellae* (Duckworth *et al*. 1995, Geissmann 1995). The extensive forested parts of the Nam Theun catchment (notably Nakai-Nam Theun NBCA) support a population of equally high global significance, which is likely to be taxonomically different from that in the south (Evans *et al*. in prep. b). North of the Nam Theun catchment, gibbons are rarer than to the south. Surveys in 1997-1998 across the NBCAs of north Lao PDR found large populations only in Nam Xam NBCA and parts of Phou Louey NBCA. Indeed, in some areas there were no direct records of gibbons: Nam Ha NBCA (where they appear to have been hunted out; M. Meredith verbally 1999) and Phou Dendin NBCA (where effort has been insufficient to speculate on status). The pale-cheeked gibbons in Lao PDR are of major global significance, as populations in Vietnam and China have been

severely depleted and their habitat is heavily fragmented. The status of *Nomascus* gibbons in Cambodia is unclear, but it is highly unlikely that significant numbers of any form other than *H. gabriellae* occur, leaving Lao PDR as supporting the majority of remaining *H. l. siki* and *H. l. leucogenys*.

On account of their small national range and the pressures on all diurnal primates, White-handed, Pileated and Black-cheeked Crested Gibbons are all clearly At Risk in Lao PDR. White-cheeked Crested Gibbon (including *siki*) probably has a large range and so is considered Potentially At Risk in Lao PDR. However, few areas north of the Nam Theun basin support high densities of gibbons over a large area. Thus, if *H. l. leucogenys* occurs only in this area, as a subspecies it would better be considered as At Risk in Lao PDR. The taxonomic uncertainty over the large Xe Pian - Dong Hua Sao NBCAs population means that Yellow-cheeked Crested Gibbon can only be considered Little Known in Lao PDR.

Conservation Management and Research Proposed for Gibbons:

- Complete protection of gibbons in Lao PDR from hunting and capture (all except White-handed Gibbon have a very high to high priority for international conservation action; Eudey 1987).
- Evaluation and implementation of the precise conservation needs of Black-cheeked Crested Gibbon in Nam Kan PNBCA, its only known site.
- Surveys of north-west Lao PDR for other populations of Black-cheeked Crested Gibbon.
- Protection of evergreen forest in Dong Khanthung PNBCA, which supports the only known population of Pileated Gibbon in Lao PDR.
- Selection of key sites for each individual pale-cheeked taxon, which can only proceed when their distribution is better understood. Progress with tape-recording and analysis of calls, coupled with detailed pelage description, is needed. For the group as a whole, the Nam Theun and the Xe Kong basins are both of high importance. The northernmost form (*H. l. leucogenys*) may prove to be the most threatened taxon as no large areas of the north are known to hold healthy gibbon populations: Nam Xam and Phou Louey NBCAs may be the most likely areas.
- Specific consideration to White-handed Gibbon in the management plan of Nam Phoun NBCA, its only known Lao site.

Canidae: Jackals, dogs, foxes (2-6 species in Lao PDR; 34 worldwide)

[• *Canis lupus* **Grey Wolf** (= Wolf[M1, M4, M5]; = Timber Wolf)]. *Conservation Significance:* Conditionally At Risk in Lao PDR. *Context:* Ginsberg and Macdonald (1990) included northern Lao PDR in the former range of Grey Wolf, but primary evidence for this is unclear and it may have been an error (D. Mech and J. Ginsberg pers. comm. to Duckworth *et al*. 1998c). However, there are records in southern China from as close to Lao PDR as Xishuangbanna (Wang Yingxiang 1987) and it is thus possible that wolf may be found to occur (or to have formerly done so) in Lao PDR. As a large carnivore it would undoubtedly be at risk in the country were it found to occur.

• *Canis aureus* **Golden Jackal** (= Asiatic Jackal[M2]; = Jackal[M1]). *Conservation Significance:* Little Known in Lao PDR. *Documented Range and Habitat:* North (RJTiz), centre (historically, provisionally, Deuve 1972), south (Duckworth *et al*. 1998c). Recent records come from large blocks of lowland dry dipterocarp forest; historical and village information suggests that other open habitats are used. *Status Information:* Recent records from Xe Pian NBCA (Xe Kong Plains and Dong Kalo sectors) and Dong Khanthung PNBCA (Duckworth *et al*. 1998c). A captive puppy in Vientiane in 1996 reportedly came from Vientiane Province (WGR). Two at Ban Keun Zoo were trapped at the zoo's chicken farm (close to Phou Khaokhoay NBCA) in 1996 (N. Krathintong per RJTiz). Delacour (1940) gave no records for Lao PDR, but Deuve (1972) claimed occurrence in many provinces north to Phongsali. Jackals may remain well distributed, but their noses are reportedly used in traditional medicine (Martin 1992), and most medium- or large-bodied mammal species inhabiting open areas are under pressure (see Duckworth *et al*. 1998c), so the species is considered Little Known in Lao PDR.

[*Canis familiaris* **Domestic Dog** (included in *C. lupus*[M6])]. Feral dogs may occur in Lao PDR, primarily around human settlements (Corbet and Hill 1992), but there is no evidence of self-sustaining populations. Domestic / feral dogs are sometimes seen, apparently unaccompanied by people, deep within forest (Duckworth *et al*. 1998c, Fernando in prep.). Some village reports taken by the interviewers to indicate Dhole may well refer to this species or to jackals, as neither of the latter species was included in the standard interview.

[*Vulpes vulpes* **Red Fox**]. Recorded from Langson and Cao Bang, Tonkin, Vietnam (Delacour 1940, Dao Van Tien 1977), so may extend into extreme northern Lao PDR.

[*Nyctereutes procyonoides* **Raccoon Dog**]. Occurs widely in Tonkin (Vietnam) and (at least formerly) was not rare (Osgood 1932, Bourret 1942); may therefore inhabit adjacent north Lao PDR.

• *Cuon alpinus* **Dhole** (= Asian Wild Dog[M2]; = Red Dog). *Conservation Significance:* Globally Threatened - Vulnerable; At Risk in Lao PDR; CITES Appendix II. *Documented*

Range and Habitat: North[M15], centre (Tobias 1997), south[M8]. Wide habitat use; recent sightings in various habitats from dense evergreen forest to open dry dipterocarp forest. *Status Information:* Wild dogs were reported in 94% of 1988-1993 village interviews (*n* = 328), in all areas except the most heavily settled parts of the Mekong Plain (Annex 5) but it is unclear how many reports refer to Dhole. There are recent field records from numerous areas (Table 12), but some may no longer support viable populations. The lack of detail with most local reports and concerning signs hampers assessment of the species's status as it can be difficult to rule out feral dogs and jackals. In Indonesia, van Strien (1983) stated that "prints of [domestic] dogs and [Dhole] are almost indistinguishable" although in Lao PDR few village dogs match Dhole in size. Delacour (1940) considered Dhole widely distributed, but the only Lao locality listed by Osgood (1932) is Ban Thateng (Bolaven Plateau). It was very numerous in Savannakhet Province in the 1940s (David-Beaulieu 1949-1950). Skins are sold as curios and body parts are used in traditional medicine (Srikosamatara *et al*. 1992, Salter 1993a, Baird 1995b). Wild dogs are accused of stock-killing and as with all large carnivores may be persecuted uncritically. Although Dhole is still widespread, densities are low and it should be considered At Risk in Lao PDR.

Conservation Management and Research Proposed for Dogs and foxes:

- Complete protection of Dhole from hunting, starting within designated NBCAs.
- Protection of very large areas (i.e. entire NBCAs with sufficiently large blocks of habitat within, surrounding and linking them) to support viable populations of Dhole. This species is unlikely to survive into the long-term outside protected areas except in remote regions (Ginsberg and Macdonald 1990).
- Gathering of more information on the distribution and abundance of Dhole in Lao PDR, particularly within the protected areas system and surrounding areas.
- Formulation of a policy for cases of proven stock predation.
- A clearer understanding of the status of domestic dogs (including any feral populations), to assess their effects on wild canid species (through disease transmission, aggressive displacement and/or interbreeding), other potential conservation and/or management problems (predation on livestock and wildlife), and the level to which they are confounding interview and sign survey information currently assumed to relate to wild species.
- Clarification of the status of other dog species confirmed or suspected to occur in Lao PDR, incidental to other work as all species are of much lower global conservation concern than is Dhole.

Ursidae: Bears (2 species in Lao PDR; 8 worldwide)

• *Ursus thibetanus* (= *Selenarctos thibetanus*[M1, M2, M4])
Asiatic Black Bear (= Himalayan Black Bear[M1]). *Conservation Significance:* Globally Threatened - Vulnerable; At Risk in Lao PDR; CITES Appendix I. *Documented Range and Habitat:* North (WGR; Plate 4), centre[M10], south (Showler *et al*. 1998a). Wide range of forest types perhaps mainly in hills; any remote areas may support animals. *Status Information:* See below. This is the only large carnivore with no recent wild sight records in Lao PDR. The only recent records are of single fresh skins in Nakai-Nam Theun NBCA in 1994 (Evans *et al*. in prep. b) and in Muang Viengthong (Bolikhamxai Province) in 1997 (WGR; Plate 4) and two skulls of recently killed animals from just south of Xe Sap NBCA in 1998 (Showler *et al*. 1998a, R. S. Hoffmann *in litt*. 1999). A captive in Muang Sing, Louang-Namtha Province in 1997 was reportedly caught locally (Tizard *et al*. 1997). A camera-trap photograph from Nam Theun Extension PNBCA assigned to this species by Robichaud (1998b) cannot be identified to species (WGR). Faeces in Nam Ha NBCA (Tizard *et al*. 1997; RJTiz) and footprints in Nakai-Nam Theun NBCA (Tobias 1997), the main block of Xe Pian NBCA in 1997 and Khammouan Limestone NBCA (Steinmetz 1998b, in prep.) were large and may have been of this species. It was reported from several other recent survey areas (Table 12). It was reported during 93% of 1988-1993 village interviews (*n* = 328) but these data (Annex 5) doubtless overestimate the distribution today. Occurrence in south Lao PDR is south of the range mapped in e.g. Corbet and Hill (1992), although Fraisse (1955) observed a pair near the Xe Xou river (Attapu Province). Historically, Delacour (1940) speculated that the species might be common in Lao PDR, but gave no details. One was recorded from the north (Ban Laophouchai; Osgood 1932) and it was reportedly common in Xiangkhouang (David-Beaulieu 1944). Deuve and Deuve (1962a) and Deuve (1972) listed six provinces as supporting the species from Louang-Namtha south to Attapu, considering that it was commoner in the north than the south.

• *Ursus malayanus* (= *Helarctos malayanus*[M1, M2, M3, M4, M6, M7])
Sun Bear (= Malayan Sun Bear[M2, M1]). *Conservation Significance:* Data Deficient (Global); At Risk in Lao PDR; CITES Appendix I. *Documented Range and Habitat:* North (provisionally, Tizard *et al*. 1997; historically, David-Beaulieu 1944), centre[M10], south[M8]. Wide variety of forest types up to at least 1450 m. *Status Information:* See below. Reported in 91% of 1988-1993 village interviews (*n* = 328), occurring in all areas except the heavily settled Mekong Plain (Annex 5). The three recent field sightings are all of singles: in Dong Hua Sao NBCA (Duckworth *et al*. 1994), the Phou Ahyon area (Timmins and Vongkhamheng 1996a) and Xe Pian NBCA (Dong Kalo, 1997, also camera-trapped in the main block; Steinmetz in prep.; C. Sisomphone verbally 1998; Plate 15).

Identifiable remains or captive animals come from several survey areas with local reports from many more (Table 12). Historically, the species was reportedly common in the centre and south (Delacour 1940) and in Xiangkhouang (north; David-Beaulieu 1944), with a skull coming from the far north at Ban Laophouchai (Osgood 1932). There is no recent confirmation of occurrence in north Lao PDR, although a captive in Louang-Namtha town in 1997 reportedly came from a local village (Tizard *et al*. 1997).

Status Information on Bears: There are no field-validated guidelines incorporating the influence of age, sex and other factors on size and appearance of bear signs in Indochina. Signs are thus best regarded as 'unidentified bear sp.' (Plate 15). Bear scratch marks can probably persist for years on tree trunks. Surveys may therefore record signs from individuals long dead, or from populations now locally extinct. Marks in the logged lowlands of Dong Hua Sao NBCA observed in 1993 may in fact all have been made prior to logging (Duckworth *et al*. 1994). It was not practicable to limit records in Table 12 to those of recent signs. Although bear signs have been recorded widely, populations are low across the country. Of all areas surveyed by RJTim, only in Xe Pian NBCA (1992-1993) were fresh signs found frequently.

Villagers report two forms of bear widely (and sometimes Binturong is also reported as a bear) which outside questioners often relate to Asiatic Black Bear and Sun Bear. Detailed questioning suggests this may be rash. In the central Annamites, villagers often report (as well as a form fitting Sun Bear) two sorts of 'Asiatic Black Bear', which are said to differ in size and colour of the chest pelage (Robichaud 1998d). This may explain the findings of Duckworth (1996b) in Sangthong District, where informants reported two sorts of bears, but stated differences between them were not the obvious morphological ones between Asiatic Black Bear and Sun Bear.

Bears are occasional crop pests in Lao PDR and rare livestock predators (Table 2). Asiatic Black Bears used to maul people frequently (Fraisse 1955, Deuve and Deuve 1962a). There are few recent reports of attacks by bears (Table 3), presumably because populations are now so low. Furthermore, wide gun use has probably made animals shyer of people. Both species are kept as pets and in menageries. Gall, skins and fat are used locally for medicinal purposes (Martin 1992, Salter 1993a, Baird 1995b; Plate 5). Skins are preserved (Plate 4), probably for sale as curios. The well known trade in Lao bears and bear parts with China, Thailand and Vietnam for pets, restaurants and medicine is poorly documented quantitatively (Mills and Servheen 1990, Srikosamatara *et al*. 1992, Baird 1993, Davidson *et al*. 1997). The east Asian market is considered in Mills *et al*. (1995).

Bears are caught by various methods as well as opportunistic shooting. Steel-cable snares strong enough to hold even adult Asiatic Black Bears are set in some areas, especially near the Vietnam border (Robichaud 1999; Plate 5). Young are reportedly caught by hand when mothers are guzzling honey sources (and are apparently oblivious to outside events), or are shot (I. Johnson verbally 1999, from village reports).

The relative status of Sun Bear and Asiatic Black Bear is difficult to judge. All indications are that Asiatic Black Bear is much the scarcer. None of the few recent field sightings of bears in Lao PDR was of this species. Only about a fifth of dozens of bears traded through Bolikhamxai Province over several years were this species (I. Johnson verbally 1999). It is apparently the more favoured species in trade (presumably because it is larger and more powerful). This could presumably only drive a faster decline through the initial selection of hunting area: hunters presumably cannot target one species over the other, and are unlikely to ignore any Sun Bears they come across, even if they would rather have had the larger species.

This level of threats and the relative scarcity of recent field evidence indicate that both species are At Risk in Lao PDR.

Conservation Management and Research Proposed for Bears:

- Formulation of a national bear conservation action and management plan by central government, involving full participation of provincial / district authorities, protected area staff and local people's representatives.
- Development and enforcement of appropriate controls on hunting and on trade in bears and bear parts.
- Nation-wide ban, with active enforcement, of all snares and traps strong enough to catch bears.
- Parallel with this, understanding of current status of wild bears in Lao PDR.
- Specification in all survey reports of the estimated age of signs, and dimensions of clear footprints, to allow retrospective identification if possible.
- Establishment of guidelines for identifying bear signs to species, using measurements taken in Lao PDR from animals of various ages and sexes of both species.
- Inclusion in survey reports of interview-derived information with detail on the appearance of each named form, precisely as described by informants.
- High priority to bear conservation in management plans of Xe Pian, Nakai-Nam Theun and Nam Ha NBCAs, and in those of any other areas subsequently found to support large populations of either species.
- As measures are needed in so many different fields and a considerable amount of work is needed both to gather information and to formulate appropriate directed action, the designation of specific personnel in CPAWM to be responsible for bear conservation issues seems appropriate. These people (perhaps two, with the part-time assistance of a foreign adviser) would develop a national

bear action and management plan and ensure that its recommendations were enacted to schedule and involved all appropriate people.

Ailuridae: Red Panda (0-1 species in Lao PDR; 1 worldwide)

[• *Ailurus fulgens* **Red Panda** (= Lesser Panda[M4, M7]; = Cat-bear[M1])]. *Conservation Significance:* Globally Threatened - Endangered; CITES Appendix I. *Context:* Deuve and Deuve (1963c) and Deuve (1972), citing Cheminaud (1942), recorded this species from north Lao PDR on the basis of villagers' descriptions. Interviews around Phongsali in 1996 yielded no positive indications of Red Panda's occurrence (RJTiz in Duckworth 1997a), but recent fieldwork in far northern Lao PDR has been limited. The species is known in Yunnan (China) south to Xishuangbanna National Nature Reserve, although its status there is obscure (Wang Yingxiang 1987, verbally 1998) and it could perhaps occur in Lao PDR. (Plate 5)

Mustelidae: Weasels, martins, badgers, otters (10-13 species in Lao PDR; 65 worldwide)

[*Mustela nivalis* **Least Weasel** (= Weasel[M4, M5])]. An animal from Chapa, Tonkin (Vietnam), was described by Björkegren (1942) as *M. tonkinensis*. Ellerman and Morrison-Scott (1951), and many subsequent authors, considered this specimen to represent a widely disjunct southern population of *M. nivalis*. However, marked differences in size and morphology do not support this, and it is better considered a distinct species (C. P. Groves *in litt*. 1999). The proximity of Chapa to extant similar habitat in Lao PDR suggests that it may be found to occur in the latter.

• *Mustela kathiah* **Yellow-bellied Weasel**. *Conservation Significance:* Little Known in Lao PDR. *Documented Range and Habitat:* North[M16]. Sole recent sighting was in *Fokienia* forest at about 1500 m. *Status Information:* Historical records came from Xiangkhouang and Phongsali (Osgood 1932, Delacour 1940). The only recent record is of one seen by day in Nam Xam NBCA in January 1998 (Showler *et al*. 1998b; DAS).

• *Mustela sibirica* **Siberian Weasel** (= Himalayan Weasel[M1]; = Kolinsky). *Conservation Significance:* Little Known in Lao PDR. *Documented Range and Habitat:* Centre[M12]. Sole documented Lao record came from primary evergreen forest at 1000 m. *Status Information:* Although mapped for parts of Lao PDR in e.g. Corbet and Hill (1992), Delacour (1940) gave no records of Siberian Weasel for Lao PDR and Duckworth (1997a) traced none prior to 1996. One was observed in Nakai-Nam Theun NBCA in 1996 (Duckworth 1997a) and one (provisionally identified) was seen in Khammouan Limestone NBCA on 25 January 1998 in valley semi-evergreen forest amid karst at about 500 m (Robinson and Webber 1998a; M. F. Robinson *in litt*. 1998).

• *Mustela strigidorsa* **Back-striped Weasel** (= Striped-backed Weasel[M1]). *Conservation Significance:* Globally Threatened - Vulnerable; Little Known in Lao PDR. *Documented Range and Habitat:* North[M12], centre[M12]. Recent records in Lao PDR come only from evergreen forest in hills and mountains, but records from other countries suggest wide habitat use. *Status Information:* Delacour (1940) called it rare and found it only at Phongsali. There are recent records from Nam Kading, Nakai-Nam Theun, and Nam Ha NBCAs (Table 12). Duckworth (1997a) reviewed records prior to 1997, since when there have been only two: a single in evergreen forest at 720 m in Nam Ha NBCA in March 1997 (Tizard *et al*. 1997), and one dead in a village near Nam Ha NBCA in early 1998 (S. Ling per RJTiz).

Martes flavigula **Yellow-throated Marten**. North[M12], centre[M12], south[M12]. Forests and various other habitats across a wide altitudinal range. Records prior to 1997 were reviewed in Duckworth (1997a). (Plates 5, 14)

[*Meles meles* **Eurasian Badger** (= Badger)]. Although mapped for extreme northern Lao PDR by Corbet and Hill (1992), the primary basis for this is not clear. Zheng Yonglie (1987) mapped badger in China right on Vietnam's north-eastern border. The most southerly records from China known to Wang Sung (*in litt*. 1999) are from Simao, Luchun and Jinping counties (i.e. about 22º30'N). There is no ecological reason derivable from this distribution to assume that the species occurs in Lao PDR.

• *Arctonyx collaris* **Hog Badger** (= Hog-nosed Badger). *Conservation Significance:* Little Known in Lao PDR. *Documented Range and Habitat:* North[M12], centre[M12], south[M11]. Forested areas, perhaps mainly in hills and mountains. *Status Information:* Recent reports come from many survey areas, but few have documented records (Table 12). Information from prior to 1997 was reviewed by Duckworth (1997a); all seven records in 1992-1996 were from in and around the Nam Theun catchment at sites above 500 m. Both historical sites listed by Delacour (1940) are in mountainous areas: Phongsali and the Bolaven Plateau. Deuve (1972), however, considered that the species occurred in Lao PDR only in the south, listing several lowland sites. Post-1996 records (Table 13) are also all from hills and mountains. People in some areas dislike Hog Badger's rank taste (e.g. the flesh of one killed near Hin Namno NBCA was used for fish bait). But in others (e.g. southern Attapu Province) the species is eaten (Fernando in prep.) and indeed some ethnic groups in parts

Plate 14:

Yellow-throated Marten, origin unknown, Ban Lak (20), Bolikhamxai Province, January 1997. The pelage of this individual is typical of the species in Lao PDR. In many other parts of Asia, animals are much darker-bodied. *W. G. Robichaud / WCS.*

Large Indian Civet, Nakai Plateau, late 1998. This common species is distinct in field appearance from the rare Large-spotted Civet, but field-marks for distinguishing it from the recently discovered Taynguyen Civet remain unclear. Camera trapped by night; note part of unit in background. *R. Boonratana / IUCN.*

Large-spotted Civet, Xe Pian NBCA, early 1997. Camera-trapped by night. Very little field information is available on this species from anywhere in its world range. *WWF Thailand / FOMACOP.*

Large-spotted Civet, origin unknown, Savannakhet Province, March 1997. The tail is damaged but the distinctive body and tail pattern is clearly visible. *T. D. Evans / IUCN.*

Common Palm Civet, Ban Lak (20) market, early 1994. Pelage is quite variable; this animal is relatively well marked. Also shown are the squirrels *Dremomys rufigenis*, *Callosciurus erythraeus* and *C. inornatus*. *T. D. Evans / WCS.*

Owston's Civet, Ban Lak (20), September 1997. As yet there are no field records of this species in Lao PDR, which occurs otherwise only in small parts of China and Vietnam.
W. G. Robichaud / WCS.

Hog Badger, Nakai-Nam Theun NBCA, January 1998. Paws and other parts of killed animals are often preserved.
W. G. Robichaud / WCS and IUCN.

Hog Badger, southern Attapu Province, early 1998. *P. Fernando / WWF.*

Table 13. Hog Badger field records in Lao PDR, 1997-1998.

Site/Area	Altitude	Date	Source	Notes
Nam Phoun NBCA	hills	April / May 1997	Boonratana 1997; RB	field sighting of single (by day) in mixed deciduous forest
Phou Khaokhoay NBCA	600-700 m	29 Nov. 1996	JWKP	field sighting of single (by day)
Nam Theun Extension PNBCA	600-800 m	May 1997	WGR	field sighting of single (about 16h00) in evergreen forest
Edge of the Nakai Plateau	550 m	late 1998	RB	dead animal in a village (Plate 1)
Nakai-Nam Theun NBCA	1200 m	Dec. 1998	Robichaud 1999	field sighting of single (by day)
Nakai-Nam Theun NBCA	900 m	Dec. 1998	Robichaud 1999	field sighting of single (by day)
Nakai-Nam Theun NBCA	unknown	late 1998	WGR	feet found in a Vietnamese poachers' camp (Plate 14)
Nakai- Nam Theun NBCA	about 600 m	May 1998	J. Baker verbally 1999	one, freshly killed, seen in a village
Hin Namno NBCA	200-400 m	early 1998	Walston in prep.; J. L. Walston verbally 1998	pelt and claws of an animal recently killed nearby in evergreen forest
Phou Xang He NBCA	unknown	unknown	Boonratana 1998b; RB	photograph of an animal held at the NBCA headquarters; lacks detail
Nam Ghong Provincial PA	hills	early 1998	RJTiz	skin for sale along nearby road (Plate 14)
Dong Ampham NBCA	840 m	early 1997	Davidson *et al.* 1997; WGR	old skull in Ban Taigieu village

Details on a record from Xe Kaman lowlands in Davidson *et al*. (1997) can no longer be traced; it may have been an error.

of the Nam Theun basin (and perhaps widely elsewhere) seek the species specifically for food (J. Baker verbally 1999). Dogs reportedly track scents to setts and at least some dogs in Lao PDR attack Hog Badgers readily and may seek and kill them of their own accord (J. Baker verbally 1999, BLS). As a ground-living mammal, it is susceptible to snaring. Being diurnal and not wary it can be taken opportunistically by people and dogs during other activities in the forest. The species has been observed on most surveys in and around the Nam Theun catchment, indicating that it can be common and observable in some areas. The contrasting paucity of direct sightings elsewhere suggests that it is either naturally patchy in abundance or under widespread decline. Thus, Hog Badger is categorised as Little Known in Lao PDR. (Plates 1, 14)

• *Melogale personata* **Large-toothed Ferret Badger** (= Burmese Ferret Badger[M2, M1, M4]). *Conservation Significance:* Little Known in Lao PDR. *Documented Range and Habitat:* Centre[M17], south (historically)[M18]. Habitat use in Lao PDR unclear. *Status Information:* See below. A skull was found in Khammouan Limestone NBCA in early 1998 (Robinson and Webber 1998a). The species was previously common on the Bolaven Plateau (Osgood 1932, Delacour 1940).

• *Melogale moschata* **Small-toothed Ferret Badger** (= Chinese Ferret Badger[M1, M4]). *Conservation Significance:* Little Known in Lao PDR. *Documented Range and Habitat:* North (historically)[M18]. Habitat use in Lao PDR unclear. *Status Information:* See below. No recent field records; previously very common around Xiangkhouang and Phongsali (Delacour 1940).

Status Information on Ferret badgers: Several ferret badgers have been taken into captivity at Ban Lak (20) and singles, not identified to species, were seen in the Louang-Namtha market in early 1997, and running across a road in Sangthong District, Vientiane, in January 1997. The road ran through an area of scrub and degraded forest (RJTiz). Parts of all badgers are used in traditional medicine (Baird 1995b).

• *Lutra lutra* **Eurasian Otter** (= Common Otter[M2, M1]; = European Otter[M4]). *Conservation Significance:* Conditionally At Risk in Lao PDR; CITES Appendix I. *Documented Range and Habitat:* North (historically)[M18]. Habitat in Lao PDR unknown. *Status Information:* See below; no recent records. Recorded only from Phongsali (Delacour 1940), as claims from across Lao PDR in Deuve and Deuve (1963c) and Deuve (1972) cannot be upheld (Duckworth 1997a). Although sometimes stated to be mainly montane in tropical Asia (Corbet and Hill 1992), recent work in Thailand (Kruuk *et al*. 1994) suggests that this species could occur widely in Lao PDR and at a variety of altitudes. Given the level and type of recent survey work in Lao PDR, the statement by Conroy *et al*. (1998: 25) that "[*Lutra lutra* is] believed to be extinct in Laos" is premature.

[• *Lutra sumatrana* **Hairy-nosed Otter**]. *Conservation Significance:* Globally Threatened - Vulnerable; Conditionally At Risk in Lao PDR; CITES Appendix II. *Context:* Recorded from Annam, Vietnam (Osgood 1932), and even considered to be common in central Annam by Delacour (1940). May therefore be found in lowland south Lao PDR.

• *Lutrogale perspicillata* (= *Lutra perspicillata*[M1, M2, M3, M7]) **Smooth-coated Otter** (= Smooth Otter[M3]; = Smooth Indian Otter[M1]). *Conservation Significance:* Globally Threatened - Vulnerable; At Risk in Lao PDR; CITES Appendix II. *Documented Range and Habitat:* North (historically)[M18], south[M8]. Rivers and probably other water-bodies. *Status Information:* See below. Recently recorded only from Xe Pian NBCA (Duckworth 1997a) and Nam Ghong Provincial PA (a group of five on a rocky stream amid open deciduous forest at 150-200 m, in early 1998; RJTiz), but many signs of large otters found at various localities may belong to this species. Historically recorded from Xiangkhouang, Pakxe and Ban Thateng on the Bolaven Plateau (Delacour 1940); common in at least the former (David-Beaulieu 1944).

• *Aonyx cinerea* (= *Amblonyx cinereus*[M6]) **Oriental Small-clawed Otter** (= Small-clawed Otter[M2]; = Clawless Otter[M1]; = Short-clawed Otter). *Conservation Significance:* Globally Near-Threatened; At Risk in Lao PDR; CITES Appendix II. *Documented Range and Habitat:* North[M12], centre[M12], south[M11]. Rivers and streams through forest and adjacent degraded areas. *Status Information:* See below. Records of this species (usually tracks) come from several areas (Table 12), with recent sight records from Nakai-Nam Theun and Dong Ampham NBCAs and the Nakai Plateau (Duckworth 1997a, Davidson *et al*. 1997), and, provisionally, the Dakchung Plateau (Showler *et al*. 1998a). The only historical record is from Ban Thateng, Bolaven Plateau (Delacour 1940).

Status Information on Otters: Otters were reported during 90% of 1988-1993 village interviews (n = 328) and remain widely distributed (Annex 5). However, sightings are infrequent on surveys and populations of all species may be low and dispersed, although sign densities suggest that some populations (e.g. in the Nam Theun basin) are locally healthy. Villagers frequently refer to two sorts of otters, one with 'duck's' feet and one with 'dog's' feet. The former may refer to Eurasian and/or Smooth-coated Otters and the latter to Oriental Small-clawed Otter, although Crab-eating Mongoose was suggested by Bergmans (1995). Lowe's Otter Civet could be a further confusion. Ecological findings in Thailand (Kruuk *et al*. 1994) challenge some previous assumptions about ecological separation between otter species. Kruuk *et al*. (1993) indicated that, with experience, clear footprints can be identified to species. Even identification of direct sightings of the larger species is difficult.

Otter footprints / spraints were found, or local reports were received, widely on recent surveys (Table 12). Field sightings of big otters come from few areas. Those prior to 1997 were documented by Duckworth (1997a). Two subsequent ones have been traced: 5-7 animals in Nam Theun Extension PNBCA in May 1997 in little-degraded evergreen forest (about 550 m) at about 08h00 (WGR), and the Smooth-coated Otters in Nam Ghong Provincial PA (see species account). Otters are stated by some villagers to be competitors for fish (Baird 1992, Showler *et al*. 1998b). They are trapped widely (e.g. Baird 1992, Annex 1) for their fur. Reportedly, Cambodians purchase otter pelts in southern Lao PDR and skins from the north go to Chinese and Vietnamese traders (Baird 1993, Nash 1997, Davidson 1998, Robichaud 1998b). In Nam Theun Extension PNBCA a device reportedly for trapping otters consisted of a thick line run across a stream with small lines run off it terminating in large fish-baited hooks (WGR). In Nam Et NBCA, hunters prepare fish-baited explosives for otters (Davidson 1998). Various parts are used in traditional medicine (Baird 1995b).

These threats, coupled with historical information on sighting rates in Indochina (Monestrol 1952) indicate that all species of otter are At Risk in Lao PDR. Because there are no recent records of *Lutra lutra*, and none ever of *L. sumatrana*, these species are listed as Conditionally At Risk in Lao PDR.

Viverridae: Civets, linsangs, palm civets, otter civets (9-11 species in Lao PDR; 34 worldwide)

Viverra zibetha **Large Indian Civet**. North[M12], centre[M12], south[M12]. Tall forest both evergreen and deciduous, and adjacent degraded areas, over at least 200-1000 m. Few recent records from below 400 m. Records prior to 1997 were reviewed by Duckworth (1994a, 1997a). *Taxonomic issues:* The recently-described species *V. tainguensis* (see below) resembles this species. As *V. tainguensis* is currently known only from seven specimens, further analysis is needed before an assessment can be made of whether Lao field sightings of *V. zibetha* should be re-assessed as only provisional records. (Plate 14)

[*Viverra tainguensis* **Taynguyen Civet**]. This newly described species from Vietnam (Sokolov *et al*. 1997) is known from Tonkin to the Tay Nguyen Plateau at 21º29'N south to 14º34'N (Rozhnov and Pham Trong Anh 1999). It may therefore be found in Lao PDR.

• *Viverra megaspila* **Large-spotted Civet**. *Conservation Significance:* Potentially At Risk in Lao PDR. *Documented Range and Habitat:* Centre[M12], south[M12]. Recent records came from lowland evergreen/semi-evergreen forest (including

degraded areas) with one in open dry dipterocarp forest, all below 300 m altitude. *Status Information:* Records prior to 1997 were reviewed by Duckworth (1994a, 1997a). The only subsequent field records are of four singles camera trapped in Xe Pian NBCA (main block and Dong Kalo) in early 1997 (C. Sisomphone verbally 1998; photographs held at FOMACOP office, Vientiane; Plate 14). Delacour (1940) traced no historical records. Recent records come only from Phou Xang He and Xe Pian NBCAs (Table 12). A captive animal was held in Savannakhet in 1997 (TDE; Plate 14). There are no Lao records from hill and montane forest, but the species has been found at each forest site below 300 m subjected to substantial nocturnal survey effort or camera trapping. This suggests that it is genuinely patchy in occurrence. Ground-living carnivores such as this species are vulnerable to snaring and if the species is restricted to lowland forest it is at least Potentially At Risk in Lao PDR.

Viverricula indica (= *V. malaccensis*[M2]) **Small Indian Civet** (= Rasse). North[M14], centre[M12], south[M12]. Semi-evergreen and deciduous forest, including adjacent degraded areas; patchily distributed. Records prior to 1997 were reviewed by Duckworth (1994a, 1997a). There are few records of the species in Lao PDR. In other countries it is tolerant of habitat degradation and lives in proximity to human communities (e.g. Lekagul and McNeely 1977) and it seems unlikely to be at risk in Lao PDR. It is not considered a key species as the few records may reflect little more than a paucity of nocturnal work in deciduous and open areas. However this standpoint may need review after further surveys have been undertaken.

• *Prionodon pardicolor* **Spotted Linsang**. *Conservation Significance:* Little Known in Lao PDR; CITES Appendix I. *Documented Range and Habitat:* North[M14], centre[M12], south[M14]. Both recent field sightings came from an extensive area of little degraded hill evergreen forest. *Status Information:* Records prior to 1997 were reviewed by Duckworth (1997a). Delacour (1940) traced historical records only from Xiangkhouang. Field sightings come from Nakai-Nam Theun NBCA (Evans *et al*. 1994, Duckworth 1997a). Dead animals have been seen in Xekong and Xaignabouli Provinces (Bergmans 1995). There are few Lao records, but the species may not necessarily be under threat. It inhabits hilly and mountainous areas, where large-scale forest clearance is more difficult than in lowlands. It uses a wide range of habitats, at least in other countries (Van Rompaey 1995). The species is best considered Little Known in Lao PDR.

Paradoxurus hermaphroditus **Common Palm Civet** (= Toddy-cat). North[M12], centre[M12], south[M12]. All habitats surveyed, from Mekong lowlands to montane areas, evergreen to deciduous forest to scrub. Records prior to 1997 were reviewed by Duckworth (1997a). (Plate 14)

Paguma larvata **Masked Palm Civet** (= Himalayan Palm Civet[M1]). North[M12], centre[M12], south[M12]. Recent records come only from large blocks of evergreen forest above 500 m, and the three historical sites listed in Osgood (1932) are all also above this altitude. Records prior to 1997 were reviewed by Duckworth (1997a).

• *Arctictis binturong* **Binturong** (= Bearcat). *Conservation Significance:* At Risk in Lao PDR. *Documented Range and Habitat:* North[M12], centre (Walston in prep.), south (historically, provisionally, Deuve 1972). Recent Lao records come from extensive evergreen forest; in other countries a variety of tall forests is used. *Status Information:* Records prior to 1997 were reviewed by Duckworth (1997a), who traced only two recent sightings, both from Nam Kading NBCA. The sole subsequent record is of a single seen in Hin Namno NBCA in early 1998 (Walston in prep.). Details cannot now be traced of records from Phou Xang He NBCA (Boonratana 1998b) and Dong Ampham NBCA (Davidson *et al*. 1997) and they are best dismissed (RB, PD). There are local reports from various other recent survey areas (Table 12). Delacour (1940) traced no historical records. Deuve (1972) considered that the species was common (and listed various provinces from Louang-Namtha south to Champasak as supporting it) but the basis for this is unclear. Binturong is one of most frequently displayed caged live carnivores across Lao PDR and skins are traded frequently in at least Vientiane (RJTiz). This probably reflects more its striking appearance than a natural abundance relative to other species. Binturong is classed as At Risk in Lao PDR because it is not prone to wariness, is partly diurnal, and often visits fruiting trees. These features make it conspicuous both to surveyors (suggesting that the few encounters reflect a low population) and to hunters (thus exposing it to elevated risk). Where Binturongs are not hunted, sightings can be frequent (e.g. Khao Yai National Park, Thailand; Nettelbeck 1997). Although primarily arboreal, Binturongs do descend to the ground and some are snared. Many traded animals are young; it is possible that trees are felled to allow them to be caught (I. Johnson verbally 1999). Furthermore, the species is considered particularly tasty in at least parts of Lao PDR, and is traded to Vietnam (I. Johnson verbally 1999). Duckworth (1997a) speculated that hunting was unlikely to be the cause of the few recent sightings of Binturong in Lao PDR, citing the many Black Giant Squirrels and gibbons in several areas lacking Binturong records. This comparison is not valid as it overlooks possible interspecific differences in population dynamics, which in turn affect resilience to hunting pressure.

Arctogalidia trivirgata **Small-toothed Palm Civet** (= Three-striped Palm Civet[M2,M4]). North[M12], centre[M12], south[M12]. Evergreen forest, including degraded areas provided some contiguity of canopy remains; up to at least 1200 m. Records prior to 1997 were reviewed by Duckworth (1997a).

• *Hemigalus owstoni* (= *Chrotogale owstoni*[M4, M6, M7]) **Owston's Civet** (Owston's Palm Civet[M4, M7]; = Owston's Banded Civet[M5]). *Conservation Significance:* Globally Threatened - Vulnerable; Little Known in Lao PDR. Endemic to parts of Lao PDR, southern China and a wide latitudinal range in Vietnam; occurs only east of the Mekong (Corbet and Hill 1992, Rozhnov *et al*. 1992). *Documented Range and Habitat:* North (provisionally, Tobias 1997; historically[M18]). Habitat use in Lao PDR unclear; village reports suggest climatically wet evergreen forest. *Status Information:* No recent field sightings. Dozens have been held captive in Ban Lak (20) during 1994-1998, reportedly from the Nam Phao valley in 1995-1996 (RJTim) and the Nam Pan valley, Nam Theun Extension PNBCA, in 1997 (Tobias 1997). Villagers report that the species is caught easily in banana plantations, but until home range and movements are studied, it would be rash to assume that such high capture rates can be sustained (I. Johnson verbally 1999). Delacour (1940) traced records only from Xiangkhouang. The habitat use of, and threats to, this species are unclear and so, despite the global threat designation, listing as Little Known in Lao PDR is more appropriate than would be (Potentially) At Risk in Lao PDR. (Plates 5, 14)

[• *Cynogale lowei* **Lowe's Otter Civet** (= Tonkin Otter Civet[M5]); (included in *C. bennettii* Otter Civet[M3, M4, M6, M7], *C. bennetti* Otter Civet[M2])]. *Conservation Significance:* Globally Threatened - Endangered, as *C. bennettii*. Endemic to northern Vietnam and possibly adjacent countries (Schreiber *et al*. 1989). *Context:* The species is known only from a skin collected in Tonkin (Pocock 1933), but its range possibly includes south Yunnan (China) and north-east Thailand (Schreiber *et al*. 1989) and thus perhaps Lao PDR. *Taxonomic issues:* Separation of the single specimen as a species distinct from the Sundaic *C. bennettii* is not universally accepted (see Schreiber *et al*. 1989).

Conservation Management and Research Proposed for Small carnivores (Ailuridae, Mustelidae and Viverridae):

- Further baseline status surveys for all species (only for Yellow-throated Marten and for a few species of civet is current status documented adequately) to allow species at risk to be identified, the development of appropriate conservation measures and the identification of important sites.
- Focus of survey work on Back-striped Weasel, Large-spotted Civet, Spotted Linsang and Owston's Civet (for which Lao PDR was speculated to be globally significant by Schreiber *et al*. 1989), otters (threatened by trade and doubtless under pressure from the generally heavy use of wetlands) and Hog Badger (for which recent records show an unexplained imbalance in frequency between regions). Duckworth (1997a) compiled existing information, but the need for directed survey remains pressing. Of the Schreiber *et al*. (1989) priority species, Spotted Linsang and Back-striped Weasel may prove to be secure, but Large-spotted Civet is clearly of concern. Owston's Civet remains enigmatic.
- Field investigation of the possibility of occurrence in Lao PDR of Red Panda and Lowe's Otter Civet (both afforded the second highest global threat category by IUCN 1996), 'Least Weasel' *M. (n.) tonkinensis* (which, being known from only one specimen anywhere, is an enigma) and Taynguyen Civet. Investigations for Red Panda should focus on montane evergreen forest with much bamboo in far northern Lao PDR. If Taynguyen Civet is shown to occur, status reassessment of Large Indian Civet would be needed. Pending clarification of field characters to distinguish these two species, specimen examination and/or genetic analysis are needed. In the interim, animals and pelts should be photographed, and a tissue sample for analysis collected, whenever possible, for retrospective identification.
- Protection of habitat integrity in NBCAs, especially forested riverine and other wetland habitat in them and in adjacent and corridor riverine areas.
- Cessation of use of snares and other ground-level traps in all NBCAs, with priority action in areas supporting Large-spotted or Owston's Civets. These include: Xe Pian, Phou Xang He and (probably) Nakai-Nam Theun NBCAs and Nam Theun Extension PNBCA. A balanced prioritisation to evaluate areas for initial snare-control activity should consider other threatened species vulnerable to snaring, e.g. Saola and Crested Argus.
- Prevention of pollution of wetland habitats.
- Field investigation of the extent to which key species are harvested followed by development of appropriate conservation measures; civets are often eaten in rural Lao PDR (Table 1), and meat and skins are traded in urban markets in both Lao PDR and adjacent parts of Thailand (Srikosamatara *et al*. 1992, Annex 1; Plate 14) and at very high levels to Vietnam (RJTim) and presumably China. Information is yet too thin to identify species specifically at risk from harvesting.
- Assessment of current hunting and trading methods and levels on otters, and the international otter pelt trade from Lao PDR, to allow formulation of specific, achievable, controls on their exploitation.
- Substantial direct observation in all mammal surveys, including spot-lighting at night. Many civets (including some key species such as Spotted Linsang and Binturong) are partially arboreal and thus are difficult to survey with camera traps.
- Assessment of the value of other survey techniques. For most species neither signs nor village information are readily separable to species. Thus, direct recording techniques, notably camera-trapping, and perhaps live-trapping, are needed.

- Clarification of the balance of diurnal / nocturnal activity of weasels and badgers in Lao PDR, to aid in survey planning. The low stature of weasels and ferret badgers means that camera trapping may not be a useful technique to survey them.
- Assessment of the level of fisheries-otter conflict and the effects (if any) of fish-stock depletion on otter populations.
- Investigation of the effects of explosives fishing and other illegal fishing techniques on otters.
- Investigation of the need for government intervention over stock predation; civets are frequent small livestock predators in rural Lao PDR (Table 2).

Herpestidae: Mongooses (2 species in Lao PDR; 37 worldwide)

Herpestes javanicus **Small Asian Mongoose** (= Javan Mongoose[M2]); (includes *H. auropunctatus* Small Indian Mongoose[M1, M4] and *H. javanicus* Javan Mongoose[M4]). North[M12], centre[M12], south[M12]. Dry dipterocarp forest, grasslands and other open areas, also secondary vegetation. Apparently rather local: Duckworth (1997a) traced few recent records, and Delacour (1940) no historical ones. *Taxonomic issues:* Two taxa were formerly recognised and Deuve (1972) recorded both for Lao PDR; being partly sympatric, they were considered full species. Wells (1989) argued on morphological grounds that the two were not distinct. Further information (notably skulls and other specimens) from across the range would clarify the situation.

Herpestes urva **Crab-eating Mongoose**. North[M12], centre[M12], south[M12]. Evergreen forest (including degraded areas), mainly near water; most recent records are from mountainous areas. Records prior to 1997 were reviewed by Duckworth (1997a).

Felidae: Cats (8-9 species in Lao PDR; 36 worldwide)

[*Felis catus* (included in *F. silvestris*[M6]) **Domestic Cat**]. Feral populations may occur around human settlements (Corbet and Hill 1992), but none has yet been documented in Lao PDR. Given the ease with which domestic cats form feral populations in a wide variety of ecological/climatic zones, the occurrence of feral populations in Lao PDR seems highly likely; the lack of documentation may be due primarily to a lack of interest in them.

• *Felis chaus* **Jungle Cat**. *Conservation Significance:* At Risk in Lao PDR; CITES Appendix II. *Documented Range and Habitat:* North (historically, provisionally, Deuve 1972), centre (RJTiz), south (historically, provisionally, Deuve 1972). Open deciduous forest and other habitats lacking a closed tall canopy, e.g. grassland; usually not far from rivers (Deuve 1972). *Status Information:* Delacour (1940) traced no historical records, and the sole historical evidence for this species's occurrence in Lao PDR appears to be Deuve (1972), who stated that Jungle Cat inhabited open forest and grassy savanna between Pakkading and Pakxe, being abundant along the road from Pakkading to Thakhek. There is only one recent record: a single seen by car headlights in degraded flatland mixed deciduous forest in Boulapha District, Khammouan Province, at 21h00 on 4 May 1999 (RJTiz) There is also a claim based on village interviews from the nearby Nakai Plateau (WCS 1996b). Jungle Cat is now rare in Thailand (Graham and Round 1994; S. Jaisomkom verbally 1997) and has presumably decreased in Lao PDR for similar reasons. Jungle Cat shuns dense forest (Prater 1971) and in Lao PDR, the more open areas generally support higher human presence and thus hunting pressure. Thus, among small cat species, Jungle Cat's decline is likely to be the most severe; all the others have been recorded recently from large little-degraded blocks of dense forest. It is considered to be At Risk in Lao PDR.

Prionailurus bengalensis (= *Felis bengalensis*[M1, M2, M3, M4]) **Leopard Cat**. North[M12], centre[M12], south[M12]. Evergreen and deciduous forest and adjacent degraded areas from the Mekong plains to at least 1200 m. Historical and recent records of Leopard Cat are much more numerous than are those of other cats (Delacour 1940, Duckworth 1997a); the reasons for this presumed greater abundance are unclear. Duckworth (1997a) reviewed records prior to 1997. Subsequently the species has been confirmed in several other survey areas. Its former status as a species of special conservation concern (Salter 1993b) is now shown to be unwarranted. *Special Significance:* CITES Appendix II.

• *Prionailurus viverrinus* (= *Felis viverrina*[M1, M2, M4]) **Fishing Cat**. *Conservation Significance:* Globally Near-Threatened; Little Known in Lao PDR; CITES Appendix II. *Documented Range and Habitat:* North (Tizard 1996), south[M11]. Recent records were in hill evergreen forest and lowland riverine forest amid open deciduous forest. *Status Information:* Two recent records: one in the Nam Pan river, Nam Theun Extension NBCA, in early 1996 (WCS 1996b) and one in the Xe Xou lowlands, Dong Ampham NBCA in January 1997 (Davidson *et al*. 1997). The first was in evergreen forest, the second in dense riverside tangles amid dry dipterocarp forest at 300 m (RJTiz). There is also a provisional record from Nam Kan PNBCA (J.-F. Reumaux *in litt*. 1998), and reports from several other areas (Table 12). Delacour (1940) traced no historical records. Deuve and Deuve (1963c, quoting Cheminaud 1942) and Deuve (1972) recorded the species provisionally along the Mekong around Ban Houayxai (Bokeo Province) and in the lower Nam Ou (Louangphabang Province).

Table 14. Asian Golden Cat locality records in Lao PDR, 1992-1998.

Site/Area	Altitude	Date	Source	Notes
Moung Boun-nua, Phongsali Province	hills / mountains	March 1996	WGR	skin of one reportedly killed five days earlier 17 km distant[1]
Nam Et / Phou Louey NBCAs	unknown	1998	Davidson 1998	two locally preserved specimens seen
Louang-Namtha	unknown	1996	M. Meredith verbally 1996	one locally preserved specimen seen
Sangthong District	220 m	March 1996	Duckworth 1996a	field sighting of single (by day) in bamboo
Nakai-Nam Theun NBCA	1100 m	February 1997	Tobias 1997	camera-trapped (by night)
Nakai-Nam Theun NBCA	650 m	December 1998	Robichaud 1999	field sighting of single (by day) in evergreen forest (provisional)
Near Nam Kading NBCA	300 m	early 1995	Evans *et al*. in prep. b	freshly-killed in scrub near village
Xe Pian NBCA	lowland	early 1997	Steinmetz in prep.	found dead in semi-evergreen forest[2]

The record from Dong Ampham NBCA in Davidson *et al*. (1997) was intended to indicate merely a report.
[1]photograph retained at WCS Vientiane (Plate 15).
[2]skull preserved at WWF Thailand office, Bangkok.

• *Catopuma temminckii* (= *C. temminckii*[M7]; = *Felis temminckii*[M4]; = *F. temminckii*[M1, M2]) **Asian Golden Cat** (= Asiatic Golden Cat[M4, M7]; = Golden Cat[M5]; = Temminck's Cat). *Conservation Significance:* Globally Near-Threatened; Little Known in Lao PDR; CITES Appendix I. *Documented Range and Habitat:* North[M9], centre (Tobias 1997), south (Steinmetz in prep.). Many habitats: little-degraded evergreen forest, bamboo regrowth, scrub and degraded forest. From Mekong plains to at least 1100 m. *Status Information:* The several recent sightings (Table 14) involved a mix of colour phases. None was of the complex-patterned so-called '*tristis*' form. There are plausible reports from several other areas (Table 12). Several have been held in both Ban Keun zoo and in Ban Lak (20). Historical specimens come from the north (Xiangkhouang, Ban Laophouchai and Louangphabang), but two are merely pelts (Thomas 1927, Osgood 1932). The species seemed not uncommon in Xiangkhouang Province (David-Beaulieu 1944). Deuve (1972) reported the species from the Savannakhet plain. In total, recent records are more numerous than for any other small / medium cat in Lao PDR except Leopard Cat. Furthermore, tracks suggested that in Nam Phoun NBCA, this species was "possibly relatively more abundant than the other cat species" (Boonratana 1997). Nonetheless, threat levels are unclear (skins are traded at least on the Myanmar - Thai border close to Lao PDR; Davidson 1999), so the species is considered Little Known in Lao PDR. (Plate 15)

• *Pardofelis marmorata* (= *Felis marmorata*[M1, M2, M3, M4]) **Marbled Cat**. *Conservation Significance:* Data Deficient (Global); Little Known in Lao PDR; CITES Appendix I. *Documented Range and Habitat:* North[M16], centre[M13], south (provisionally, historically, Deuve 1972). Recent records come from evergreen forest at 1000-1350 m. *Status Information:* Both recent field sightings, in Nakai-Nam Theun NBCA (Duckworth 1998) and in Nam Xam NBCA (Showler *et al*. 1998b), were by day. The skin of one shot in March 1996 along the Nam Ngay river (about 1000 m; Phongsali Province), is retained at WCS Vientiane (WGR; Plate 15). A skin was seen on the Nakai Plateau (Evans *et al*. in prep. b) and a stuffed animal shot in Nam Ha NBCA is portrayed in Phiapalath (1996). S. Chape (verbally 1998) was given a photograph (retained at IUCN Vientiane) of a fresh dead Marbled Cat from Muang Sing (Louang-Namtha Province) in about 1996. The reliability of reports from other areas (Table 12) is low, as village information is plagued by confusion with Clouded Leopard (Showler *et al*. 1998a, Davidson 1998) and probably with other patterned cats. No captives have been documented. All recent sites are in or near mountains. Delacour (1940) traced a historical record only from Xiangkhouang, also a high-altitude area. Deuve (1972) recorded the species only at Khemmarat and Khinak (Mekong lowlands of the far south) but gave no details. With so few records, and uncertain threats (although skins are traded at Tachileik on the Myanmar - Thai border close to Lao PDR; Davidson 1999) the species is clearly Little Known in Lao PDR.

• *Pardofelis nebulosa* (= *Neofelis nebulosa*[M1, M2, M3, M4, M6, M7]) **Clouded Leopard**. *Conservation Significance:* Globally Threatened - Vulnerable; At Risk in Lao PDR; CITES Appendix I. *Documented Range and Habitat:* North (JWKP), centre[M13], south[M11]. Habitat use in Lao PDR unclear: recent sightings from unencroached hill evergreen forest and

Plate 15:

Tiger, border of Louangphabang and Vientiane Provinces, December 1998. Reportedly shot while raiding cattle.
Dodongdy Diraporn / IUCN.

Tiger, Nakai-Nam Theun NBCA, January 1999. Camera-trapped by night. This may be the first photograph of a free-living Tiger in Lao PDR. *W. G. Robichaud / WCS and IUCN.*

Marbled Cat, Phongsali Province, March 1996. There are very few recent records of this species. *W. G. Robichaud / WCS.*

Asian Golden Cat, Phongsali Province, March 1996. A golden-phase individual of this polymorphic species. *W. G. Robichaud / WCS.*

Sun Bear, Xe Pian NBCA, early 1997. Camera-trapped by night. Direct sight records of bears in Lao PDR are now very rare. *WWF Thailand / FOMACOP.*

Clouded Leopard, Nakai-Nam Theun NBCA, March 1997. Camera-trapped by night. *W. G. Robichaud / WCS and IUCN.*

Bear foraging sign, Khammouan Province, February 1997. Signs are the best way of confirming recent bear presence and of assessing bear status. *W. G. Robichaud / WCS.*

Leopard, southern Attapu Province, early 1998. The condition of the skin indicates that it has been prepared opportunistically, rather than by a professional hunter for the fur trade. *P. Fernando / WWF.*

extensive mid-altitude bamboo and scrub. *Status Information:* Reported during 69% of 1988-1993 village interviews (*n* = 328), throughout (Annex 5), although some reports may be in error (see Marbled Cat). There are two recent sightings, from Nakai-Nam Theun NBCA (where also camera-trapped, Plate 15; Tobias 1997, Duckworth 1998) and the central hills of Dong Ampham NBCA (Davidson *et al*. 1997, Schaller 1997). A skin was found on the Nakai Plateau (Evans *et al*. in prep. b) and photographs of a skin of an animal killed in Phou Khaokhoay NBCA in about 1995 were examined by JWKP. Several animals have been held captive in Ban Lak (20). The reliability of reports and sign identifications from other areas (Table 12) is low. Historically, Delacour (1940) considered the species only to inhabit the north and centre of the country; no specific locations are given either by Delacour or in Osgood (1932), but there are reports in Deuve and Deuve (1962c) from Champasak town and Phontiou (Khammouan Province) and the species seemed not uncommon in Xiangkhouang (David-Beaulieu 1944). Documented trade in Clouded Leopard parts involves skins, bones and teeth (Annex 1) and is probably similar to that reported for Tigers (see below). The trade in Clouded Leopard skins (e.g. at least 70 for sale on one day at Tachileik on the Myanmar - Thai border close to Lao PDR in 1998; Davidson 1999) and persecution of large carnivores in Lao PDR indicates that Clouded Leopard is clearly At Risk in Lao PDR.

• *Panthera pardus* **Leopard** (= Panther). *Conservation Significance:* At Risk in Lao PDR; CITES Appendix I. *Documented Range and Habitat:* North (provisionally[M16]; historically[M18]), centre[M13], south (Fernanado in prep.). Probably occurs in many habitat-types; recent records come from extensive unencroached hill evergreen forest and from degraded lowland deciduous forest. *Status Information:* Reported in 82% of 1988-1993 village interviews (*n* = 328), distributed throughout (Annex 5). The only recent sight records come from Nakai-Nam Theun NBCA (Duckworth 1998). A pelt of a recently killed animal seen in early 1998 approximately 10 km from Muang Phouvong, close to Nam Ghong Provincial PA, was reportedly killed in scrubby mixed deciduous forest (Fernando in prep. RJTiz; Plate 15). The identification of this species by local reports and signs is difficult and some claims from the region are over-confident (Duckworth and Hedges 1998a). Nonetheless, footprints perhaps of Leopards, or suggestive local reports, have been found widely (Table 12). Historically, Leopard was distributed throughout. It was scarce in Xiangkhouang but common in Savannakhet Province in the 1930s-1940s (Delacour 1940, David-Beaulieu 1944, 1949-1950). Skins are traded both domestically and with Thailand (Srikosamatara *et al*. 1992, Baird 1993, Salter 1993a, Srikosamatara and Suteethorn 1994), and other parts are probably traded as with Tigers, including for use as medicines (Baird 1995b). The trade in big cat skins and the low density of signs even possibly attributable to this species show that Leopard is clearly At Risk in Lao PDR.

• *Panthera tigris* **Tiger**. *Conservation Significance:* Globally Threatened - Endangered; At Risk in Lao PDR; CITES Appendix I. *Documented Range and Habitat:* North (Davidson 1998), centre[M13], south[M8]; recent records and reports mapped in Duckworth and Hedges (1998a) and Rabinowtz (1999). Many habitats, from plains to mountains. *Status Information:* Reported during 87% of 1988-1993 village interviews (*n* = 328) spread across Lao PDR (Annex 5). Although historically Tiger was common throughout (Delacour 1940) the Lao range is fragmented and the species is declining steeply (Duckworth and Hedges 1998a). Recent sight records and a camera-trap photograph (Plate 15) come only from Nakai-Nam Theun NBCA (Duckworth 1998, Robichaud 1999) but signs too large for other cats have been found widely across Lao PDR. Tigers still occur throughout forested (and some degraded) areas of Lao PDR (Table 12), but at low densities. Particularly important areas include: (1) a large area centred on the Nam Theun basin (including the Nakai-Nam Theun, Nam Kading, Hin Namno and Khammouan Limestone NBCAs and the Nakai Plateau), (2) much of the remaining habitat in the Xe Kong basin and the slopes of the Bolaven Plateau (including Xe Pian, Dong Hua Sao and Dong Ampham NBCAs, Xe Khampho PNBCA and Nam Ghong Provincial PA), (3) the contiguous Phou Louey and Nam Et NBCAs, (4) Nam Phoun NBCA and probably (5) Nam Kan PNBCA (Duckworth and Hedges 1998a). The first two areas could support large Tiger populations if persecution issues are addressed, and their potential contribution to global Tiger conservation cannot be overstated. Occasional Tigers still appear outside remote areas, e.g. one shot at Phou Khoun on the Louangphabang / Vientiane Province border in December 1998, reportedly while raiding cattle (S. Dangers verbally 1998; Plates 4, 15). Historical information is thin, perhaps because the species was so widespread. It was common in Savannakhet Province in the 1940s, but seemed scarce in Xiangkhouang Province (David-Beaulieu 1944, 1949-1950). Tigers are the most frequently reported livestock predator in rural Lao PDR (Table 2), taking mainly buffaloes and cattle, and occasionally pigs. The proportion of reports truly referring to Tigers is unclear. Despite their legally protected status, Tigers are shot, snared, poisoned, lured to carcases baited with explosives or walk-in traps and persecuted by other means. Indirectly, the greatly reduced densities of wild ungulates mean that numbers can only be low (see Karanth and Stith 1999). It is notable that one of few survey areas assessed as having relatively healthy Sambar populations (the contiguous Nam Et and Phou Louey NBCAs) is also assessed as one of the most important for Tigers (Davidson 1998). Various parts (nose, skins, bones, teeth, claws and others) are sold as amulets, for medicines and as curios, and are traded both domestically and with Thailand,

China and Vietnam (Martin 1992, Srikosamatara *et al*. 1992, Baird 1993, Salter 1993a, Mills and Jackson 1994, Baird 1995b, Mainka 1997, Nash 1997). Three main causes (international trade; low prey densities; and killing over livestock conflict) make the species clearly and gravely At Risk in Lao PDR.

Conservation Management and Research Proposed for Cats:

- Formulation of a national Tiger conservation action and management plan by the central government, involving full participation of provincial / district authorities, protected area staff and local people's representatives (see Duckworth and Hedges 1998a).
- As measures are needed in so many different fields and a considerable amount of work is needed both to gather information and to formulate appropriate directed action, the designation of specific personnel in CPAWM to be responsible for cat conservation issues seems appropriate. These people (perhaps two, with the part-time assistance of a foreign adviser) would develop the national Tiger action and management plan and ensure that its recommendations were enacted to schedule and involving all appropriate people.
- Complete protection of big cats (Tiger, Leopard and Clouded Leopard) from hunting and trade. Development of hunting and trade controls for all other cat species (except feral domestic cat).
- Conservation of very large areas of habitat (blocks of at least 1000-2000 sq. km) in which no domestic ungulates are grazed. Key NBCAs for Tigers and presumably for other cat species include Nakai-Nam Theun, Phou Louey, Nam Et, Xe Pian and Dong Ampham.
- Protection to allow recovery of wild ungulate populations within conservation areas, starting with those where big cat predation on livestock is a chronic problem.
- Focus by protected area staff in key areas on cat-related issues, especially anti-poaching activities including intensive patrolling for, and destruction of, snares and other cat traps; building of local intelligence networks regarding poaching activities; and monitoring of Tiger and other cat populations.
- Development of a specified policy, perhaps including a compensation system, for cases of livestock depredation, focussing on rapid action by government on notification of such cases.
- Awareness programmes within Lao PDR to reduce use of wild cat products in medicine.
- Investigation of domestic and international trade in other cat species (particularly Leopard, Clouded Leopard, Marbled Cat and Asian Golden Cat).
- Investigation of local medicine production techniques and areas and people involved (believed to be largely in rural homesteads and thus difficult to control) to allow formulation of measures to cut production.
- Further surveys on the distribution, status and habitat use of small and medium-sized cats in Lao PDR. The national status of Jungle Cat may be critical, and the habitat use and status of Fishing Cat are particularly unclear. Except with Leopard Cat, sightings of live or freshly-killed cats are rare, and signs and village information are not demonstrably or reliably separable to species; thus alternative survey techniques, notably camera-trapping, merit consideration. Establishment of guidelines for identifying cat signs to species, and understanding of where this is not possible, using measurements taken from animals of all species, of a wide variety of age and sex, in Lao PDR. Pending further information, key areas for cat species other than Tiger cannot be identified.

Delphinidae: Marine dolphins (1 species in Lao PDR; 32 worldwide)

• *Orcaella brevirostris* **Irrawaddy Dolphin** (= Snubfin Dolphin). *Conservation Significance:* Data Deficient (Global); At Risk in Lao PDR; CITES Appendix II. *Documented Range and Habitat:* South (Baird and Mounsouphom 1997, where mapped). Major rivers, usually in association with deep pools. *Status Information:* Occurs in two areas in Lao PDR: (1) the Mekong River from Cambodia upstream to the Khonphapheng Falls, and (2) the Xe Kong river and the lower reaches of its major tributaries the Xe Pian, Xe Khampho, Xe Kaman (and its affluent the Houay Twai) and (marginally) the Xe Namnoy and (through connexion in Cambodian territory) the Houay Kaliang. Contrary to earlier claims, the Xe Xou seems unlikely to be used (Baird and Mounsouphom 1994, 1997, Baird 1995a, Cunningham 1998). The populations in the Mekong and Xe Kong were formerly contiguous through river connexions within Cambodia. Cheminaud (1939) believed that dolphins did not pass upstream of the Khonphapheng Falls but a group reportedly visited the area just upstream for a month in the 1960s (Baird and Mounsouphom 1994). Villagers reported that dolphins were once very common residents in the lower 200 km of the Xe Kong basin in Lao PDR (including the Houay Kaliang), but since the late 1980s, they have occurred only during the high-water season. They used to ascend the Xe Kong as far as Ban Kaleum (Xekong Province) and even a little beyond (Baird and Mounsouphom 1997). Vietnamese soldiers reportedly shot many in the Xe Kong basin during the 1970s - 1980s, and decline has been so marked that Baird and Mounsouphom (1994, 1997) did not observe the species directly in the basin. Villagers reported to Robichaud (1998e) seeing 4-5 in the Xe Kong near Ban Sompoy (Xe Pian NBCA) in October 1997. The last animal recorded in the Xe Kaman died in the late 1980s (Baird and Mounsouphom 1997), although Robichaud (1998e) received a second-hand report of one in the lower reaches in late 1997. Fewer than 10 were estimated

to remain in the Lao Mekong in 1997 (Cunningham 1998, Baird in prep.), down from approximately 30 in 1993 (Baird and Mounsouphom 1994). Dolphins are not hunted or eaten by villagers of local origin (belief that they are reincarnated people is widespread), but they are sometimes shot by non-local people. In the southern Mekong, at least 18 dolphins died in 33 months in 1990-1993, and seven in 27 months in 1994-1996, through both entanglement in large-mesh gill-nets (Plate 6) and the effects of explosives fishing (Baird and Mounsouphom 1994, 1997). These levels indicate imminent national extinction. An overall decline in fish stocks, the dolphins' main food, is estimated by local fishermen as 20-25% per year. Various large scale hydropower projects in the Mekong and Xe Kong basins are unlikely to have positive effects (Baird and Mounsouphom 1994). Trade seems to be minimal (Baird and Mounsouphom 1994). Although dolphin bones and oil are used in traditional medicine, animals are apparently not killed specifically for this purpose (Baird 1995b). The species is clearly At Risk in Lao PDR.

Conservation Management and Research Proposed for Irrawaddy Dolphin:

- Limiting accidental capture of dolphins in fishing nets.
- Cessation of explosives fishing.
- Encouragement of sustainable fishing practices with, after an appropriate lead-in period, enforceable regulation of activity.
- Monitoring and regulation of boat traffic.
- Establishment of stretches of river, including the deep-water pools often used by dolphins, as dolphin protection zones, in which no harvesting of any species occurs.
- These measures are discussed in Baird and Mounsouphom (1994, 1997) and Baird (in prep.), stressing the need for community-led action. Measures should focus on the Mekong rather than the Xe Kong basin, as dolphins are now only irregular visitors to the latter. Close Cooperation with Cambodian authorities, ideally in the implementation of similar measures over the same time-scale, is essential for the Mekong population, which is shared with Cambodia. For a non-forest species, specific awareness-raising activities among policy-makers have a special role and should be maintained.

Elephantidae: Elephants (1 species in Lao PDR; 2 worldwide)

• *Elephas maximus* **Asian Elephant** (= Asiatic Elephant[M2]; = Indian Elephant[M1, M4]). *Conservation Significance:* Globally Threatened - Endangered; At Risk in Lao PDR; CITES Appendix I. *Documented Range and Habitat:* North[M9], centre[M8], south[M8]; recent records and reports mapped in Duckworth and Hedges (1998a). Many habitats, up to at least 1200 m. *Status Information:* Reported during 60% (*n* = 328) of 1988-1993 village interviews. Elephants remain widely distributed in forested, often hilly, areas (Table 12). They seem to be absent from patches of the country, including much of the north, much of the flat and densely populated Mekong Plain from Vientiane to southern Savannakhet Province, and most of the Bolaven Plateau. Recent reports from Nakai-Nam Theun NBCA indicate local extirpation from forests along a band about 20 km wide along the international border. It is not known how widespread this phenomenon is. The two largest and/or most viable populations known in Lao PDR are those in (i) Xaignabouli Province (west of the Mekong, including Nam Phoun NBCA); and (ii) centred on the Nakai Plateau, in Nakai-Nam Theun NBCA, the Nam Theun Corridor PNBCA, fringes of the Khammouan Limestone NBCA and adjacent unprotected parts of the Nam Theun catchment. Other populations potentially valuable for conservation include those in: (1) outlying parts of Vientiane Province/Municipality, including Phou Phanang and Phou Khaokhoay NBCAs; (2) Phou Xang He NBCA; (3) Dong Khanthung PNBCA; and (4) a large swathe of the south including Xe Pian NBCA, Nam Ghong Provincial PA, Phou Kathong PNBCA and probably Xe Sap NBCA (Duckworth and Hedges 1998a). Populations within or adjacent to other NBCAs (e.g. Xe Bang-Nouan and Phou Xiang Thong) are smaller and fragmented. Only in the Nam Theun basin and at Nam Phoun NBCA is there any understanding of seasonal movements (Boonratana 1997, 1998b, Tobias 1997, Steinmetz 1998b); elsewhere numbers, ranges, and crucial habitat linkages are unclear. No estimate can be made of the national population but it is certainly much larger than the 200-500 animals given in Lair (1997). The historical status of elephant is unclear, but it seems to have been generally distributed. Neese (1975) discussed status in the south in the 1960s-1970s. The species was not rare in Savannakhet Province in the 1940s (David-Beaulieu 1949-1950), was unknown in Xiangkhouang Province in the 1930s (David-Beaulieu 1944) and inhabited the Bolaven Plateau in the 1920s (Engelbach 1932). Serious threats to individual populations include fragmentation of herd seasonal ranges (notably by large hydropower projects and infrastructural developments) and poaching for ivory; the Nakai Plateau population is particularly at risk from both. Local people stated in 1997 that they had recently ceased capturing elephants in Xe Pian NBCA, as numbers were so reduced and furthermore they were dissuaded by the area's status as an NBCA coupled with conservation messages and legal penalties. Hunting may still be taking place by professional Cambodian poachers, however (Steinmetz in prep.). Elephants occasionally damage crops (Table 2), but this is a serious chronic problem in only a few areas e.g. Sangthong District. The motivation for some recent elephant killings in Lao PDR is unknown, e.g. two killed in Phou Khaokhoay NBCA in 1998 in separate incidents (JWKP). Wild elephants were captured until recently for use as work animals, primarily in Xaignabouli and Champasak Provinces (Gullmark

1986, Dobias 1992a, Salter 1989b), but this has nearly or entirely ceased as awareness is now high that it is outlawed (KK). The national captive population was estimated at 1300 animals in 1988 (Venevongphet 1988) and 135 were found to live in one district alone of Xaignabouli Province in 1997 (Boonratana 1997). Elephants have had strong national cultural significance for centuries. A small ivory carving industry in Lao PDR supplies amulets, rings and other small carved objects to major urban areas (Martin 1992, Salter 1993a). Minority tribes in Salavan and Attapu Provinces wear large ivory discs in their ear-lobes (KK). Elephant skin, tusks and other parts are used in medicine and can be purchased in Vientiane (Martin 1992, Baird 1995b) and molar teeth are sold as curios (Salter 1993a). Urine is collected from domestic elephants in Ban Phathoumphone (Champasak Province) and boiled for ingestion to treat diabetes (Baird 1995b). Lao PDR has probably the most important national population for conservation in Indochina (Duckworth and Hedges 1998a), with viable numbers in several areas, but elephants are At Risk in Lao PDR in the medium term. (Plate 7)

Conservation Management and Research Proposed for Asian Elephant:

- Formulation of a national elephant conservation action and management plan by central government, involving full participation of provincial / district authorities, protected area staff and local people's representatives. This structured approach is under discussion already.
- Realistic prioritisation of areas, accepting that elephant populations in some may no longer be viable. Technical, financial and human resources are best concentrated where long-term gains are possible.
- Focus on elephant-related issues in the management plans and activities of key conservation areas: those with the largest and/or most viable populations (listed above).
- Establishment of managed elephant ranges (habitat management areas linking NBCAs and/or incorporating seasonal habitats of all major elephant populations, including those shared with neighbouring countries).
- Incorporation of appropriate measures to minimise elephant depredation in agricultural and forestry development schemes in areas of wild elephant populations.
- Establishment of a trial site for conflict-resolution concerning crop-raiding elephants (Phou Phanang NBCA / Sangthong District might be a suitable area).
- Development of effective anti-poaching measures (recognising the international dimension of the problem) and enforcement of existing legal restrictions on the sale of ivory and other elephant products.
- Co-operation with military personnel in areas retaining elephant populations; these groups have more disciplinary power than do provincial government field staff. Awareness programmes to reduce elephant poaching are also needed among the soldiers themselves (see e.g. Boonratana 1997).
- Investigation of captive animals in Lao PDR to update Venevongphet (1988): their number and distribution, and when and where they were captured. Lair (1997) gave further details of the work needed.
- Active management of small populations may be appropriate if protection is possible and the sex ratio is highly skewed. Sexual imbalance decreases population viability, and may cause local extinction. Villagers in Xaignabouli Province habitually breed captive elephants with wild individuals and techniques could be transferred elsewhere if necessary.
- Establishment of elephant population monitoring programmes in key areas (e.g. the Nam Theun catchment).
- Investigation of trade in ivory and other parts, particularly source, routes and destinations, and the possibilities for use of substitute materials.
- Explicit legal provision for the disposal of ivory trimmed from captive elephants.
- Surveys of areas representing gaps in recent knowledge where there seems some positive reason to believe that a population both large (over 20) and potentially conservable may occur.
- Intensive surveys of annual range and movements of elephants in areas under large land-use or infrastructural development plans, to allow effective mitigation activities designed to minimise elephant population declines and agricultural-elephant conflict. Such work is particularly important in the Nam Theun catchment, where a suite of proposed and on-going developments are likely to displace elephants from traditional ranges.
- In-depth training of selected Lao personnel in elephant survey and management techniques.
- The background to these (and more minor) recommendations is given in Duckworth and Hedges (1998a).

Tapiridae: Tapirs (0-1 species in Lao PDR; 4 worldwide)

[• *Tapirus indicus* **Asian Tapir** (= Malayan Tapir[M4, M5, M7])].
Conservation Significance: Globally Threatened - Vulnerable; Conditionally At Risk in Lao PDR; CITES Appendix I.
Context: Cheminaud (1939) observed a dead male tapir brought into Champasak town (= Bassac) market by local hunters in 1902. The beast was cut up and sold for meat, of which Cheminaud bought a piece after examining the animal at leisure. The size, general appearance and taste of the animal are all described and there seems no doubt of the identity. He also claimed twice to have found signs of the animal in Lao PDR, at unspecified localities. He considered that the species, although formerly common in the Mekong valley, had begun to disappear from Lao PDR by the end of the nineteenth century. Deuve (1961b) cited Cheminaud (1942; untraced, but the title suggests it was a later edition of the 1939 work) as recording the species in Attapu and near Ban

Houayxai (Bokeo Province). Fraisse (1955) was very doubtful that tapirs inhabited Indochina, despite being aware of Cheminaud's market observation; he gave no reasons for rejecting the latter. He also discussed some (rather unconvincing) local reports from Kon Tum Province, Vietnam, which Deuve (1961b) mistakenly cited as referring to Attapu, although Attapu was mentioned by Fraisse merely because some Kon Tum residents had learnt the Lao language through trade with merchants from Attapu. Deuve (1972) repeated the claim of occurrence in Attapu Province, but considered that no tapirs had been caught or killed since at least 1950. Monestrol (1952) was clearly sceptical of the species's presence in Indochina. Deuve (1961b) considered, on the basis of recent work in Khammouan, Savannakhet and Champasak Provinces, that the animal might already be extinct in Lao PDR. Tapirs were not recognised (from monochrome drawings) or indicated as ever having been present during any 1988-1993 village interviews (n = 138 interviews in which tapir was discussed). Of these areas, 62 were in or adjacent to areas reported by Deuve (1972) or Chazee (1990) to be inhabited by tapirs. Further investigation by KK in many areas across the country during 1994-1998 also failed to elicit any recognition of tapir. At least some interview respondents who appear to recognise a picture of a tapir are referring to Hog Badger (WGR). If it occurs, Asian Tapir would be very vulnerable to hunting, so it is classed as Conditionally At Risk in Lao PDR.

Conservation Management and Research Proposed for Asian Tapir:

- Confirmation or refutation of occurrence in Lao PDR. The recent failure to locate any local people knowing the animal, or to find any signs during field survey, suggests that the chances of finding the species are minimal. Thus, specific action has a low likelihood of producing positive results and would divert resources from higher conservation priorities. Pending information about the current presence of tapir, work should be confined to including it in interviews and being alert for possible field signs.
- Careful consideration during any further interviews of the danger of Hog Badger / tapir confusion.

Rhinocerotidae: Rhinoceroses (2 species in Lao PDR; 5 worldwide)

• *Rhinoceros sondaicus* **Lesser One-horned Rhinoceros** (= Javan Rhinoceros[M4, M5, M7]; = Smaller One-horned Rhinoceros[M1]). *Conservation Significance:* Globally Threatened - Critical; Conditionally At Risk in Lao PDR; CITES Appendix I. Among the rarest large mammals in the world, now known only from one site each in Java and southern Vietnam (Foose and van Strien 1997). *Documented Range and Habitat:* Possibly extinct in Lao PDR; probably formerly occurred across the country (Rookmaaker 1980). Former habitat use unclear; post 1940s records of rhinos (below) were associated with isolated, heavily forested, mountainous areas (Deuve 1972) or well-watered lowlands in the vicinity of hills (Neese 1975). *Status Information:* The only documented Lao record of this species may be a sketch of an animal killed east of Louangphabang (Mouhot 1864). High levels of field work since 1991 (including many of the areas with post-1940 rhino claims), found no rhinoceros tracks or signs. The circumstantial information accumulated is considered below.

• *Dicerorhinus sumatrensis* (= *Didermocerus sumatrensis*[M1]) **Asian Two-horned Rhinoceros** (= Sumatran Rhinoceros[M4, M5, M7]; = Asiatic Two-horned Rhinoceros[M1]). *Conservation Significance:* Globally Threatened - Critical; Conditionally At Risk in Lao PDR; CITES Appendix I. *Documented Range and Habitat:* Possibly extinct; formerly at least north (David-Beaulieu 1944). Former habitat use unclear, but remains were observed in villages in hills and mountains. *Status Information:* Delacour (1940) observed a 'beautiful double horn' at Ban Nonghet (Xiangkhouang Province), but gave no details; his statement that the species could be extinct in Indochina suggests that the specimen was not recent. He suspected that the species had occurred in Indochina mainly in the north. Monestrol (1952) reported a head skin retaining both horns, reportedly from Lao PDR, but gave no details. Rookmaaker (1980) reviewed information possibly pertaining to this species in Indochina, but overlooked the most conclusive evidence of its presence: David-Beaulieu (1944) found in local keeping an unspecified number of remains of two-horned rhinoceroses in Xiangkhouang Province in five years' residence. The species was by then evidently very rare as he knew of none being killed during the period. Deuve (1972) stated that local hunters reported the species to survive in isolated areas of the Annamites. Rookmaaker (1980) felt that the lack of evidence of the species from Indochina argued against its existence. The discovery of several new species of ungulate in recent years in the Annamites, however, suggests that the lack of historical evidence of this rhinoceros in Lao PDR means little, especially as it may well have inhabited hills and mountains (see Groves 1967), which were the least explored areas of Indochina.

Status Information on Rhinoceroses: After 1940, rhinos disappeared from much of their Lao range (Deuve 1972). Locality records since then (all assigned by Deuve 1972 to Lesser One-horned Rhinoceros) come from the Nam Tha Plain (Area A on map in Annex 5, 1961), the Nam Phoun (B, 1957), south of Ban Nonghet (C, 1940-1959), upper Nam Mouan and drainages on the right bank of the Nam Kading (D, 1945-1961), Kengkabao (E, 1954), and the wild area between the Nam Mo and the Nam Kading (C-D). Neese (1975) received reports, again suggesting Lesser One-horned

Table 15. Summary of observations of rhinoceros products, 1988-1993.[1]

Vientiane 1988-1993 Whole horns and pieces displayed by a number of jewellery shops. No comprehensive inventory was made, but up to 10 horns and 75-100 small pieces were observed in shops in the central market on a given day. The eventual destination of the larger horns is believed to be Chinese pharmacies in Bangkok (Martin 1992). Of eight horns examined in 1990 four were considered to be from Asian Two-horned Rhinoceros, two were possibly from Lesser One-horned Rhinoceros, and two were unidentifiable (Martin 1992).
Louangphabang 1989 Three to five horns observed in market (Chazee 1990).
Pakxe 1989 Three small pieces of horn in jewellery shops.
Savannakhet 1990, 1993 Advised by three jewellery shop owners in 1990 that old rhino horn offered for sale by villagers is purchased by them for resale to buyers from Thailand. Estimated 13 horns purchased and resold by two shops in 1989. Origin Kengkok in south of Savannakhet Province. One horn ~5 cm diameter and two small pieces in silver bases seen in 1993 (RJTim own data).
Xam-Nua 1991 One old horn in shop in central market, purchased from villager resident near Vietnamese border. Stall owner estimated ~10 horns sold in recent past, largest 0.5 kg. Destination Thailand.
Thakhek 1991 One piece of horn in jewellery shop, set in silver base.
Attapu 1992 One old piece of horn in jewellery shop, origin reportedly Attapu.
Salavan 1992 Two pieces of horn and one small piece of skin in jewellery shop, bought from villagers resident in Vietnamese border area.

Some 'rhinoceros horn' for sale is fake, and although the best effort was made to restrict data in this table to genuine horn, it is possible that some data refer to fake horn. Additionally, in most cases it was not possible to age the horn, and the balance between old and fresh horn is unknown.

[1]all information is from Salter (1993a) unless otherwise specified. Very little specific checking for this product has been carried out since.

Rhinoceros, from areas now in Dong Hua Sao and Xe Sap NBCAs, the northern part of Nam Ghong Provincial PA, and from a scatter of other areas across south Lao PDR. He considered that rhinos survived at low density. These records and other historical information were reviewed by Rookmaaker (1980: 254), whose cautions about identifying South-east Asian rhinos to species attach some doubt to the identifications of past Lao reports. Past workers assigned the Lao name *Het* to *Rhinoceros*, and *Sou* to *Dicerorhinus*, names which accord with those in Thai for the two, *Raed* and *Krasou* respectively (J. Baker verbally 1999). Recent investigation by KK found, however, that villagers from Nam Phoun, Nakai-Nam Theun and Dong Ampham NBCAs (i.e. spanning the country) all stated that *Het* refers to a male, and *Sou* to a female, rhinoceros. Past usage, and any regional variations in it, can probably never be elucidated. The predominance of past Lao rhinoceros records to '*Het*' may well indicate that Lesser One-horned Rhinoceros was more common than was Asian Two-horned. The frequency of reports of one-horned animals cannot be taken alone to suggest Lesser One-horned; the second horn of Asian Two-horned Rhino is sometimes barely visible, thus suggesting a one-horned animal (Rookmaaker 1980).

Circumstantial evidence for the survival of rhinoceroses in Lao PDR into the late 1980s comes from several villagers' reports, and from observations on trade in horns and other parts (Table 15). Post-1940 and recent records are grouped along the central Annamites (areas C-D, 3-5), incorporating the Nam Xam, Nam Chouan (proposed), Nam Kading, Nakai-Nam Theun and Khammouan Limestone NBCAs, and this region is perhaps the most likely in Lao PDR to support living rhinoceroses. Reports also came from the Lao/Thai border in Xaignabouli Province, Phou Khaokhoay NBCA, the far south, and other areas as listed in Duckworth and Hedges (1998a). Fieldwork during 1992-1998 found no field evidence of rhinos, and further interviews in these and other areas have traced no detailed first-hand description of a recent incident. Robichaud (1998d), who received 1998 assurances that rhinos persisted near Nam Chouan PNBCA but could get no detail, speculated that it may be difficult to get details as some ethnic groups have taboos against speaking about rhinos. Neese (1975) also discussed this issue. The strongest recent evidence is from remote parts of the Nam Theun catchment, where it appears that a rhinoceros was shot around 1990; at least one small piece of skin from the animal was stated to be retained by a villager (reported, independently, to RJTim in 1994 and to J. Baker in 1998). According to villagers, rhinos disappeared from most of south Lao PDR during the 1940s to 1960s. They also seem to have disappeared from the north; no rhinos were reported in 17 village interviews conducted in 1991 in the Louang-Namtha region indicated by Deuve (1972) as supporting them into the 1960s, although one

recent interview claimed the presence of rhinos in the area in the 1950s. Even in the areas with recent local reports, most respondents made clear that these were isolated events.

Rhinoceroses have long been hunted in Lao PDR, as the horn and other parts are used in traditional medicine (Deuve 1972, Baird 1995b). The main destination of rhinoceros products appears to be Bangkok, where during the 1960s and 1970s traders purchased large quantities of horn originating in Lao PDR (Martin 1992). Horns, and less frequently toenails, blood and skin, were marketed openly in Vientiane and provincial centres into the 1990s (Martin 1992, Salter 1993a); there is little recent information. The main agents are jewellers, probably because they can afford the stock brought in by villagers (Martin 1992). The main use is believed to be medicinal, although some small pieces are polished and set in silver bases for display. Many small pieces are obvious fakes made from bone, buffalo horn or wood. Much horn observed (see below) was clearly antique but some may have come from recently killed animals (Martin 1992).

Both species, if present in Lao PDR, are clearly on the verge of extinction and so are classed as Conditionally At Risk in Lao PDR.

Conservation Management and Research Proposed for Rhinoceroses:

- Specific searches for rhinos in Nam Chouan PNBCA, from which there are several plausible reports of recent presence. On general bird and mammal grounds, Nam Chouan PNBCA is a high priority for survey as it is likely to support a very important community. Work for rhinos should therefore be in the context of a general wildlife and habitat survey of the area.
- These two rhinoceroses are among the world's most endangered mammal species. Any populations confirmed to persist in Lao PDR would be of the highest global and national conservation priority, but the chances of finding either species are low. Thus, survey action away from Nam Chouan PNBCA should largely be confined to including the species in interviews and remaining alert for field signs, particularly in the area of Nakai-Nam Theun NBCA and Nam Theun Extension PNBCA (see also tapir).
- Immediate field follow-up of any suggestive interview results, signs found during general wildlife surveys, or other indications of presence.
- Development of effective protective measures for any remaining wild populations, guided by the discussion in Foose and van Strien (1997). *Ex-situ* activity, perhaps as fenced, guarded enclosures within natural habitat might be advisable. True *in situ* conservation (management of populations within their natural range and habitat) would be extremely challenging, given the lure of the species to poachers.
- Resolution of the legal protection status of species of rhinoceros in Lao PDR and control of the domestic use and marketing of all rhinoceros products.
- Educational campaigns across the country concerning the conservation impacts of medicinal use of rhinoceros horn and other body parts are needed in Lao PDR, for the global conservation of the species, even if no rhinoceroses remain in Lao PDR.

Suidae: Pigs (2 species in Lao PDR; 16 worldwide)

• *Sus scrofa* **Eurasian Wild Pig** (= Wild Boar[M4, M5]; = Common Wild Pig[M2]; = Indian Wild Boar[M1]). *Conservation Significance:* Little Known in Lao PDR. *Documented Range and Habitat:* Range unclear; past records need re-evaluation. Wild pigs (species unclear) occur in many habitats, from cultivation to wet forests, surviving well in degraded areas. *Status Information:* The many previous pig records from Lao PDR given as *S. scrofa* should not be assumed to relate to that species, now that *S. bucculentus* has been found in Lao PDR. The latter is known only from bones, meaning that pig sign and sight records from across Lao PDR (Table 12) are best considered as of 'unidentified pig sp.'. Historical specimens of '*S. scrofa*' merit re-examination. Pigs (species unclear) are widespread and common in Lao PDR, but pending clear guidelines on distinguishing the two species, *S. scrofa* can only be considered Little Known in Lao PDR. *Taxonomic issues:* The effects, if any, of interbreeding with domestic pigs on the genetic purity of wild pigs in Lao PDR are unknown. The whole *Sus scrofa* complex needs taxonomic revision; it is unlikely that only one species is involved (C. P. Groves *in litt.* 1999).

• *Sus bucculentus* **Heude's Pig** (= Indochinese Warty Pig; = Vietnam Warty Pig[M7]); (?included in *S. verrucosus* Javan Pig[M5]). *Conservation Significance:* Extinct (classification assigned before the 1995 rediscovery); Little Known in Lao PDR. Probably endemic to Lao PDR and Vietnam (Groves *et al*. 1997, RJTim). *Documented Range and Habitat:* North (Groves *et al*. 1997). Habitat use unclear. *Status Information:* A partial skull was collected from hunters along the Nam Gnouang (Nam Theun Extension PNBCA) in January 1995 (Groves *et al*. 1997). Village reports suggest that two types of pig, one of which may be this species, co-occur widely in the Annamites from Xiangkhouang Province south to Xe Sap NBCA (Table 12; Schaller and Robichaud 1996) and perhaps in Nam Et / Phou Louey NBCAs (Davidson 1998). Interpreting these reports and the field identification of pigs are both hampered by the lack of understanding of interspecific differences in signs and external appearance. Although villagers consistently describe the 'second' pig in Lao PDR as yellow or red, to use this as a diagnostic feature of *S. bucculentus* would be rash as "overall coat-colour in adult [*Sus*] is not species characteristic" and furthermore the

race of *S. scrofa* in Lao PDR, *S. s. moupinensis*, has brindled yellow body hairs (Groves 1981). Pig livers and other parts are used in traditional medicine (Baird 1995b), but this use seems unlikely to represent a significant threat. *Taxonomic issues:* The species was described from two skulls procured prior to 1892, reportedly from the Dong Nai river, Cochinchina (Heude 1892). The form was then largely forgotten until the 1980s (Groves *et al*. 1997).

Status Information on Pigs: Wild pigs (species unknown) were reported during 99.7% of 1988-1993 village interviews (*n* = 328), are clearly common and widespread, are often eaten in rural areas (Table 1) and are the most frequently reported crop pest (Table 2). Their meat is widely available in markets and urban restaurants, and some is smuggled to markets in Thailand (Srikosamatara *et al*. 1992, Salter 1993a, Baird 1993). Pig tusks are valued as talismans, curios and for medicinal use, and are sold in all major markets (Baird 1993, Salter 1993a). Many pigs hunted in Lao PDR are shot at night or snared; this has important implications for the options of differential legal protection of the two species, as with these methods hunters cannot select between the species prior to death.

Conservation Management and Research Proposed for Pigs:

- Clarification of the status of both pig species and their geographical and ecological distributions, to allow assessment of conservation measures needed.
- Pending this, collection of detailed notes on appearance of animals (supported whenever possible with photographs and tissue samples) seen on field surveys or in markets to allow possible retrospective identification.
- Interim cessation of pig hunting in Nam Theun Extension PNBCA, as the only region in the world known to support *Sus bucculentus*.
- Cessation of pig hunting in further areas found to support *S. bucculentus*, unless the species is found to be widespread and of low conservation concern.
- Development of a response programme for crop damage by pigs in areas in and adjacent to those where pig hunting is banned.

Tragulidae: Chevrotains (1-2 species in Lao PDR; 4 worldwide)

Tragulus javanicus **Lesser Oriental Chevrotain** (= Lesser Mousedeer[M2, M3]; = Lesser Malay Mousedeer[M5]; = Lesser Malay Chevrotain[M1, M4]). North[M8], centre[M8], south[M8]. Forests, probably mainly evergreen, and adjacent degraded areas. Many records, including field sightings, may have been distinguished from *T. napu* solely on the basis of range; if the latter were found in Lao PDR, reassessment of this species's status would be needed. Reported during 82% of 1988-1993 village interviews (*n* = 328), from north-western through central and southern Lao PDR (Annex 5). Recent interviews suggest that chevrotains do not inhabit parts of north-east Lao PDR (Davidson 1998, Showler *et al*. 1998b). Many chevrotains are eaten in rural areas (Table 1) and some are sold in urban markets in Lao PDR and adjacent parts of Thailand (Srikosamatara *et al*. 1992, Baird 1993). Chevrotain 'antlers' are believed to be powerful aphrodisiacs and artificial trophies are sometimes offered for sale at high prices (WGR). As the 'fakes' are so obvious, however, it is difficult to believe that this could pose a threat to the species.

[*Tragulus napu* **Greater Oriental Chevrotain** (Greater Mousedeer[M2, M3]; = Greater Malay Mousedeer[M5]; = Larger Malay Chevrotain[M1]; = Greater Malay Chevrotain[M4])]. This species was recorded from Nhatrang, Vietnam (about 12ºN), by Thomas (1910). Neither Osgood (1932) nor Delacour (1940) listed any records for Indochina, but Thomas's record was maintained by Corbet and Hill (1992), who mapped the species for Cochinchina and southern Cambodia. The species may thus be found in adjacent Lao PDR, although according to Dang Huy Huynh (1994) it has not subsequently been recorded from any other province in Vietnam.

Moschidae: Musk deer (0-1 species in Lao PDR; 4 worldwide)

[• *Moschus berezovskii* **Chinese Forest Musk Deer** (= Forest Musk Deer[M7]); (included in *M. moschiferus* by some former authors)]. *Conservation Significance:* Globally Near-Threatened; Conditionally At Risk in Lao PDR; CITES Appendix II; endemic to central and southern China and adjacent Indochina (Corbet and Hill 1992). *Context:* Deuve (1961a, 1972) mentioned local reports from mountains east of the Nam Seng river (Louangphabang Province) and speculated that the species might inhabit Phongsali and Houaphan Provinces. *Moschus b. caobangis*, described from northern Vietnam, inhabits southern Yunnan (China) very close to Lao PDR (Dao Van Tien 1977, Groves *et al*. 1995) and it is likely that the species occurs, or formerly did so, in Lao PDR. Known altitude records for this species lie between 50 and 400 m (Groves *et al*. 1995). The high financial value of, and international trade in, musk deer products (Wemmer 1998) indicates that the species is Conditionally At Risk in Lao PDR.

Conservation Management and Research Proposed for Musk deer:

- Clarification as to whether the species occurs in Lao PDR, investigation of trade threats, and design of appropriate action if the species is found to occur.

Plate 16:

Banteng, Ujon Kulon National Park, Java. No photograph of a living animal in Lao PDR is available. The species is fast approaching national extinction. *S. Chape / IUCN.*

Saola, Ban Lak (20), Bolikhamxai Province, January 1996. This species was discovered in 1992, in Vietnam, and has since only otherwise been found in Lao PDR. None has survived long in captivity and further attempts to keep them are now actively discouraged. *W. G. Robichaud / WCS.*

Young Southern Serow, Hin Namno NBCA, February 1998. *P. Davidson / WCS.*

Sambar, Xe Pian NBCA, early 1997. Camera-trapped by night. Although this species remains common and widespread in some countries, hunting pressure in Lao PDR is so heavy that populations are much reduced and direct sightings are rare.
WWF Thailand / FOMACOP.

Eld's Deer footprint, Dong Khanthung PNBCA, July 1998. This fresh imprint was left by an animal from the last known population in Lao PDR, estimated to number fewer than 20 individuals. The race concerned, *Cervus eldii siamensis*, may be close to global extinction. *B. L. Stuart / WCS.*

Muntjac antlers, the recently-described Large-antlered (left) and the widespread Red. Nakai-Nam Theun NBCA, February 1994. *T. D. Evans / WCS.*

Red Muntjac, Nam Theun Extension PNBCA, August 1998. One of four species of muntjac known to occur in Lao PDR, this species is the only one widespread across tropical Asia. It is easily distinguished by its red-brown pelage including the upperside of the tail. *W. G. Robichaud / WCS and IUCN.*

Large-antlered Muntjac, Ban Lak (20), Bolikhamxai Province, March 1997. This species was first found in 1993 and is known only from Lao PDR, Cambodia and Vietnam. *W. G. Robichaud / WCS.*

Cervidae: Deer (7 species in Lao PDR; 43 worldwide)

• *Cervus eldii* (= *C. eldi*[M1, M2, M7]) **Eld's Deer** (= Brow-antlered Deer[M2]; = Thamin[M1, M4, M5]). *Conservation Significance:* Globally Threatened - Vulnerable; At Risk in Lao PDR; CITES Appendix I. *Documented Range and Habitat:* North (provisionally, historically, Deuve 1972), centre (historically, RJTim), south (Round 1998). Dry dipterocarp forests and other open plains habitats. *Status Information:* The only recent confirmation of Eld's Deer is from Dong Khanthung PNBCA, where it inhabits only one small area and is under intense threat (Round 1998; Plate 16). Evidence from elsewhere in Lao PDR is equivocal (Annex 5). Xe Pian NBCA and the plains immediately south and east of the Xe Kong are perhaps the most likely other areas to retain the species. Two sets of antlers in an Attapu shop in 1997 were obtained at least a decade previously (Davidson *et al*. 1997), and one of two sets displayed in Xe Kong town was reportedly over 50 years old (Showler *et al*. 1998a). A pair of antlers was observed in Phou Xang He NBCA by Boonratana (1998b), where the species was reported to have been common in the 1960s. None of the few other antlers observed on display (Annex 1) was reportedly of recent origin. Schaller (1997) found no interviewees in Attapu Province claiming knowledge of extant Eld's Deer. A specimen from the Nakai Plateau is held in the American Museum of Natural History (RJTim). Deuve (1961a, 1972) reported the species from five provinces: Salavan (valley of the Xe Kong), Champasak (Mekong plains, to the Cambodian border, where also recorded by Engelbach 1932), Savannakhet (Mekong plain and the road to Xe Pon), Khammouan (Ban Bok and Ban Phonsi) and Louang-Namtha; he traced no record from north Lao PDR after 1938. A rapid population decline was underway even by 1940 (Delacour 1940) and villagers in 1988-1993 reported wide disappearance from much of its Lao range between 1940 and 1980. This was clearly caused mainly by hunting, as extensive suitable habitat remains but is bereft of Eld's Deer. Antlers are sold along the Lao/Thai border (Srikosamatara *et al*. 1992, Srikosamatara and Suteethorn 1994). Many parts of the animal are used in traditional medicines (Baird 1995b). The Indochinese subspecies *C. e. siamensis* is listed as Data Deficient (Global) by IUCN (1996); however it is unquestionably globally endangered, perhaps critically so. Of all large mammals still known to occur in Lao PDR, this is probably the species closest to national extinction. *Taxonomic issues:* The known distribution of *C. e. thamin* suggests that it may have occurred in north-west Lao PDR (C. P. Groves *in litt*. 1999). It was reported for Ban Houayxai (Bokeo Province) by Deuve (1961a) and, provisionally, Louang-Namtha by Deuve (1972), but there are no confirmed records of the species from this part of Lao PDR, and no recent reports. This race is much less threatened, globally, than is *C. e. siamensis* (Wemmer 1998).

• *Cervus unicolor* **Sambar** (= Sambar Deer[M3]). *Conservation Significance:* Potentially At Risk in Lao PDR. *Documented Range and Habitat:* North[M9], centre[M8], south[M8]. Wooded areas, perhaps commonest in broken areas amid semi-evergreen forest, but also uses open deciduous forest and unbroken evergreen forest; to at least 1650 m (Nakai-Nam Theun NBCA; Tobias 1997). *Status Information:* Sambar was described as very common throughout the wooded parts of Lao PDR by Delacour (1940), but sightings on recent surveys are very rare, and while calls heard by night and signs indicate a wide distribution (Table 12), numbers are heavily depressed. Sambar has survived better in Lao PDR than have Eld's and Hog Deer. This reflects its wide altitudinal range and its use of denser forest where hunting is more difficult (although compared with e.g. muntjacs it is still best considered an animal of broken and more open forest types). Only in Nam Et/Phou Louey NBCAs did Sambar seem at least locally commoner than muntjacs (Davidson 1998). The Nakai Plateau and Nam Ghong Provincial PA also support relatively high densities (Steinmetz 1998b, Fernando in prep.). Many field signs in Table 12 were only identified as *Cervus* / *Axis* sp., but in most survey areas trophy antlers confirmed the presence of Sambar. The species was reported during 86% of 1988-1993 village interviews (n = 328) and was still widespread throughout, except in the most heavily settled areas (Annex 5). It is a common and preferred food in rural areas (Table 1), and an occasional crop pest (Table 2). Antlers are widely displayed as trophies and are used in traditional medicine (Martin 1992, Baird 1995b). Their market value means that, compared with muntjacs, a much higher proportion is sent to town; for example, only two sets of antlers were seen in houses in and around Dong Ampham NBCA as against 37 sets in Attapu town (Davidson *et al*. 1997). Many are sold openly in tourist centres such as Louangphabang (C. Poole verbally 1998). Fresh and dried meat is sold in urban markets (Annex 1) and exported to Thailand (Baird 1993), but it is imported from Cambodia to southern Lao PDR (Nash 1997). Many antlers are taken to Thailand for sale as trophies; dealers in Pakxe reportedly buy up antlers from southern Lao PDR and Cambodia for bulk shipments to Thailand, and a consignment in June 1993 reportedly weighed one ton (Baird 1993, La-Ong *et al*. 1997). Antlers are also traded through Phongsali to China (WGR). The species is clearly Potentially At Risk in Lao PDR until the issues of hunting are addressed. (Plate 16)

• *Axis porcinus* (= *Cervus porcinus*[M2, M4]) **Hog Deer**. *Conservation Significance:* Conditionally At Risk in Lao PDR; CITES Appendix I. The Indochinese subspecies *A. p. annamiticus* is listed as Data Deficient (Global). *Documented Range and Habitat:* Unclear. North and centre (provisionally, historically, Deuve 1972), south (historically, Robichaud 1998e). Marshy areas, open forest, great grassy glades; always near water, and moving into the hills from flooded

areas during the rainy season (Deuve 1972). *Status Information:* Villagers in 1988-1993 reported Hog Deer locally in south and central Lao PDR and from two locations in the north (Annex 5), primarily near watercourses and seasonally flooded wetlands. Descriptions of deer long extinct in Phou Khaokhoay NBCA suggest Hog Deer (JWKP). However, Schaller (1997) found no interviewees in Attapu Province claiming knowledge of extant Hog Deer and indeed there are no recent plausible reports from anywhere in Lao PDR (S. Sawathvong verbally 1999; KK). Hog Deer is now very rare or extinct in Lao PDR, as it is throughout Indochina (Wemmer 1998; Lic Vuthy verbally 1997). A set of antlers in a shop in Attapu in 1997 was at least a decade old (Davidson *et al*. 1997). Residents of Ban Sompoy (Xe Pian NBCA) retain an old Hog Deer antler (Robichaud 1998e). Although very few Indochinese Hog Deer are held in museums, Osgood (1932) specifically noted that it was reported as abundant in Indochina. Deuve (1961a, 1972) gave a distribution as: around Ban Houayxai (Bokeo Province); the east bank of the Mekong in southern Oudomxai Province east to Louangphabang; Houaphan Province; and north-west Savannakhet Province (Ban Xeno and Kengkabao). No basis for this is given. The species is clearly Conditionally At Risk in Lao PDR. *Taxonomic issues:* Some sources (e.g. IUCN 1996) implied that the nominate subspecies of Hog Deer occurs in Lao PDR, as well as *A. p. annamiticus*. There is no evidence that it does; Grubb and Gardner (1998) limit the range of *A. p. porcinus* to Myanmar and areas further west.

Muntiacus muntjak **Red Muntjac** (= Indian Muntjac[M4, M5]; = Common Barking Deer[M2]; = Muntjac[M1]). North, centre, south (Timmins *et al*. 1998). All types of forest over a wide altitudinal range. Muntjacs (not identified to species, but doubtless mostly of this species) were reported during all 1988-1993 village interviews (n = 328) and remain widespread and locally numerous. They are a common and preferred food in rural areas (Table 1), occasionally damaging crops (Table 2). Antlers are very commonly displayed in rural and urban areas (Plate 16), and meat is widely sold in urban markets and restaurants (Annex 1). As of 1998, antlers were still being sold by the basket-load in Vientiane markets. Skins also are sold, apparently as curios, and the feet are used in traditional medicine (Martin 1992). Some meat and antlers are exported to Thai markets (Srikosamatara *et al*. 1992, Baird 1993, La-Ong *et al*. 1997). The current status was reviewed, and known recent records mapped, in Timmins *et al*. (1998). *Taxonomic issues:* Two distinct subspecies-groups inhabit continental South-east Asia and southern China: a reddish-yellow one with forehead and legs coloured like the body, or at most rather greyer (Plate 16), and a bright reddish or orange one with dark forehead and legs. The first (including *M. m. curvostylis, M. m. menglalis* and *M. m. annamensis*) lives in Myanmar, Thailand, southern Yunnan (China), southern Vietnam and southern Lao PDR; the second (including *M. m. nigripes* and *M. m. yunnanensis*) lives in Hainan and the uplands of Yunnan north of 23º10' N (China), Chapa and Hoi Xuan in Vietnam, and Phongsali in Lao PDR (C. P. Groves *in litt*. 1999). A 1997 camera trap photograph from Nakai-Nam Theun NBCA (Robichaud 1997b, where not named to species) fits an animal of this latter group. The two groups are not regarded as separate species as they interbreed naturally. This makes identification to subspecies-group very difficult; a complete body description and, ideally, photographs are needed.

• *Muntiacus vuquangensis* (= *Megamuntiacus vuquangensis*) **Large-antlered Muntjac** (= Giant Muntjac). *Conservation Significance:* Recommended by Timmins *et al*. (1998) to be listed as Globally Threatened - Vulnerable; Potentially At Risk in Lao PDR; CITES Appendix I. Endemic to Lao PDR, Vietnam and north-east Cambodia; occurs only east of the Mekong (Timmins *et al*. 1998 and references therein). *Documented Range and Habitat:* North, centre, south (Timmins *et al*. 1998, including map of all records prior to 1997). Various forest types in hill and mountain areas. *Status Information:* Since the first record of the species (in Phou Xang He NBCA in 1993), considerable effort has been made to understand its distribution and status (Schaller and Vrba 1996, Timmins *et al*. 1998). It is known from 12 recent survey areas along the Annamites and in outlying foothills from the Nam Theun basin south to the Cambodian border (Table 12). It is clearly common in some areas. Most of the few field sightings remain unconfirmed, as pelage features are known from few animals and so variation is as yet unclear. However, one being killed by a pack of Dholes in Nam Theun Extension PNBCA was clearly of this species (Schaller 1995a), and single sightings on the Nakai Plateau and in Nakai-Nam Theun NBCA also probably were (Evans *et al*. in prep. b). Muntjac antlers are used in traditional medicine (Baird 1995b). The small range, likely narrower habitat use (than that of *M. muntjac*), and unknown tolerance of hunting all indicate that the species should be considered Potentially At Risk in Lao PDR. *Taxonomic issues:* No authorised translation of the type description of this species, originally in Vietnamese (Do Tuoc *et al*. 1994), is available. However, recent genetic analysis (Amato *et al*. in press b) suggests that Large-antlered Muntjac is not the sister species to all other muntjacs, a necessary condition for the genus *Megamuntiacus* to be valid. It is thus referred to here as *Muntiacus vuquangensis*, and placed next to *M. rooseveltorum*, to which genetics suggest that it is closely related. (Plate 16)

• *Muntiacus rooseveltorum* **Roosevelts' Muntjac** (= Roosevelt's Muntjac); (included in *M. feae*[M6], in *M. feai* Fea's Muntjac[M7]). *Conservation Significance:* Data Deficient (Global), as *M. feai*; Little Known in Lao PDR. Endemic to northern Lao PDR and perhaps Vietnam, Myanmar and/or China; so far known only from east of the Mekong (Timmins *et al*. 1998,

RJTim). *Documented Range and Habitat:* North (Amato *et al*. in press a). Habitat use unclear; likely to be upper hill and montane forest. *Status Information:* First described from Ban Muangyo, Phongsali Province (Osgood 1932), specimens were collected in central Xiangkhouang Province in 1996 (Amato *et al*. in press a, in press b). Some reports of small muntjacs from other areas (Table 12) may be of this species. Deuve (1961a, 1972) speculated that it inhabited Louang-Namtha Province. However, this was based on a local name. Apparently he never observed the animal and was given few details of its appearance by villagers, as *Elaphodus cephalophus* Tufted Deer was suggested as an alternative possibility. A set of antlers obtained from Nam Et / Phou Louey NBCAs was perhaps of this species (Davidson 1998), but until the species's morphological characters are clarified, firm identifications are ill-advised. Muntjac antlers are used in traditional medicine (Baird 1995b). Too little is yet known of this species to consider it anything other than Little Known in Lao PDR. *Taxonomic issues:* Morphology and genetics both indicate that Roosevelts' Muntjac is clearly not a subspecies of *M. feae* of Thailand and Myanmar (Amato *et al*. in press a; RJTim).

• *Muntiacus truongsonensis* **Annamite Muntjac** (= Truongson Muntjac). *Conservation Significance:* Discovered too late for inclusion in [M7]; Little Known in Lao PDR. Endemic to Lao PDR and Vietnam; likely to occur only east of the Mekong (Giao *et al*. 1998, Timmins *et al*. 1998, RJTim). *Documented Range and Habitat:* South (Amato *et al*. in press b). Habitat use unclear, but may inhabit upper hill and montane evergreen forest and degraded derivatives. *Status Information:* The first example of an animal presumed to be this species was found alive in a small zoo in Ban Lak (20) in 1995 (Schaller 1995b, Timmins 1996). The photograph in Robichaud (1997b) listed as the "new species of muntjac" probably in fact portrays a dark *Muntiacus muntjak*. The species was formally described on the basis of genetics (Giao *et al*. 1998) and DNA testing has confirmed the species from the Phou Ahyon area (Amato *et al*. in press b). Knowledge of the species's morphology remains embryonic and other information about it in Lao PDR is thus provisional. It may occur widely along the Annamites from the Nam Theun basin south to at least Phou Ahyon (Timmins and Vongkhamheng 1996a, Timmins *et al*. 1998; RJTim; Table 12). Skulls of small muntjacs not *M. muntjak* have also been found in Dong Ampham NBCA (Davidson *et al*. 1997). Muntjac antlers are used in traditional medicine (Baird 1995b). Too little is yet known of this species to consider it anything other than Little Known in Lao PDR. *Taxonomic issues:* The morphological diagnosis in the type description of *M. truongsonensis* (Giao *et al*. 1998) does not rule out *M. rooseveltorum* and some information concerning the species in Lao PDR is erroneous, as is the statement that a new species of muntjac awaits formal description from Lao PDR. The name *M. napensis* was used, prematurely, in Tobias (1997) for the small dark muntjac in the Nam Theun area, now presumed to be *M. truongsonensis*; it has never been formally applied to any species.

Conservation Management and Research Proposed for Deer:
Hog Deer:
- Immediate investigation of any plausible reports of surviving Hog Deer.
- Immediate and total protection of any site supporting Hog Deer, with management focussing on controlling hunting.

Eld's Deer:
- Immediate cessation of hunting of the last known Lao population of Eld's Deer, in Dong Khanthung PNBCA.
- Declaration of Dong Khanthung as an NBCA, including the entire region known to support Eld's Deer and an ample surrounding buffer zone in which no further new farmland or roads are developed.
- Formation of a local government staffed Eld's Deer team, to (a) monitor Eld's Deer status, (b) raise awareness through a consistent long-term education programme with local communities and (c) monitor illegal activities and facilitate punishment of law-breakers.
- Discussion with provincial authorities over development plans, which currently involve the relocation of large numbers of people from the Mekong islands into Dong Khanthung.
- Study of soil characteristics of Dong Khanthung to identify which areas are not suitable for agriculture, followed by assessment of the ability of the latter areas in combination to conserve Eld's Deer and the area's general wildlife community.
- Surveys of other areas reported to retain the species (parts of Savannakhet, Salavan and Champasak Provinces) by surveyors with prior experience of Eld's Deer signs.
- Collaboration with army bases in Dong Khanthung over hunting issues, with focus on reducing killing of Eld's Deer (and selected other key species, notably Banteng).
- Immediate and total protection of any other site supporting Eld's Deer, with management focussing on controlling hunting.
- Swift action in the Dong Khanthung area is essential, to prevent extirpation within a couple of years: Round (1998) estimated that six Eld's Deer died within 18 months in 1997-1998, while local opinion placed the remaining population at only a dozen or so individuals.

Muntjacs:
- Documentation of the distribution and status of muntjac species other than *M. muntjak* so that conservation needs of each species can be determined.
- Designation and protection of appropriate core zones of NBCAs and other protected areas to protect key populations of each species.

- Consideration of appropriate methods of legal protection for muntjac species other than *M. muntjak*. Identification of muntjacs to species in the field is too difficult for differential national protection levels between species to be operable, while *M. muntjak* is too widespread a quarry species for a blanket ban on hunting of all muntjacs throughout Lao PDR to be feasible, or desirable.

All species of deer:

- Regulation of trade and ownership of trophy antlers, hunting and trading of meat.
- Zonation of NBCAs to reflect seasonal needs and ranging of deer, notably to include adequate dry-season water supplies and salt-licks.
- Cessation of snaring in all areas supporting large numbers of any deer species other than *M. muntjac*.
- Development and implementation of measures to reduce poaching for meat, currently believed to be the main reason behind deer hunting.
- Investigation into the contribution of medicinal reasons in deer poaching.
- Investigation of possibilities for farmed deer to substitute for wild-taken animals in domestic and/or international trade, if stemming poaching seems too challenging. However, such farming is unlikely to preserve either the large tracts of wildlife habitat that conservation in the wild will necessitate, or the Tiger and other carnivore populations which prey on wild deer.

Bovidae: Cattle, goat-antelopes (5-10 species in Lao PDR; 137 worldwide)

[*Bos taurus* **Domestic Cattle**]. Delacour (1940) mentioned that feral domestic cattle inhabited south Indochina, but there is no recent evidence of such animals. It is likely that they would be as heavily hunted as wild cattle and/or assimilated back into domestic stock.

• *Bos sauveli* **Kouprey**. *Conservation Significance:* Globally Threatened - Critical; Conditionally At Risk in Lao PDR; CITES Appendix I. Endemic to Cambodia and small parts of Thailand, Lao PDR and Vietnam; extirpated from most or all of this range (Hedges in prep.). One of the world's most threatened vertebrate species, and perhaps the rarest species of large mammal if it is not already extinct. *Documented Range and Habitat:* South (provisionally[M8]; historically, Lekagul 1952). Grass plains covered by tree savanna and patches of open and dense forest (Wharton 1957, for Cambodia). *Status Information:* Post-1980 reports of Kouprey were received at eight locations during 1988-1993 village interviews (Salter *et al*. 1990). Field surveys at three of these during 1991-1993 and 1997-1998 saw neither animals nor fresh signs certainly of the species (Cox *et al*. 1991, 1992, Duckworth *et al*. 1994, Steinmetz in prep.). Evidence for the persistence of Kouprey in Lao PDR is limited to villagers' reports (synthesised in Duckworth and Hedges 1998a). Salter *et al*. (1990) stated that 40-100 animals in Lao PDR was "certainly of the correct order of magnitude ... and may even be conservative" but the species may have disappeared from Lao PDR since then. Historically Kouprey appears to have ranged from Cambodia north to, but not crossing, the Xe Bang-Nouan river (Prince Petcharaj in Lekagul 1952). Deuve (1972) recorded it only from Khinak, Champasak Province (near Dong Kalo, Xe Pian NBCA), but gave no details. Five sets of Kouprey horns seen in a village in southern Champasak Province in 1989 reportedly came from Cambodia (Salter *et al*. 1990: Appendix 3). Two sets of bulls' horns in Attapu homes in 1997 were obtained prior to 1967 and their origin is unclear (Davidson *et al*. 1997). Salter *et al*. (1990: Appendix 4) cautioned that the recent distributional information for Lao PDR used by MacKinnon and Stuart (1988) was of uncertain quality; e.g. one supposed set of horns was from a Gaur, not a Kouprey. Extensive areas of otherwise suitable habitat are now heavily disturbed, primarily through hunting and burning. This prevents their use by Kouprey (Cox *et al*. 1992). The national origin of horns reportedly sold to Thai buyers along the Lao/Thai border (Srikosamatara *et al*. 1992, Baird 1993, Srikosamatara and Suteethorn 1994, La-Ong *et al*. 1997) is uncertain. Most parts of Kouprey were used in traditional medicine (Baird 1995b). The lack of recent records despite substantial effort suggests that Kouprey may already be extinct in Lao PDR, hence its categorisation as Conditionally At Risk in Lao PDR.

• *Bos gaurus* **Gaur** (included in *B. frontalis*[M6], in *B. frontalis* Gaur[M7]). *Conservation Significance:* Globally Threatened - Vulnerable; At Risk in Lao PDR; CITES Appendix I. *Documented Range and Habitat:* North[M16], centre[M8], south[M8]; recent records and reports mapped in Duckworth and Hedges (1998a). Evergreen forest, sometimes in mosaic with other, more open habitats, from Mekong plains up to at least 2000 m. *Status Information:* Reported during 74% of 1988-1993 village interviews (n = 328), discontinuously distributed throughout Lao PDR (Annex 5). Field records come from many survey areas (Table 12), but over-hunting has reduced the population and survivors occur mainly in remote sites. Area with populations likely to be nationally important include: (1) the Nam Theun catchment (especially the Nakai Plateau, Nam Theun Corridor PNBCA and the fringes of Khammouan Limestone NBCA), (2) Nam Phoun, (3) Nam Ha, (4) Phou Louey, (5) Nam Xam, (6) Phou Xang He, (7) Dong Phou Vieng, (7) Dong Ampham and (8) Xe Pian NBCAs, and (9) Dong Khanthung PNBCA (Duckworth and Hedges 1998a). Historical information is thin, but Gaur still occur in some sites noted by Deuve (1972), e.g. Sangthong District (provisionally), the Nakai Plateau and Nam Kading NBCA. Many Gaur inhabited the Bolaven Plateau (Engelbach 1932) and eastern Savannakhet Province (David-Beaulieu

1949-1950), but only a few were found in Xiangkhouang Province (David-Beaulieu 1944). Gaur horns are widely displayed (and sold) as trophies in Lao PDR (Annex 1), and most horns sold along the Lao/Thai border seem to be from Lao PDR and Cambodia (Srikosamatara *et al*. 1992, Baird 1993, Srikosamatara and Suteethorn 1995, La-Ong *et al*. 1997). Gaur bile and other parts are used in medicinal preparations (Martin 1992, Baird 1995b, Duckworth and Hedges 1998a). This is probably the major force driving cattle poaching, as local belief is strong in the efficacy of wild cattle parts to cure various conditions; even small parts command high prices (KK). The few encounters of animals on surveys and small group sizes at most sites indicate a population that is not healthy. The species is At Risk in Lao PDR. *Taxonomic issues:* If domestic and wild animals are not distinguished as separate species, Gaur is known as *B. frontalis*. The type of the latter name is a domestic Mithan. These animals are not kept in Lao PDR (Hedges in prep.).

• *Bos javanicus* (= *B. banteng*[M1]) **Banteng** (= Tembadau[M3]). *Conservation Significance:* Globally Threatened - Endangered; At Risk in Lao PDR. One of the world's fastest-declining mammals; mainland South-east Asian population assessed as Critical by Heinen and Srikosamatara (1996). *Documented Range and Habitat:* North (provisionally, Davidson 1998; historically, Brix and Deuve 1963), centre (provisionally[M10]; historically, L. M. Talbot verbally 1999), south[M8]; recent records and reports mapped in Duckworth and Hedges (1998a). Open grassy plains, deciduous forest and adjacent dense forest; known sites are in lowlands but Banteng probably also occurs, or did so formerly, on higher altitude plateaux. *Status Information:* Historical accounts are conflicting over the species's occurrence in north Lao PDR. Delacour (1940) did not list it from Lao PDR at all, although it had already been reported from the Nakai Plateau by Legendre (1932). Wharton (1968: 135) mapped "known Banteng localities" north through Lao PDR at least to 20ºN (near Nam Xam NBCA), but his sources are unclear. Recent reports suggest that Banteng does occur in the north; those from Nam Et NBCA are convincing in their detail (Davidson 1998). Deuve (1972) limited Banteng in Lao PDR to south of the Savannakhet - Xe Pon road, with one isolated record by the lower Nam Kading in June 1962 (Brix and Deuve 1963). It was not known on the Xiangkhouang plateau in the 1930s (David-Beaulieu 1944). Savannakhet Province supported many in the 1940s, particularly in the open forests south of the Xe Banghiang (David-Beaulieu 1949-1950). In the south, Banteng were commonest near the base of hills (Engelbach 1932). Banteng was reported during 49% of 1988-1993 village interviews (n = 328) distributed throughout Lao PDR including many areas in the north (Annex 5), but recent work suggests cattle are a particularly difficult group about which to gather knowledge (Duckworth and Hedges 1998a: 62-63) and thus this distribution should be taken cautiously. Banteng are in very steep decline due to hunting pressure. The only recent field sightings come from Dong Khanthung PNBCA (one seen during aerial survey in 1996; ICF 1996) and the Xe Pian NBCA region: six animals on the Xe Kong Plains in 1991 and one (recently shot) in the Dong Kalo area in 1992 (Cox *et al*. 1992). Despite substantial further effort in both areas, none has been seen since. However, Round (1998) re-confirmed occurrence in Dong Khanthung PNBCA, and Steinmetz (in prep.) found Banteng signs to be locally common in early 1997 in Dong Kalo, but found no evidence on the Xe Kong plains. There is recent evidence (from signs) in several other southern survey areas (Table 12), north perhaps to the Nakai Plateau. This is a known historical site (L. M. Talbot verbally 1999) and prints provisionally identified as Banteng were found in 1995-1998 (Evans *et al*. in prep. b; RB). Banteng horns are widely displayed (and sold) as trophies in Lao PDR (Annex 1) and most of those sold along the Lao/Thai border are reportedly from Lao PDR and Cambodia (Srikosamatara *et al*. 1992, Baird 1993, Srikosamatara and Suteethorn 1995, La-Ong *et al*. 1997). A skin perhaps of a Banteng calf in the Ban Lak (20) menagerie in 1995 (referred to in various unpublished sources) was not satisfactorily distinguished from a young Gaur (RJTim). The record from Phou Xang He NBCA in Duckworth *et al*. (1994: Table 1) was a typographical error. Among mammals confirmed still extant in Lao PDR, after Eld's Deer, Banteng may be closest to extinction, hence the At Risk in Lao PDR categorisation. (Plate 16)

[*Bubalus bubalis* **Domestic Water Buffalo**]. Used as a domestic animal throughout. Feral populations were formerly reported on the Bolaven Plateau (Deuve 1972), but there is no recent evidence of such animals. They would presumably be as heavily hunted as the wild species and/or assimilated back into domestic stock. In some areas (e.g. the Xe Kong plains of Xe Pian NBCA, the Nakai Plateau and Dong Ampham NBCA; Davidson *et al*. 1997, RJTim) domestic buffaloes wander at will for weeks or months with no human contact, but these are not truly feral. *Taxonomic issues:* See *B. arnee*.

[• *Bubalus arnee* **Wild Water Buffalo** (= Water Buffalo[M4]; = Water Buffalo (wild)[M5]; = Asian Buffalo); (included in *B. bubalis*[M6], in *B. bubalis* Wild Water Buffalo[M2, M7]; Wild Buffalo[M1])]. *Conservation Significance:* Globally Threatened - Endangered; Conditionally At Risk in Lao PDR. *Context:* 'Wild' buffaloes were reported during 1988-1993 village interviews from Xe Pian NBCA and other areas scattered north almost to Nam Ha NBCA (Annex 5), and as present into the 1950s-1970s in some other southern locations. We have traced no specimens or detailed records of wild buffalo from Lao PDR. Osgood (1932) considered that "uncertainty apparently exists as to whether or not the water buffalo of this region are feral", but Delacour (1940), who had (in contrast to Osgood)

wide-ranging field experience in Indochina was convinced that buffaloes in the south were truly wild. He mentioned no sites, perhaps suggesting that they were widespread, and, by implication, present in Lao PDR. Deuve (1972) recorded wild buffaloes from Khinak (near Xe Pian NBCA). It seems barely plausible that wild buffalo never inhabited Lao PDR, but the possibility that any remain seems low. Small numbers of horns of large buffaloes are displayed (and available for purchase) in Lao PDR (Annex 1) and adjacent Thai towns (Srikosamatara *et al*. 1992), but the large horns borne by occasional domestic animals make identification as 'wild' solely on the basis of horn size rash. Wild buffalo horns are used for traditional medicine (Baird 1995b), but whether these are preferred over domestic horns was not stated. As the species may be nationally extinct, it is categorised as Conditionally At Risk in Lao PDR. *Taxonomic issues:* If domestic animals are not distinguished as separate species, Wild Water Buffalo is known as *B. bubalis*. The domestic animal to which this name strictly refers is widespread in Lao PDR.

[• *Naemorhedus caudatus* **Long-tailed Goral** (= Chinese Goral[M5]); (included in *N. goral* Goral[M2], *Nemorhaedus goral* Common Goral[M4], Goral[M1])]. *Conservation Significance:* Globally Threatened - Vulnerable; CITES Appendix I. *Context:* See below. 'Goral' (no scientific name attributed) was reported from Lao PDR by Cheminaud (1939) but the lack of records attributed to serow and his descriptive notes of 'goral' both suggest that the animal was serow. Fraisse (1955) recorded 'goral' as not rare in Louangphabang and Khamkheut, but no specimens were procured, the author did not record serow from Lao PDR, and indeed (p. 155) he was clearly unfamiliar with the latter. A goral reported by Deuve (1972) from Boneng (Khammouan Province) was kept in captivity and, mated with an animal apparently a domestic billy goat ("un bouc domestique"), bore two kids. It seems unlikely, given their distant relatedness, that goral and goat would produce offspring (D. Shackleton *in litt*. 1998, S. Lovari *in litt*. 1999). Although confusion between them might seem unlikely, S. Lovari (*in litt*. 1999) was shown a mounted 'goral' in Thailand in the 1980s that was in fact a goat. A 1997 photograph (held at WCS, Vientiane) from a menagerie in Ban Lak (20) originally believed to be that of a goral in fact shows a serow (S. Lovari *in litt*. 1999). Among recent village interview reports suggesting goral from several NBCAs (Table 12), notable in detail of description are those from Nam Et and Phou Louey (Davidson 1998). Presence was considered possible in southern Attapu and in eastern Xiangkhouang Provinces by Schaller (1997) and Schaller and Robichaud (1996). *Taxonomic issues:* In the absence of specimens, the suggestion that *N. caudatus* occurs in Lao PDR (rather than any other goral species) is an assumption based upon range (Corbet and Hill 1992, Shackleton 1997).

• *Naemorhedus sumatraensis* (= *Capricornis sumatraensis*[M1, M2, M3, M4, M7]) **Southern Serow** (= Mainland Serow[M4, M7]; = Serow[M2, M1, M3]). *Conservation Significance:* Globally Threatened - Vulnerable; Potentially At Risk in Lao PDR; CITES Appendix I. *Documented Range and Habitat:* North[M15], centre[M10], south[M14]. Forests on steep terrain, widely on both limestone and non-calcareous rocks, from lowlands into the higher montane zone. *Status Information:* See below. Historical information is sparse, but Delacour (1940) noted serow as 'abundant' in Xiangkhouang and inhabiting all rocky areas of north and central Lao PDR. Deuve's (1972) summary listed 13 specific areas, south to Nape and Khammouan Limestone NBCA. Indications (tracks and/or remains) have come from many survey areas (Table 12), but the only direct sight records come from Phou Louey NBCA (twice; Davidson 1998) and by a road in Oudomxai Province (R. Jelinek verbally 1999). In 1998, the species was camera-trapped in Nakai-Nam Theun NBCA and in Nam Theun Extension NBCA (Robichaud 1998b, 1999). Horns are commonly displayed in domestic and retail situations in both rural and urban Lao PDR. Bones, feet, blood, teeth, innards, perhaps almost all body parts, are widely used in medicine (Martin 1992, Baird 1993, 1995b). There is cross-border trade in serow parts from Lao PDR to Thailand (Srikosamatara *et al*. 1992, Baird 1993, La-Ong *et al*. 1997), Vietnam (Compton in prep. b) and China. Villagers in several areas informed RS that serow is less sought after and less valuable than are other large ungulates, but trade / trophy levels in body parts are apparently high. One communal house near Xe Sap NBCA displayed 21 sets of serow horns (Showler *et al*. 1998a) and there are various cases where large stocks of internal organs (e.g. over a dozen stomachs drying over a brazier in Ban Lak (20) in late 1994) have been stated to be of this species. This suggests that either exploitation levels have risen recently, and/or that serow can sustain a high harvest. These two possibilities have very different repercussions on conservation policy. Nonetheless, the clear spread of recent reports indicates that the species should currently only be listed as Potentially At Risk in Lao PDR. (Plates 1, 5, 16)

Status Information on Goral and/or Serow: Serow/goral were reported in 91% of 1988-1993 village interviews (n = 328), distributed throughout the country except the Mekong Plain (Annex 5). During this work, all trophies observed were serow, suggesting that most or all reports also referred to serow.

• *Pseudoryx nghetinhensis* **Saola** (= Spindlehorn Bovid; = Vu Quang Ox[M7]). *Conservation Significance:* Globally Threatened - Endangered; At Risk in Lao PDR; CITES Appendix I. Endemic to Lao PDR and Vietnam, east of the Mekong (Vu Van Dung *et al*. 1994, Schaller and Rabinowitz 1995, Timmins in prep.). *Documented Range and Habitat:* North and centre (Schaller and Rabinowitz 1995), south (provisionally, Schaller 1995a). Mainly or solely in wet evergreen forest of the Annamites and foothills. *Status Information:* The discovery and status of Saola in Lao PDR was documented

by Schaller and Rabinowitz (1995) and Timmins (in prep.). The species has never been seen in the wild in Lao PDR and signs are not unambiguously identifiable. There are two camera-trap photographs from Nam Theun Extension PNBCA in early 1999 (WGR). The following information is derived from the examination of remains (some fresh) and local opinion. Saola is apparently centred around Nakai-Nam Theun NBCA and Nam Theun Extension PNBCA (Robichaud 1997a). Unsurveyed habitat extends north of the species's current known northernmost record (Nam Chouan PNBCA) into southern Houaphan Province, and the southernmost record (discounting an old report from Xekong Province) is from the headwaters of the Xe Bangfai (Robichaud 1997a, Walston in prep.; WGR). A villager's report from Phou Xang He NBCA (Boonratana 1998b) would represent an exceptional range extension. Recent interview work in the lower Nam Xan catchment (Bolikhamxai Province) has received village reports (supported by trophy frontlets) in areas substantially north-west of the species's previously understood range (WGR). Extensive questioning of villagers in and around Dong Ampham NBCA in 1997 elicited no recognition of the species (Davidson *et al*. 1997). A claim from Xekong Province, (a single interviewee reporting an event 10 years past; Schaller 1995a) was not corroborated by Bergmans (1995), Schaller and Boonsou (1996), Timmins and Vongkhamheng (1996a) or Showler *et al*. (1998a). Reportedly, about six animals were killed in Bolikhamxai Province by villagers attempting to capture and hold them in response to a rumoured US$ 1000 reward for a live Saola. The party concerned therefore withdrew the offer and apparently in 1996/1997 some villagers released a Saola on the explicit instruction of the same party (WGR). The small range of Saola, a likely need for closed forest, its vulnerability to hunting (it is easily caught with dogs, which are widely used in hunting within its range), and the uncertain future of important forested areas of the central Annamites all place the species very much At Risk in Lao PDR. (Plates 4, 16)

[• *Pseudonovibos spiralis* **Khting Vor** (= Linh-duong[M7])]. *Conservation Significance:* Globally Threatened - Endangered; Conditionally At Risk in Lao PDR; Endemic to Cambodia and Vietnam (Feiler and Nadler 1997a). *Context:* Current world range unknown, if indeed it is not already extinct. So far specimens come only from Cambodia and Vietnam (Peter and Feiler 1994, Dioli 1995, Feiler and Nadler 1997a and references therein). In late 1997, a man in Muang Dakchung (Xekong Province) spoke of a male ungulate (the description fitting this species) netted and killed in southern Attapu in 1964. A visit to the area produced no corroboration, as very few old people remained (Robichaud 1998e). Extensive questioning in and around Dong Ampham NBCA in 1997 elicited no recognition of the species (Davidson *et al*. 1997). The many negative responses from today's hunters suggest that the species is extinct in Lao PDR, if indeed it ever occurred. *Taxonomic issues:* The position of this species in the systematic list is arbitrary, pending further analysis of its relationships with other taxa.

Conservation Management and Research Proposed for Bovidae:

Kouprey, Wild Water Buffalo and Khting Vor:

- Incorporation of hunting and access controls in the management of Xe Pian NBCA (the location of the most recent and persistent reports of Kouprey).
- Continuing compilation of villagers' reports of Kouprey and Wild Water Buffalo and implementation of further surveys (possibly including aerial surveys as proposed by Cox *et al*. 1992) centred upon Banteng and other very large mammals.
- Immediate follow-up of any plausible leads on any of these species, and rapid protection of any areas found to hold any one or more of them.

Banteng:

- Field investigation of possible occurrence in north Lao PDR, notably at Nam Et NBCA.
- Specific activity in Dong Khanthung PNBCA (see under 'Conservation Management and Research Proposed for Deer: Eld's Deer').
- Focus on Banteng in management aims and activities in other key areas: Dong Ampham, Xe Pian and Phou Xiang Thong NBCAs.

Gaur:

- Focus on Gaur in management aims and activities in key areas (see above).

Goral:

- Continuing compilation of reports of goral.

Serow:

- Clearer understanding of serow status, population dynamics and current and recent levels of exploitation and its effects.

Saola:

- Updating of the *Conservation Action Plan for Saola in Lao PDR* (Robichaud 1997a) by CPAWM, involving full participation of provincial and district authorities, protected area staff and local people's representatives, stressing the following objectives:
- Management of a large tract of the Nam Theun basin and important surroundings for the species.
- Cessation of all snaring and of hunting with dogs in and adjacent to all NBCAs retaining Saola.
- Prohibition of killing and capture of Saola.
- Development of controls over trophy ownership and trade.
- Awareness-raising activities for villagers within the species's range, both of the above proposals and the reasons behind them.
- Further surveys to delineate the range and identify areas supporting large numbers, with specific surveys in (1)

the headwaters of the Xe Bangfai and adjacent areas immediately to the south, (2) the Nam Chouan PNBCA and adjacent Xiangkhouang Province, and (3) Bolikhamxai Province to determine the western extent of distribution.

- Judicious road planning to prevent currently remote areas bring opened up to vehicle access. The range of Saola is narrow in shape and consequently the population is vulnerable to being severed into smaller fragments, the total viability of which would be considerably less than that of the population in its current state.
- Basic field studies of Saola's ecology, to allow design and management of conservation areas for it. There are no closely related taxa from which extrapolations can be made.
- Such studies should certainly precede any further attempts at capture, for which there is at present no clear rationale: all 13 known to have been brought into captivity in Lao PDR and Vietnam during 1992-1996 died relatively rapidly (Robichaud 1998c; WGR).
- Further detail is given in Tizard (1996), Robichaud (1997a) and Timmins (in prep.). Action is of very high priority as, unlike species such as Kouprey, rhinos and Hog Deer, sufficient numbers of Saola persist for protective measures to be successful, if appropriate political support is forthcoming (Robichaud 1997a).

All species:

- Identification of critical areas (those holding in excess of 30 Gaur, 10 Banteng or five Saola, or any Kouprey, Wild Water Buffalo or Khting Vor).
- Control of retail outlets selling wild bovid products (for medicine or trophies), including closure of persistent offenders dealing in wild cattle and/or Saola.
- Effective hunting and access controls in NBCA management plans / land use plans to allow maintenance of large tracts of wilderness to support populations of all species.
- Clear and absolute legal protection for all species except possibly serow with committed enforcement activity across the country, especially with regard to snaring.
- Educational campaigns against trophy collection and, particularly, medicinal use, which is believed to be the major reason in Lao PDR behind poaching of wild cattle and serow.
- Investigation of the current trade in parts, particularly source, routes and destinations, and the possibilities for use of substitute materials; with focus on parts for medicinal use rather than trophy horns.
- Wild cattle present one of the toughest national conservation challenges to Lao PDR and for any chance of success action needs to be concerted, cross-sectoral, coordinated, internationally collaborative, and rapidly instigated (Srikosamatara and Suteethorn 1995, Le Xuan Canh *et al*. 1997, Duckworth and Hedges 1998a, Hedges in prep.).

Sciuridae: Non-flying squirrels (9-12 species in Lao PDR; 230 worldwide)

• *Ratufa bicolor* **Black Giant Squirrel** (= Malayan Giant Squirrel[M1]). *Conservation Significance:* Potentially At Risk in Lao PDR; CITES Appendix II. *Documented Range and Habitat:* North[M13], centre[M8], south[M8]. Evergreen forest, from plains up to at least 1400 m, rare in fragmented and/or heavily degraded areas. *Status Information:* Recorded from most survey areas (Table 12) but susceptible to habitat disruption, probably through increased hunting (Plate 17), rather than an inability to use such habitat. In some areas, populations are now so low that the species was not seen during field surveys, e.g. Sangthong District, Nam Et and Phou Louey NBCAs (Duckworth 1996a, Davidson 1998). Historical information is thin; Delacour listed it only for the north, but Deuve (1972) considered it widespread. Formerly one of the most commonly sold mammals in the That Luang fresh food market in Vientiane (Srikosamatara *et al*. 1992). The species's decrease in encroached areas means that it should be considered Potentially At Risk in Lao PDR, although national extinction is unlikely in the foreseeable future.

Callosciurus erythraeus **Pallas's Squirrel** (= Belly-banded Squirrel[M4]) (separated as *C. flavimanus* Belly-banded Squirrel[M2]). North, centre, south (Moore and Tate 1965); recent records from across the country. Mainly in mountains, foothills and adjacent lowland areas; rare in extensive lowlands such as the Mekong plain or the Xe Kong plains, but one anomalous record from the latter (Evans *et al*. in prep. b). Forests of all types, including heavily degraded areas. *Taxonomic issues*: The genus *Callosciurus* has many phenotypic forms in Indochina. Collecting has been too patchy to allow their full documentation, understanding of relationships between them, and the number of species involved (see Moore and Tate 1965). The named Lao forms of *C. erythraeus* (*sensu* Corbet and Hill 1992, but separated by Moore and Tate 1965 as part of the highly variable *C. flavimanus*) are: *C. e. hendeei*, from Phongsali south to at least Ban Houayxai (Bokeo Province) and *C. e. flavimanus*, including '*quantulus*' from Xiangkhouang (Tranninh plateau; Delacour 1940), '*pirata*' from Nape and '*bolovensis*' from Pakxong. Intermediates between *hendeei* and *flavimanus* were found along the Nam Khan east of Louangphabang. Too few specimens existed to allow Moore and Tate (1965) to distinguish between geographic, seasonal and individual variation. Recent observations within Lao '*flavimanus*' indicate that further populations merit naming (e.g. the Nam Kading river separates two morphologically distinct populations; Evans *et al*. in prep. b). (Plates 14, 17)

Callosciurus finlaysonii (= *C. finlaysoni*[M2]) **Variable Squirrel** (= Finlayson's Squirrel[M4, M5]). North (Boonratana 1997), centre (TDE), south[M8]. Forests and scrub, mainly along the plains

Plate 17:

Black Giant Squirrel, Phongsali Province, March 1996. This is the only squirrel that has shown a clear and widespread decline across Lao PDR. *W. G. Robichaud / WCS.*

Largely de-quilled Asiatic Brush-tailed Porcupine, Hin Namno NBCA, February 1998. Porcupines are widely eaten across the country. *P. Davidson / WCS and WWF.*

Hoary Bamboo Rat *Rhizomys pruinosus*, Xam-Nua market, January 1998. Commonly traded in hill and montane areas of at least north Lao PDR. *P. Davidson / WCS.*

Indian Giant Flying Squirrel, Xiangkhouang, 1992. This species is typical of forests below about 1000 m. It is highly variable in pelage across its wide world range; animals in Lao PDR, at least south of 20ºN, are of the race *Petaurista philippensis annamensis*. Also shown are four Red-cheeked Squirrels and one Inornate Squirrel. *W. G. Robichaud.*

The three squirrels most commonly traded in northern and Annamite markets: Red-cheeked, Inornate and Pallas's. Ban Lak (20), early 1994. *T. D. Evans / WCS.*

One Pallas's Squirrel (left) and two Inornate Squirrels, Phou Louey NBCA, May 1998. Pallas's is common and widespread in many habitats, but the status and habitat use of Inornate remain unclear. *P. Davidson / WCS.*

Inornate Squirrel, Ban Lak (20), early 1994. Many vegetable traders sell small numbers of squirrels as the opportunity arises. *T. D. Evans / WCS.*

Lesser Giant Flying Squirrel, Bolikhamxai Province, May 1994. This species is typical of forests above about 1000 m. Its pelage varies across its wide world range. Animals in Lao PDR, at least south of 20ºN, show the rufous tail of the race *Petaurista elegans marica*. Many Lao animals are much more heavily flecked white than is this individual. *T. D. Evans / WCS.*

of the Mekong, Xe Kong and presumably of other wide lowland rivers; recorded up to 500 m in both Xe Pian and Phou Xiang Thong NBCAs. Absent from low-lying parts of some hilly regions supporting *C. erythraeus*. Although treated as a species of special conservation significance by Salter (1993b), based on its restricted world range, the species (as currently defined) is too common in Lao PDR to merit designation as a key species. *Special Significance:* Endemic to non-peninsular Thailand and adjacent parts of Myanmar, Lao PDR, Cambodia and Vietnam (Corbet and Hill 1992). *Taxonomic issues*: See note under *C. erythraeus*. The bright red race *C. f. williamsoni* (*C. ferrugineus williamsoni* in some past literature) is known so far only from Lao PDR, occurring from at least Ban Thangon (Vientiane Municipality) south to the Cambodian border (Moore and Tate 1965). It is still abundant in the latter area, and is known in the north from recent Vientiane markets. The presence of another red form (superficially similar and as yet undescribed) in Vientiane markets hampers field identification to species in north Lao PDR (Evans *et al*. in prep. b). A striking new form, as yet un-named, found in central Lao PDR in 1995 has a vivid black and red pelage (Evans *et al*. in prep. b). *C. f. annellatus*, bright red with a pale tail band, was collected near Champasak town (west of the Mekong River) and, reportedly, east of the Mekong, to the east of Pakxe (Moore and Tate 1965). It is common in Dong Khanthung PNBCA (Round 1998). There are no recent records east of the Mekong, suggesting that the historical specimen may be misleadingly labelled. Animals resembling *C. f. bocourti* (strikingly patterned black and white) and *C. f. menamicus* (red with a buffy tail tip) were seen in Nam Phoun NBCA in 1997 (Boonratana 1997); Deuve (1972) recorded the former (as *C. f. tachardi*) from Xaignabouli Province. The possibility of hybridisation between this species and *C. erythraeus* ssp. in Lao PDR was discussed by Moore and Tate (1965). Some animals in a market close to Phou Xang He NBCA in 1993 showed a mix of characters of the two species (RJTim). A record not assigned to subspecies for Nakai (Delacour 1940) is outside the species's range as currently understood, and there is also a provisional 1998 record from Hin Namno NBCA (Walston in prep.).

[*Callosciurus caniceps* **Grey-bellied Squirrel**]. This species, not recorded east of the Mekong by Moore and Tate (1965) or Corbet and Hill (1992), occurs across much of continental Thailand and may well inhabit Xaignabouli Province, and/or the parts of Champasak which lie west of the Mekong.

• *Callosciurus inornatus* (= *C. imitator*) **Inornate Squirrel** (included in *C. pygerythrus*[M7]). *Conservation Significance*: Globally Threatened - Vulnerable, as *C. pygerythrus*; Little Known in Lao PDR. Endemic to northern Lao PDR, northern Vietnam and southern Yunnan (China); occurs only east of the Mekong (Corbet and Hill 1992). *Documented Range and Habitat:* North[M8], centre[M13]. Wide habitat use: known recently from degraded evergreen forest of the Mekong plain to pristine evergreen forest at 1100 m in the Annamites, and recorded in scrub at various sites. *Status Information:* Found in most survey areas within its range (Table 12), but only in low numbers. Yet, Osgood (1932) and Deuve (1972) stated that the species was abundant, and numbers are high in some markets in the 1990s (e.g. Ban Lak (20), Timmins and Evans 1996; Xam-Nua, Showler *et al*. 1998b; Ban Phonsavan, Xiangkhouang Province, Duckworth *et al*. in prep.). The main numbers thus seem to be in areas and/or habitats not recently surveyed and thus probably not in protected areas. The southern range limit is unclear; recent records come largely from east and north of the Nam Theun, but there is one from the north bank of the upper Xe Bangfai (Walston in prep.). Bourret (1942) described a specimen from Xe Pon in the upper Xe Banghiang showing some characters of this species. Deuve (1972) claimed (with no details) this species from the Xe Banghiang. Further detail is given in Duckworth *et al*. (in prep.). Uncertainty over the habitat use of this species, and the absence of large populations in NBCAs, indicate that it should be classed as Little Known in Lao PDR. *Taxonomic issues*: Unlike its Lao congeners, this species is not taxonomically complex. The apparent inclusion of it by IUCN (1996) within *C. pygerythrus* reflects the treatment of Ellerman and Morrison-Scott (1951). Although it was still treated as a subspecies of *C. pygerythrus* by Deuve (1972), Moore and Tate (1965: 211-212) demonstrated clearly the specific distinctiveness of *C. inornatus*. (Plates 14, 17)

Tamiops mcclellandii (= *T. macclellandi*[M6]; = *T. mcclellandi*[M2]; = *Callosciurus macclellandi*[M1]) **Western Striped Squirrel** (Himalayan Striped Squirrel[M1, M4, M5]; = Burmese Striped Tree Squirrel[M2]). North[M14]. Occurs west of the Mekong, in Hongsa special zone (Bergmans 1995), and possibly to the east, around Vientiane (Moore and Tate 1965); the possibility that the latter specimens were brought across the Mekong needs assessment. Habitat use unclear. *Taxonomic issues:* Collecting has not been extensive enough to document the forms of the genus *Tamiops* in Lao PDR. Consequently the relationships between them, and even how many species are involved, are unclear.

Tamiops rodolphii (= *T. rodolphei*[M2, M4, M6]) **Cambodian Striped Squirrel** (= Cambodian Striped Tree Squirrel[M2]). North[M10], centre[M8], south[M8]. Specimens examined by Moore and Tate (1965) come only from Champasak and Attapu Provinces, but recent field observations extend the range north of the Nam Theun (Evans *et al*. in prep. b). Evergreen forest in Lao PDR; in adjacent countries, animals showing field characters of this species occur widely in open deciduous forest. Although treated as a species of special conservation significance by Salter (1993b), based on its restricted world range, the species (as currently defined) remains too common in its

Lao range to merit designation as a key species. *Special Significance:* Endemic to Cambodia and parts of Lao PDR, Thailand and Vietnam (Corbet and Hill 1992). *Taxonomic issues*: See under *T. mcclellandii*.

[*Tamiops swinhoei* **Swinhoe's Striped Squirrel**]. Range possibly extends into far northern Lao PDR, as the species occurs relatively close by in Yunnan, China, and northern Tonkin, Vietnam (Moore and Tate 1965).

Tamiops maritimus **Eastern Striped Squirrel** (= Chinese Striped Squirrel). North, south (Moore and Tate 1965): no specimens from centre but provisional sight records in e.g.[M8]. Occurs only east of the Mekong (Moore and Tate 1965). Habitat use unclear; where sympatric with *T. rodolphii*, forms resembling this species occur in degraded evergreen forest, mixed deciduous forest and scrub, with *T. rodolphii* in denser, more evergreen forest (Duckworth *et al*. 1994, Steinmetz 1998b). Elsewhere in Lao PDR, *T. 'maritimus'* occurs in little degraded evergreen forest. *Taxonomic issues*: See under *T. mcclellandii*. Squirrels keying out as this species in Corbet and Hill (1992) occur widely in Lao PDR, but several forms are probably involved as both calls and habitat-use differ across the Lao range.

[*Dremomys pernyi* **Perny's Long-nosed Squirrel**]. This species inhabits southern Yunnan, China, and west Tonkin, Vietnam (Moore and Tate 1965, Dang Huy Huynh 1994) and may thus be found in northern Lao PDR.

Dremomys rufigenis **Red-cheeked Squirrel** (= Red-cheeked Ground Squirrel; Red-cheeked Squirrel[M2, M4, M5]). North[M8], centre[M8], south[M8]. Evergreen and deciduous forests, and dense scrub, from the Mekong plains to higher montane areas. The species is common in many lowland areas, e.g. Xe Pian NBCA; the genus was considered to "occur only in the mountains or hills" by Moore and Tate (1965), but this assessment is not applicable in Lao PDR. (Plates 14, 17)

Menetes berdmorei **Berdmore's Squirrel** (= Indochinese Ground Squirrel[M2, M5]). North[M14], centre[M8], south[M8]. Common in dry dipterocarp forest and present in many other forest types, including deep within little degraded semi-evergreen forest. Mainly lowlands and lower hills.

Conservation Management and Research Proposed for Non-flying squirrels:

- Structured collecting programme of *Tamiops* spp., *Callosciurus finlaysonii* and *C. erythraeus* across Lao PDR; appropriate conservation prioritisation within these genera can only be carried out after their systematics are better documented.
- Pending this, documentation of these genera by (1) assessment whether each morph observed fits visually a form named from the area and (2) for each that does not, inclusion in the survey report of a precise description of pelage (detailing intra-population variation). Tape-recorded calls may facilitate retrospective identification.
- Year-round protection from hunting for Black Giant Squirrel in NBCAs, and seasonal protection throughout the country.
- Research into status and habitat use of Inornate Squirrel to allow selection of appropriate areas for its conservation and assessment of the need for hunting controls.

Pteromyidae: Flying squirrels (6-8 species in Lao PDR; 43 worldwide)

• *Trogopterus pearsonii* (= *Belomys pearsoni*[M1, M2]; = *B. pearsonii*[M4, M6, M7]) **Hairy-footed Flying Squirrel**. *Conservation Significance:* Globally Near-Threatened; Little Known in Lao PDR. *Documented Range and Habitat:* Centre[M17]. Habitat use in Lao PDR unknown. *Status Information*: See below. Remains of two individuals were found in owl pellets collected in Khammouan Limestone NBCA in early 1998 (Robinson and Webber 1998a). Lekagul and McNeely (1977) and Corbet and Hill (1992) both mapped the species over a diffuse area centred on Chapa (Tonkin, Vietnam) and extending into Lao PDR, but we have traced no published historical records from Lao PDR.

[*Petaurista petaurista* **Red Giant Flying Squirrel** (= Red Flying Squirrel[M5]); (included in *P. petaurista* Red Giant Flying Squirrel[M2, M3], Common Giant Flying Squirrel[M1])]. Although mapped for north-west Lao PDR by Corbet and Hill (1992), we have traced no primary records. Boonratana's (1997) listing for Nam Phoun NBCA was an editorial error for *P. philippensis* (RB). *Taxonomic issues:* see note under *P. philippensis*.

Petaurista philippensis **Indian Giant Flying Squirrel** (included in *P. petaurista* Red Giant Flying Squirrel[M2, M3], Common Giant Flying Squirrel[M1]). North[M13], centre[M8], south[M8]. Closed forest, evergreen or deciduous, from Mekong plains to almost 1000 m; altitudinally separated from *P. elegans* at least in the Nam Theun basin (Duckworth 1998). *Taxonomic note:* Forms of this species occurring in Lao PDR were known historically as *P. lylei badiatus* and *P. annamensis* (Plate 17). These may not be distinct from each other (Corbet and Hill 1992). All recent Lao field records refer to them. Until recently, they were included within *P. petaurista* by many authors (e.g. Lekagul and McNeely 1977). Other forms currently included in *P. philippensis* might also be found to occur in north Lao PDR. As there is little agreement between workers as to within which species various named forms belong (contrast Corbet and Hill 1992 with Zhang Yongzu 1997), detailed description of any *Petaurista* seen in Lao PDR

not *P. ph. annamensis* (including *badiatus*) or *P. elegans marica* is essential to allow identification.

Petaurista elegans **Lesser Giant Flying Squirrel** (= Spotted Giant Flying Squirrel[M3, M4]). North[M13], centre[M13]. Forests above 1000 m. Recent records come from the Annamites (Duckworth 1998, Evans *et al*. in prep. b; Plate 17), Nam Phoun NBCA in the north-west (a skin of a hunted animal, lacking information on origin; Boonratana 1997, RB) and Ban Phonsavan market (Xiangkhouang Province; JWD). Historically, a specimen was taken in Xiangkhouang (Delacour 1940).

• *Hylopetes spadiceus* **Red-cheeked Flying Squirrel** (included in *H. lepidus* Red-cheeked Flying Squirrel[M2]). *Conservation Significance:* Little Known in Lao PDR. *Documented Range and Habitat:* North (provisionally, Tizard *et al*. 1997), centre[M17], south (historically)[M18]. Habitat in Lao PDR unknown. *Status Information*: See below. The species was recorded from Paleng and Ban Thateng, two adjacent sites on the north-east Bolaven Plateau (Osgood 1932) and it was considered very rare by Delacour (1940). Deuve (1972) recorded it (without details) from the centre and south. A single (provisionally identified) was found dead in Nam Ha NBCA in early 1997 (Tizard *et al*. 1997, as *H. lepidus*). The only recent confirmation in Lao PDR is of a skull near a hunters' cooking site in Khammouan Limestone NBCA in 1998 (Robinson and Webber 1998a). *Taxonomic issues:* see *H. lepidus*, Appendix.

• *Hylopetes alboniger* **Particolored Flying Squirrel**. *Conservation Significance:* Globally Threatened - Endangered; Little Known in Lao PDR. *Documented Range and Habitat:* North (provisionally)[M16], south (historically)[M18]. Habitat in Lao PDR unknown. *Status Information*: See below. One was collected at Pakxe in 1931-1932 (Osgood 1932, Delacour 1940). The species was mapped for most of Lao PDR by Lekagul and McNeely (1977), perhaps by extrapolation. Deuve (1972) stated that the species inhabited trees right in the town centre of Vientiane. Recent records possibly of this species include one in *Fokienia* forest (about 1700 m) in Nam Xam NBCA in early 1998 (Showler *et al*. 1998b; DAS), a skin near Nam Phoun NBCA in 1997 (Boonratana 1997, RB) and one in a Vientiane market in 1991 (Srikosamatara *et al*. 1992). *Taxonomic issues:* Separation of this species from *H. phayrei* is difficult, and indeed animals from the Korat Plateau, Thailand (adjacent to Lao PDR) fit neither species clearly (Lekagul and McNeely 1977, Corbet and Hill 1992). Animals apparently of this species-pair observed recently in several field localities of Lao PDR had pale grey cheeks, paler than the crown and darker than the throat, and are thus unidentifiable from Corbet and Hill (1992: 315). Until pelage characters are more clearly understood in Lao PDR, identifications to species can only be made using skull characters.

• *Hylopetes phayrei* **Phayre's Flying Squirrel**. *Conservation Significance:* Little Known in Lao PDR. *Documented Range and Habitat:* North (provisionally, Boonratana 1997), centre[M17], south (provisionally[M11]). No confirmed historical specimens. Mapped for north-west Lao PDR by Lekagul and McNeely (1977) and Corbet and Hill (1992), perhaps by extrapolation from extralimital records. Habitat in Lao PDR unclear. *Status Information*: See below. Bourret (1944) reported provisionally a specimen from Savannakhet in 1943, but suffered from the same problem as current workers: a lack of comparative material. Deuve (1972) considered the species montane in Lao PDR but gave no other detail. Remains of four individuals were found in owl pellets in Khammouan Limestone NBCA in 1998 (Robinson and Webber 1998a). Two purchased fresh in the Ban Lak (20) market are held in the NHM, UK, where identification was confirmed (Evans *et al*. in prep. b). There are provisional identifications from Dong Ampham NBCA (two juveniles, apparently from the Xe Kaman lowlands, obtained from a villager and deposited in the Royal Ontario Museum, Canada; Davidson *et al*. 1997, C. M. Francis *in litt*. 1998) and Nam Phoun NBCA in 1997 (a preserved skin; Boonratana 1997, RB).

[*Petinomys setosus* **Temminck's Flying Squirrel** (= White-bellied Flying Squirrel[M2, M4])]. Not recorded for Lao PDR, but may be found to occur in north as in adjacent north Thailand it has been found in deciduous forests at 1300-1700 m (Muul and Thonglongya 1971); similar habitat occurs in parts of northern Lao PDR.

Status Information on Small flying squirrels: Small flying squirrels occur widely in markets, but these lack information on capture site. They have been seen regularly on field surveys only in deciduous parts of Xe Pian NBCA and in degraded evergreen forest of Phou Xang He NBCA (Duckworth *et al*. 1994). Scattered records from many other areas (Table 12), including evergreen forest at 1200 m (Duckworth 1998), presumably involve several taxa. Low sighting rates are as likely to reflect difficulties of detection (eyeshine is weak) as low numbers. Local declines have obviously occurred (no species is now observed regularly at large in the centre of Vientiane town), but whether declines have been widespread, or whether any species is associated with a preferentially threatened habitat, is unclear. All members of the genera *Trogopterus* and *Hylopetes* are categorised as Little Known in Lao PDR as there are few certain records of any species, some are listed as of global conservation concern by IUCN (1996) and species which are truly at risk can only be identified once there is a basic understanding of the status, habitat use and distribution of each.

Conservation Management and Research Proposed for Flying squirrels:

- Clarification of the status of all species in *Trogopterus*, *Hylopetes* and *Petinomys* by a structured collecting programme, and of *Petaurista petaurista* (field observations will suffice), so that taxa in need of action can be identified, and areas and actions prioritised. For small flying squirrels, only field trapping, acquisition of freshly captured animals from hunters in the field, and collection of remains left by predators (as used successfully by Robinson and Webber 1998a) will allow understanding of distribution and habitat use.
- Conservation of adequate areas of habitat through the NBCA system.
- Monitoring of trade levels.

Muridae (mice, rats, voles and bamboo rats): see separate chapter

Hystricidae: Porcupines (2 species in Lao PDR; 11 worldwide)

• *Hystrix brachyura* **East Asian Porcupine** (separated as *H. hodgsoni* Crestless Himalayan Porcupine[M2], Hodgson's Porcupine[M1]). *Conservation Significance:* Globally Threatened - Vulnerable. Not At Risk in Lao PDR (see below). *Documented Range and Habitat:* North[M9], centre[M13], south[M8]. All forest-types, scrub and agricultural areas from plains to at least 1600 m. *Status Information:* Field records from many recent survey areas (Table 12). Porcupines are both frequent crop pests and food in rural Lao PDR (Tables 1, 2), and their meat is sold in urban markets (Annex 1) and exported to Thailand (Srikosamatara *et al*. 1992). Quills, stomachs and other parts are used in traditional medicine, but there is no evidence that this threatens the species (Martin 1992, Baird 1995b). *Taxonomic issues:* Lekagul and McNeely (1977) divided this species into *H. hodgsoni* Crestless Himalayan Porcupine and *H. brachyura* Malayan Porcupine. The latter is primarily Sundaic, with an isolated population in west Yunnan (China), but there is no evidence of it in Lao PDR. This arrangement was not followed by Corbet and Hill (1992), nor by IUCN (1996). The latter categorised *H. brachyura* in the wide sense as Globally Threatened, thus including populations in Lao PDR, although these were not listed (J. Baillie *in litt*. 1998).

Atherurus macrourus **Asiatic Brush-tailed Porcupine** (= Bush-tailed Porcupine[M2]; = Brush-tailed Porcupine[M1]). North[M15], centre[M8], south[M8]. Wide range of forest and degraded habitats from plains to at least mid altitudes. (Plate 17)

Conservation Management and Research Proposed for Porcupines:

- Monitoring of trade levels.
- Clarification of the global status of *H. brachyura*; if its status in Lao PDR reflects that range-wide, it does not merit the IUCN (1996) category of Globally Threatened. Conversely, if the species is genuinely threatened elsewhere, the Lao population is internationally significant and should be monitored, although currently the species is not At Risk in Lao PDR or even potentially so.

Leporidae: Hares and rabbits (2-3 species in Lao PDR; 54 worldwide)

Lepus peguensis **Siamese Hare** (= Burmese Hare[M4, M5]); (sometimes included in *L. nigricollis* Indian Hare). North[M9], centre[M8], south[M8]. Naturally in dry dipterocarp forest and dry-season river channel vegetation; also in secondary grasslands and other disturbed areas.

[*Lepus comus* **Yunnan Hare**]. Not recorded from Lao PDR but mapped range in Corbet and Hill (1992) comes very close to the Yunnan (China) - Lao PDR border and the species may yet be found to occur in the far north, from whence there appear to be no specimens of any hare.

• *Nesolagus* sp. **Annamite Striped Rabbit**. *Conservation Significance:* Discovered too late for assessment by IUCN (1996); Little Known in Lao PDR. Endemic to the Annamite mountains of Lao PDR and Vietnam (Surridge *et al*. 1999). *Documented Range and Habitat:* North (provisionally, Tizard 1996), centre (RJTim). Reported by villagers to inhabit climatically wet evergreen forest. *Status Information:* Several specimens found in the Ban Lak (20) market in 1996 are under formal description. Villagers report the species from Nam Theun Extension PNBCA (Tobias 1997) and the southern parts of Nakai-Nam Theun NBCA (RJTim), but there are as yet no field records. Rabbits are used in traditional medicine (Baird 1995b), but there is no evidence that this species is used. The species is currently listed as Little Known in Lao PDR as any threats to it are unclear.

Conservation Management and Research Proposed for Hares and rabbits:

- Field surveys and study to determine the range of *Nesolagus* in Lao PDR, habitat use, and threats (if any) to the species.
- Formal taxonomic analysis of the Annamite form to determine the degree of divergence from *N. netscheri* Sumatran Rabbit (Globally Threatened - Critical; IUCN 1996). This is currently ongoing by RJTim (morphological aspects) and A. Surridge and D. Bell (University of East Anglia, U.K.; genetics).

Appendix: Species Omitted from the Foregoing List

Tupaia glis **Common Treeshrew** (included in *T. glis* Common Treeshrew[M2, M3], *T. glis* Malay Treeshrew[M1]). Various recent reports (e.g. Davidson 1998) following Corbet and Hill's (1992) taxonomy listed *T. glis* for Lao PDR; this was an accidental error for *T. belangeri*.

Hylobates hoolock **Hoolock Gibbon**. Suggestions that Hoolock Gibbon occurs in Lao PDR (e.g. Gressitt 1970, and "Laos?" under the species's range in IUCN 1996) seem to stem from Deuve and Deuve (1963a). Although they knew of no Lao specimen, they felt that the species might inhabit Lao PDR, as it occurred in nearby parts of Myanmar. This caution was later abandoned and the species was stated to be present in Lao PDR, although only in the north (Deuve 1972: 12). It is most unlikely that Hoolock Gibbon occurs in Lao PDR as it would have to cross two major rivers, the Salween and the Mekong (see Geissmann 1995).

Rhinoceros unicornis **Indian Rhinoceros** (= Great Indian One-horned Rhinoceros[M1], = Great Indian Rhinoceros[M7]). Deuve and Deuve (1962b) suggested that this rhinoceroses may occur or may have occurred in Lao PDR. Rookmaaker (1980) considered the special Lao name for a large one-horned rhinoceros documented by the Deuves to be "the soundest reason yet presented to accept the presence of *R. unicornis* in Laos". However, it means little as in Lao PDR size variants of quarry species often have special names. Rookmaaker (1980) concluded that there is no evidence that this species ever inhabited Lao PDR.

Cervus duvaucelii **Barasingha** (= Swamp Deer[M5]); (separated as *C. schomburgki*[M6], Schomburgk's Deer[M2, M4]). A set of antlers apparently of this species was seen in a Phongsali medicine shop in 1991. Although Schroering (1995) stated that the shop owner had reported that they came from an animal killed nearby in 1990, when WGR revisited him in 1996 he disclaimed all knowledge of their origin. Although *C. d. schomburgki* is often considered to have been restricted to the Chao Phrya basin of Thailand prior to its extinction (e.g. Lekagul and McNeely 1977), there are unresolved historical indications of a wider distribution (G. Schroering verbally 1997).

Callosciurus pygerythrus **Irrawaddy Squirrel** (= Hoary-bellied Himalayan Squirrel[M1]). Deuve (1972) listed *C. p. pygerythrus* for Lao PDR as well as '*C. p. imitator*' (= *C. inornatus*). However, except around Mandalay, Myanmar, *C. pygerythrus* occurs only west of the Irrawaddy / Sittang Rivers (Moore and Tate 1965). Deuve's (1972) mistake is clearly a mis-citation of Gray's (1867) type description of *C. inornatus*.

Petaurista alborufus **Red-and-white Giant Flying Squirrel** (Red-and-white Flying Squirrel[M4, M5]). This species is mapped in Lekagul and McNeely (1977) for most of northern Lao PDR. However, this population, *P. "a." barroni*, is better regarded as a form of *P. petaurista* (Corbet and Hill 1992). Furthermore, we have traced no primary sources concerning the occurrence of *barroni*, whatever species it is associated with, in Lao PDR.

Hylopetes lepidus **Grey-cheeked Flying Squirrel** (included in *H. lepidus* Red-cheeked Flying Squirrel[M2]). This species was listed for Nam Ha NBCA by Tizard *et al*. (1997), but as accepted by Hill (1960) and Corbet and Hill (1992), *lepidus* is a Sundaic form which would be most unexpected in Lao PDR. However, Lekagul and McNeely (1977) considered *H. lepidus* to include *H. spadiceus*, which does occur in Lao PDR, and the identification in Nam Ha NBCA was made on this basis (RJTiz). Wilson and Reeder (1993) recorded *H. lepidus* from southern Vietnam, based on a mention in Sokolov *et al*. (1986). This may stem from a specimen listed (without details) from Phu Quoc island and held in the MNHN, Paris, by Cao Van Sung (1984).

Aeromys tephromelas **Black Flying Squirrel** (= Large Black Flying Squirrel[M2]). This species was listed for Nam Ha NBCA by Tizard *et al*. (1997), but it is known only from the Malay Peninsula, Sumatra and Borneo (Corbet and Hill 1992). Lekagul and McNeely (1977), mentioning specimens perhaps of this squirrel in shops in Chiangmai (north-west Thailand), speculated about the existence of a northern population as yet undocumented. If there is one, the species may indeed occur in Lao PDR. As, at least locally, melanistic individuals of the genus *Petaurista* can look uniformly very dark (e.g. Duckworth 1997d), a specimen would be necessary to confirm this species's presence in Lao PDR.

ORDER INSECTIVORA

M. F. Robinson

INTRODUCTION

This list includes all species of the mammalian order Insectivora with Lao records known to the author. Species are listed as confirmed in Lao PDR only where a documented record has been traced; portrayal of parts of Lao PDR in the range maps of general works (e.g. Lekagul and McNeely 1977, Corbet and Hill 1992) is not sufficient, as most maps extrapolate to some degree. Additionally, several species known from neighbouring countries which may potentially occur in Lao PDR are placed in square brackets. The taxonomy and species limits of this order are unsettled and it is likely that further species will be named, including both reassessments of existing material and new discoveries. World species totals for families are taken from Corbet and Hill (1992).

Sequence, species limits and scientific names follow *Mammals of the Indomalayan Region* (Corbet and Hill 1992), with minor exceptions, including some presented by Hutterer (1993). Synonymies are presented except when extensive, where reference is made to an existing compilation. No English names are given as there is no stability of usage, in or outside the region, for these species. Little is known about the distribution and habitat of species of Insectivora in Lao PDR, so detail is presented of recent records supplemented (explicitly) with information from neighbouring countries.

No species are listed in CITES Appendix I or II (WCMC 1998) and only a single species, *Hylomys sinensis*, is of international conservation significance in IUCN (1996). No other key species of special conservation significance are designated as there is insufficient information to assess national conservation status. There is no reason to believe that any species is threatened in Lao PDR other than indirectly through habitat change.

Often species can only be identified by critical comparison of specimens with those held in museum collections. Thus, information presented here is restricted to identifications verified with voucher specimens, except where indicated.

ANNOTATED LIST OF SPECIES

Erinaceidae: Gymnures (1 species in Lao PDR; 1 potentially; about 19 species worldwide)

Subfamily Galericinae

***Hylomys suillus* Müller, 1841** (= *H. peguensis* Blyth, 1859; = *H. parvus* Robinson and Kloss, 1916). North (Osgood 1932), centre (provisionally, Deuve 1972) and south (sight record, Duckworth *et al.* 1994). Occurs throughout most of Indochina (Corbet and Hill 1992, Hutterer 1993) with specific records from Phongsali and Xiangkhouang (Osgood 1932), and Dong Hua Sao NBCA at 1200 m on the Bolaven Plateau amid degraded scrub land (Duckworth *et al.* 1994; TDE). Deuve (1972) stated that the subspecies *H. s. microtinus* is found in north Lao PDR from Vientiane to the Chinese border and *H. s. siamensis* in central and south Lao PDR. He detailed no specific localities, although Deuve and Deuve (1963b) listed "Vientiane" for the species. Bergmans (1995) mentioned village reports of sightings from Sekong Province, perhaps attributable to this species. From specimens in NHM, Osgood (1932), Allen (1938) and Dao Van Tien (1985), it seems that three taxa (whether best regarded as species or subspecies is unclear) inhabit Indochina: (1) *H. s. siamensis*, which extends from eastern Thailand to Xiangkhouang in Lao PDR; (2) one as yet un-named known from Dak To, in the Vietnamese Annamites; and (3) *H. s. microtinus*, from Phongsali in Lao PDR and several localities in Tonkin, Vietnam (C. P. Groves *in litt*. 1999).

[• ***Hylomys sinensis* (Trouessart, 1909)** (= *Neotetracus sinensis*)]. *Conservation Significance:* Globally Near-Threatened (IUCN 1996). *Context:* Not recorded from Lao PDR; however, as it is found from north Vietnam (Osgood 1932) west to Sichuan it seems very likely to inhabit adjacent parts of Lao PDR (C. P. Groves *in litt*. 1999).

Talpidae: Moles (2 species in Lao PDR; 1 potentially; about 31 species worldwide)

Subfamily: Talpinae

***Talpa micrura* Hodgson, 1841** (= *T. cryptura* Blyth, 1843; = *T. klossi* Thomas, 1929; = *T. parvidens* Miller, 1940). North, centre (provisionally, Corbet and Hill 1992) and south (Osgood 1932). Recorded throughout Lao PDR by Corbet and Hill (1992) and Deuve (1972), but no specific localities or habitat information are given. A single specimen was collected at Ban Thateng (Osgood 1932). Also recorded from areas of northern Vietnam (Osgood 1932) and Thailand (Allen and Coolidge 1940). In Thailand it occurs in forests, particularly in mountainous areas (Lekagul and McNeely 1977), at altitudes of 1000-2000 m (Corbet and Hill 1992).

[***Talpa longirostris* Milne-Edwards, 1870**]. No Lao records, but found in neighbouring areas of northern Vietnam at altitudes of 1800-2900 m (Corbet and Hill 1992) and so may be found in adjacent parts of Lao PDR.

***Talpa leucura* Blyth, 1850**. North (Osgood 1932). Single specimen recorded from Xiangkhouang by Osgood (1932), listed as *Parascaptor leucurus*. Also, recorded in north Lao

PDR by Corbet and Hill (1992), presumably on the basis of Osgood's record. Delacour (1940) stated that the species seemed fairly well distributed; the basis for this is unclear, as it is for Deuve and Deuve's (1963b) statement that the species was common in all Lao provinces.

Soricidae: Shrews (5 species in Lao PDR; 7 potentially; about 272 species worldwide)

Subfamily: Soricinae

[***Soriculus leucops* Hodgson in Horsfield, 1855** (= *S. minor* Dobson, 1890; = *S. baileyi* Thomas, 1914; = *S. gruberi* Weigel, 1969)]. Not recorded from Lao PDR, but found in northern Vietnam at altitudes of 3000 m (Osgood 1932), and thus potentially occurs in adjacent parts of Lao PDR.

[***Soriculus macrurus* Blanford, 1888** (= *S. irene* Thomas, 1911)]. No Lao records, but found in northern Vietnam, close to the Lao border (Corbet and Hill 1992), and thus potentially occurs in adjacent parts of Lao PDR.

[***Soriculus parca* (Allen, 1923)** (= *Chodsigoa smithii parca* Allen, 1923; = *C. lowei* Osgood, 1932; = *C. s. furva* Anthony, 1941)]. Not known from Lao PDR, but found in northern Vietnam, near the Lao border (Osgood 1932, Deuve 1972) and Thailand (Allen and Coolidge 1940). Lekagul and McNeely (1977) recorded *S. salenskii* Kastschenko, 1907 in Thailand, and their generalised distribution map included northern Lao PDR, but Lao PDR was not mentioned in the text. At the time *salenskii* was taken to include the form *smithii*, of which *parca* was considered a subspecies. However, *S. parca*, *S. smithii* and *S. salenskii* are all now considered to be separate species; *S. salenskii* is currently only recognised from an incomplete holotype from north Sichuan, China (Corbet and Hill 1992).

[***Anourosorex squamipes* Milne-Edwards, 1872** (= *A. assamensis* Anderson, 1875)]. No specific records for Lao PDR, although Corbet and Hill (1992) stated that it probably occurs. Also, Lekagul and McNeely (1977) showed a generalised distribution map which includes areas of north Lao PDR; however, this is not mentioned in the text. Known from neighbouring northern Vietnam (Osgood 1932), north Thailand (Allen and Coolidge 1940), Myanmar (Corbet and Hill 1992) and China (Osgood 1932). In Yunnan, China, it has been collected between 2438 and 3048 m (Allen 1923).

***Chimarrogale himalayica* (Gray, 1842)** (= *Crossopus himalayica* Gray, 1842; = *C. leander* Thomas, 1902; = *C. varennei* Thomas, 1927). North (Osgood 1932). Single specimen caught in Phongsali (Osgood 1932). Deuve (1972) recorded it in Lao PDR, apparently (Deuve and Deuve 1963b) extrapolating from Ellerman and Morrison-Scott (1951). Also occurs in northern Vietnam (Osgood 1932), north Myanmar and south China (Corbet and Hill 1992). Referred to by Osgood (1932) as a water shrew and reported to occur in mountain streams by Corbet and Hill (1992). *Taxonomic issues:* Deuve (1972) recorded *C. platycephala* Temminck, 1842, which included *C. himalayica* as a synonym; however, Hutterer (1993) retained both as separate species. *C. platycephala* is larger with a relatively longer tail and broader skull and is known only from Japan (Osgood 1932, Corbet and Hill 1992).

Subfamily: Crocidurinae

[***Suncus murinus* (Linnaeus, 1766)** (See Corbet and Hill 1992 for synonyms)]. Described as widespread across Indochina by Lekagul and McNeely (1977) and Corbet and Hill (1992), although neither specifically mentioned Lao PDR. Deuve (1972) recorded *S. m. murinus* in Lao PDR, but gave no specific records or localities. Found around houses and buildings (Deuve 1972) and in grassland, scrub and forest (Lekagul and McNeely 1977, Corbet and Hill 1992).

***Suncus etruscus* (Savi, 1822)** (See Corbet and Hill 1992 for synonyms). Centre (Smith *et al*. 1998). Widespread in the Indomalayan region (Corbet and Hill 1992), but with few records, probably due to its small size of 1.8 g (Innes 1994). On mainland South-east Asia it is known from only three localities east of Bangkok; Loei Province, north-east Thailand (Jenkins and Smith 1995), Cuc Phuong National Park, Vietnam (Feiler and Nadler 1997b) and Khammouan Limestone NBCA (Smith *et al*. 1998). In Khammouan Limestone NBCA, Robinson and Webber (1998a) recovered cranial remains from two sites. At Ban Mauang they were found in owl pellets collected from a cave entrance. The area comprised limestone karst with heavily degraded, mixed deciduous forest, scrub and bamboo at its base. The low-lying areas away from the karst had been cleared for the cultivation of paddy rice. At a cave near Ban Vieng a ramus was found in the prey remains of the carnivorous bat *Megaderma lyra*. The area comprised dense, relatively undisturbed semi-evergreen forest, with small areas of grassland, maintained for grazing.

***Crocidura fuliginosa* Blyth, 1856** (See Corbet and Hill 1992 for synonyms). North (Osgood 1932) centre and south (Corbet and Hill 1992). Widespread in Indochina (Corbet and Hill 1992). Lekagul and McNeely (1977) and Corbet and Hill (1992) showed the species as widespread in Lao PDR on their generalised distribution maps, although made no reference to it in the text. There are few specific records from Lao PDR. A specimen was recorded from Muong Chao Noi, near Phongsali (Osgood 1932), Deuve (1972) recorded it in the north and Delacour (1940) referred to it as the common shrew

of north-east Laos. In Malaysia it appears to inhabit a range of habitats from agricultural areas, grassland and both montane and lowland forest (Medway 1969). In Tonkin (Vietnam) it occurs up to 2700 m (Lekagul and McNeely 1977). *Taxonomic issues:* Lekagul and McNeely (1977) listed both *C. dracula* and *C. fuliginosa* as present in Thailand, showing generalised distribution maps which include areas of Lao PDR. Deuve (1972) also listed *C. dracula* as present in northern Lao PDR. However, *C. dracula* is a synonym of *C. fuliginosa* (Jenkins 1982, Corbet and Hill 1992).

***Crocidura hilliana* Jenkins and Smith, 1995**. Centre (Smith *et al.* 1998). Recorded from two localities in Khammouan Limestone NBCA where Robinson and Webber (1998a) found cranial remains in owl pellets and among the prey of the carnivorous bat *Megaderma lyra*. The habitat comprised limestone karst with heavily degraded, mixed deciduous forest, scrub, bamboo and paddy rice at Ban Mauang and relatively undisturbed, semi-evergreen forest, with small areas of grassland, maintained for grazing near Ban Vieng. *Special significance:* endemic to a small area; north-east (Jenkins and Smith 1995) and central Thailand (Motokawa and Harada 1998), and Khammouan Limestone NBCA (Smith *et al*. 1998). However, this limited range probably reflects lack of knowledge as a result of limited survey work.

[***Crocidura attenuata* Milne-Edwards, 1872** (= *C. rubricosa* Anderson, 1877; = *C. kingiana* Anderson, 1877; =? *C. fuliginosa trichura* Dobson in Thomas, 1889; =? *C. aequicauda* Robinson and Kloss, 1918; = *C. grisea* Howell, 1926; = *C. tanakae* Kuroda, 1938)]. Widespread in Indochina (Corbet and Hill 1992), but although Lekagul and McNeely (1977) and Corbet and Hill (1992) showed it to be present on their generalised distribution maps, they gave no specific records for Lao PDR in the text. Known to occur in Vietnam from near sea level up to 1700 m (Heaney and Timm 1983) and has been collected in agricultural areas in Thailand (Lekagul and McNeely 1977).

***Crocidura pullata vorax* Allen, 1923** (= *C. rapax* Allen, 1923). Centre and south (Smith *et al*. 1998). In Xe Pian NBCA, a single specimen was caught in semi-evergreen forest near Ban Taong (Robinson 1997). In Khammouan Limestone NBCA, the species was recorded among the prey remains of the carnivorous bat *Megaderma lyra*, in an area comprising dense, relatively undisturbed, semi-evergreen forest surrounded by karst formations reaching heights of 200-300 m and in an area of dense, relatively undisturbed, semi-evergreen forest, within the small areas of grassland maintained for grazing (Robinson and Webber 1998a). It is poorly recorded in Indochina. The nearest records to Lao PDR are from north (Allen and Coolidge 1940), west (Robinson *et al*. 1995) and north-east Thailand (Smith *et al*. in prep.), and Yunnan, China, up to 3650 m (Allen 1923). *Taxonomic issues:* The taxonomy is uncertain. Originally listed as *C. vorax* by Allen (1923), subsequently as a subspecies of *C. russula* (Lekagul and McNeely 1977), and as *C. gueldenstaedtii* (Corbet and Hill 1992), it has more recently been grouped provisionally with *C. pullata* (Hutterer 1993).

[***Crocidura horsfieldi* Tomes, 1856** (= *C. retusa* Peters, 1870; =? *C. indochinensis* Robinson and Kloss, 1922; = *C. watasei* Kuroda, 1924; = *C. tadae* Tokuda and Kano, 1936)]. No specific records in Lao PDR. However, Hutterer (1993) recorded its distribution as north Thailand to Vietnam, while Corbet and Hill (1992) and Lekagul and McNeely (1977) showed the species in Lao PDR on their generalised distribution maps, but made no reference to Lao PDR in the text. It was also listed by Deuve (1972), but again with no specific records or localities. Known to occur in neighbouring northern Vietnam (Robinson and Kloss 1922, Osgood 1932, Heaney and Timm 1983), north-east Myanmar (Anthony 1941) and south China (Corbet and Hill 1992). In Thailand, it is classed as "an intermediate montane form, found from 1220 to 2120 m in areas of fairly heavy cover" (Lekagul and McNeely 1977).

Miscellaneous records: Deuve (1972) recorded *Soriculus caudatus* (Horsfield, 1851) from north Lao PDR. However, both Corbet and Hill (1992) and Hutterer (1993) recorded it from northern Myanmar and south-west China, several hundred kilometers north of Lao PDR. As Deuve (1972) provided no specific information for this record, it may have been erroneous.

CONSERVATION MANAGEMENT AND RESEARCH PROPOSED FOR INSECTIVORA

In Lao PDR, as with much of Indochina, there is very little information on species of the Insectivora. Most information available is either non-specific (Deuve 1972, Lekagul and McNeely 1977, Corbet and Hill 1992, Hutterer 1993) or in the form of historical records (Allen 1923, Osgood 1932) which were often based on individual specimens with little or no ecological data. Even where ecological information is presented, such as by Lekagul and McNeely (1977), this is very general, and indeed questionable due to the (at least occasional) misidentification of species (see Heaney and Timm 1983). Insectivores, particularly shrews, are difficult to survey because they are not easily caught in conventional cage traps, being light-footed and not attracted to bait. However, a recent study, collecting owl pellets and the prey remains of a carnivorous bat, has identified three species previously unrecorded in Lao PDR (Robinson and Webber 1998a, Smith *et al*. 1998), providing both ecological and taxonomic information. Due to the limited data available for this group it is not possible to make any meaningful conservation recommendations or to identify any species of conservation significance. Before these can be done, a systematic programme of research is needed to survey insectivores and determine their ecological and conservation requirements in Lao PDR.

ORDER CHIROPTERA: BATS

C. M. Francis, A. Guillén and M. F. Robinson

INTRODUCTION

Recent surveys in Lao PDR have recorded nearly 90 species of bats, and new species for the country continue to be recorded on most surveys. Because many areas of Lao PDR have not yet been surveyed, it seems likely that additional species remain to be found. For this reason, following the practice of the first edition (Salter 1993b), the list below includes species potentially occurring in Lao PDR based on known occurrence in adjacent countries, even if they have not yet been reported from Lao PDR. These species are indicated in square brackets. If the identity of a species has not yet been confirmed in Lao PDR, the account is again set in square brackets. Bats caught which clearly did not belong to any named species known from Lao PDR, and where the correct name remains uncertain are not in square brackets, and are listed as 'sp.' or using 'cf.' in the provisionally-assigned scientific name. Some of these are doubtless undescribed to science. Including species thought likely to occur, but not yet confirmed, as well as several species whose identity has not yet been worked out, the number of species in Lao PDR is probably over 100. In each species account, 1-3 references are cited for specific reports of specimens in each of north, central and south Lao PDR. No attempt has been made to list all records for each species in a region, and some species have been identified from many localities. Because we are most concerned with the current status of each species, preference has been given for recent reports. Older references are only cited if there is little doubt about the identification, based on the fact that the record has been repeated or confirmed in more recent compilations (e.g. Corbet and Hill 1992). References frequently cited for distribution are abbreviated thus: [C1]Francis and Khounboline (1996), [C2]Francis *et al*. (1996), [C3]Francis *et al*. (1997a), [C4]Francis *et al*. (1997b), [C5]Francis *et al*. (1997c), [C6]Francis and Khoonmy (1998a), [C7]Francis and Khoonmy (1998b), [C8]Francis and Khoonmy (1998c), [C9]Francis and Khoonmy (1998d), [C10]Francis and Vongkhamheng (1998), [C11]Guillén *et al*. (1997), [C12]Guillén and Francis (1998a), [C13]Guillén and Francis (1998b), [C14]Guillén and Francis (1998c), [C15]Robinson (1998), [C16]Robinson and Webber (1998a), [C17]Bergmans (1995) and [C18] WCS (1995b).

Most of the citations for surveys by WCS refer to unpublished reports. Those reports were generally prepared shortly after completion of field work, at which point many identifications were still tentative. Subsequent study of voucher specimens in museum collections has resulted in re-identification of some specimens. Citations in this report refer to the currently accepted identification, and discrepancies from the original identification are only discussed with respect to published references. CMF and AG are preparing a separate report on the WCS bat surveys for formal publication that will provide more complete details on individual surveys. Taxonomy and nomenclature follow Corbet and Hill (1992), except as mentioned in the text.

Conservation significance is indicated for individual species if they have been listed under one of the IUCN red list categories (IUCN 1996; see Conventions), or are listed in CITES Appendix I or II (WCMC 1998). Also mentioned are species with changes in conservation status proposed in the draft global action plan for microchiropteran bats (Hutson *et al*. in prep.). Most status listings for South-east Asian bats are based on very limited information, because the region has not yet been well surveyed for bats. Some species listed in IUCN (1996) as threatened, on the basis of the few known records, were found at several additional localities during our surveys, and probably should be reclassified. Conversely, some other species, that were not listed, appear to be fairly rare (at least based on our surveys in Lao PDR) and probably should be listed. Where appropriate, we have indicated this additional information on status in the species accounts. In addition, our surveys suggest that bats roosting in large colonies, primarily in caves, are at risk of extirpation in many parts of Lao PDR because of exploitation for food. Cave-dwelling species that roost in small scattered groups may be less at risk, but they are also often rare species, so they could be vulnerable to incidental harvest along with more common species. Species that use caves, but also roost elsewhere are probably less at risk, but in many cases it is not known which species those are. Because of this uncertainty, we have listed most cave-roosting species as Potentially At Risk in Lao PDR. A few species are listed as At Risk in Lao PDR, because they are only known to roost in large colonies that are clearly being exploited. The list of key species for Lao PDR is given in Annex 6; species listed in CITES Appendix I or Appendix II are detailed in Annex 3.

ANNOTATED LIST OF SPECIES

Pteropodidae: Old-world fruit bats (8-11 species)

[• ***Pteropus vampyrus*** Large Flying-fox]. *Conservation Significance:* Potentially At Risk in Lao PDR; CITES Appendix II. *Documented Range and Habitat:* North? A captive bat apparently of this species was photographed in western Bolikhamxai Province in 1998, well north of its range as mapped in Corbet and Hill (1992) but its origin is not known (WGR; Plate 18). May occur as a vagrant, but unlikely to be regular or resident in Lao PDR because not reported by villagers who have been asked in central or southern Lao PDR where it would be most expected based on range. Species usually roosts in large flocks in tree tops, but is semi-nomadic, probably in response to regional variation in fruit availability. Likely to be hunted for food if encountered; large camps would be vulnerable to disturbance from hunting.

Plate 18:

Scotomanes ornatus, Hin Namno NBCA, February 1998. A medium-sized and very colourful species of forest glades and streams. *C. M. Francis / WCS.*

Myotis ricketti, Khammouan Limestone NBCA, January 1998. The large feet of this species are used to scoop large insects and small fish from water. *C. M. Francis / WCS.*

Harpiocephalus sp., Khammouan Limestone NBCA, January 1998. A poorly known insectivorous bat unusual in the thick hairs all over the tail membrane and tubular nostrils. Two species of the genus occur in Lao PDR; they are difficult to distinguish.
C. M. Francis / WCS.

Megaderma spasma, Dong Ampham NBCA, May 1997. This species takes prey (large invertebrates and sometimes small vertebrates) from surfaces. *C. M. Francis / WCS.*

Rhinolophus acuminatus, Dong Khanthung PNBCA, February 1998. Individuals of this species may be bright orange or dark grey-brown. *C. M. Francis / WCS.*

Myotis formosus, Dong Ampham NBCA, May 1997. A poorly-known bat of which this individual is the only Lao record. *C. M. Francis / WCS.*

Cynopterus sphinx, Dong Ampham NBCA, April 1997. One of the most widespread fruit bats in Lao PDR. An important seed-disperser and pollinator of fruit trees. *C. M. Francis / WCS.*

A bat believed to be *Pteropus vampyrus*, the largest bat from Lao PDR. This individual, caged in a village in Bolikhamxai Province in 1998, is the only Lao record and its origin is unclear. *Po Souvannalath / WCS and IUCN.*

• ***Rousettus leschenaulti*** Leschenault's Rousette. *Conservation Significance:* Potentially At Risk in Lao PDR. *Documented Range and Habitat:* North[C17], centre[C10] (Phillips 1967), south[C17, C8]. Roosts in caves (Lekagul and McNeely 1977).

• ***Rousettus amplexicaudatus*** Geoffroy's Rousette. *Conservation Significance:* Potentially At Risk in Lao PDR. *Documented Range and Habitat:* Centre[C16], south[C3, C15]. Roosts in caves (Lekagul and McNeely 1977). Appears to be less widespread than *R. leschenaulti*, but there are relatively few records on which to base this judgement; externally, both species are similar in appearance.

Cynopterus brachyotis Lesser Short-nosed Fruit Bat. South[C9]; range maps in Corbet and Hill (1992) suggest it may extend to centre and north, but the nearest location cited in the text is Vietnam. Forests, orchards and open country (Lekagul and McNeely 1977).

Cynopterus sphinx Short-nosed Fruit Bat. North[C1], centre[C7, C10, C16], south[C8, C9] (Plate 18). Probably widespread throughout the country, especially in open forest areas (Corbet and Hill 1992). Often feeds on flowers of cultivated plants such as kapok and bananas, presumably pollinating them (Robinson and Webber 1998a).

[***Cynopterus horsfieldi*** Horsfield's Fruit Bat]. Centre (provisionally[C7]). One specimen captured at Hin Namno NBCA, together with *C. sphinx*, appeared to be this species, but further study of the specimen is required to confirm the identity.

Megaerops niphanae Northern Tail-less Fruit Bat. North[C17, C11], centre[C2, C10], south[C3, C9]. Probably the most widespread fruit bat in forested areas of Lao PDR, but also found in more open areas. This species was described in 1983, prior to which it was confused with *M. ecaudatus*.

Megaerops ecaudatus Tail-less Fruit Bat. South[C3, C9], sympatric with *M. niphanae*. Probably has similar habitat requirements to *M. niphanae*, but may not extend as far north. Externally, this species is similar to *M. niphanae*, and further research is required to determine which field marks are most reliable for identifying live animals.

[***Sphaerias blanfordi*** Mountain Fruit Bat]. Not recorded from Lao PDR, but occurs in northern Thailand and Myanmar (Corbet and Hill 1992) and might be expected in northern Lao PDR.

• ***Eonycteris spelaea*** Cave Nectar Bat. *Conservation Significance:* Potentially At Risk in Lao PDR. *Documented Range and Habitat:* North[C17, C12], centre[C16], south[C3, C15] (Osgood 1932). Probably widespread throughout the country. Roosts in caves (Lekagul and McNeely 1977). Feeds on nectar and pollen from flowers, and pollinates many trees including some economically important species such as durian, jackfruit and jambu (Start and Marshall 1976), as well as kapok and bananas (Robinson and Webber 1998a).

Macroglossus sobrinus Hill Long-tongued Fruit Bat. North[C12, C13], centre[C2] (Phillips 1967). Mapped from south by Corbet and Hill (1992). Evergreen forests (Lekagul and McNeely 1977). In older literature was known as *M. minimus*, but that name is now known to belong to a different species found only in Malaysia (Hill 1983). Feeds primarily on nectar and pollen of bananas and hence is an important pollinator (Start and Marshall 1976).

Emballonuridae: Sheath-tailed bats (3-4 species)

Note: Most species in Lao PDR are known from few records, because they forage relatively high off the ground and hence are difficult to catch away from roosts. Unidentified *Taphozous* bats have been recorded in many areas based on echolocation calls (CMF and AG), indicating that at least some species are fairly widespread.

Taphozous melanopogon Black-bearded Tomb Bat. North, at Pakou (Osgood 1932). Mapped as throughout Lao PDR (Corbet and Hill 1992), but basis for records not listed. Forested hills, roosting in caves and faults in cliffs (Lekagul and McNeely 1977).

[***Taphozous longimanus*** Long-winged Tomb Bat]. Not recorded from Lao PDR, but occurs in adjacent Thailand (Lekagul and McNeely 1977, Corbet and Hill 1992), and probably therefore also in Lao PDR. Roosts in houses, hollow trees and caves (Lekagul and McNeely 1977).

• ***Taphozous theobaldi*** Theobald's Tomb Bat. *Conservation Significance:* Potentially At Risk in Lao PDR. *Documented Range and Habitat:* Centre[C16], south[C15]. Roosts in caves (Lekagul and McNeely 1977, Robinson 1998) and possibly also hollow trees.

• ***Taphozous saccolaimus*** Pouched Tomb Bat. *Conservation Significance:* Potentially At Risk in Lao PDR. *Documented Range and Habitat:* South[C17]. In Thailand, the species roosts in houses, rock crevices or hollow trees (Lekagul and McNeely 1977).

Megadermatidae: False-vampires (2 species)

Megaderma spasma Lesser False-vampire. Centre[C10, C7], south[C3, C15] (Plate 18). Probably throughout (Corbet and Hill

1992). In Lao PDR has been found roosting in caves (Robinson and Webber 1998a) and hollow trees (Robinson 1998).

Megaderma lyra Greater False-vampire. North[C13], centre[C7, C10], south[C3, C15]. In Lao PDR has been found roosting in caves (Francis and Khoonmy 1998b, Robinson 1998), but also roosts in temples, wells and old buildings in Thailand (Lekagul and McNeely 1977). Often caught foraging in the same sites as the smaller *M. spasma* (Francis *et al.* 1997a, Francis and Vongkhamheng 1998).

Rhinolophidae: Horseshoe bats (15-19 species)

• ***Rhinolophus luctus*** Large Woolly Horseshoe Bat. *Conservation Significance:* Potentially At Risk in Lao PDR. *Documented Range and Habitat:* North[C12], centre[C10], south[C3]. Apparently widespread, but appears to be relatively uncommon. Has been caught roosting in caves (Francis and Vongkhamheng 1998, Robinson and Webber 1998a) but also may use hollow trees (Lekagul and McNeely 1977). Probably not in large colonies.

• ***Rhinolophus paradoxolophus*** Bourret's Horseshoe Bat. *Conservation Significance:* Globally Threatened - Vulnerable; Potentially At Risk in Lao PDR. Now known from several more localities than were known at the time of the IUCN (1996) listing, and probably should be reclassified. *Documented Range and Habitat:* North[C12], centre[C2, C10]. A roost of about 50 individuals was found in a cave in Khammouan Limestone NBCA (Robinson and Webber 1998a). Has been caught foraging in relatively undisturbed evergreen forest.

• ***Rhinolophus marshalli*** Marshall's Horseshoe Bat. *Conservation Significance:* Proposed IUCN listing (Hutson *et al*. in prep.): Globally Near-Threatened; Potentially At Risk in Lao PDR. In Lao PDR appears to be less common than preceding species. *Documented Range and Habitat:* North[C11, C12]. Has been caught near limestone caves in Lao PDR (Guillén and Francis 1998a), and has been found roosting in caves in Thailand (Robinson and Smith 1997). May also roost in hollow trees.

• ***Rhinolophus macrotis*** Big-eared Horseshoe Bat. *Conservation Significance:* Potentially At Risk in Lao PDR; apparently rare in region but not listed by IUCN (1996). *Documented Range and Habitat:* North[C12], centre[C2]. Probably roosts in caves, and potentially hollow trees.

• ***Rhinolophus* cf. *siamensis***. *Conservation Significance:* Potentially At Risk in Lao PDR; formerly considered a subspecies of *R. macrotis* (Corbet and Hill 1992), so not evaluated by IUCN (1996). *Documented Range and Habitat:* North[C12, C13, C14], centre[C2]. Has been caught near limestone caves. This species resembles *R. macrotis*, and is very similar genetically (AG), but differs in smaller size, slightly different noseleaf and higher echolocation calls. It has been caught in the same sites as the larger form (*R. m. caldwelli*) in both Lao PDR (Francis *et al*. 1996, Guillén and Francis 1998a) and Vietnam (Osgood 1932). The appropriate name appears to be *R. siamensis*, which was originally described as a subspecies of *R. macrotis* (Gyldenstolpe 1916), but the type specimen has not yet been examined to confirm this.

• ***Rhinolophus coelophyllus*** Croslet Horseshoe Bat. *Conservation Significance:* Potentially At Risk in Lao PDR. *Documented Range and Habitat:* North[C11]. So far recorded in Lao PDR only from Phou Khaokhoay NBCA, but widespread in Thailand, and probably occurs elsewhere in Lao PDR. Has been recorded roosting in caves in Thailand (Robinson *et al*. 1995, Robinson and Smith 1997).

• ***Rhinolophus shameli*** Shamel's Horseshoe Bat. *Conservation Significance:* Globally Near-Threatened; Potentially At Risk in Lao PDR. *Documented Range and Habitat:* North[C1], centre[C7], south[C3, C8]. Probably roosts mainly in caves.

• ***Rhinolophus pearsonii*** Pearson's Horseshoe Bat. *Conservation Significance:* Potentially At Risk in Lao PDR. *Documented Range and Habitat:* North[C11, C12, C13], centre[C7, C10], south[C8]. Roosts in caves (Francis *et al*. 1996, Robinson and Webber 1998a).

[• ***Rhinolophus yunanensis*** Dobson's Horseshoe Bat]. *Conservation Significance:* Globally Near-Threatened. *Documented Range and Habitat:* Not recorded from Lao PDR, but known from southern China, Myanmar and Thailand (Corbet and Hill 1992), and may extend into Lao PDR, most likely in the north-west.

Rhinolophus acuminatus Acuminate Horseshoe Bat. South[C3, C9, C15] (Plate 18). Has been caught in dry evergreen, mixed deciduous, and dry dipterocarp forests. In Xe Pian NBCA was caught roosting in a hollow log, hollow tree, and a cave (Robinson 1998).

• ***Rhinolophus pusillus*** Least Horseshoe Bat. *Conservation Significance:* Potentially At Risk in Lao PDR. *Documented Range and Habitat:* North[C12, C13, C14, C6], centre[C2, C16], south[C3, C8]. Roosts in caves (Francis *et al*. 1996, Robinson and Webber 1998a). Specimens referred here to this species appear to represent at least two and probably three species, based on genetic, morphological and echolocation call differences (AG). Some of them may represent one or both of the following two species, but further study is required to determine their identities.

[***Rhinolophus lepidus*** Blyth's Horseshoe Bat]. Not recorded from Lao PDR, but occurs in north Myanmar and southern China, and may well be in northwestern Lao PDR (Corbet and Hill 1992). Roosts in caves (Lekagul and McNeely 1977).

[***Rhinolophus subbadius***]. A skull and ramus possibly of this species was found in central Lao PDR (Robinson and Webber 1998a). Occurs in north Myanmar and northern Vietnam (Corbet and Hill 1992), and probably in intervening areas of Lao PDR.

Rhinolophus* cf. *chaseni. North[C1, C11], south[C3]. So far recorded from relatively few, scattered sites. It probably roosts mainly in hollow trees, rather than in caves. These bats match the description of bats from Cambodia reported by Hill and Thonglongya (1972) as *R. borneensis chaseni*. However, they are quite distinct in morphology and genetics from specimens of *R. borneensis* from Sabah and appear to represent a distinct species. Further study, including comparison with the type is required to determine whether *R. chaseni* is the correct name for this species.

• ***Rhinolophus malayanus*** Malayan Horseshoe Bat. *Conservation Significance:* Potentially At Risk in Lao PDR. *Documented Range and Habitat:* North[C6], centre[C2, C10], south[C3, C8]. Relatively widespread. Roosts in caves in Thailand (Robinson *et al*. 1995, Robinson and Smith 1997), and probably also in Lao PDR.

• ***Rhinolophus thomasi*** Thomas's Horseshoe Bat. *Conservation Significance:* Globally Near-Threatened; Potentially At Risk in Lao PDR. *Documented Range and Habitat:* North[C12, C13], centre[C2, C10, C7], south[C4]. Roosts in caves (Lekagul and McNeely 1977, Robinson and Webber 1998a).

• ***Rhinolophus stheno*** Lesser Brown Horseshoe Bat. *Conservation Significance:* Potentially At Risk in Lao PDR. *Documented Range and Habitat:* North[C12, C13], centre[C2, C10], south[C3]. In Thailand has been found roosting in caves (Robinson *et al*. 1995). May also roost in hollow trees. Widespread but not common. Bats in Lao PDR represent the subspecies *R. s. microbullatus* which was recently described from Vietnam (Csorba and Jenkins 1998).

[***Rhinolophus rouxii***]. Mapped in northern Lao PDR by Corbet and Hill (1992), but the only records they cite are from adjacent southern China and northern Vietnam.

• ***Rhinolophus affinis*** Intermediate Horseshoe Bat. *Conservation Significance:* Potentially At Risk in Lao PDR. *Documented Range and Habitat:* North[C12, C13, C6], centre[C2], south[C3, C4]. In Thailand has been found roosting in caves (Robinson *et al*. 1995). May also roost in hollow trees. Echolocation calls of specimens from Dong Hua Sao NBCA differed from those of specimens caught elsewhere in Lao PDR, suggesting the possibility of some genetic differentiation among regions (Francis *et al*. 1997b).

Hipposideridae: Roundleaf bats, trident bats (9-17 species)

• ***Hipposideros pomona***. *Conservation Significance:* Data Deficient (Global). *Documented Range and Habitat:* North[C11, C12, C13], centre[C2, C10], south[C3, C15]. Captured on most surveys in Lao PDR. Has been found roosting in caves (Robinson and Webber 1998a, Robinson 1998), but probably also uses hollow trees. Listed as a synonym of *H. bicolor* in Lekagul and McNeely (1977), but recent work has shown that *H. pomona* and *H. bicolor* are distinct species (Hill *et al*. 1986), and the species formerly known as *H. fulvus* in Thailand (Lekagul and McNeely 1977) is *H. pomona*.

• ***Hipposideros cineraceus*** Least Roundleaf Bat. *Conservation Significance:* Potentially At Risk in Lao PDR. *Documented Range and Habitat:* North[C12, C13, C6], centre[C10], south[C3, C15]. Caught much less frequently than *H. pomona*. May roost mainly in caves, and a cave roost has been found in southern Lao PDR (Robinson 1998).

• ***Hipposideros* spp**. *Conservation Significance:* Potentially At Risk in Lao PDR. *Documented Range and Habitat:* Two undescribed species in the *H. bicolor* group, both with some resemblance to *H. ridleyi* of peninsular Malaysia, have been captured in north Lao PDR (Guillén *et al*. 1997, Guillén and Francis 1998c), and one of them also in the centre (Francis *et al*. 1996). Both species potentially roost in caves and are so far known only from Lao PDR.

• ***Hipposideros galeritus*** Cantor's Roundleaf Bat. *Conservation Significance:* Potentially At Risk in Lao PDR. *Documented Range and Habitat*: South[C3, C9]. Known to roost in caves in Malaysia (Payne *et al*. 1985).

[• ***Hipposideros pratti*** Pratt's Roundleaf Bat]. *Conservation Significance:* Globally Near-Threatened. *Documented Range and Habitat:* Occurs in southern China and northern Vietnam (Corbet and Hill 1992), and may therefore occur in Lao PDR.

• ***Hipposideros lylei*** Shield-faced Roundleaf Bat. *Conservation Significance:* Globally Near-Threatened; Potentially At Risk in Lao PDR. *Documented Range and Habitat:* Centre[C2]. Roosts in caves (Medway 1983). In Lao PDR, so far recorded only from around Nakai-Nam Theun NBCA.

• ***Hipposideros armiger*** Great Roundleaf Bat. *Conservation Significance:* Potentially At Risk in Lao PDR. *Documented Range and Habitat:* North[C11, C12, C13], centre[C2, C7], south[C3, C8]. Roosts in caves (Lekagul and McNeely 1977, Robinson and Webber 1998a). Has been caught foraging low among trees, but also seen foraging high in the sky (Francis *et al*. 1996).

[• ***Hipposideros turpis*** Lesser Great Roundleaf Bat]. *Conservation Significance:* Globally Threatened - Endangered. *Documented Range and Habitat:* Occurs in south Thailand, northern Vietnam, and the Ryukyu Islands in Japan (Corbet and Hill 1992), so may be found in Lao PDR.

• ***Hipposideros larvatus*** Intermediate Roundleaf Bat. *Conservation Significance:* Potentially At Risk in Lao PDR. *Documented Range and Habitat:* North[C11, C12, C13], centre[C2], south[C3, C8]. Roosts in caves in Malaysia (Medway 1983), and large numbers have been caught around limestone areas in Lao PDR suggesting also roosts in caves there (Francis *et al*. 1996). Has also been found roosting in buildings near Wat Phu, Champasak (CMF, AG).

• ***Hipposideros* spp**. *Conservation Significance:* Potentially At Risk in Lao PDR. *Documented Range and Habitat:* Centre[C2]. Two species closely resembling *H. larvatus* have been caught near Khammouan Limestone NBCA. Most likely these will prove to be forms originally described as subspecies of *H. larvatus*, which actually should be recognised as full species. Further research is required to determine which names are appropriate.

• ***Hipposideros diadema*** Diadem Roundleaf Bat. *Conservation Significance:* Potentially At Risk in Lao PDR. *Documented Range and Habitat:* Centre[C16], south[C3, C9]. Roosts in caves (Medway 1983, Robinson and Webber 1998a), although has also been caught far from known caves (Francis *et al*. 1997a, Francis and Khoonmy 1998d).

• ***Aselliscus stoliczkanus*** Stoliczka's Trident Bat. *Conservation Significance:* Potentially At Risk in Lao PDR. *Documented Range and Habitat:* North[C11, C12, C13], centre[C2, C7]. Roosts in limestone caves (Lekagul and McNeely 1977).

• ***Coelops frithii*** Larger Tail-less Leaf-nosed Bat. *Conservation Significance*: Potentially At Risk in Lao PDR. *Documented Range and Habitat:* Hill (1972) cited a specimen from Lao PDR in the NHM, London, but no locality details were given. Roosts in hollow trees or caves (Lekagul and McNeely 1977).

[• ***Coelops* cf. *robinsoni*** Lesser Tail-less Leaf-nosed Bat]. *Conservation Significance:* Globally Near-Threatened; Potentially At Risk in Lao PDR. *Documented Range and Habitat:* North[C18, C12, C14]. These specimens more closely resemble *C. robinsoni*, for which the next nearest known location is peninsular Malaysia (Corbet and Hill 1992), than *C. frithii*, but their identity has not yet been confirmed.

[***Paracoelops megalotis***]. Known only from one specimen in northern Vietnam (Corbet and Hill 1992), but potentially also occurs in Lao PDR.

Vespertilionidae: Evening bats (37-53 species)

***Myotis* spp**. At least four, and possibly five species of *Myotis* additional to those listed below have been captured during surveys by WCS. D. Kock (*in litt*. 1997) tentatively referred one of these to *M. alticraniatus* as a species distinct from *M. siligorensis* and another as *M. deignani* as a species distinct from *M. horsfieldi*. In addition, two species resembling, but larger than, *M. muricola* have been captured. One of these might be *M. ater*. Further study of the specimens is required to determine which names are actually appropriate for each of these species.

[***Myotis chinensis*** Large Myotis]. Recorded from south China and north Thailand. May prove to occur in Lao PDR.

Myotis formosus Painted Myotis. South[C3] (Plate 18). Probably occurs sparsely in all regions, because known records are scattered from India to Taiwan and south to Indonesia and the Philippines, with very few in mainland South-east Asia (Corbet and Hill 1992).

• ***Myotis annectans*** Hairy-faced Myotis. *Conservation Significance:* Globally Near-Threatened; Little Known in Lao PDR. *Documented Range and Habitat:* North[C12], centre[C2], south[C3].

• ***Myotis rossetti*** Thick-thumbed Myotis. *Conservation Significance:* Globally Near-Threatened; Little Known in Lao PDR. *Documented Range and Habitat:* South[C3]. The only known Lao specimen was caught beside a small stream in open dipterocarp forest.

• ***Myotis siligorensis*** Small-toothed Myotis. *Conservation Significance:* Potentially At Risk in Lao PDR. *Documented Range and Habitat:* North[C12, C14], centre[C2, C7, C10]. Most records are in the vicinity of limestone, where it has been found roosting in caves (Francis *et al*. 1996). Bats currently keyed out to *M. siligorensis* include at least two and possibly three species in Lao PDR (see *Myotis* spp.).

Myotis* cf. *muricola Eastern Whiskered Myotis. North[C1, C12, C13], centre[C2], south[C3, C15]. Bats currently keyed out to *M. muricola* include at least three species, differing mainly in size, colour and insertion of the wing membrane. Further

research, including comparison with type specimens, is required to determine which species (if any) is actually *M. muricola*, and whether appropriate names exist for the other two species.

• ***Myotis montivagus*** Large Brown Myotis. *Conservation Significance:* Globally Near-Threatened; Little Known in Lao PDR. *Documented Range and Habitat:* Centre[C2]. Lao records come from hill forest at 1000 m altitude, and open forest on the Nakai Plateau at 500 m.

Myotis horsfieldii Horsfield's Myotis. North[C6], centre[C2], south[C3, C9].

[***Myotis hasseltii*** Large-footed Myotis]. Not yet reported from Lao PDR, but occurs in Vietnam, Thailand and Cambodia (Lekagul and McNeely 1977). However, in Malaysia it is most frequently encountered in coastal areas (Medway 1983), and if that is true elsewhere, it may not occur in Lao PDR.

• ***Myotis ricketti*** Rickett's Large-footed Myotis. *Conservation Significance:* Globally Near-Threatened; Potentially At Risk in Lao PDR. *Documented Range and Habitat:* North[C2], centre[C2, C16] (Plate 18). Feeds low over streams and roosts in caves (Francis *et al*. 1996, Robinson and Webber 1998a). Known to feed on fish (Robinson and Webber 1998b), but probably also eats insects.

• ***Scotomanes ornatus*** Harlequin Bat. *Conservation Significance:* Globally Near-Threatened; Little Known in Lao PDR. *Documented Range and Habitat:* North[C12, C13], centre[C7] (Plate 18). Roosts in trees (Lekagul and McNeely 1977), but also caught near limestone caves (Francis and Khoonmy 1998b).

• ***Thainycteris aureocollaris*** Gold-collared Bat. *Conservation Significance:* Proposed listing as Data Deficient (Global) (Hutson *et al*. in prep.). Little Known in Lao PDR. *Documented Range and Habitat:* North[C12]. Only recently described from Thailand (Kock and Storch 1996), and hence not included in Corbet and Hill (1992).

Scotophilus kuhlii Asiatic Lesser Yellow House Bat. Centre[C3]. Probably throughout Lao PDR (Corbet and Hill 1992). Roosts in buildings and hollow trees (Lekagul and McNeely 1977). A colony was found roosting in the top of a fan palm in Savannakhet town (Francis *et al*. 1997a).

Scotophilus heathii Asiatic Greater Yellow House Bat. North[C12], south[C3, C8]. Probably throughout Lao PDR. In Thailand, common around towns and villages (Lekagul and McNeely 1977), but specimens in Lao PDR have been caught in open forests or over rivers.

Eptesicus serotinus Serotine. North[C12], centre[C2]. Probably roosts mainly in hollow trees. Both Lao records are from hill forest at over 1000 m.

[• ***Eptesicus pachyotis*** Thick-eared Serotine]. *Conservation Significance:* Globally Near-Threatened. *Documented Range and Habitat:* Not recorded from Lao PDR, but occurs in northern Thailand (Lekagul and McNeely 1977) and may well occur in Lao PDR.

• ***Ia io*** Great Evening Bat. *Conservation Significance:* Globally Near-Threatened; Potentially At Risk in Lao PDR. *Documented Range and Habitat:* North (Bourret 1942), centre[C7, C16]. Central records are from areas with limestone caves. Roost sites have been found both near the cave entrance and up to 1.5 km within cave systems (Robinson and Webber 1998a).

Tylonycteris pachypus Lesser Flat-headed Bat. North[C12] (Osgood 1932), centre[C10], south[C3]. Roosts in bamboo (Lekagul and McNeely 1977).

Tylonycteris robustula Greater Flat-headed Bat. North[C12, C13, C14] (Osgood 1932), centre[C10], south[C3]. Roosts in bamboo and also rock crevices (Lekagul and McNeely 1977).

• ***Eudiscopus denticulus*** Disc-footed Bat. *Conservation Significance:* Globally Near-Threatened; Little Known in Lao PDR. *Documented Range and Habitat:* North (Osgood 1932). Monospecific genus known only from Lao PDR (around Phongsali) and central Myanmar (Corbet and Hill 1992).

***Pipistrellus* spp**. At least seven species of pipistrelles have been captured during WCS surveys in Lao PDR, but reliable keys for field identification of these bats are not yet available. The list below gives tentative identifications for some of these specimens, and lists previously published records, but all of them are subject to review. Further study of museum specimens, including the use of molecular analyses, is required to sort out species within this genus.

[***Pipistrellus ceylonicus*** Kelaart's Pipistrelle]. Tentatively identified from centre (Eger and Francis 1999). Also known from south China and Vietnam (Corbet and Hill 1992).

[***Pipistrellus abramus*** Japanese Pipistrelle]. Occurs in south China and Vietnam, and mapped as occurring in Lao PDR (Corbet and Hill 1992).

Pipistrellus javanicus Javan Pipistrelle. Centre (Eger and Francis 1999). Possibly widespread, as also occurs in the adjacent countries including Thailand and Cambodia (Corbet and Hill 1992).

[***Pipistrellus coromandra*** Indian Pipistrelle]. Reported from northern Thailand, and hence might also occur in Lao PDR.

Pipistrellus tenuis Least Pipistrelle. North (Osgood 1932, Corbet and Hill 1992), centre[C16], south[C15] (Eger and Francis 1999). Probably widespread throughout Lao PDR. Forested areas and villages, roosting in buildings and hollow trees (Lekagul and McNeely 1977).

• ***Pipistrellus cadornae*** Cadorna's Pipistrelle. *Conservation Significance:* Globally Near-Threatened; Little Known in Lao PDR. *Documented Range and Habitat:* Centre (Eger and Francis 1999). Similar specimens have also been reported from north (Guillén and Francis 1998a) and south (Francis *et al*. 1997a).

• ***Pipistrellus pulveratus***. *Conservation Significance:* Globally Near-Threatened; Little Known in Lao PDR. *Documented Range and Habitat:* Centre[C16].

Glischropus tylopus Thick-thumbed Pipistrelle. North[C11, C18]. Forests, roosting in bamboo and rock crevices (Lekagul and McNeely 1977). D. Kock (pers. comm. 1996) considered a specimen from Nam Kading NBCA (WCS 1995b) to resemble *G. javanus* (which is otherwise known only from Java) more closely than *G. tylopus*. The taxonomy of this genus needs to be reviewed.

[***Nyctalus noctula*** Noctule]. Reported from northern Vietnam and tentatively from northern Thailand (Corbet and Hill 1992), so may occur in Lao PDR.

Hesperoptenus tickelli. North[C18], south[C9, C15]. Captured flying over streams or ponds.

Hesperoptenus blanfordi. Centre[C10, C16], south[C3, C15]. Captured flying near water.

***Miniopterus* spp**. Bent-winged bats. There are several species of this genus in South-east Asia, differing mainly in size. There is disagreement about the taxonomy of these groups, because of uncertainty as to which populations are distinct species. The notes below refer to species based on the taxonomy in Corbet and Hill (1992). In several areas of Lao PDR, at least two species (one large and one small) are found together, but it is not yet certain whether these always involve the same two species. Some species overlap in external measurements, so confirmed identifications require extracting and measuring the skull of a museum specimen.

• ***Miniopterus schreibersii*** Common Bent-winged Bat. *Conservation Significance:* Potentially At Risk in Lao PDR. *Documented Range and Habitat:* Centre[C16]. Mapped as throughout Lao PDR by Corbet and Hill (1992). Forested areas, roosting in large caves (Lekagul and McNeely 1977).

• ***Miniopterus magnater*** Large Bent-winged Bat. *Conservation Significance:* Potentially At Risk in Lao PDR. *Documented Range and Habitat:* North[C11, C12], centre[C10], south[C8]. Habitat probably similar to other *Miniopterus* spp. Although confirmed from each region, its abundance relative to other species is uncertain because of difficulties in identifying specimens in the field.

• ***Miniopterus pusillus*** Small Bent-winged Bat. *Conservation Significance:* Potentially At Risk in Lao PDR. *Documented Range and Habitat:* North[C13], centre[C10], south[C9]. Habitat similar to other *Miniopterus*. Specimen from centre confirmed based on skull measurements, but others were identified solely based on external measurements and still need to be confirmed.

***Murina* spp.** Tube-nosed bats. In addition to the four species listed below, three additional, apparently undescribed, species have been found in Lao PDR (Francis *et al*. 1996, Francis and Khounboline 1996, Francis *et al*. 1997a, Francis and Khoonmy 1998d). One of these has been found in dry areas both near Vientiane and in the south, while the other two have been found in Lao PDR only in the Annamites around the Nakai Plateau.

Murina tubinaris. North[C11], centre[C2], south[C3]. One of the more widespread species of *Murina* in Lao PDR, occurring in both primary and disturbed forest.

• ***Murina aurata*** Golden Tube-nosed Bat. *Conservation Significance:* Globally Near-Threatened; Little Known in Lao PDR. *Documented Range and Habitat:* Centre[C2], in hill forest of Annamites.

• ***Murina huttonii*** Hutton's Tube-nosed Bat. *Conservation Significance:* Globally Near-Threatened; Little Known in Lao PDR. *Documented Range and Habitat:* Centre[C2]. Habitat reported as grasslands and crops in Lekagul and McNeely (1977), but was caught in relatively undisturbed hill forest at 1100 m in Lao PDR. Known from very few specimens anywhere across its world range.

Murina cyclotis Round-eared Tube-nosed Bat. North[C6, C7], centre[C2], south[C3, C9]. The most widespread *Murina* in Lao PDR, found in primary and disturbed forests.

• ***Harpiocephalus mordax***. *Conservation Significance:* Globally Near-Threatened; Little Known in Lao PDR. *Documented Range and Habitat:* North[C12], centre[C7]. Overlaps in external characters with *H. harpia*, so abundance relative to next species is uncertain, although specimens are confirmed from each region.

Harpiocephalus harpia Hairy-winged Bat. North[C13, C18], centre[C16]. Owing to similarity with *H. mordax*, identity of

some specimens has not yet been confirmed, but there are confirmed records from Nam Kading and Khammouan Limestone NBCAs.

Kerivoula picta Painted Bat. North[C1] (Duckworth *et al*. 1994). Probably in most parts of Lao PDR, but possibly rather scarce (or using habitats where it is hard to catch). Has been caught in dry dipterocarp forest just outside Vientiane. Roosts in vines, flowers, tall grass (Lekagul and McNeely 1977).

Kerivoula papillosa Papillose Woolly Bat. North[C11], centre[C2], south[C3]. In forest or scrub. Probably roosts in hollows in trees or among leaves.

Kerivoula hardwickii Hardwicke's Woolly Bat. North[C11, C12, C13], centre[C2, C10], south[C3, C9]. Most abundant and widespread *Kerivoula* in Lao PDR.

***Kerivoula* sp.** At least one additional species of *Kerivoula* has been caught in Lao PDR, intermediate in size between *K. hardwickii* and *K. papillosa*. It was sympatric with both of those species at Dong Ampham (Francis *et al*. 1997a) and Phou Khaokhoay NBCAs (Guillén *et al*. 1997). Its identity has not yet been determined.

Phoniscus jagorii Greater Groove-toothed Bat. North[C12, C14], centre[C2, C10], south[C9]. Found in forest understorey. Some of the specimens, including those from the north, appear to be slightly smaller, and may represent a different species, possibly *P. atrox* which occurs in peninsular Thailand.

Molossidae: Free-tailed bats (2 species)

• ***Tadarida teniotis*** Eurasian Free-tailed Bat. *Conservation Significance:* Potentially At Risk in Lao PDR. *Documented Range and Habitat:* North[C12], centre (Evans *et al*. in prep. b). Record from the centre relates to market specimens from Ban Lak (20), of unknown but presumably local origin. Probably roosts in caves or rock crevices.

• ***Tadarida plicata*** Wrinkle-lipped Bat. *Conservation Significance:* At Risk in Lao PDR. *Documented Range and Habitat:* North[C13], centre (Robinson and Webber 1999, Evans *et al*. in prep. b); mapped range includes all of Lao PDR (Corbet and Hill 1992). Roosts in caves (Lekagul and McNeely 1977). The only confirmed large colony in Lao PDR, in the vicinity of Louang-Namtha, was being very heavily exploited, with several thousand bats per day being sold in the market. No data are available on how long this exploitation has been taking place, but it seems very unlikely that this level of exploitation could be sustainable, and the species is apparently at risk in Lao PDR. The records from centre refer to a dead specimen found in a cave that appeared to be this species (Robinson and Webber 1999), as well as specimens purchased from the market in Ban Lak (20).

THREATS TO BATS

Most bat species in Lao PDR are threatened by loss of habitat, by hunting for food or by both. Loss of habitat is a problem that affects most mammals in Lao PDR. All bats are dependent upon suitable habitat for foraging. Many species are able to forage in secondary forest or disturbed areas, but only a limited suite of species (those that feed outside of forest cover) can survive in areas cleared for agriculture. The majority of Lao bats are dependent upon some degree of forest cover. Many species of bats also require forest for roosting sites. Some species roost in bamboos. Although bamboos are abundant in disturbed areas, many bats are probably killed if the areas are burned for shifting cultivation. Other bats roost in hollow trees. Such trees are generally only found in relatively mature forests, and hence the species dependent upon them are not likely to be found in young regenerating habitats except if they are adjacent to tall forest. Many bats roost in caves, of which the largest occur in limestone karst areas. Most caves in Lao PDR are probably not (so far) seriously threatened with destruction, although some, along the Vietnamese border, were damaged by bombing during the war, and others (e.g. Louangphabang) are used for temples which may reduce their value for bats. However, cave dwelling bats are particularly vulnerable to disturbance, because so many are concentrated in a limited area.

Bats are sometimes reported as crop pests (Table 2). However, such reports are not widespread and no specific information has been gathered recently on the subject.

The greatest threat to bats in Lao PDR appears to be exploitation for food. In all areas surveyed by WCS, bats were reported as being eaten by local villagers. On many occasions, local villagers reported that many bats were found in a particular cave, but subsequent surveys found few if any bats present. The explanation was that the villagers (often the guides) had trapped the bats until there were too few left to be worth trapping. The only large colony of bats seen by CMF or AG in a town was a maternity colony of *Scotophilus kuhlii* roosting in palm trees in Savannakhet town. This colony was being harvested by young boys who were killing bats by shooting into the trees with sling shots at dusk. Over 40 bats were seen to be killed within a 20 minute period at dusk. These youths indicated that up to 100 had been killed on each of the previous several nights, and the colony had only formed relatively recently. It appeared to contain no more than a few thousand individuals (including juveniles) and probably did not last long after that time. Bats have been observed for sale in the market at Ban Lak (20), including *Hipposideros armiger* and *H. lylei* (Francis *et al*. 1996) and *Tadarida* spp. (Evans *et al*. in prep. b). Robinson (1994) reported bats for sale in the markets of Chiang Khan in north-

east Thailand, that had apparently all come from Lao PDR. Trading is widespread (Annex 1). Very large numbers of bats have been observed for sale in northern Lao PDR. R. Tizard (pers. comm.) saw large vats containing several hundred or more small bats (at least some were *Myotis* spp.) being cooked for sale in markets north of Vientiane. Thousands of *Tadarida plicata* were being smoked in April/May 1999 at Ban Phoulan, a village in the vicinity of Louang-Namtha near the Nam Ha NBCA (Guillén and Francis 1998a). Over 3000 were sold to a single passing truck. The bats were apparently harvested using some sort of funnel trap as they flew out of a cave, and carried back to the village in large sacks. Even a colony of several hundred thousand bats will not be able to withstand this type of harvest pressure for long. Unlike rodents, bats are slow breeders, usually producing only one or two young per year, so they cannot recover quickly from heavy harvest. The bats most vulnerable to harvest are those that appear to be most abundant, because they roost in large colonies where they are concentrated and easy to harvest. Species that roost in small numbers in hollow trees or among branches or leaves are likely to be much less at risk. Although quantitative data are not available for confirmation, it seems likely that most species of cave-dwelling bats in Lao PDR have suffered very serious population declines over the past few decades.

CONSERVATION MANAGEMENT AND RESEARCH PROPOSED FOR BATS

The greatest conservation need is to encourage villagers to reduce or stop harvesting and eating bats. An educational campaign would be helpful that highlights the value of bats, especially their benefits to humans (pollination of various tree flowers including commercially important fruits, seed dispersal of forest fruits, consumption of harmful insects). Legal protection of all bats might be desirable, but is probably impractical and excessive as occasional disturbance to small numbers of bats is not a serious threat. The greatest need is to protect large colonies of bats, especially cave-dwelling species. A practical short-term solution might be to ban the harvest of bats in the vicinity of caves, and to ban the sale of bats for food. Also, elsewhere in South-east Asia (e.g. Malaysia), many bats roost safely in towns, using buildings and ornamental trees. This enhances the wildlife value of urban areas, and may help with control of various insect pests. In Lao PDR, few bats appear to live in towns. The reason is not known for certain, but it may again relate to exploitation of bats for food. Encouraging people not to disturb and consume bats they find in towns might help to restore bat populations.

It is also necessary to ensure continued protection of caves in limestone karst areas, as well as adequate areas of intact habitat around the caves for the bats to use. For forest-dwelling bats, protection of adequate forested areas is necessary, including retention of larger trees with hollow cavities suitable for roosting sites. Such areas are also needed for many other species of wildlife and this activity falls within the general management objectives of the protected area system. Because few surveys for bats have been done outside the current network of NBCAs, it is not known whether these protected areas are adequate to protect all Lao species of bat. Several species found in south-west Lao PDR around Dong Khanthung, which is not currently an NBCA, have not been reported elsewhere in Lao PDR. It is not yet known whether this is due to geographic limitations on range, differences in available habitat, or inadequate surveys in other areas. In addition, several important limestone areas are not currently within NBCAs, including at Vangviang, Louangphabang, and elsewhere in Lao PDR. Preliminary surveys of Vangviang (Guillén and Francis 1998c) suggest that significant populations of bats occur there. Land management in that area should be compatible with protecting the bat colonies. There is a need to survey potential bat habitat outside NBCAs, both limestone areas and other areas, to determine whether they also support significant populations of bats, and if so to identify appropriate conservation measures. Such measures need not be incompatible with other land uses. For example, around limestone outcrops, the most critical measures would probably involve protection of the major roosting caves from disturbance, and ensuring that adequate natural habitat (e.g. forest cover) is retained within the general vicinity of the caves.

ORDER RODENTIA, FAMILY MURIDAE

C. M. Francis

INTRODUCTION

Very little recent field research has been done on mice and rats in Lao PDR, despite the fact that they are widely trapped and sold in markets for food. Recent work includes some general market surveys (Bergmans 1995) and field surveys around Nam Kading, Nakai-Nam Theun, Dong Ampham and Khammouan Limestone NBCAs (WCS 1995b, Francis *et al*. 1996, 1997a, Robinson and Webber 1998a). The latter surveys found a few new records for Lao PDR, and the surveys of Francis *et al.* (1996) turned up at least one undescribed species from the Annamite mountains (Engstrom and Francis 1999). This suggests that more thorough surveys of additional sites would be very worthwhile. Voucher specimens, preferably with series of several individuals, are required to sort out the taxonomy and identity of many murids.

The following accounts are based on recent reviews where available, especially if they mention examination of individual specimens from Lao PDR. However, such reviews have not yet been undertaken for many species. In those cases, the accounts rely mainly on Marshall (1977) and Corbet and Hill (1992), despite the fact that precise locations and specimen data are not usually cited in those sources. Older references are usually only cited if the identity of the specimens has subsequently been reaffirmed by more recent reviews; the changing taxonomic treatments of many groups make it unsafe to assume that specimens referred to a given name several decades ago would still be known under that name today.

Taxonomy follows Corbet and Hill (1992). Recent research has resulted in changes in the taxonomy and nomenclature of many mice and rats. For example, many rats formerly classified in the genus *Rattus* (e.g. Marshall 1977) are now considered to belong in many separate genera. Some genera contain numerous names that are variously considered separate species, subspecies, or direct synonyms. Several groups of rats (e.g. *Niviventer*) are still in need of thorough revision. In the following accounts, older names are only listed if a source, using that name, is referenced. English names have largely been selected from published sources (Marshall 1977, Medway 1983, Payne *et al*. 1985, Nowak 1991, Corbet and Hill 1992), with a preference for descriptive names if multiple names have been suggested.

ANNOTATED LIST OF SPECIES

Murinae: Mice and rats (28-31 species)

Mus musculus House Mouse. North (Bourret 1942); range maps suggest extends to central Lao PDR (Corbet and Hill 1992). Probably confined to areas near towns, where it is often in buildings (Corbet and Hill 1992).

Mus cookii Cook's Mouse. Centre (Robinson and Webber 1998a); range maps suggest occurs throughout Lao PDR (Marshall 1977, Corbet and Hill 1992). Grassy areas in upland conifer and broad-leaved forest, adjacent cultivated land and clearings (Marshall 1977).

Mus cervicolor Fawn-colored Mouse. Centre (Robinson and Webber 1998a), south (Osgood 1932); range maps suggest occurs throughout Lao PDR (Corbet and Hill 1992). Paddy-fields, grasslands and grassy areas in deciduous dipterocarp forest (Marshall 1977).

Mus shortridgei Shortridge's Mouse. Centre (Robinson and Webber 1998a). In dry grass and pygmy bamboo in dry dipterocarp forest (Marshall 1977).

Mus caroli Ryukyu Mouse. Centre (Robinson and Webber 1998a), south (Bergmans 1995); range maps suggest occurs throughout Lao PDR (Marshall 1977, Corbet and Hill 1992). Rice and other grassy agricultural areas where it feeds on seeds and invertebrates (Marshall 1977).

Mus pahari Gairdner's Shrew Mouse. North (Osgood 1932); range maps suggest occurs throughout Lao PDR (Corbet and Hill 1992). Mainly forested areas (Marshall 1977).

Vandeleuria oleracea Long-tailed Cane Mouse. North (Osgood 1932); range maps suggest occurs throughout Lao PDR (Marshall 1977, Corbet and Hill 1992). Tall cane (Marshall 1977).

Rattus rattus House Rat. Centre (Robinson and Webber 1998a), South (Robinson 1997). Range maps suggest occurs throughout Lao PDR (Marshall 1977, Corbet and Hill 1992). Buildings, other domestic and agricultural habitats, open natural habitats, but probably not unbroken forest (Marshall 1977, Corbet and Hill 1992).

Rattus losea Lesser Ricefield Rat. Centre (Robinson and Webber 1998a), south (Musser and Newcomb 1985); probably widespread throughout Lao PDR (Musser and Newcomb 1985). Rice fields and other cultivated habitats (Marshall 1977, Corbet and Hill 1992).

Rattus argentiventer Ricefield Rat. Centre (Robinson and Webber 1998a). Rice fields and other cultivated habitats. Musser and Newcomb (1985) noted that this species had not been found in the same areas as *R. losea*, but specimens from Khammouan Limestone NBCA were reported from owl pellets in the same caves as *R. losea* (Robinson and Webber

1998a); it is not known whether the owls had caught them in the same sites.

Rattus nitidis Himalayan Rat. Centre (Robinson and Webber 1998a), south (Bergmans 1995); mapped as occurring in north as well (Marshall 1977, Corbet and Hill 1992). Houses in small villages (Marshall 1977).

• ***Rattus sikkimensis*** Sladen's Rat. *Conservation Significance:* Globally Threatened - Vulnerable. *Documented Range and Habitat:* North (Musser and Heaney 1985), centre (Engstrom and Francis 1999), south (Musser and Heaney 1985). Probably throughout Lao PDR in forests. Formerly known as *R. koratensis* (Marshall 1977). Musser and Heaney (1985) later suggested that it was the same species as *R. remotus*, and Corbet and Hill (1992) pointed out that since *R. remotus* is the older name, the species should be called *R. remotus*. However, G. Musser (pers. comm. 1999) has since concluded that *R. remotus* is actually a distinct species, and hence the name *R. sikkimensis* should continue to be used for the species in Lao PDR.

Rattus exulans Polynesian Rat. North (Osgood 1932); range maps suggest occurs throughout Lao PDR (Marshall 1977, Corbet and Hill 1992). Houses, granaries, cultivation, scrub, forest edge (Marshall 1977, Corbet and Hill 1992).

Bandicota indica Large Bandicoot Rat. North (Musser and Brothers 1994, Bergmans 1995); centre (Robinson and Webber 1998a); south (Robinson 1997). Cultivated habitats (Marshall 1977, Corbet and Hill 1992).

[***Bandicota savilei*** Burmese Bandicoot Rat]. Not yet recorded from Lao PDR, but occurs in east Thailand, adjacent to Lao border and southern Vietnam, so probably also in Lao PDR (Musser and Brothers 1994). Open dry forests, cultivated fields and gardens (Marshall 1977, Corbet and Hill 1992).

Chiropodomys gliroides Pencil-tailed Tree Mouse. North (Musser 1979), centre (Robinson and Webber 1998a), south (Musser 1979). Primary and secondary forest, roosting in bamboo (Marshall 1977, Musser 1979).

• ***Hapalomys delacouri*** Lesser Marmoset Mouse. *Conservation Significance:* Globally Near-Threatened; Little Known in Lao PDR. *Documented Range and Habitat:* North (Musser 1972). Reported from wet tropical forest and dry forest in hills over 1200 m; arboreal, probably lives in bamboo (Musser 1972). Also occurs in Hainan (China) and central Vietnam, but populations in those areas are considered a separate subspecies so the species does not necessarily occur in intervening areas.

• ***Dacnomys millardi*** Large-toothed Giant Rat. *Conservation Significance:* Little Known in Lao PDR; known from only a few specimens in Nepal, north-east India and Phongsali (Lao PDR). *Documented Range and Habitat:* North (Osgood 1932, Musser 1981), in forest above 1000 m.

[*Niviventer confucianus* White-bellied Rat]. Mapped from northern Lao PDR in Marshall (1977) and Corbet and Hill (1992), but nearest confirmed record is from northern Thailand (Musser 1981). Specimens from hill forest in the Annamites of central Lao PDR (Engstrom and Francis 1999) might be this species, but could also prove to be the same as the species tentatively referred to *N. tenaster* (see below). Occurs in montane mossy forest in Thailand (Corbet and Hill 1992) and a wide range of habitats from forest to cultivation in China (Corbet and Hill 1992).

Niviventer* cf. *tenaster. South (Bergmans 1995). Hill forest (Bergmans 1995). The taxonomy of the genus *Niviventer* is confused, and further study is required to determine the appropriate distinctions among species, and which name actually belongs to this species.

Niviventer fulvescens Chestnut Rat. Centre (Engstrom and Francis 1999); range maps suggest throughout Lao PDR (Corbet and Hill 1992). Evergreen, pine, deciduous, and secondary forests (Marshall 1977). Listed as *N. bukit* in Marshall (1977), but Musser (1981) considered *N. bukit* to be a separate species found in the Malay peninsula, Sumatra, Java and Bali. Account of *N. rapit orbus* in Marshall (1977) also apparently refers to the species *N. fulvescens* (Musser 1981). Overlaps with *N. confucianus* in some identification characters, but they appear to be separate species (Musser 1981).

Niviventer langbianis Pencil-tailed Rat. North (Bourret 1942), centre (Engstrom and Francis 1999), south (Bergmans 1995); range maps suggest occurs throughout Lao PDR (Corbet and Hill 1992). Arboreal species found in mixed deciduous and evergreen forest (Marshall 1977). Formerly considered a subspecies of *N. cremoriventer* (Marshall 1977), but shown to be a distinct species by Musser (1981).

• ***Chiromyscus chiropus*** Fea's Tree Rat. *Conservation Significance:* Little Known in Lao PDR; restricted to Indochina. *Documented Range and Habitat:* North (Osgood 1932), centre (Robinson and Webber 1998a, Engstrom and Francis 1999); mapped as probably occurring throughout most of Lao PDR (Musser 1981, Corbet and Hill 1992). A highly arboreal species in moist and deciduous forest (Musser 1981, Corbet and Hill 1992).

Leopoldamys sabanus Long-tailed Giant Rat. North (Bergmans 1995), centre (Robinson and Webber 1998a, Engstrom and Francis 1999), south (Osgood 1932, Robinson

1997). Forest habitats, probably at lower altitudes than *L. edwardsi* (Corbet and Hill 1992).

Leopoldamys edwardsi Edwards's Giant Rat. North (Osgood 1932), south (Bergmans 1995); range maps suggest occurs throughout Lao PDR (Marshall 1977, Corbet and Hill 1992). Montane evergreen forest, generally at higher altitudes than *L. sabanus* (Marshall 1977).

Maxomys surifer Red Spiny Rat. North (Osgood 1932), centre (Engstrom and Francis 1999), south (Osgood 1932, Engstrom and Francis 1999); widespread throughout Lao PDR (Marshall 1977, Corbet and Hill 1992). Lowland (including secondary) forests and adjacent gardens (Marshall 1977, Corbet and Hill 1992).

• ***Maxomys moi***. *Conservation Significance:* Little Known in Lao PDR; Indochinese endemic occupying a restricted range (Corbet and Hill 1992). *Documented Range and Habitat:* South (Musser *et al*. 1979, Bergmans 1995).

***Maxomys* sp.** Several rats that were captured in the Annamites within Nakai-Nam Theun NBCA appear to represent an undescribed species of *Maxomys* (Francis *et al*. 1996, Engstrom and Francis 1999).

Berylmys berdmorei Lesser White-toothed Rat. North (Musser and Newcomb 1983), centre (Robinson and Webber 1998a); probably also in south (Marshall 1977). Swampy forests and marshes (Marshall 1977).

Berylmys bowersii Bowers's White-toothed Rat. North (Musser and Newcomb 1983), south (Bergmans 1995). Mainly in montane forests above 1000 m (Marshall 1977).

[***Berylmys mackenziei*** Kenneth's White-toothed Rat]. Occurs in mountains of central Myanmar, Szechuan, and southern Vietnam (Musser and Newcomb 1983), so may occur in Lao PDR.

Platacanthomyinae: Spiny and pygmy dormice (0-1 species)

[***Typhlomys cinereus*** Pygmy Dormouse]. Occurs in southern China and northern Vietnam, so might occur in extreme northern Lao PDR (Corbet and Hill 1992). Moss-forest at 1200-2100 m, with an undergrowth of bamboo (Nowak 1991).

Arvicolinae: Voles (0-2 species)

[***Eothenomys melanogaster*** Pere David's Vole]. Occurs in northern Thailand (Doi Inthanon) and northern Vietnam (Marshall 1977), so could occur in intervening area of Lao PDR. High altitude moss and rhododendron forests; at an altitude of 2500 m in Thailand (Marshall 1977).

[***Eothenomys miletus***]. Not known from Lao PDR, but occurs in southern China and adjacent Myanmar (Corbet and Hill 1992), so it might be expected. Corbet and Hill (1992) also list it tentatively from Thailand, but it is not clear whether this refers to the same specimens as Marshall (1977) referred to *E. melanogaster*.

Rhyzomyinae: Bamboo rats (3 species)

Rhizomys pruinosus Hoary Bamboo Rat. North (Osgood 1932, Duckworth 1998); range maps suggest occurs throughout Lao PDR (Lekagul and McNeely 1977, Corbet and Hill 1992), but it is rare or unrecorded during market surveys in the lowlands of the country; by contrast it is commonly traded in markets in mountainous areas, e.g. Xiangkhouang Province (JWD). Bamboo in hill and montane forest in Thailand (Lekagul and McNeely 1977), perhaps similar in Lao PDR (Duckworth 1998).

Rhizomys sumatrensis Large Bamboo Rat. North (Osgood 1932, Payne *et al*. 1995, Duckworth 1996a), centre (Walston in prep.), south (Osgood 1932, Bergmans 1995). Secondary forests with bamboo (Lekagul and McNeely 1977, Corbet and Hill 1992), commonly recorded on the Mekong plain and in lower hill areas (JWD).

Cannomys badius Lesser Bamboo Rat. North (Bergmans 1995, Duckworth 1996a), south (Bergmans 1995); probably in between. Bamboo groves (Lekagul and McNeely 1977). Too few records in Lao PDR to assess altitudinal range, but occurs in at least Mekong plains.

RECENT INFORMATION ON MURIDAE

All species of rats, as with most other mammals, are potentially trapped or hunted for food in rural Lao PDR (Table 1). Various species are frequently sold in urban food markets (Annex 1). Most species, especially commensals, are fairly prolific breeders and should be able to tolerate moderate to high levels of trapping. However, little or no research has been done on the breeding ecology and population dynamics of any of the native or near-endemic forest-dwelling species, and it is not known whether they can also tolerate similar levels of harvest. Rats also are reported to be important crop pests in some areas (Table 2).

CONSERVATION MANAGEMENT AND RESEARCH PROPOSED FOR MURIDAE

Native, forest-dwelling species require conservation of adequate areas of intact habitat. It is not known whether the current NBCA system is adequate for them, because too little is known about their habitat needs. Further surveys throughout Lao PDR, including in forested areas outside NBCAs, are required to determine the habitat use and range of non-commensal species. There is a particular need for further scientific studies and museum collections to determine the taxonomic status of many groups of rats. Long series of specimens are required to determine the identification characters of some groups (especially in the genus *Niviventer*) and to determine their relationships with species elsewhere in South-east Asia. It is quite possible that additional species of rats remain to be discovered in Lao PDR.

Research is also required to determine whether these species, especially native forest rats, can tolerate current levels of harvesting for food. Urban and commensal species are not presently in need of any special conservation efforts, and may in some areas actually be pests.

Key species which may be of special concern are listed in Table 6. Most other species could have been listed as 'Little Known in Lao PDR'. This designation has mainly been used for those species for which Lao PDR may be of special significance (e.g. regional endemics).

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Unpublished personal communications

Many people provided unpublished records for incorporation in the text. The names of those cited frequently in the text are abbreviated as follows:

AG: A. Guillén
BLS: B. L. Stuart
CMF: C. M Francis
DAS: D. A. Showler
JAW: J. A. Wolstencroft
JWD: J. W. Duckworth
JWKP: J. W. K. Parr
KK: K. Khounboline
PD: P. Davidson
PDR: P. D. Round
RB: R. Boonratana
RJTim: R. J. Timmins
RJTiz: R. J. Tizard
RS: R. Steinmetz
TC: T. Chan-ard
TDE: T. D. Evans and L. G. Watson
WGR: W. G. Robichaud

ANNEX 1

Selected bird and mammal species[1] observed in markets, jewellery shops, souvenir shops, restaurants, zoos or otherwise in trade in Lao PDR, 1988-1993.

Species and products[2]	Region				
Observed in:	Far north[3]	North-central	Central	South	References[4]
BIRDS					
Partridges/quail spp.	U	M,R	M,U	U	1,4,5
Red Junglefowl	M	C,M	U	M	1,2,3,4
Silver Pheasant	M	F,M,Z	M	-	3,4
Siamese Fireback	-	-	U	R	5
Grey Peacock Pheasant	L	-	-	-	4
Green Peafowl	-	F,M	-	F	1,2,3,4
[Northern Shoveler]	-	M	-	-	3
Oriental Pied Hornbill	-	M	-	-	3
Great Hornbill	Ca	Z	-	-	4
Wreathed Hornbill	-	Z	-	-	4,5
Hornbill spp.	Ca	Ca	-	Ca	2,4
Coral-billed Ground Cuckoo	-	-	-	L	4
Vernal Hanging Parrot	-	L	-	-	4
Alexandrine Parakeet	-	L	-	-	3
Blossom-headed Parakeet	-	-	-	L	4
Red-breasted Parakeet	-	L	-	L	3,4,5
Parakeet/parrot spp.	U	U	-	L	1,6
Owlet spp.	-	L,M	-	-	4
Owl spp.	-	U	-	-	1,2
Spotted Dove	-	L	M	L,M	3,4,5,6
Red Collared Dove	-	M	-	L	3,4
Dove spp.	U	M	-	L	1,4,6
Thick-billed Green Pigeon	-	L	-	L	2,3,4,6
Green pigeon spp.	M	U	-	-	1,4
Mountain Imperial Pigeon	-	L	-	-	3
Imperial pigeon spp.	-	U	-	-	1
Sarus Crane	-	-	M,Z	-	4,5
White-breasted Waterhen	-	L,M	-	-	3,4
Black Kite	-	M	-	-	3
[Grey-headed] Fish Eagle	-	M	-	-	3
Crested Serpent Eagle	-	U	-	-	3
Shikra	-	U	-	-	3
Besra	-	-	L	U	5
Falcon spp.	-	M	-	-	4
Raptor spp.	-	C,Z	-	U,L	1,3,6
Woolly-necked Stork	-	-	-	L	5
Lesser Adjutant	-	Z	-	-	4
Black Drongo	-	-	-	M	4
Ashy Drongo	-	M	-	-	3
Bronzed Drongo	-	M	-	-	3
Hill Myna	-	-	-	L	4,6
Red-tailed Laughingthrush	M	-	-	-	4
MAMMALS					
Pangolin spp.	S	C,L,M,R,S	L,M,S	L,M,S	1,2,3,4,6
Bat spp.	U	B,M	-	-	1,2,4
Large loris sp.	U	U,Z	-	-	1,4
Small loris sp.	-	L	-	-	1,3
Bear Macaque	-	Z	-	-	4
Macaque spp.	-	Z	-	L,M	4,6

Species and products[2]	**Region**				
Observed in:	Far north[3]	North-central	Central	South	References[4]
Douc Langur	-	-	L	-	4
Langur spp.	-	I	-	L,M	2,4,6
Gibbon spp.	-	Z	-	-	4
Golden Jackal	-	N	-	-	2
Dhole	-	N,S,Z	-	I	3,4,6
Asiatic Black Bear	-	S,Z	-	B	3,4
Sun Bear	-	Z	-	-	4
Bear spp.	G,S	C,G,S	-	C,I,S,T	1,2,3,4,6
Otter spp.	S	M,S	-	L	1,2,4
Small Indian Civet	-	Z	-	-	4
Civet spp.	S	M,S,Z	S	L,M	1,2,3,4,6
Binturong	-	S	-	-	1
Leopard Cat	-	S	S	L,M	4,6
Asian Golden Cat	-	Z	-	-	5
Small cat spp.	-	C,S,T,Z	S	-	1,2,4,6
Clouded Leopard	B?	B,S,T,Z	-	S	1,2,3,4
Leopard	-	S	-	C,S,T	1,3,4,6
Tiger	B	B,C,N,S,T	-	M,S,T	1,2,3,4,6
Asian Elephant	T	N,S,T,Z	T	L,T	1,2,3,4,6
Rhinoceros spp.	H	C,H,S	H	H,S	1,2,4
Chevrotains	-	L,M,Z	-	M	1,2,3,4,6
Eld's Deer	-	H	H	H	1,2,3,4
Sambar	H	H,M,Z	H,Z	H,M,Z	1,2,3,4,6
Muntjac spp.	H,S	B,C,H,M,R,S,Z	H,M,Z	H,M,S	1,2,3,4,5,6
Kouprey	-	-	-	H	3,4
Gaur	G,H	G,H	H,M	H	1,2,3,4,5,6
Banteng	-	H	H	H	1,3,4,6
[Wild Water Buffalo]	-	H	-	H	1,2,3,4
Southern Serow	H	B,C,G,H,I,M	Z	G,H,I,S	1,2,3,4,6
Saola	-	-	H	-	5
Black Giant Squirrel	-	M	-	-	3
Variable Squirrel	-	M	-	-	3
Giant flying squirrel spp.	-	M	-	-	3
Flying squirrel spp.	-	M	S	S,U	1,3,4,5
Rat spp.	M	M	L,M	U	1,2,4
Hoary Bamboo Rat	-	M	-	-	3
Large Bamboo Rat	-	M	-	-	3
Bamboo rat spp.	L	L,M	L	-	1,4
East Asian Porcupine	-	Z	-	-	4
Asiatic Brush-tailed Porcupine	-	M,Z	-	-	3
Porcupine spp.	M	Q	U	M,U	1,2,4,6

[1]species listed here are those formerly of conservation and management significance in Lao PDR (as defined in Salter 1993b). In addition, wild pigs, hares, several species of rats and squirrels, a variety of bird, reptile, frog, fish and invertebrate species were commonly observed for sale at fresh food markets.

[2]B, bones; C, claws and hooves; Ca, casques; F, feathers; G, gall bladders or bile; H, horns and antlers; I, innards; L, live animals at markets, captured by villagers or being transported; M, meat or dead animals; N, nose; Q, quills; R, animals seen at restaurants or on menus; S, skins including pangolin scales; T, teeth or tusks; U, unspecified; Z, live animals seen at zoos.

[3]provinces: Far north = Phongsali, Louang-Namtha, Bokeo, Oudomxai, Louangphabang and Houaphan; North-central = Xaignabouli, Vientiane, Vientiane Municipality, Xiangkhouang and Bolikhamxai; Central = Khammouan and Savannakhet; South = Salavan, Champasak, Xekong and Attapu.

[4]References: 1, Chazee 1990; 2, Martin 1992; 3, Srikosamatara *et al*. 1992; 4, Salter 1993a; 5, R. Dobias pers. comm. to Salter 1993b; 6, Baird 1993.

ANNEX 2

CITES-listed wildlife species reported by CITES parties as exported from or originating in Lao PDR, 1983-1990[1].

Species	Commodity and quantity	Main destination
REPTILES		
Tortoises/Turtles	live animals	
Manouria emys [3]	40	Japan[2]
Testudo horsfieldi [3]	90	Japan[2]
Lizards	live animals	
Varanus salvator	30	Belgium
Snakes	live animals	
Eryx conicus [3]	30	Japan[2]
Eryx johnii [3]	30	Japan[2]
Eryx tataricus [3]	15	Japan[2]
Python molurus bivittatus	2600	USA[2]
Python reticulatus	350	USA and Belgium
Ptyas mucosus	10,000	Spain
BIRDS		
Hornbills	live birds	
Buceros rhinoceros [3]	64	
Buceros bicornis	130	Japan[2], Singapore and USA
Parakeets	live birds	
Psittacula spp.	7	Sweden
Owls	live birds	
Tyto alba	85	
Bubo nipalensis	1	
Bubo coromandus [3]	1	
Ketupa zeylonensis	5	
Strix leptogrammica	4	
Birds of Prey	live birds	
Pernis ptilorhyncus	2	
Elanus caeruleus	160	
Haliaeetus leucogaster	3	
Haliaeetus leucophrys [3]	2	
Spilornis cheela	9	
Accipiter badius	36	Japan[2]
Ictinaetus malayensis	1	
Aquila clanga	1	
Spizaetus cirrhatus	6	
Spizaetus nipalensis	110	
Spizaetus alboniger [3]	1	
Microhierax caerulescens	122	
MAMMALS		
Pangolins	skins	
Manis javanica	7000	Japan[2]
Primates	live animals	
Hylobates lar	21	USSR
Macaca arctoides	20	Japan[2]
Macaca fascicularis	120	USA

Species	Commodity and quantity	Main destination
Macaca mulatta	400 (50 from Vietnam)	Japan[2] and USA
Macaca nemestrina	50	Japan[2] and USA
Nycticebus coucang	450 (30 from Vietnam)	Japan[2], UK and USA
Nycticebus pygmaeus	12	Sweden
Pongo pygmaeus [3]	2	USSR
Presbytis melalophus/P. femoralis [3]	6	Japan[2]
Semnopithecus obscurus [3]	18	Japan[2]
Pygathrix nemaeus	5	UK
Elephant	tusks	
Elephas maximus	95 (seized)	USA
Others	live animals	
Aonyx cinerea	80 (3 from Vietnam)	Japan[2] and USA
Felis chaus	8	Japan[2]
Ratufa bicolor	50	Japan[2], UK and USA

[1]from: Nash and Broad (1993).
[2]via Singapore.
[3]species not known to occur in Lao PDR. The extent to which the other species listed were actually captured in Lao territory is unknown.

ANNEX 3

Amphibian, reptile, bird and mammal species listed in CITES Appendix I or II recorded or reported from Lao PDR.

Species	Key species: status reviewed in species list	Current wild status	Marginal non-breeding visitor
Appendix I			
REPTILES			
Bengal Monitor	+	w?	
Siamese Crocodile	+		
BIRDS			
Crested Argus	+		
White-winged Duck	+		
Great Hornbill	+		
Rufous-necked Hornbill	+		
Imperial Eagle	+		+
Peregrine Falcon		w	
MAMMALS			
Douc Langur	+	w	
White-handed Gibbon	+		
Pileated Gibbon	+		
Black-cheeked Crested Gibbon	+		
White-cheeked Crested Gibbon	+	w?	
[Yellow-cheeked Crested Gibbon]	+		
Asiatic Black Bear	+		
Sun Bear	+		
[Red Panda]	+		
Eurasian Otter	+		
Spotted Linsang	+		
Asian Golden Cat	+		
Marbled Cat	+		
Clouded Leopard	+		
Leopard	+		
Tiger	+		
Asian Elephant	+		
[Asian Tapir]	+		
Lesser One-horned Rhinoceros	+		
Asian Two-horned Rhinoceros	+		
Eld's Deer	+		
Hog Deer	+		
Large-antlered Muntjac	+	w	
Kouprey	+		
Gaur	+		
[Long-tailed Goral]	+		
Southern Serow	+	w	
Saola	+		
Appendix II			
AMPHIBIANS			
Hoplobatrachus rugulosa		w	
REPTILES			
Elongated Tortoise	+	w?	

Species	Key species: status reviewed in species list	Current wild status	Marginal non-breeding visitor
Impressed Tortoise	+	w?	
Water Monitor	+	w?	
Burmese Python	+	w?	
Reticulated Python	+	w?	
Common Ratsnake	+		
Monocellate Cobra	+	w?	
King Cobra	+	w?	
BIRDS			
Grey Peacock Pheasant		w	
Green Peafowl	+		
Comb Duck	+		?
Oriental Pied Hornbill		w	
Brown Hornbill	+	w	
Wreathed Hornbill	+	w	
Vernal Hanging Parakeet		w	
Alexandrine Parakeet	+		
Blossom-headed Parakeet	+		
Red-breasted Parakeet		w	
Grey-headed Parakeet		w	
Barn Owl	+		
Oriental Bay Owl		w	
Mountain Scops Owl		w	
Oriental Scops Owl		w	
Collared Scops Owl		w	
Spot-bellied Eagle Owl	+		
Brown Fish Owl	+		
Tawny Fish Owl	+		
[Buffy Fish Owl]	+		
Spotted Wood Owl	+		
Brown Wood Owl		w	
Collared Owlet		w	
Asian Barred Owlet		w	
Spotted Owlet			
Brown Hawk Owl		w	
Long-eared Owl			+
Short-eared Owl			+
Sarus Crane	+		
Osprey		w	
Jerdon’s Baza	+		
Black Baza		w	
Oriental Honey-buzzard		w	
Black-shouldered Kite		w	
Black Kite	+		+
Brahminy Kite	+		
White-bellied Sea Eagle	+		
Lesser Fish Eagle	+		
Grey-headed Fish Eagle	+		
White-rumped Vulture	+		
Long-billed Vulture	+		
[Cinereous Vulture]	+		+
Red-headed Vulture	+		
Short-toed Snake Eagle			+
Crested Serpent Eagle		w	
Eurasian Marsh Harrier		w	
Hen Harrier			+
Pied Harrier		w	

Species	Key species: status reviewed in species list	Current wild status	Marginal non-breeding visitor
Crested Goshawk		w	
Shikra		w	
Chinese Sparrowhawk		w?	
Japanese Sparrowhawk		w?	
Besra		w?	
Eurasian Sparrowhawk			+
Rufous-winged Buzzard	+	w	
Grey-faced Buzzard		w	
Common Buzzard		w	
Black Eagle		w	
Greater Spotted Eagle	+		+
Bonelli's Eagle			+
Booted Eagle			+
Rufous-bellied Eagle		w	
Changeable Hawk Eagle			
Mountain Hawk Eagle		w	
White-rumped Falcon	+		
Collared Falconet		w	
Pied Falconet	+	w	
Lesser Kestrel	+		+
Common Kestrel		w	
Amur Falcon			+
Merlin			+
Eurasian Hobby			+
Oriental Hobby		w	
Black Stork	+		+
Hill Myna		w	
Silver-eared Mesia		w	
MAMMALS			
Chinese Pangolin	+		
Sunda Pangolin	+	w	
Northern Treeshrew		w	
Mainland Slender-tailed Treeshrew	+		
[Large Flying-fox]	+		?
[Slow Loris]	+	w?	
[Pygmy Loris]	+	w?	
[Intermediate Loris]	+		
Pig-tailed Macaque	+	w	
Assamese Macaque	+	w	
Rhesus Macaque	+	w	
Long-tailed Macaque	+	w	
Bear Macaque	+	w	
Francois's Langur	+	w	
Silvered Langur	+	w	
Phayre's Langur	+		
Dhole	+	w	
[Hairy-nosed Otter]	+		
Smooth-coated Otter	+		
Oriental Small-clawed Otter	+		
Jungle Cat	+		
Leopard Cat		w	
Fishing Cat	+		
Irrawaddy Dolphin	+		
[Chinese Forest Musk Deer]	+		
Black Giant Squirrel	+	w	

Notes:
+: species answers the criterion of the column.
+?: species is believed to answer the criterion of the column.
Current status in Lao PDR: 'w' indicates that the species remains widespread, and often common, in remaining suitable habitat in Lao PDR.

All species in CITES Appendices I and II are listed, according the most recent lists as presented in WCMC (1998). The majority are considered as key species for Lao PDR and so receive a status review in the text. Most of the remainder have either been shown by recent field surveys to be common and widespread in Lao PDR and of no short- or mid-term conservation concern, or are non-breeding visitors to the country of marginal or irregular occurrence. Many of these species are of limited national conservation interest, and indeed many (e.g. most owls and many raptors) are merely included on CITES appendices because of their similarity in appearance to a rare species.

The remaining species, which have not been shown to be widespread, and are not already treated as key species, include several owls and one raptor, all of which are likely to have been recorded patchily due to identification difficulties and / or low detactability. The locations and habitats of the recent records do not suggest that any are likely to be at risk in Lao PDR; further information from field surveys to confirm this is desirable.

ANNEX 4

Birds and large mammals associated with wetlands in Lao PDR.

Species	Association with wetlands	Recent records	Wetland habitat is primarily			Persists in cultivation	Locally distributed non-breeding visitor
			Forest streams	Rocky rivers	Pools amid dryland		
BIRDS							
Lesser Whistling-duck	+++	+				+	
• Swan Goose	+++	+					+
• Greylag Goose	+++	+					+
• Bar-headed Goose	+++	+					+
• Ruddy Shelduck	+++	+					+
• Common Shelduck	+++	+					+
• **White-winged Duck**	+++	+					
• **Comb Duck**	+++	-					?
• **Cotton Pygmy-goose**	+++	+					
Falcated Duck	+++	-					+
Eurasian Wigeon	+++	-					+
Spot-billed Duck	+++	+					
Northern Pintail	+++	+					+
Garganey	+++	+					
Common Teal	+++	+					+
• Blyth's Kingfisher	+++	+	+				
Common Kingfisher	+++	+				+	
Blue-eared Kingfisher	+++	+	+				
Oriental Dwarf Kingfisher	++	+	+				
Stork-billed Kingfisher	+++	+				+	
• Ruddy Kingfisher	++	+	+				
White-throated Kingfisher	++	+				+	
Black-capped Kingfisher	++	+				+	
Crested Kingfisher	+++	+		+			
• **Pied Kingfisher**	+++	+					
• **Blue-tailed Bee-eater**	++	+					
Lesser Coucal	+	+				+	
• **Brown Fish Owl**	+++	+	+				
• **Tawny Fish Owl**	+++	+	+				
[• **Buffy Fish Owl]**	+++	?	+				
Short-eared Owl	+	-					+
• **Sarus Crane**	+++	+			+		
• **Masked Finfoot**	+++	+					
[Red-legged Crake]	+++	?					?
Slaty-legged Crake	+++	+	+				?
Slaty-breasted Rail	+++	+					
Water Rail	+++	-					+
White-breasted Waterhen	+++	+				+	
• **Black-tailed Crake**	++	-					
Baillon's Crake	+++	-					?
Ruddy-breasted Crake	+++	+					
• **Watercock**	+++	+					
• **Purple Swamphen**	+++	+					
Common Moorhen	+++	+					
Common Coot	+++	+					+
Eurasian Woodcock	+	+	+				
• Wood Snipe	++	+	+				+
Pintail Snipe	++	+				+	
[Swinhoe's Snipe]	++	?					+
Common Snipe	++	+				+	

Species	Association with wetlands	Recent records	Wetland habitat is primarily			Persists in cultivation	Locally distributed non-breeding visitor
			Forest streams	Rocky rivers	Pools amid dryland		
Eurasian Curlew	++	-					+
Spotted Redshank	+++	+					
Common Redshank	+++	+					+
Marsh Sandpiper	+++	+					
Common Greenshank	+++	+					
Green Sandpiper	++	+					
Wood Sandpiper	+++	+				+	
Terek Sandpiper	+++	-					+
Common Sandpiper	+++	+				+	
Sanderling	+++	+					+
Red-necked Stint	+++	+					+
Temminck's Stint	+++	+					
Long-toed Stint	+++	+					+
Dunlin	+++	+					+
Curlew Sandpiper	+++	+					+
Ruff	+++	+					+
Red-necked Phalarope	+++	+					+
Greater Painted-snipe	+++	+					
Pheasant-tailed Jacana	+++	+					
Bronze-winged Jacana	+++	+					
• Great Thick-knee	+++	+					
Black-winged Stilt	+++	+					
• Long-billed Plover	+++	+					+
Little Ringed Plover	++	+					
Kentish Plover	+++	+					
Lesser Sand Plover	+++	?					+
Greater Sand Plover	+++	?					+
Northern Lapwing	++	+				+	+
• River Lapwing	+++	+					
• Grey-headed Lapwing	++	+				+	
Oriental Pratincole	++	+					
• Small Pratincole	+++	+					
• Indian Skimmer	+++	-					
Pallas's Gull	+++	+					+
Brown-headed Gull	+++	+					+
Black-headed Gull	+++	+					+
• River Tern	+++	+					
• Black-bellied Tern	+++	+					
• Little Tern	+++	+					
Whiskered Tern	+++	+					+
White-winged Tern	+++	+					+
Osprey	+++	+					
• Black Kite	+	+				?	+
• Brahminy Kite	+++	+					
• White-bellied Sea Eagle	+++	-					
• Lesser Fish Eagle	+++	+					
• Grey-headed Fish Eagle	+++	+					
Eurasian Marsh Harrier	++	+					
Hen Harrier	++	+					+
Pied Harrier	++	+					
• Greater Spotted Eagle	+	+					+
• Imperial Eagle	+	+					+
Little Grebe	+++	+					
• Darter	+++	+					
• Little Cormorant	+++	+					

Species	Association with wetlands	Recent records	Wetland habitat is primarily			Persists in cultivation	Locally distributed non-breeding visitor
			Forest streams	Rocky rivers	Pools amid dryland		
• **Great Cormorant**	+++	-					
Little Egret	+++	+					
• **Grey Heron**	+++	+					
• **Purple Heron**	+++	+					
Great Egret	+++	+					
Intermediate Egret	+++	+					
Cattle Egret	+++	+					
Chinese Pond Heron	+++	+				+	
Little Heron	+++	+	+				
• **Black-crowned Night Heron**	+++	+					
Malayan Night Heron	++	+	+				
Yellow Bittern	+++	+				+	
• Von Schrenck's Bittern	+++	+				+	+
Cinnamon Bittern	+++	+				+	
Black Bittern	+++	+					+
• **Great Bittern**	+++	+					
• **Black-headed Ibis**	+++	-					
• **Black Ibis**	+++	+			+		
• **Giant Ibis**	+++	+			+		
• **Spot-billed Pelican**	+++	+					
• **Painted Stork**	+++	+					
• **Asian Openbill**	+++	+					
• **Black Stork**	+++	+					+
• **Woolly-necked Stork**	+++	+			+		
• **Black-necked Stork**	+++	+			+		
• **Lesser Adjutant**	+++	+			+		
• **Greater Adjutant**	+++	?			+		
• Brown Dipper	+++	+	+				
Blue Whistling Thrush	++	+	+				
Scaly Thrush	+	+	+				
Dark-sided Thrush	+	+	+				
Eurasian Blackbird	+	+	+				
Siberian Rubythroat	+	+				+	
Bluethroat	++	+				+	
White-capped Water Redstart	+++	+		+			
Plumbeous Water Redstart	+++	+		+			
Slaty-backed Forktail	+++	+	+				
White-crowned Forktail	+++	+	+				
• **Jerdon's Bushchat**	+	+					
Black-collared Starling	+	+				+	
White-vented Myna	++	+				+	
Crested Myna	++	+				+	
Sand Martin	+++	+				+	+
• **Plain Martin**	+++	+				+	
• **Wire-tailed Swallow**	+++	+		+		+	
Zitting Cisticola	++	+				+	
Bright-headed Cisticola	++	+				+	
Yellow-bellied Prinia	++	+				+	
Plain Prinia	++	+				+	
Rusty-rumped Warbler	++	+				+	
Black-browed Reed Warbler	+++	+				+	
• Paddyfield Warbler	+++	+				+	?
Blunt-winged Warbler	+++	?				+	
Oriental Reed Warbler	+++	+				?	

Species	Association with wetlands	Recent records	Wetland habitat is primarily			Persists in cultivation	Locally distributed non-breeding visitor
			Forest streams	Rocky rivers	Pools amid dryland		
Clamorous Reed Warbler	+++	?				?	?
Striated Grassbird	+++	+				+	
White Wagtail	+	+				+	
Citrine Wagtail	+++	+					+
Yellow Wagtail	++	+				+	
Grey Wagtail	+++	+				+	
Paddyfield Pipit	+	+					
Red-throated Pipit	++	+				+	
• **Baya Weaver**	+++	+				+	
• **Asian Golden Weaver**	+++	+			+		
Yellow-breasted Bunting	++	+				+	
MAMMALS							
• **Eurasian Otter**	+++	-					
[• **Hairy-nosed Otter**]	+++	-					
• **Smooth-coated Otter**	+++	+					
• **Oriental Small-clawed Otter**	+++	+					
[• **Lowe's Otter Civet**]	+++	-					
Crab-eating Mongoose	++	+	+				
• **Fishing Cat**	++	+					
• **Irrawaddy Dolphin**	+++	+					
• **Hog Deer**	++	-					
[• **Wild Water Buffalo**]	++	-					

Species in square brackets have not been confirmed to occur in Lao PDR. Bulleted species (•) are key species for conservation (Annex 6).

Association with wetlands: +++, almost invariably in wetlands; ++, strongly associated with wetlands and although individuals may be found outside with some regularity, species's population probably depends on wetlands; +, frequently in wetlands, but may not depend upon them.

Recent records: +, yes; ?, provisionally; -, no.

Habitat association: + indicates that the species is found primarily within the habitat indicated.

Persists in cultivation: the species is observed frequently in cultivated areas and may be independent of natural / semi-natural wetlands.

Local non-breeding visitor: the species visits Lao PDR only as a non-breeder and is scarce, scattered, or irregular in distribution. Some additional species which have undergone catastrophic recent declines through human agency and are only now scarce non-breeding visitors. They are not indicated as such in this column, as this is not a natural situation and breeding populations could perhaps be re-established with appropriate management.

The wetlands of Lao PDR are of outstanding international importance (Claridge 1996, Thewlis *et al*. 1998). The Ramsar Convention defines wetlands as 'areas of marsh, fen, peatland, or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six meters'. Many of the habitats included do not occur in Lao PDR (e.g. all salt, brackish and tidal wetlands), and some habitats provided for under this definition which do occur in Lao PDR are of minimal biodiversity conservation importance; following Claridge (1996), rice paddies and aquaculture ponds are omitted from further consideration here. In contrast to Claridge, however, rivers, even including small forest streams, are retained in the definition as used here. This is necessary because many wetland bird and large mammal species occur in both non-flowing and flowing wetlands. Because they are also in areas preferentially settled by people, the current system of NBCAs under-represents the occurrence of many types. Thus, their vertebrate wildlife has been under-surveyed, but current indications are that many species are under steep national decline (birds: Thewlis *et al*. 1998; mammals: this table). In recognition of the importance of the habitats and the conservation needs of vertebrates, CPAWM has a specific wetland unit.

The present list is given for guidance in anticipation that future field surveys will rectify the present imbalance. Species are classified

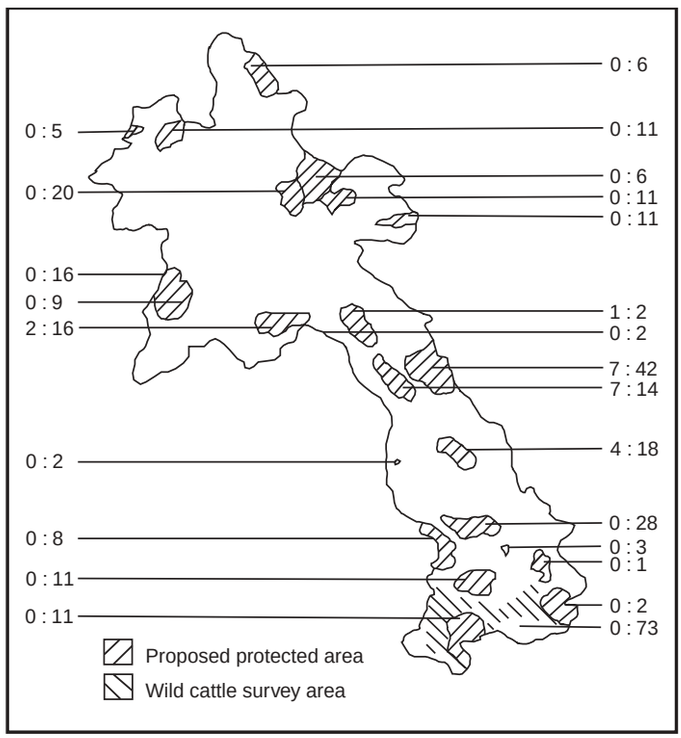
with respect to the strength of their association with wetlands. Many species in addition to those listed here also occur in wetlands but as they occur widely and as commonly in other habitats they are not here considered to be wetland species. Attention is given to four categories of marginal wetlands (narrow forest streams; pools amid otherwise dry land; rocky rivers; and those converted to cultivation). Species occurring widely in these are distinguished as (i) they have been relatively well recorded by recent surveys and their wetland microhabitats are potentially well protected within the existing protected area network, (ii) these habitats are not universally considered wetlands and therefore (iii) are not and should not be foci for wetland conservation efforts to supplement the NBCA system. Consequently, the species they support may not necessarily be considered as conservation priorities within wetland conservation efforts outside the NBCA system. Additionally, many species of wetland birds are merely non-breeding visitors in small and often irregular numbers; their centre of range and / or habitat lies outside Lao PDR. Although rare or scarce in Lao PDR, these species merit little consideration in wetland conservation planning activities as their occurrence in the country is merely marginal. Taking into account the foregoing factors, species considered to be indicators of wetland quality and meriting consideration in wetland conservation management action in addition to NBCA-based activities are placed in **bold face**. Major concentrations of numbers of the other species may also merit attention.

The information given in this table is a first attempt at presenting species conservation priorities of wetlands in Lao PDR. The lack of recent survey work in most types of wetlands means that some arbitrariness has been necessary in assigning categories for each species. This tentativeness emphasises the need for a structured survey programme of the birds and mammals of wetlands across Lao PDR, concentrating on medium-sized and large marshes and other non-flowing wetlands, and wide lowland rivers.

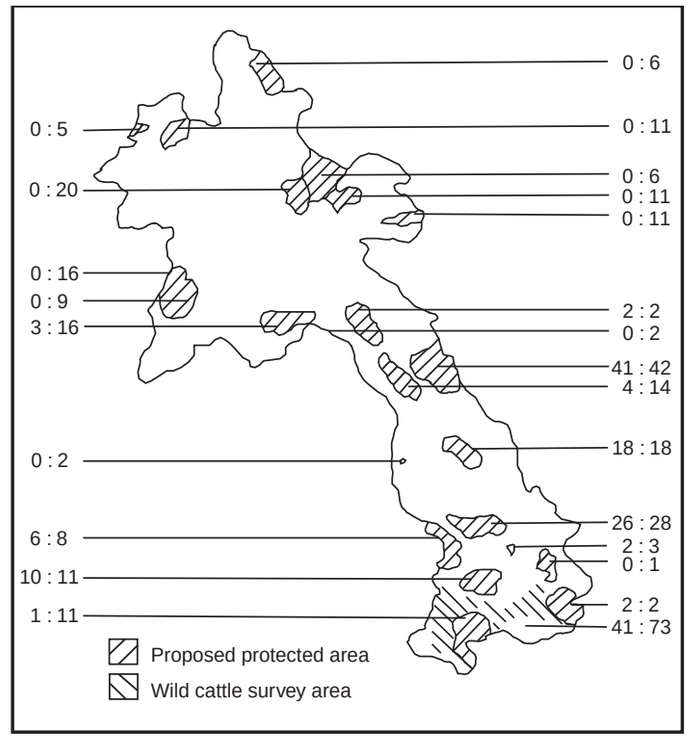
ANNEX 5

Distribution of selected species of mammal as assessed from village interviews in 1988-1993.

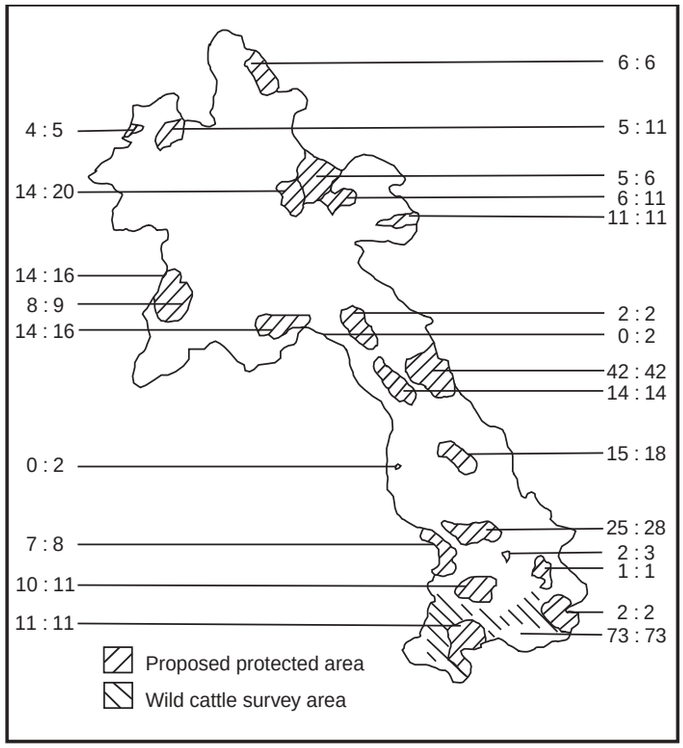
The maps in this annex are taken directly from Salter (1993b) and show the distribution in interview survey areas across Lao PDR during 1988-1993. They serve as a valuable snapshot for comparison with later information. Also noteworthy is the fair correlation of interview-derived ranges with those subsequently found with direct field data for Francois's and Douc Langurs, distinctive species which are relatively easily found and identified in the field and show limited distributions in Lao PDR. The wide geographical distributions indicated in the maps for gibbons, Dhole, otters, Lesser Oriental Chevrotain, Sambar, Gaur and Serow/goral have also all confirmed by field work, although at many individual sites there has been insufficient work to confirm or refute the reports. The indications from these maps that both bear species, Clouded Leopard, Leopard and Banteng are all widespread remain to be confirmed; although all are difficult species to gather information on through interviews, they are also difficult to confirm in the field. The maps almost certainly show much wider distributions of Eld's Deer, Hog Deer and Wild Water Buffalo than are now occupied, reflecting probably a mix of genuine decreases and over-positive responses during the interviews.



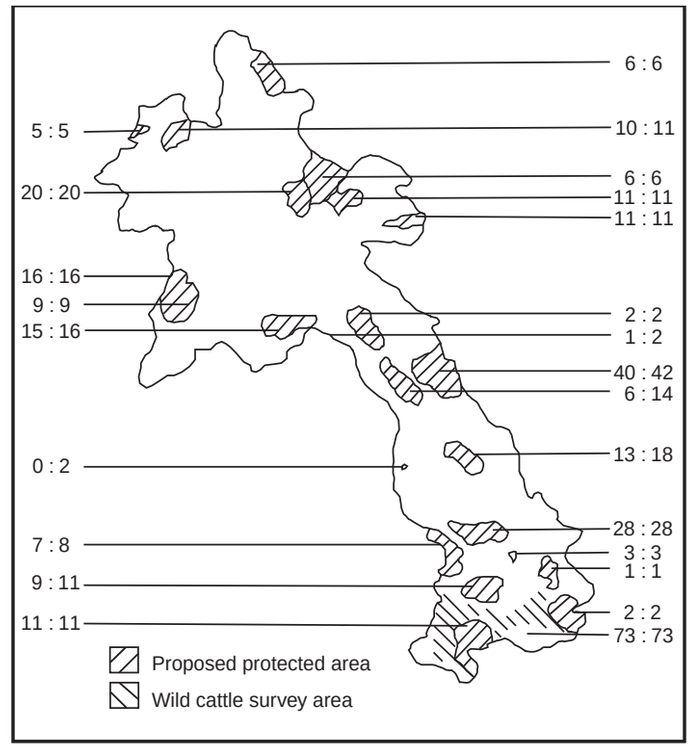
Reports of Francois's Langur during village interviews in and around proposed protected areas, 1988-93. xx: = number of villages reporting species in vicinity, :yy = total number of villages at which interviews were conducted.



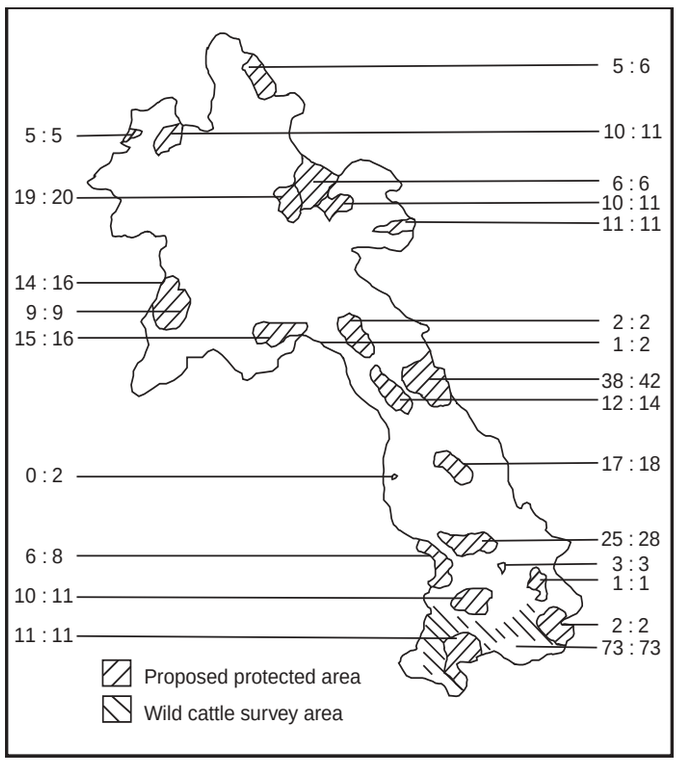
Reports of Douc Langur during village interviews in and around proposed protected areas, 1988-93. xx: = number of villages reporting species in vicinity, :yy = total number of villages at which interviews were conducted.



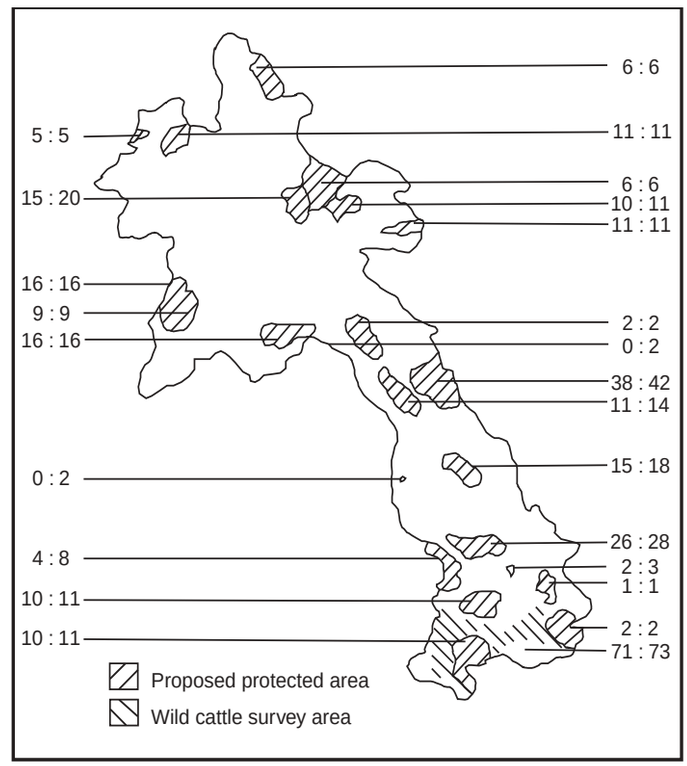
Reports of gibbons during village interviews in and around proposed protected areas, 1988-93. xx: = number of villages reporting species in vicinity, :yy = total number of villages at which interviews were conducted.



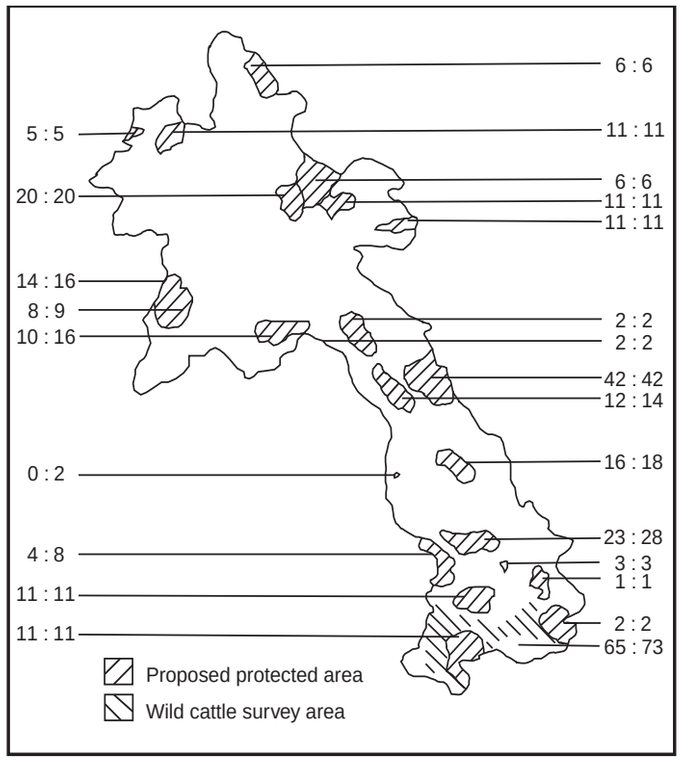
Reports of Dhole during village interviews in and around proposed protected areas, 1988-93. xx: = number of villages reporting species in vicinity, :yy = total number of villages at which interviews were conducted.



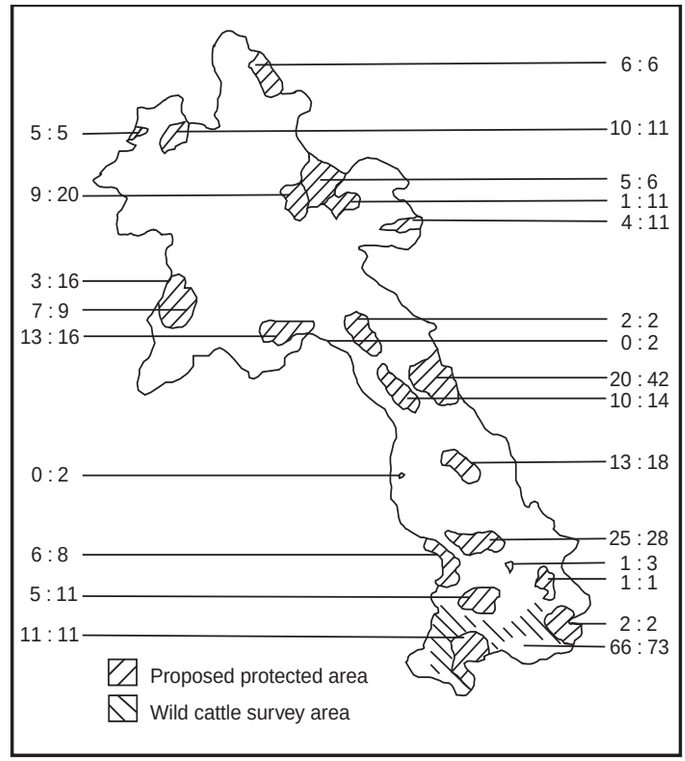
Reports of Asiatic Black Bear during village interviews in and around proposed protected areas, 1988-93. xx: = number of villages reporting species in vicinity, :yy = total number of villages at which interviews were conducted.



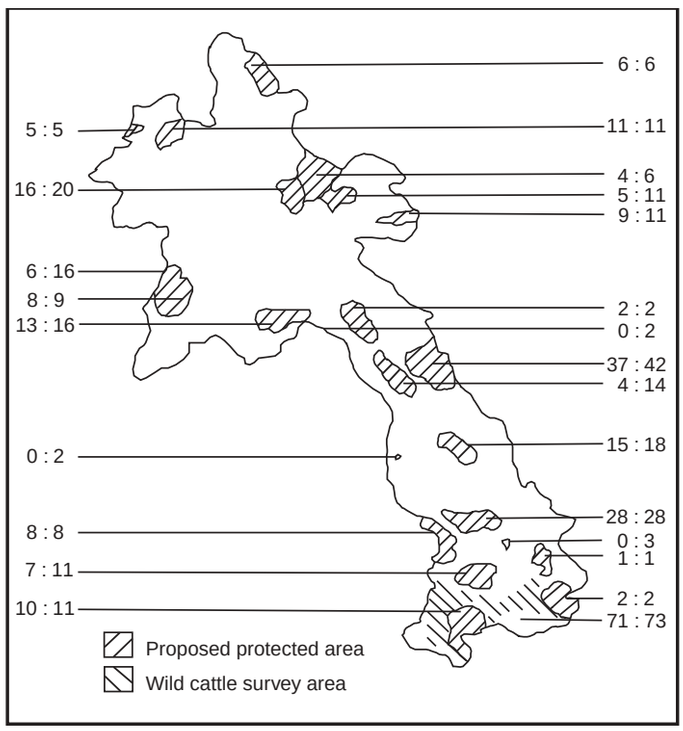
Reports of Sun Bear during village interviews in and around proposed protected areas, 1988-93. xx: = number of villages reporting species in vicinity, :yy = total number of villages at which interviews were conducted.



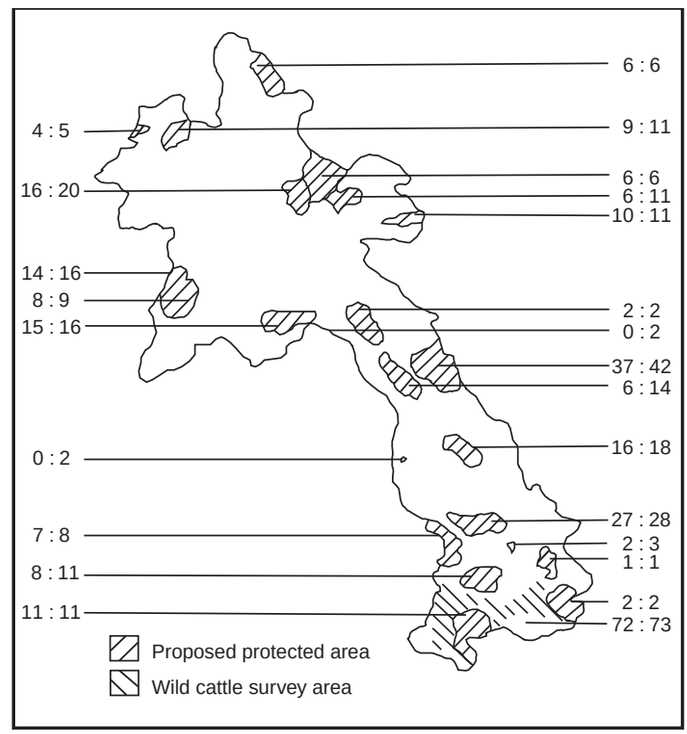
Reports of otters during village interviews in and around proposed protected areas, 1988-93. xx: = number of villages reporting species in vicinity, :yy = total number of villages at which interviews were conducted.



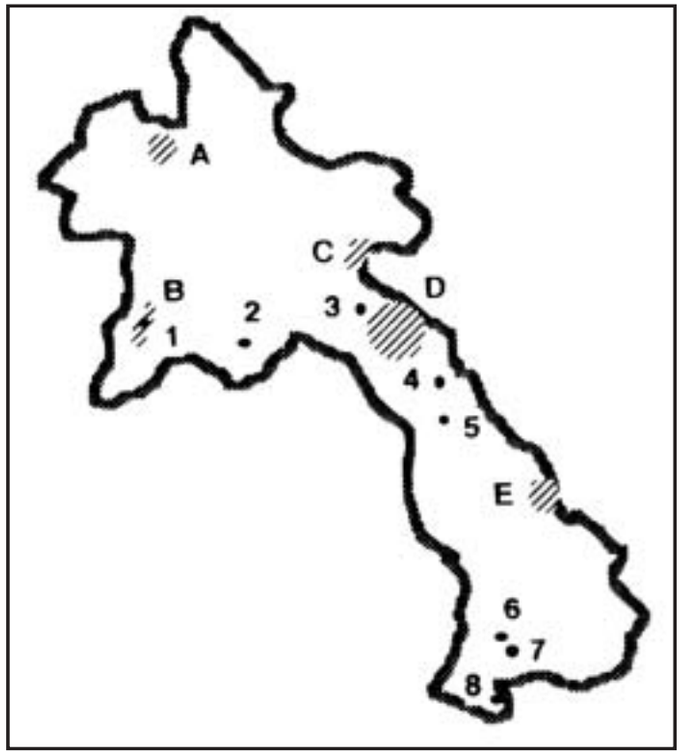
Reports of Clouded Leopard during village interviews in and around proposed protected areas, 1988-93. xx: = number of villages reporting species in vicinity, :yy = total number of villages at which interviews were conducted.



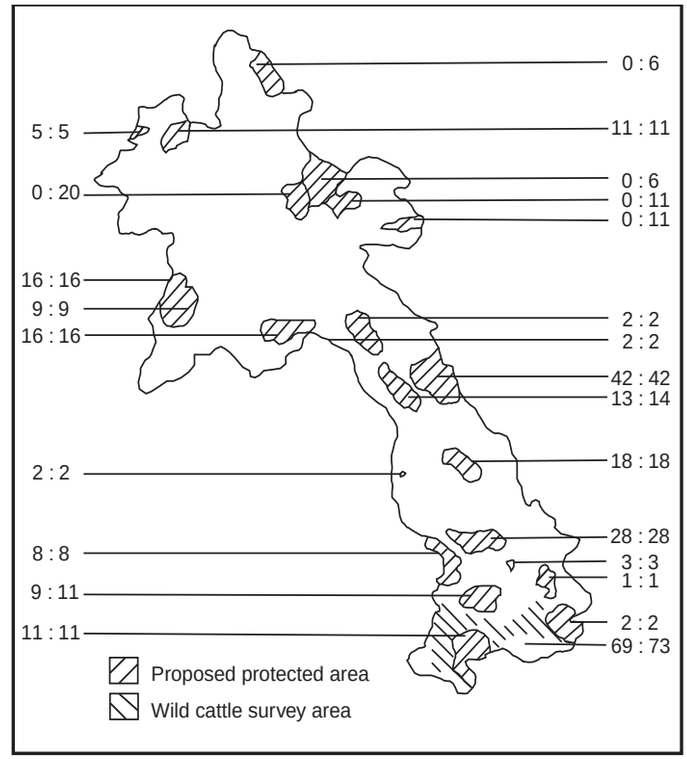
Reports of Leopard during village interviews in and around proposed protected areas, 1988-93. xx: = number of villages reporting species in vicinity, :yy = total number of villages at which interviews were conducted.



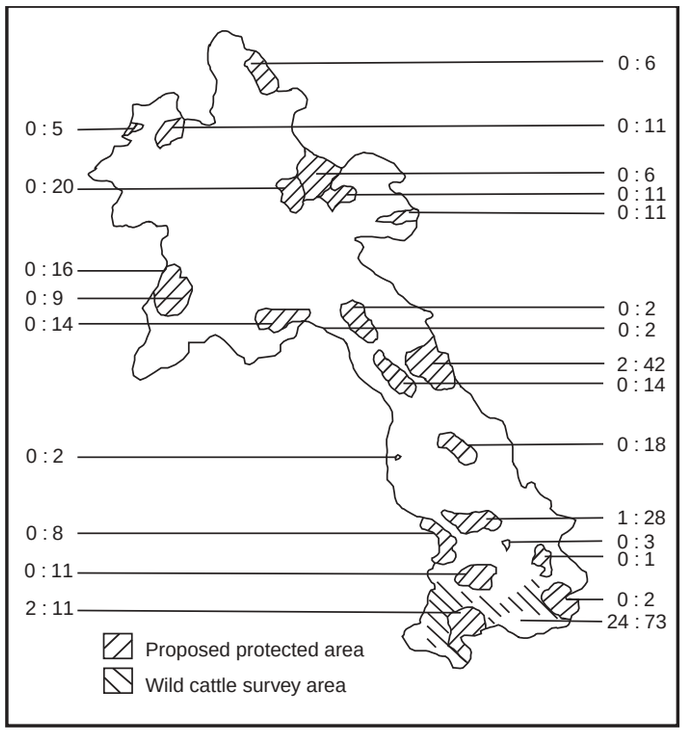
Reports of Tiger during village interviews in and around proposed protected areas, 1988-93. xx: = number of villages reporting species in vicinity, :yy = total number of villages at which interviews were conducted.



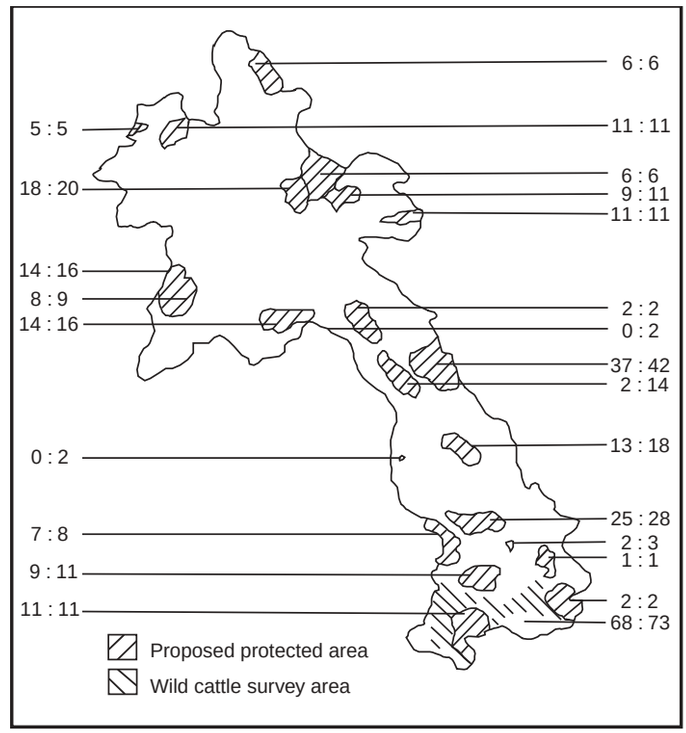
Reports of rhinoceroses during village interviews, 1988-93, compared with post-1940 distribution of Javan Rhinoceros reported by (29).



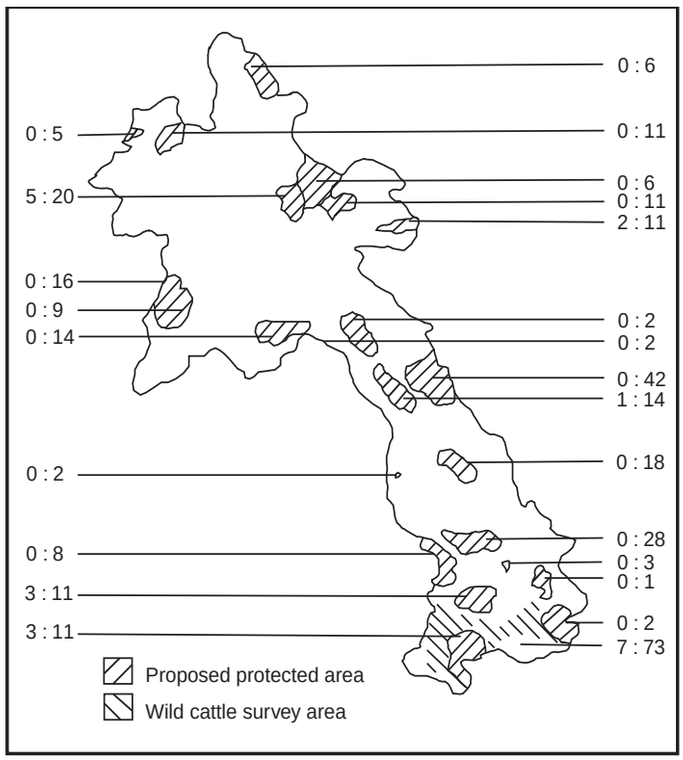
Reports of chevrotains during village interviews in and around proposed protected areas, 1988-93. xx: = number of villages reporting species in vicinity, :yy = total number of villages at which interviews were conducted.



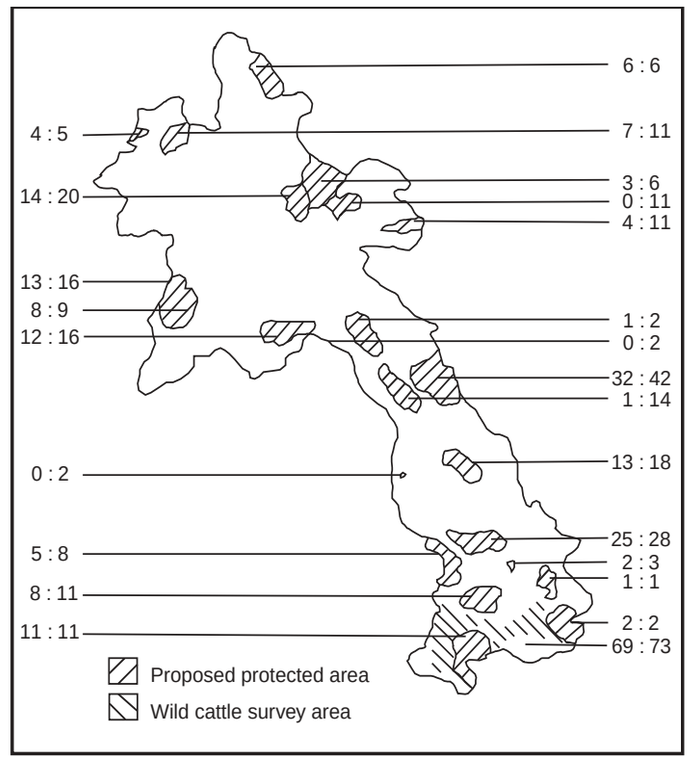
Reports of Eld's Deer during village interviews in and around proposed protected areas, 1988-93. xx: = number of villages reporting species in vicinity, :yy = total number of villages at which interviews were conducted.



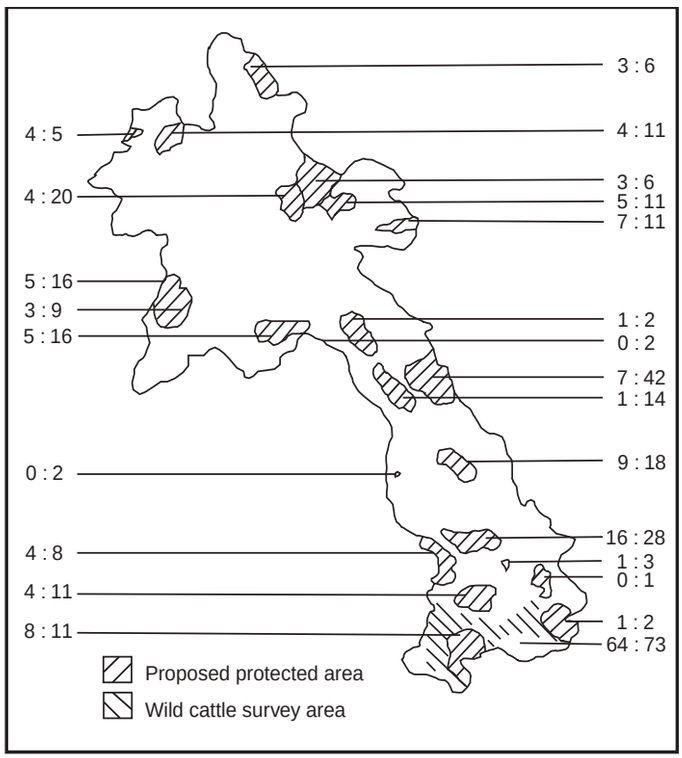
Reports of Sambar during village interviews in and around proposed protected areas, 1988-93. xx: = number of villages reporting species in vicinity, :yy = total number of villages at which interviews were conducted.



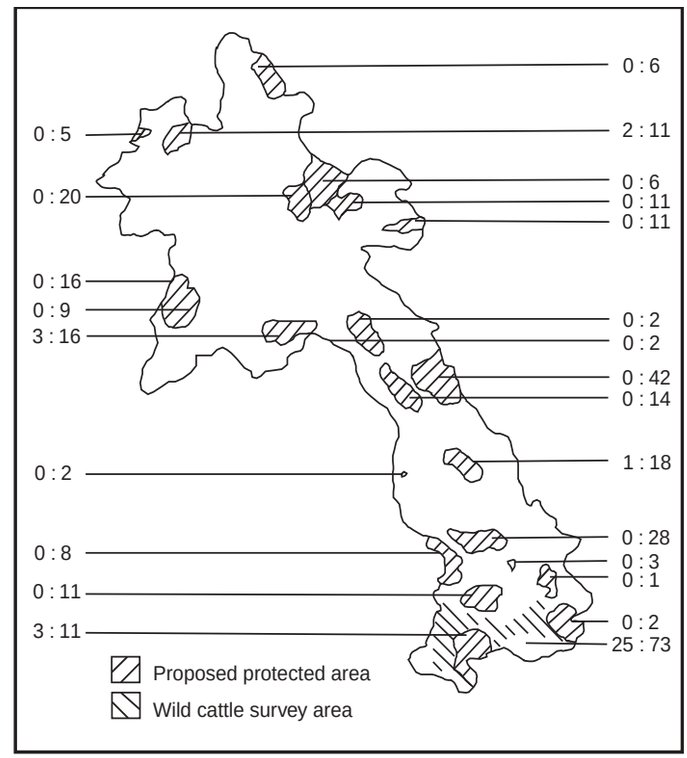
Reports of Hog Deer during village interviews in and around proposed protected areas, 1988-93. xx: = number of villages reporting species in vicinity, :yy = total number of villages at which interviews were conducted.



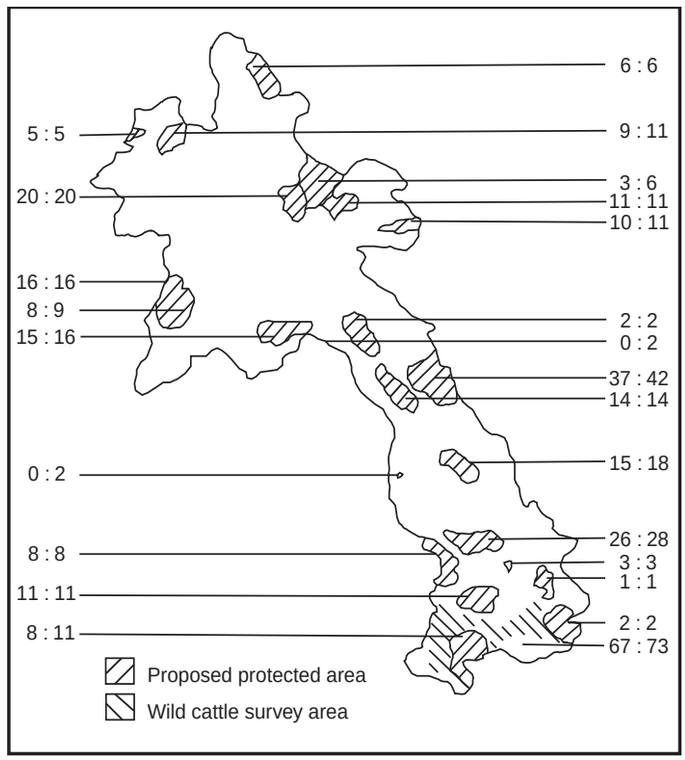
Reports of Gaur during village interviews in and around proposed protected areas, 1988-93. xx: = number of villages reporting species in vicinity, :yy = total number of villages at which interviews were conducted.



Reports of Banteng during village interviews in and around proposed protected areas, 1988-93. xx: = number of villages reporting species in vicinity, :yy = total number of villages at which interviews were conducted.



Reports of Wild Water Buffalo during village interviews in and around proposed protected areas, 1988-93. xx: = number of villages reporting species in vicinity, :yy = total number of villages at which interviews were conducted.



Reports of Serow and/or Goral during village interviews in and around proposed protected areas, 1988-93. xx: = number of villages reporting species in vicinity, :yy = total number of villages at which interviews were conducted.

ANNEX 6

Revised list of key species of amphibians, reptiles, birds and mammals in Lao PDR.

Species	Global threat status	Lao risk status
AMPHIBIANS		
Salamander sp.	n/a	LKL
REPTILES		
Big-headed Turtle	**DD**	**ARL**
Malayan Box Turtle	**GNT**	**ARL**
Indochinese Box Turtle	**GNT**	**ARL**
[Chinese Three-striped Box Turtle]	**GT-EN**	**CARL**
Asian Leaf Turtle	0	PARL
Stripe-necked Leaf Turtle	0	PARL
Giant Asian Pond Turtle	**GNT**	**PARL**
Yellow-headed Temple Turtle	**GT-VU**	**ARL**
Malayan Snail-eating Turtle	0	PARL
Keeled Box Turtle	0	ARL
Four-eyed Turtle	**GT-VU**	**PARL**
[Black Marsh Turtle]	0	CARL
Elongated Tortoise	**GT-VU**	**ARL**
Impressed Tortoise	**GT-VU**	**ARL**
Asiatic Softshell Turtle	**GT-VU**	**PARL**
Asian Giant Softshell Turtle	**GT-VU**	**ARL**
Water Dragon	0	PARL
Bengal Monitor	0	PARL
Water Monitor	0	PARL
Burmese Python	**GNT**	**PARL**
Reticulated Python	0	PARL
Indochinese Ratsnake	0	PARL
Common Ratsnake	0	PARL
Monocellate Cobra	0	PARL
Indochinese Spitting Cobra	0	PARL
King Cobra	0	PARL
Siamese Crocodile	**GT-CR**	**ARL**
BIRDS		
Japanese Quail	0	LKL
Blue-breasted Quail	0	LKL
Siamese Fireback	**GT-VU**	**PARL**
Crested Argus	**GT-VU**	**ARL**
Green Peafowl	**GT-VU**	**ARL**
Swan Goose	**GT-VU**	**ARL**
Greylag Goose	0	ARL
Bar-headed Goose	0	ARL
Ruddy Shelduck	0	ARL
Common Shelduck	0	ARL
White-winged Duck	**GT-EN**	**ARL**
Comb Duck	0	ARL
Cotton Pygmy-goose	0	ARL
Small Buttonquail	0	LKL
Fulvous-breasted Woodpecker	0	LKL
Yellow-crowned Woodpecker	0	ARL
Great Spotted Woodpecker	0	LKL
White-bellied Woodpecker	0	PARL
Streak-throated Woodpecker	0	PARL
Red-collared Woodpecker	**GT-VU**	**0**
Bamboo Woodpecker	0	LKL
Great Hornbill	0	ARL
Brown Hornbill	**GNT**	**PARL**
Rufous-necked Hornbill	**GT-VU**	**ARL**
Wreathed Hornbill	0	ARL
Blyth's Kingfisher	**GT-VU**	**PARL**
Ruddy Kingfisher	0	LKL
Collared Kingfisher	0	LKL
Pied Kingfisher	0	ARL
Blue-tailed Bee-eater	0	PARL
Moustached Hawk Cuckoo	0	LKL
Coral-billed Ground Cuckoo	**GNT**	**0**
Alexandrine Parakeet	0	ARL
Blossom-headed Parakeet	0	PARL
Barn Owl	0	LKL
Spot-bellied Eagle Owl	**GNT**	**PARL**
Brown Fish Owl	0	PARL
Tawny Fish Owl	**GNT**	**LKL**
[Buffy Fish Owl]	0	LKL
Spotted Wood Owl	0	LKL
Ashy Wood Pigeon	0	LKL
Pale-capped Pigeon	**GT-VU**	**LKL**
Little Cuckoo Dove	0	PARL
Orange-breasted Green Pigeon	0	PARL
Pompadour Green Pigeon	0	ARL
Yellow-footed Green Pigeon	0	ARL
Yellow-vented Green Pigeon	**GNT**	**0**
White-bellied Green Pigeon	**GNT**	**LKL**
Green Imperial Pigeon	0	ARL
Sarus Crane	**GNT**	**ARL**
Masked Finfoot	**GT-VU**	**ARL**
Black-tailed Crake	0	LKL
Watercock	0	ARL
Purple Swamphen	0	ARL
Wood Snipe	**GT-VU**	**LKL**
Eurasian Thick-knee	0	LKL
Great Thick-knee	0	ARL
Long-billed Plover	**GNT**	**LKL**
River Lapwing	0	ARL
Grey-headed Lapwing	**GNT**	**PARL**
Small Pratincole	0	PARL
Indian Skimmer	**GT-VU**	**ARL**
River Tern	0	ARL
Little Tern	0	ARL
Black-bellied Tern	**GT-VU**	**ARL**
Jerdon's Baza	**GNT**	**0**
Black Kite	0	ARL
Brahminy Kite	0	ARL

Species	Global threat status	Lao risk status
White-bellied Sea Eagle	0	ARL
Lesser Fish Eagle	**GNT**	**ARL**
Grey-headed Fish Eagle	**GNT**	**ARL**
White-rumped Vulture	**GNT**	**ARL**
Long-billed Vulture	**GNT**	**ARL**
[Cinereous Vulture]	**GNT**	**ARL**
Red-headed Vulture	**GNT**	**ARL**
Rufous-winged Buzzard	**GNT**	**0**
Greater Spotted Eagle	**GT-VU**	**LKL**
Imperial Eagle	**GT-VU**	**LKL**
White-rumped Falcon	**GNT**	**PARL**
Pied Falconet	**GNT**	**LKL**
Lesser Kestrel	**GT-VU**	**LKL**
Darter	**GNT**	**ARL**
Little Cormorant	0	ARL
Great Cormorant	0	ARL
Grey Heron	0	PARL
Purple Heron	0	PARL
Black-crowned Night Heron	0	PARL
Von Schrenck's Bittern	**GNT**	**LKL**
Great Bittern	0	ARL
Black-headed Ibis	**GNT**	**ARL**
Black Ibis	**GT-EN**	**ARL**
Giant Ibis	**GT-CR**	**ARL**
Spot-billed Pelican	**GT-VU**	**ARL**
Painted Stork	**GNT**	**ARL**
Asian Openbill	**GNT**	**ARL**
Black Stork	0	ARL
Woolly-necked Stork	0	ARL
Black-necked Stork	0	ARL
Lesser Adjutant	**GT-VU**	**ARL**
Greater Adjutant	**GT-EN**	**ARL**
Blue-naped Pitta	**GNT**	**LKL**
Blue-rumped Pitta	**GNT**	**PARL**
Bar-bellied Pitta	**GNT**	**PARL**
White-winged Magpie	**GNT**	**PARL**
Indochinese Green Magpie	**GNT**	**PARL**
Black-billed Magpie	0	LKL
Swinhoe's Minivet	**GNT**	**0**
Japanese Paradise-flycatcher	**GNT**	**LKL**
Brown Dipper	0	PARL
Black-breasted Thrush	**GNT**	**LKL**
Grey-winged Blackbird	0	LKL
Grey-sided Thrush	**GT-VU**	**LKL**
Fujian Niltava	**GNT**	**PARL**
Blue-fronted Robin	**GNT**	**LKL**
Purple Cochoa	**GNT**	**LKL**
Green Cochoa	**GNT**	**0**
Jerdon's Bushchat	**GNT**	**0**
Asian Pied Starling	0	LKL
Golden-crested Myna	0	PARL
Chestnut-vented Nuthatch	0	LKL
White-tailed Nuthatch	0	LKL
Yellow-billed Nuthatch	**GT-VU**	**PARL**
Beautiful Nuthatch	**GT-VU**	**PARL**
Brown-throated Treecreeper	0	LKL
Plain Martin	0	ARL
Wire-tailed Swallow	0	PARL
Paddyfield Warbler	0	LKL
Yellow-vented Warbler	**GNT**	**0**
Black-hooded Laughingthrush	**GT-VU**	**PARL**
Grey Laughingthrush	**GNT**	**0**
Rufous-vented Laughingthrush	0	LKL
Laughingthrush sp. A	n/a	LKL
Spot-breasted Laughingthrush	**GNT**	**LKL**
Red-tailed Laughingthrush	**GNT**	**0**
Short-tailed Scimitar Babbler	**GT-VU**	**PARL**
Spotted Wren Babbler	**GNT**	**0**
Sooty Babbler	**GT-VU**	**0**
Grey-faced Tit Babbler	**GNT**	**0**
Black-crowned Barwing	n/a	LKL
Yellow-throated Fulvetta	**GNT**	**LKL**
Spectacled Fulvetta	**GNT**	**0**
Rufous-throated Fulvetta	**GNT**	**0**
Stripe-throated Yuhina	0	LKL
Short-tailed Parrotbill	**GT-VU**	**0**
Lesser Rufous-headed Parrotbill	**GNT**	**LKL**
Greater Rufous-headed Parrotbill	**GNT**	**LKL**
Yellow-bellied Flowerpecker	0	LKL
Baya Weaver	0	PARL
Asian Golden Weaver	**GNT**	**ARL**
Black-headed Munia	0	LKL
Mammals		
Chinese Pangolin	**GNT**	**ARL**
Sunda Pangolin	**GNT**	**ARL**
[*Hylomys sinensis*]	**GNT**	**n/a**
Mainland Slender-tailed Treeshrew	0	LKL
Sunda Colugo	0	LKL
Pteropus vampyrus	0	PARL
Rousettus leschenaulti	0	PARL
Rousettus amplexicaudatus	0	PARL
Eonycteris spelaea	0	PARL
Taphozous theobaldi	0	PARL
Taphozous saccolaimus	0	PARL
Rhinolophus luctus	0	PARL
Rhinolophus paradoxolophus	**GT-VU**	**PARL**
Rhinolophus marshalli	**GNT**	**PARL**
Rhinolophus macrotis	0	PARL
Rhinolophus cf. *siamensis*	n/a	PARL
Rhinolophus coelophyllus	0	PARL
Rhinolophus shameli	**GNT**	**PARL**
Rhinolophus pearsonii	0	PARL
[*Rhinolophus yunanensis*]	**GNT**	**n/a**
Rhinolophus pusillus	0	PARL

Species	Global threat status	Lao risk status
Rhinolophus malayanus	0	PARL
Rhinolophus thomasi	**GNT**	**PARL**
Rhinolophus stheno	0	PARL
Rhinolophus affinis	0	PARL
Hipposideros pomona	**DD**	**0**
Hipposideros cineraceus	0	PARL
Hipposideros galeritus	0	PARL
[*Hipposideros pratti*]	**GNT**	**n/a**
Hipposideros lylei	**GNT**	**PARL**
Hipposideros armiger	0	PARL
[*Hipposideros turpis*]	**GT-EN**	**n/a**
Hipposideros larvatus	0	PARL
Hipposideros diadema	0	PARL
Hipposideros spp.[1]	n/a	PARL
Aselliscus stoliczkanus	0	PARL
Coelops frithii	0	PARL
Coelops* cf. *robinsoni	**GNT**	**PARL**
Myotis annectans	**GNT**	**LKL**
Myotis rossetti	**GNT**	**LKL**
Myotis siligorensis	0	PARL
Myotis montivagus	**GNT**	**LKL**
Myotis ricketti	**GNT**	**PARL**
Scotomanes ornatus	**GNT**	**LKL**
Thainycteris aureocollaris	0	LKL
Eptesicus pachyotis	**GNT**	**0**
Ia io	**GNT**	**PARL**
Eudiscopus denticulus	**GNT**	**LKL**
Pipistrellus cadornae	**GNT**	**LKL**
Pipistrellus pulveratus	**GNT**	**LKL**
Miniopterus schreibersii	0	PARL
Miniopterus magnater	0	PARL
Miniopterus pusillus	0	PARL
Murina aurata	**GNT**	**LKL**
Murina huttonii	**GNT**	**LKL**
Harpiocephalus mordax	**GNT**	**LKL**
Tadarida teniotis	0	PARL
Tadarida plicata	0	ARL
[Slow Loris]	0	LKL
[Pygmy Loris]	**GT-VU**	**LKL**
Pig-tailed Macaque	**GT-VU**	**PARL**
Assamese Macaque	**GT-VU**	**PARL**
Rhesus Macaque	**GNT**	**PARL**
Long-tailed Macaque	**GNT**	**PARL**
Bear Macaque	**GT-VU**	**PARL**
Francois's Langur	**DD**	**PARL**
Silvered Langur	**GNT**	**ARL**
Phayre's Langur	**DD**	**ARL**
Douc Langur	**GT-EN**	**ARL**
White-handed Gibbon	**GNT**	**ARL**
Pileated Gibbon	**GT-VU**	**ARL**
Black-cheeked Crested Gibbon	**GT-EN**	**ARL**
White-cheeked Crested Gibbon	**DD**	**PARL**
[Yellow-cheeked Crested Gibbon]	**DD**	**LKL**
Grey Wolf	0	CARL
Golden Jackal	0	LKL
Dhole	**GT-VU**	**ARL**
Asiatic Black Bear	**GT-VU**	**ARL**
Sun Bear	**DD**	**ARL**
[Red Panda]	**GT-EN**	**n/a**
Yellow-bellied Weasel	0	LKL
Siberian Weasel	0	LKL
Back-striped Weasel	**GT-VU**	**LKL**
Hog Badger	0	LKL
Large-toothed Ferret Badger	0	LKL
Small-toothed Ferret Badger	0	LKL
Eurasian Otter	0	CARL
[Hairy-nosed Otter]	**GT-VU**	**CARL**
Smooth-coated Otter	**GT-VU**	**ARL**
Oriental Small-clawed Otter	**GNT**	**ARL**
Large-spotted Civet	0	PARL
Spotted Linsang	0	LKL
Binturong	0	ARL
Owston's Civet	**GT-VU**	**LKL**
[Lowe's Otter Civet]	**GT-EN**	**n/a**
Jungle Cat	0	ARL
Fishing Cat	**GNT**	**LKL**
Asian Golden Cat	**GNT**	**LKL**
Marbled Cat	**DD**	**LKL**
Clouded Leopard	**GT-VU**	**ARL**
Leopard	0	ARL
Tiger	**GT-EN**	**ARL**
Irrawaddy Dolphin	**DD**	**ARL**
Asian Elephant	**GT-EN**	**ARL**
[Asian Tapir]	**GT-VU**	**CARL**
Lesser One-horned Rhinoceros	**GT-CR**	**CARL**
Asian Two-horned Rhinoceros	**GT-CR**	**CARL**
Eurasian Wild Pig	0	LKL
Heude's Pig	**n/a**	**LKL**
[Chinese Forest Musk Deer]	**GNT**	**CARL**
Eld's Deer	**GT-VU**	**ARL**
Sambar	0	PARL
Hog Deer	0	CARL
Large-antlered Muntjac	n/a	PARL
Roosevelts' Muntjac	**DD**	**LKL**
Annamite Muntjac	n/a	LKL
Kouprey	**GT-CR**	**CARL**
Gaur	**GT-VU**	**ARL**
Banteng	**GT-EN**	**ARL**
[Wild Water Buffalo]	**GT-EN**	**CARL**
[Long-tailed Goral]	**GT-VU**	**n/a**
Southern Serow	**GT-VU**	**PARL**
Saola	**GT-EN**	**ARL**
[Khting Vor]	**GT-EN**	**CARL**
Black Giant Squirrel	0	PARL
Inornate Squirrel	**GT-VU**	**LKL**
Hairy-footed Flying Squirrel	**GNT**	**LKL**
Red-cheeked Flying Squirrel	0	LKL
Particolored Flying Squirrel	**GT-EN**	**LKL**
Phayre's Flying Squirrel	0	LKL

Species	Global threat status	Lao risk status
Rattus sikkimensis	**GT-VU**	**0**
Hapalomys delacouri	**GNT**	**LKL**
Dacnomys millardi	0	LKL
Chiromyscus chiropus	0	LKL
Maxomys moi	0	LKL
East Asian Porcupine	**GT-VU**	**0**
Annamite Striped Rabbit	n/a	LKL

Notes: [1]four additional unresolved taxa of the genus *Hipposideros*.

This list is derived from the analysis taken to compile the systematic species lists, with the automatic inclusion of all species on the most recent international red lists (Collar *et al*. 1994, IUCN 1996); these are indicated by **bold face**. For species in square brackets, no confirmed records have been traced from Lao PDR.

Global threat status (after Collar *et al*. 1994, IUCN 1996): 0, not listed as of concern; DD, Data Deficient; GNT, Globally Near-Threatened; GT-CR, Globally Threatened - Critical; GT-EN, Globally Threatened - Endangered; GT-VU, Globally Threatened - Vulnerable; n/a, not applicable (species (re)discovered too late for assessment).

Lao risk status: 0, Not At Risk in Lao PDR; ARL, At Risk in Lao PDR; CARL, Conditionally At Risk in Lao PDR (used only for reptiles and mammals); LKL, Little Known in Lao PDR; n/a, not applicable (species is not confirmed to occur in Lao PDR); PARL, Potentially at Risk in Lao PDR.