

The White-winged Duck

Cairina scutulata in Laos

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The White-winged Duck faces a high risk of global extinction in the wild in the near future. It was recorded from two regions of Laos during 1992-95. Records from six localities on the Nakai Plateau (Khammouan Province, central Laos) indicated at least nine individuals were present, and, including unsurveyed areas, the population may occupy six to 12 locations, each with one or two individuals. Fifteen adults and one brood of three young were seen at scattered sites in the southern provinces of Champasak and Attapu. Local reports suggest that the total number may be two or three times as large. Populations in both regions are in remote parts of large blocks of flatland forest. The Nakai population was mainly seen along rivers 20-30 m wide, whilst birds in the southern region were seen on shallow pools and small streams. Some observations of behaviour are presented. To date, opportunistic hunting has probably had the biggest detrimental effect on the species. Other developments, such as human population growth, road-building and hydro-electric dam-construction will reduce the available habitat and further increase hunting pressure. Prospects for conservation are discussed.

Keywords: White-winged Duck, Laos, Population Size, Conservation

No ornithological surveys were conducted in Laos (the Lao People's Democratic Republic) between 1949 and 1992. During that period, the White-winged Duck *Cairina scutulata* emerged as a species of the highest conservation concern (Green 1992 and references therein). It is now listed as globally threatened with the category 'endangered', meaning that it was thought to face a 20% chance of extinction within 20 years (Collar *et al.* 1994; IUCN 1994).

The historical range of White-winged Duck extended from northeast India through southern Indochina and peninsular Malaysia to Indonesia (Green 1992; 1993b). Recent records come from all range states, but the range within each country has apparently contracted and become fragmented, and numbers have greatly declined (Green 1992; 1993b). Lao records before 1949 came from sites in

three general areas, mapped by Green (1992; 1993b) and listed opposite.

1. Singles were seen in the eastern part of Khammouan Province (Central Laos) near Ban Nape in 1928 (Delacour 1929) and on the Nakai Plateau in January 1932 (Dickinson 1970).
2. A party of three was seen in Savannakhet Province (Central Laos) 20 km north of Muang Phin (formerly Muang Phine) (David-Beaulieu 1949). This site may be within what is now Phou Xang He National Biodiversity Conservation Area (NBCA).
3. In South Laos there were several records. One was shot around Saravane in July 1926, one was seen along the Xe Kong River (precise location uncertain) in May of an unspecified year and there were 'several sightings from the main

watch post' at Ban Thateng on the northern slopes of the Bolaven Plateau, on nearby lakes and on the plateau itself (Engelbach 1927).

Recent data from Laos were almost entirely lacking at the time of the reviews cited above. This paper discusses distribution, habitat use and abundance of White-winged Ducks stemming from extensive surveys of forest birds in Laos during 1992-95. Anecdotal information on behaviour is also presented.

Methods

Survey areas are shown on **Figure 1** and coverage is detailed in **Appendix 1**. Broad faunal inventories were conducted in conjunction with the Centre for Protected Areas and Watershed Management (CPAWM) of the Department of Forestry, Vientiane, concentrating on globally threatened species (*sensu* Collar *et al.* 1994) and their threats. Thus the White-winged Duck was a high priority species that received particular attention whenever suitable habitat was found.

Field survey areas within the NBCAs were selected to cover most major habitats and altitudes, partly on the basis of likely presence of threatened species (inferred from remoteness, reports in previous CPAWM interviews or presence of localised habitats such as wetlands) and partly on the basis of access practicalities. During fieldwork, *ad hoc* interviews were conducted by the wildlife survey teams with villagers, usually including the village chief, or people encountered in the forest. They helped fieldworkers to find localised or secretive species and provided information on low-density species that were unlikely to be observed directly during field surveys.

Interviewees were often specifically asked about the presence of White-winged Duck, variously called '(*nok*) pet paa (*nyai*)', '(*nok*) pet khaa' or '*nok* pet dong' in the Lao language. Given the diversity of rather vague local names '(*nok* pet paa *nyai*)' means large forest duck', additional descriptions were requested. Reports were considered reliable only if informants consistently mentioned features such as the honking call, very dark plumage, white wing patches, pale head or

presence throughout the year. They were sometimes asked to specify that they were not talking about domestic Muscovy Ducks *Cairina moschata* (also called '*nok* pet khaa' in the Lao language), which were found in almost every village in the surveyed areas. Further information was sought on locations, numbers, seasonality and the possibility of observing the birds.

Many sites where White-winged Ducks were reported were visited. Fieldwork involved long periods of searching for wildlife along forest trails and stream sides or by boat on forest rivers. These methods offered good chances for detecting White-winged Ducks had they been present. Effort was concentrated in the mornings and evenings when White-winged Ducks (and many other species) are known to be most mobile and easiest to detect (Green 1993a). Observations were often continued up to two hours after dark, and spotlight surveys for mammals continued throughout the night at many sites (e.g. Duckworth *et al.* 1994), allowing some limited additional opportunities to detect the species.

Evidence was sought in the form of direct sightings, calls and footprints. Footprints of large ducks with the inner toe longest have been attributed to this species since Muscovy Ducks were never encountered away from the immediate vicinity of villages and no other species known from Laos has similarly-sized feet with webbing between three toes and the inner toe longest (R.J. Timmins *in litt.* 1995).

Throughout this paper, the terms North, Central and South Laos refer to the regions described by King *et al.* (1975). Central Laos is bounded in the south by the course of the Xe Bang Hieng and in the north by a line running east-northeast to a point a little north of Ban Nape (**Figure 1**). Forest classification follows Thewlis *et al.* (in prep.), based on Round (1988). NBCA stands for National Biodiversity Conservation Area, the legal designation of the present reserves, and PPA indicates a Proposed Protected Area which is under formal consideration by the Government of Laos. The survey areas where some recent records came from are indicated by the initials XP (Xe Pian NBCA), BSW (Bolovens Southwest PPA) or NP (the Nakai Plateau).

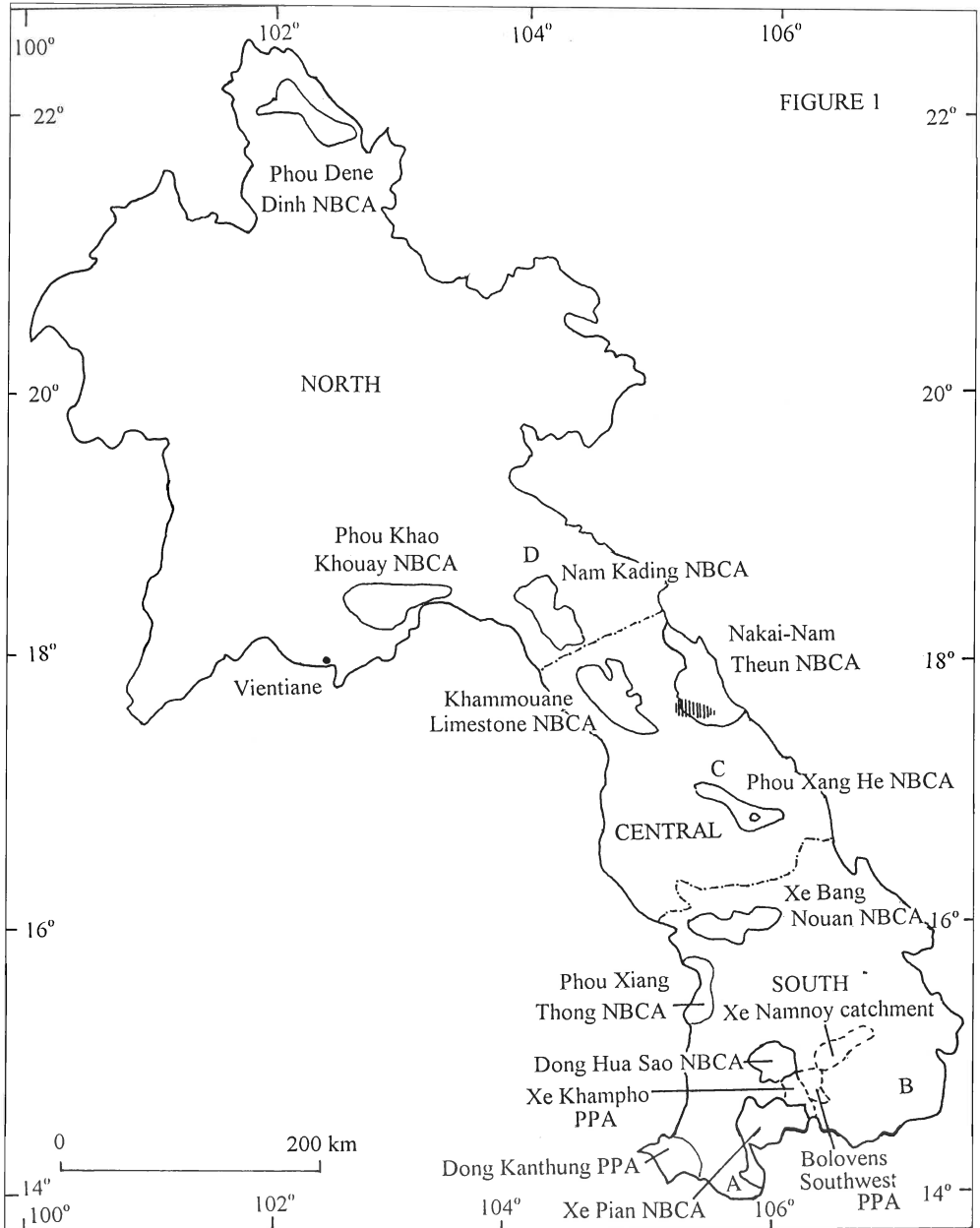


Figure 1: Laos, showing areas where surveys have been conducted (outlines, with the Nakai Plateau hatched), unsurveyed areas with moderate or high potential to support White-winged Ducks (letters, see text for explanation) and divisions between North, Central and South Laos (*sensu King et al. 1975*).

Place names are based on the 1:100,000 maps of the most recent series of the Lao Service Géographique d'État. For sites not named on the maps, the authors have transliterated the locally-used name as best they can. 'Bolaven Plateau' is used in preference to the map name 'Phoupiang Bolaven'. Protected area names follow Berk Müller *et al.* (1993; 1995a; b), even where they include place names spelled differently from those on the standard maps. Where place names given in the *Times Atlas of the World* (1990 edition) differ, these are given in parentheses at the first mention. Commonly used elements of Lao place names are *Ban* (village), *Xe* or *Nam* (both meaning river), *Houay* (stream), *Nong* (pool), *Phou* (mountain) and *Dong* (an area of dense forest).

Results

Distribution and abundance

Surviving populations were detected in only two regions, eastern Khammouan Province, central Laos (on the Nakai Plateau) and in Champasak and Attapu Provinces, south Laos.

a) Nakai Plateau (**Figure 2** and **Appendix 2**) The duck was found both within Nakai-Nam Theun NBCA and in the unprotected portion of the plateau to the west. It is likely that some occur in the neighbouring hilly part of the Nam On catchment, which was not surveyed. Extensive fieldwork was conducted elsewhere in the reserve, but no other White-winged Ducks were seen or reported, and there is little suitable habitat.

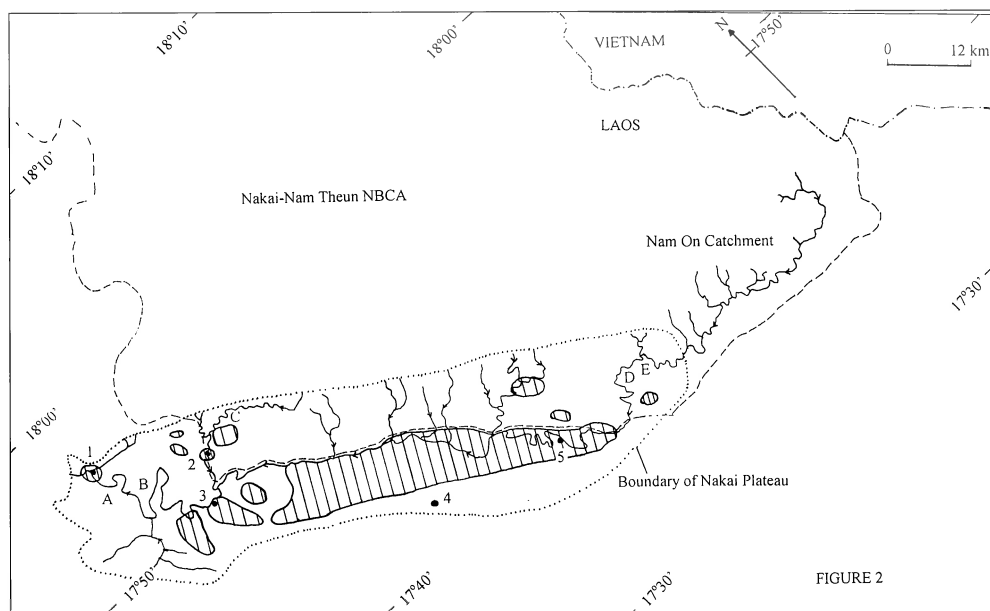


Figure 2: The Nakai Plateau and Nam On catchment, showing localities mentioned in text. Rivers with stretches suitable for White-winged Ducks are shown, but hatched areas on the plateau are heavily populated and thus unsuitable. Surrounding areas are also largely unsuitable, being mountainous or heavily populated. Letters indicate the five areas with regular sightings: A and B - Nam Theun; C - Nam Mon; D and E - Nam On. Selected villages are: 1 - Ban Sop Nian; 2 - Ban Namxot; 3 - Ban Namtheun; 4 - Hua Phou (district capital); 5 - Ban Khonken

Birds were seen repeatedly in five areas (involving a minimum of eight individuals) and footprints of at least one more bird were found at a sixth site. Two occupied areas (in the Nam On catchment) overlapped along 3.1 km of river, but records could be distinguished because there were two birds with relatively pale heads which also ranged up to 2.3 km downstream of the area of overlap and a third bird with much darker head patterning which also ranged along 16.8 km of river upstream. Since the rivers meander, these records are much less far apart in a direct line. The two birds on the Nam Mon (a tributary of the Nam Xot) were recorded seven times along 8.3 km of that stream. There were too few records in the other areas for comparable estimates of home range size to be given.

Reports also suggested presence along the Nam Theun and Houay Thong upstream of Ban Sop-On. Suitable habitat which was not surveyed included the upper Nam Nian, streams between the mouths of the Nam Xot and Nam On, the Nam Yang and the Nam Mon (a tributary of the Nam Yang). It is thus estimated that birds may occur at 6-12 locations across surveyed and unsurveyed areas of the plateau and Nam On catchment, each supporting 1-2 adults and potentially forming breeding territories.

The nearby Ban Nape area, in the valley of the Nam Phao, is another site where the species was formerly found (Delacour 1929) and was also surveyed in 1994. The main river valleys are now cultivated and forest remains only in hilly areas where the rivers and streams flow rapidly over stony beds. This is unsuitable habitat and the species is probably extinct in this area.

b) Champasak and Attapu Provinces (Figure 3 and Appendix 3)

Fifteen adults and one brood of three young were observed during 1992-95 at six widely separated sites in Xe Pian NBCA and Bolovens Southwest PPA. If hunters' reports from these sites and the neighbouring Xe Khampho PPA and Dong Hua Sao NBCA are accurate, the true population of the region may be two or three times as large as this. Some reports conceivably refer to birds wandering from the sites where presence

was confirmed, or to sites where birds formerly occurred. There was no indication of occurrence in Bolovens Northeast PPA or the Xe Namnoy headwaters but some suitable habitat remains and further surveys might detect the species.

Apparently reliable reports were also received from most villages in Dong Khanthung PPA, an area over 50 km away, to the west of the Mekong.

The nearby Ban Thateng area where the species was historically known has not been surveyed but recent 1:100,000 topographic maps published by the Service Géographique d'État were examined. These indicate that human population density is now high in this area and no large tracts of forest remain. White-winged Ducks are probably extinct in this area. The same is true of most of the remainder of the Bolaven Plateau. Extensive forest remains on the plateau only in Dong Hua Sao NBCA and Bolovens Northeast PPA, but both have steep relief and lack pools or slow-flowing streams so are unlikely to support the ducks.

Salavane and the upper Xe Kong valley, both historical localities for the species, have not been revisited. Topographic maps indicate that the environs of Salavane are wholly deforested but that extensive forest, some of it not on hilly ground, remains around the Xe Kong in the reaches northeast of the Bolaven Plateau.

Habitat use

All records stem from the dry season (December-May) and there was none from the period of monsoon rains, (mid-May to mid-October) when little fieldwork was done. In the dry season most rivers in Laos decrease dramatically in flow or dry up altogether and the majority of wetlands also dry up or shrink dramatically, radically altering the available habitat and probably concentrating the ducks in smaller areas, making them easier to locate. Hunters' reports, mainly from South Laos, suggest that White-winged Ducks range more widely during the rainy season (for example visiting pools which disappear in the dry season) and may occur closer to villages at this time.

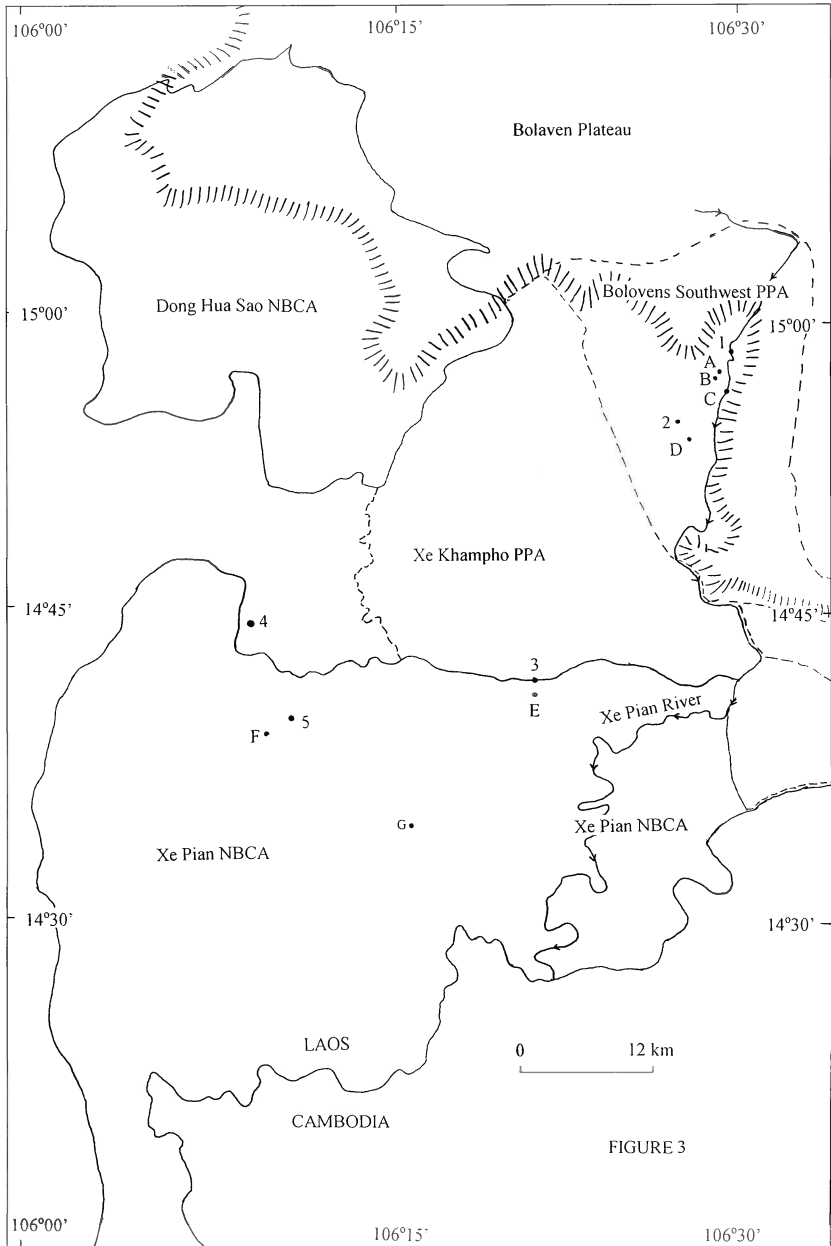


Figure 3: Central-southern Laos, showing locations mentioned in the text. NBCAs are shown with solid lines, PPAs with dashes. Hatching indicates the slopes of the Bolaven Plateau rising to the north. Letters indicate White-winged Duck sightings: A - Nong Tok; B - Nong Bung; C - Xe Pian main stream; D - Nong Hin; E - Nong Chek, F - Houay Tauang; G - Houay Kua. Selected villages are: 1 - Ban Houayko (or Ban Don Kong); 2 - Ban Nonghin; 3 - Ban Chanto; 4 - Ban Phapho; 5 - Ban Nongping.

a) Nakai Plateau

The Nam Theun river, three other large rivers and many smaller streams meander over the plateau, which lies at 500-600 m. The centre of the plateau has alluvial soils and many static wetlands, most of them cultivated, grazed and heavily fished by people from nearby villages. White-winged Ducks were found along the more remote, forested stretches of the major rivers towards the margins of the plateau, in areas with few static wetlands. The largest rivers used are 30 m or more in width, and many records came from rivers 15-25 m wide. These major rivers often had quite bare, sandy beds with very little plant growth, even within the shallows; the steep earth banks were moderately covered with thick grass, herb and bamboo growth. Semi-evergreen forest occurs along most of the watercourses and in the surrounding hilly areas but fairly extensive stands of pines predominate in drier areas of the plateau.

Footprints attributed to this species were found along the lower reaches of three small perennial streams (4-8 m wide, shady but not completely closed to the sky, with water less than 50 cm deep) and once beside a shallow open pool.

b) Champasak and Attapu Provinces

Most records and reports were from extensive areas of logged or unlogged semi-evergreen forest at 100-300 m. Two locations were along forest streams less than 10 m wide, one was along a forest river over 20 m wide and the remainder were at small or medium-sized forest pools, several of them poorly vegetated or retaining very little water at the time of the sightings, others with deeper water and quite rich emergent vegetation.

The area with reports in the Xe Pian headwaters at 750-800 m (BSW) held a number of relatively slow-flowing streams in forest and a number of small lakes in coffee plantations and scrub just outside the forest. The forest was thought to be transitional between lowland semi-evergreen and hill evergreen forest but was visited only briefly.

Behaviour

Most groups were of one or two birds (**Table 1**). The largest group was a party of four seen twice at Nong Tok (BSW). It appeared to consist of two pairs which visited and left the pool independently on more than one occasion.

Table 1. Frequency of encounters with different group sizes of White-winged Ducks[^]

	Number of adults			
	1	2	3	4
South Laos	1	4*	2	2
Nakai Plateau	9	5	2	0
Total	10	19	4	2

[^] many encounters probably refer to repeat records of the same individuals. Footprints are excluded, since group size is unknown.

* one group of two was accompanied by three young.

Table 2 indicates the behaviour of birds observed by day. All sightings in Champasak and Attapu were by day. Birds were observed feeding out in the open on three occasions long after dawn (including one group still feeding at 0800h). Sightings on the Nakai Plateau included one nocturnal record, of two birds apparently feeding. On eight of the nine occasions by day when birds on the Nakai Plateau were observed before flushing, they were noted to be loafing or roosting. On one occasion two birds were seen feeding by day (at 1620 h).

Table 2 Behaviour of White-winged Duck parties observed by day

Activity	Frequency [^]		
	Nakai	Southern Region	Total
Feeding	1	3	4
Loafing on sandbars or roosting in bankside trees	8	1	9
Flying	5	1	6
Flushed before activity determined	8	3	11
Not recorded	3	1	4

[^] a group of birds counts as a single record

In general the ducks seemed to be shy and alert. Sometimes they flushed as soon as they detected the observer or local

people passing by. At other times it was possible to approach in small canoes to within 50 m before they flew, the birds clearly being aware of the observer and bobbing their heads nervously or swimming slowly away. On the Nakai Plateau they were often re-encountered further along the same river on the same day, in the direction that they had flown. On one occasion, two individuals were found about four hours after dark on Nam Xot (NP). They both ceased natural behaviour upon illumination with a spotlight and looked at the approaching boat. The first flew off at less than 50 m range, whilst the second became transfixed by the light. It swam, then flew, towards the light, passing very close.

The birds were elusive. Even on well-surveyed stretches of river on the Nakai Plateau, where the species was recorded many times, it was possible to pass through a White-winged Duck home range several times before encountering any.

Individual Variation

The birds observed showed variation in bill colour and head pattern. The group of four seen at Nong Tok (BSW) included two with bright orange-yellow bills and two with much duller, yellower bills. It was not possible to determine the bill colours at times when the birds of this group separated into pairs. Variation in this feature was not noted with any other group.

The amount and location of black speckling on the head varied. Each of the three groups of two on the Nakai Plateau contained one individual with a darker head. The lone bird whose range overlapped with that of a pair on the Nam On in 1995 had a substantially darker head than all other birds observed on the Nakai Plateau. Three at Nong Tok had similar, quite pale, heads and the fourth had a markedly darker head. The dark-headed bird had an orange-yellow, not dull-yellow, bill.

Breeding

There were rather imprecise reports from interviewees of White-winged Ducks being

seen with chicks during the wet season. The only direct evidence of breeding was a brood of three downy young with two adults seen in December 1994 (XP). The behaviour of a bird seen alone in March 1995 along the Nam Mon (NP) suggested to the observer that it might be standing guard for a mate with a nest nearby (J.W. Duckworth *in litt.* 1995).

Discussion

The value of interviews with local hunters

Many specific localities where the species has been found in Laos were also convincingly reported to the surveyors by local villagers (either before or after the sightings). Surveys in areas where the species has not been reported by local hunters have so far been unproductive. This supports the validity of carefully conducted interviews for making rapid assessments of White-winged Duck presence in Laos, as previously maintained by Parr *et al.* (1993, 1994) for Thailand. However, some initial reports were received from areas where it became apparent the duck was not present (R.J. Timmins *in litt.* 1995). It is thus very important that reports are corroborated by more than one respondent and are assessed critically to eliminate other duck species, historical rather than current presence and very occasional rather than regular presence.

Completeness of coverage

The status of this species in Laos remains incompletely known, but the study sites included a high proportion of the areas of South and Central Laos where the species might be expected to occur. Much of the rest is too heavily populated to be likely to support such a hunting-sensitive species any longer. There is still no suggestion that White-winged Ducks occur in North Laos, although recent ornithological coverage has been sparse in that region and there are many records from further north in Burma and India (Green 1993b).

Within the survey areas, only sample areas of suitable habitat were covered. Within many of these sample areas coverage was felt to be reasonably good, but it is quite possible that small populations could have been present in areas where none was found. Moreover, since populations may be patchy, undergo local seasonal movements or be restricted to the areas least accessible to both hunters and ornithologists, it cannot be assumed that scarcity or abundance in the sample area represents equal scarcity or abundance throughout a habitat block. This is particularly relevant to the huge area of apparently suitable habitat in the main block of Xe Pian NBCA.

Global significance of the known Lao populations

The Nakai population is estimated to total nine to 24 adults. Numbers in southern Laos exceed 15 adults and may be as high as 40-50 if reports are accurate. Birds in south Laos may form more than one distinct population (those west of the Mekong in Dong Khanthung PPA, for example, are more likely to exchange individuals with the population in southeastern Thailand than with groups in the Xe Kong basin).

The minimum sizes of other known populations were listed by Green (1993b) and only ten exceeded nine individuals, the largest being 30 at Way Kambas, Indonesia and 28 at Pablakhali, Bangladesh.. Several contiguous sites in southeastern Thailand listed separately by Green (1993b) have a combined estimated population of 32-35 pairs (Parr 1993). Das (1995) reported another population, in India, numbering 23-29 individuals. The total minimum known world population in the wild is nearly 400 (combining Green 1993b; Das 1995; and this paper), with an estimated true population of only a few thousand, undergoing a continuing decline (Green 1993b). Thus both of the Lao populations are of global significance. The total population of the Xe Kong basin may be one of the largest known anywhere in the world.

Habitat use

Habitats used were consistent with the habitat preferences detailed for other range states by Green (1993b), and with the only previous description of habitat use in Laos (pools or swampy clearings in dense forest; Engelbach 1932). There was no evidence of presence in deciduous forest types. Some birds were recorded in areas of logged forest, although it is not known whether they breed in these areas. Habitat use in the two regions was somewhat different, presumably as a result of the differing availability of wetlands. It had been speculated (Timmins & Evans 1994) that the Nakai population occupied an anomalous habitat since Green (1993b) noted that large, open rivers were very seldom used. However, this stemmed from a misunderstanding of Green (1993b); the rivers on the Nakai Plateau would not be considered 'large' or 'open' by his criteria (A.J. Green *in litt.* 1996).

The wide variety of wetland types used by birds in southern Laos is noteworthy; lush emergent aquatic growth is clearly not a prerequisite, at least during February-April. No detailed analysis of habitat type and availability was attempted, but experiences during survey work and an examination of topographic maps indicates that several hundred apparently suitable forested pools occur in the flat lowlands of southern Laos, together with many hundreds of kilometres of small and medium-sized forested streams. Many areas of such habitat did not support White-winged Ducks, for reasons which have not been investigated. One important factor is almost certain to be the high hunting pressure which most of these areas experience, but some could be unsuitable for other reasons.

Behaviour

Observations on behaviour were broadly consistent with those recorded by Green (1993a). However, it was unexpected to find the species feeding freely in the open in daylight on several occasions. Green

(1993a) also indicated that sightings of more than two adults together are very unusual, but there were a number of larger groups observed in southern Laos.

The breeding season in Laos remains uncertain, with evidence from December and April and reports from the wet season. Parr *et al.* (1994) received reports that in Thailand, which experiences similar seasons, breeding began in the late dry season with chicks emerging during the rains in June-August.

Threats

Almost every rural man in Laos hunts often, and many possess efficient homemade guns or even automatic weapons. White-winged Ducks are reportedly favoured quarry because of their size and edibility, and are also concentrated in small, predictable areas through the dry season when the agricultural calendar offers a great deal of free time for hunting. High hunting pressure was also found by Parr *et al.* (1994) in northeast Thailand, an area with many cultural similarities to South and Central Laos. Although many wetlands in Laos now lack fringing forest, we suggest that the species is often hunted out well before the habitat is destroyed. This is almost certainly true in Laos, in the context of a different habitat, for the Green Peafowl *Pavo muticus* (Evans & Timmins 1996), and several other large bird species (Thewlis *et al.* in prep).

Locally, cultivation of pools in forest for paddy rice also occurs and may affect the suitability of a site for White-winged Ducks. The species is reported to feed in rice-fields (Green 1993b) and it is likely that marshes and shallow pools converted to rice remain valuable food sources for White-winged Ducks, especially in areas of oligotrophic rivers such as the Nakai Plateau. However, the increased hunting and disturbance that accompanies cultivation must limit severely the use the species can make of such sites in Laos. Pesticides may also harm the birds, although this has not been investigated.

A new and more dramatic threat has arisen in recent years. Major hydro-electric power schemes are in the advanced planning stages for both the Nakai Plateau (the Nam Theun 2 scheme) and upper Xe Pian (as part of the Xe Namnoy-Xe Pian scheme). The former is expected to flood up to 500 km² of cultivation, scrub and forest, including a high proportion of the watercourses suitable for White-winged Ducks. Since large reservoirs are not thought to be suitable habitat (Green 1993b), the reservoir would probably reduce the population at this site to just one or two pairs. The associated increase in disturbance, forest clearance and hunting might wipe out the population completely (WCS 1995a), but in any event, such a small population would have very poor prospects of long-term survival. At the time of writing the future of the scheme was in some doubt, since the World Bank (a necessary guarantor of the project) was concerned over environmental and macro-economic impacts of the dam (Anon. 1996a; b).

The Xe Namnoy project may inundate part of the habitat of birds in the Xe Pian headwaters and, if an adequate proportion of the natural flow is not released through the dam as a mitigation measure, disrupt dry season flow in the territories of others downstream (although the hydrological relationship between the river and nearby pools is not known). It is also expected to increase human population levels, demand for land from displaced and incoming residents and road access to remote areas of forest, putting further pressure on the birds (WCS 1995b).

If either or both of these projects are carried out in their present form, the known White-winged Duck population in Laos will decline. Further reservoirs are planned for other forested rivers throughout South and Central Laos, including a total of 16 more in the Xe Kong basin (JICA 1993) and several in the Nam Theun-Nam Kading basin. These projects will reduce greatly the prospect that as yet undiscovered populations can offer the species a secure future in Laos.

Conservation measures

Development of the institutional capacity of the government of Laos to manage its protected areas is being supported by bilateral aid from Sweden through the Lao-Swedish Forestry Cooperation Programme, formerly with the technical assistance of IUCN (The World Conservation Union). Various bodies, including The Wildlife Conservation Society and IUCN, are undertaking surveys and training of Lao conservation staff. If these inputs continue, extensive, long-term conservation measures are likely to become possible for the government to undertake.

Five possible conservation measures are discussed below:

1. The known populations are thinly spread over remote areas of dense forest. In view of the small staff and limited funding of the relevant government bodies, the likelihood of preventing the illegal hunting of this species through extensive direct law enforcement seems very slim. At certain NBCAs general management implementation is now underway, although low staffing levels and uncertain funding are restrictive. These sites include Xe Pian and Nakai-Nam Theun NBCAs, where White-winged Ducks occur. For most threatened species the emphasis of conservation action will be on a general reduction of hunting, disturbance and habitat destruction in the NBCAs over a period of years, in parallel with the establishment of sustainable patterns of resource use by local residents and controls on the development of new settlements and road access (Berkmüller *et al.* 1993; 1995a; b). This is likely to be much more cost-effective than operating separate conservation schemes for individual species. An imaginative approach is needed to achieve a voluntary cessation of hunting of White-winged Ducks. As a first step the White-winged Duck should be included in any extension materials aimed at educating local residents about the rare and protected species in their area. Similar action is needed for many other large waterbirds in the south of Laos, whose status is described by Thewlis *et al.* (in prep.). Such a programme may be initiated by The Wildlife Conservation Society during 1997 (W.G. Robichaud, verbally 1996). Wetlands known to be used by White-winged Ducks should be considered high priorities for site-specific action by protected areas managers (for instance, voluntary local hunting bans by reserve inhabitants).
2. An integrated approach to the planning of hydro-electric power projects is needed nationwide, taking account of the great importance of the riverine ecosystems they affect. Mitigation of impacts in the reservoir area is almost impossible, and mitigation of effects in neighbouring areas may prove very difficult, requiring indefinite and potentially costly controls on human activities which are unlikely to be enforced. In view of the importance of the Lao populations to the survival of the species, and the choice of technically feasible dam sites available, hydro-electric reservoirs should be sited wherever possible so as to avoid White-winged Duck populations. Efforts to locate White-winged Ducks and other wildlife species should be included in the terms of reference for environmental assessments and environmental impact assessments of large hydro-electric projects.
3. NBCA protection should be extended to cover Xe Khampho, Bolovens south-west and Dong Khanthung PPAs. In addition to White-winged Ducks they are known to support many other important birds and large mammals.
4. Field surveys are required to locate other key blocks of habitat which would merit protective action. These surveys should follow the detailed guidelines in Green (1992). There is limited survey expertise within CPAWM at present and it would be appropriate for outside teams to assist by conducting surveys in consultation with CPAWM. It is essential that any survey conducted should be planned so as to

offer useful training to Lao counterparts in the gathering and interpretation of data during the course of fieldwork and to investigate patterns of human resource use in the area. Data should also be gathered in a form suitable for inclusion in the next edition of the Lao national inventory of wetlands (Claridge 1995). Four high priority survey areas (A-D, especially A and B: **Figure 1**) are:

- A. the Ban Xot region (Champasak Province), bounded on the north by the Dong Kalo sector of Xe Pian NBCA and to the east and south by Cambodia.
 - B. other parts of the Xe Kong catchment (Attapu and Sekong Provinces), including Dong Amphan NBCA, the Phou Theung and Phou Katoung PPAs and the Nam Khong and Xe Xou catchments.
 - C. The lowland semi-evergreen forests in the east of Khammouan and Savannakhet Provinces, between Phou Xang He and Hin Namnu NBCAs.
 - D. Lowland river valleys to the north of Nam Kading NBCA in Bolikhamxai Province, including the Nam Xan, Nam Sun and Nam Mong.
5. The species has protection under Lao law and this should be retained and if possible strengthened. This legal basis is essential for efforts to reduce hunting within protected areas.

The survey of Dong Hua Sao NBCA (1993) was funded by a grant from the British Embassy in Bangkok. The Phou Xang He NBCA survey was carried out under contract to the Lao-Swedish Forest Resources Conservation Project. The surveys of Nakai-Nam Theun NBCA (1994), Xe Bang Nouan NBCA, Phou Khao Khouay NBCA and Dong Kanthung PPA were funded through the Wildlife Conservation Society with a grant from the MacArthur Foundation. Nam Kading NBCA was surveyed under contract to NORPLAN and to Electrowatt Engineering Services, Xe Namnoy was surveyed under contract to Electrowatt Engineering Services and the Nakai Plateau (1995) under contract to TEAM Consulting Engineers Ltd. The Xe Pian NBCA survey was funded by a variety of bodies with major donations from: The British Ornithologists' Union, BP (UK) Ltd. (through BirdLife International and Fauna and Flora International), the People's Trust for Endangered Species, The Wildfowl and Wetlands Trust, The World Pheasant Association and Mr and Mrs J. Evans. The visit to Phou Dene Dinh NBCA was funded by a grant from the Hanus Trust to the Cedar Grove Ornithological Research Station. Phou Xiang Thong and Dong Hua Sao NBCAs were surveyed under contract to the Biodiversity Conservation Project of the Lao Department of Agriculture and Forestry, with funding from the Dutch government and technical support from IUCN.

In Laos the field survey teams have been helped enormously over the past few years by Venevongphet, Bouaphanh Phanthavong, Chantaviphone, Chantavi, Somphong Souliyavong, Boonhom Sounthala, Boonhong Mounsouphom, Sukotha Vannalat, Padith Vanalatsmy, Chainoi Sisomphane, Klaus Berkmüller, Richard Salter, Bob Dobias, Thanongsy, Stuart Chape and other members of the CPAWM and IUCN staff. Guy Anderson, Bill Bleisch, Will Duckworth, Michael Dvorak, Erwin Nemeth, George Schaller, Richard Thewlis, Rob Timmins and Roger Wilkinson all took part in some of the field surveys and generously allowed their data to be included in this paper. The Department of Zoology, Cambridge, the Edward Grey Institute, Oxford and Tim Inskipp allowed access to their libraries. Andy Green and Frank Lambert answered our requests for information. Valuable comments on drafts of this paper were received from Richard Thewlis, Rob Timmins, Will Duckworth, Andy Green and Des Callaghan.

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Appendix 1 Coverage during recent ornithological surveys in Laos up to May 1996

Area (see Figure 1)	Months	Effort* (person-months)	Notes
North Laos			
Phou Dendin NBCA	June 1995	0.5	Brief coverage, but little or no suitable habitat
Phou Khao Khouay NBCA	Nov-Dec 1994	1.5	Limited habitat and high hunting pressure.
Nam Kading NBCA	Dec 1994-Jan 1995, Mar-May 1995	6	Suitable habitat very limited. Nearby Nam Mouan valley also visited.
Central Laos			
Nakai-Nam Theun NBCA	Jan-Apr 1994	8	Almost no suitable habitat. Almost no suitable habitat remains. May be the site of record by David-Beaulieu (1949).
	Feb-Mar 1995	4	
Khammouane Limestone NBCA	Mar-May 1995	<1	
Phou Xang He NBCA	Mar-Apr 1993	2	
South Laos			
Xe Bang Nouan NBCA	May-July 1994	1.5	Deciduous forest predominates along otherwise suitable streams. High hunting pressure.
Phou Xiang Thong NBCA	Mar 1996	3	Little suitable habitat - streams strongly seasonal.
Xe Namnoy headwaters and Bolovens Northeast PPA	Mar-May 1995	2	Interviews only
Bolovens Southwest PPA	April 1995	<0.5	
Xe Khampho PPA	April 1995	-	
Dong Hua Sao NBCA	May-July 1993	3	
	Jan-Mar 1996	2.5	
Xe Pian NBCA	Nov 1992 - Mar 1993	16	
	May 1993	0.5	
	May 1995	0.5	
Dong Kanthung PPA	May 1996	<0.5	

* General surveys of birds and large mammals, not solely White-winged Ducks. Includes time spent in habitat unsuitable for White-winged Duck.

Appendix 2. Recent records of White-winged Duck on the Nakai Plateau, Khammouan Province, Central Laos

Almost all records came from rivers or streams at 500-520 m with semi-evergreen gallery forest, surrounded by pine forest. The remainder were flying over gallery or pine forest away from open water. One set of footprints was found by a pool in degraded semi-evergreen forest.

Site	Date	Observations
Nam Xot/Nam Mon Area		
Nam Xot	6/2/94	One bird flushed from the river 0610 h
Nam Xot	4/3/94	Calls heard from bird flying over Ban Namxot 0530 h
West of Ban Namxot	5/3/94	Large duck, probably White-winged, flew over forest, time not noted, not calling
Nam Mon	3/2/95	Loafing group of two flushed 1000 h
Nam Mon	6/2/95	Loafing group of two flushed 0920 h and refound about 2 km upstream at 1230 h
Nam Mon	10/2/95	Two roosting 5 m up in tree on shady river bank 1419 h, called when flushed
Nam Mon	10/3/95	One on sandbar at 1800 h, entered water when approached then flew when boat within 75 m
Nam Mon	10/3/95	One bird, possibly acting as a sentry, 1800 h. Two birds, probably including the earlier one, at 2320 h and 2325 h feeding on river
Nam Mon	11/3/95	Single on river, probably loafing (between 0730 h and 1030 h, time uncertain)
Nam On and tributaries		
Nam On/Nam Yang	2/4/94	Two swam out from bankside before 0800 h, disturbed by boat, and soon flew off. Called on the water and in flight. Later two flushed from Nam Yang about 1015 h. Called as they flew off. Prints found on sandbars along the Nam On from the point of the first sighting along to the mouth of the Nam Yang. Prints also seen along several kilometres of the Nam On around Houay Maloua
Nam On	23/2/95	Two birds flying along river 1815 h
Nam On	24/2/95	One bird flushed from river 0730 h, refound 0830 h. Then one bird flushed from river 0900 h, then two birds flushed from river 0910 h
Nam On	25/2/95	One bird flushed from river 0835 h, refound 0950 h
Nam On	25/2/95	Two birds loafing on river 1200 h
Nam On	28/2/95	Two birds (different head pattern to those in 1994) in midstream 1620 h, aware of boat but still making feeding movements. Eventually flew off calling. Two flushed later some kilometres upriver. Later still, single flushed, closely followed by another two, calling. At dusk (1800 h) flushed upstream two or more from river, ten minutes later two flew back downstream past the boat
Nam On	29/2/95	Two flew over Ban Maloua area, calling, 0734 h
Houay Maloua	4/3/95	Prints seen at three places along 200 m stretch of Houay Maloua, 600 m upstream from its confluence with Nam On
Nam Theun and tributaries downstream of Ban Nam Theun		
Nam Theun	27/2/94	Footprints on a sand bar a few kilometres upstream of Ban Sop Nian
Nam Nyalong	8/2/95	Footprints seen at three points up to 3 km upstream from mouth
Nam Theun	17/2/95	Two, calling, flew over forest to river 1820 h, midway between Ban Sop Nian and Nam Nyalong
Nam Theun	12/2/95	Two seen on Nam Theun well upstream of Nam Nyalong
Nam Gnala	15/2/95	Footprints found at two points
Nam Gnala	16/2/95	Footprints found at a different point, 5 km upstream from mouth
Nam Theun	early 95	One seen on river near mouth of Nam Nyalong
West of Ban Sop-On		
Unnamed pool	26/2/95	Footprints on muddy edge of pool

Appendix 3. Recent records of White-winged Duck in Champassak and Attapeu Provinces, South Laos

Site	Date	Observations	Habitat
XE PIAN NBCA			
Houay Kua	28/12/92 -/-/92-93	One flew over, about 800h Hunters report presence elsewhere in main sector of reserve	Stream in unlogged semi-evergreen forest 150 m (1) Semi-evergreen forest with streams but few pools, 100-350 m
Houay Tauant	-/12/94	Two adults and three downy young seen (Padith Vanalatsmy verbally to R.J. Timmins, 1995, supported by photograph)	Not reported. Probably semi-evergreen forest below 200 m
Nong Chek	21/4/95	Three feeding 0600 h - 0720 h, when flushed by fishermen	Mostly dry, open pool bed in logged semi-evergreen forest 120 m (2). This sector not covered in 1992-93
XE KHAMPHO PPA			
	-/4/95	Hunters in Ban Chanto report presence on streams and pools to the north	Flatland semi-evergreen forest below 200 m
BOLOVENS SOUTHWEST PPA			
Nong Tok/Nong Bung			
Nong Tok	14/4/95	Two disturbed from roost 1 m up in tree at water's edge 1500 h	Grassy pool in logged semi-evergreen forest 320 m (3)
Nong Bung	14/4/95	Two flushed from the water 1600 h	Grassy pool in logged semi-evergreen forest 320 m (4)
Nong Tok	15/4/95	Four birds feeding 0630 h to at least 0730 h	Grassy pool in logged semi-evergreen forest 320 m
Nong Tok	16/4/95	Two birds feeding from before 0640 h, two flew in at 0720 h, two flew off 0740 h, two still feeding when observer left 0800 h	Grassy pool in logged semi-evergreen forest 320 m
Other sites			
Nong Hin	17/4/95	Three flushed from the water's edge about 1000 h	Bare, mostly dry pool in logged semi-evergreen forest 280 m (5)
Xe Pian	15/4/95	Two flying up river at 1705 h, 5 km downstream of Ban Houayko (locally called Ban Don Kong)	River in partly logged semi-evergreen forest 320 m (6)
Houay Tok-Lok Nyai, Nong Nayi & another part of the Xe PIAN mainstream	-/4/95	Reports of presence in these areas	Semi-evergreen forest at 100 - 300 m
Xe PIAN headwaters	-/4/95	Reports of presence near Ban Nongkouang-Gnai	Evergreen forest with streams and pools at 750 m
Dong Kanthung PPA	-/5/95	Presence widely reported	Deciduous forest at 70 - 150 m, with semi-evergreen gallery forest and extensive seasonally flooded forest

(1) Flying across a sluggish seasonal stream about 8 m wide (with long pools and occasional stony riffles at the time of the sighting). The forested banks, sandy in places, were low and thickly grown with shrubs and bamboo. There was almost no aquatic vegetation, emergent or submerged.

(2) Foraging in a damp grassy hollow less than 5 m in diameter, one of a few scattered in remarkably exposed positions over a sun-dried pool bed at least 400 m x 150 m covered with very short sparse turf. The only cover was some piles of dead branches.

(3) Pool approximately 150 m x 50 m, surrounded by a 20 m-wide belt of short, sun-baked turf. The pool was over 50 cm deep in places, chiefly vegetated with lush grass reaching up to 1 m above the water, although mostly shorter. This grass often concealed the ducks while they were feeding. There were scattered stones as large as the ducks throughout the pool.

(4) A grassy pool about 20 m across of unknown depth with no bare margin and lightly grazed emergent grasses up to 50 cm tall covering the whole surface.

(5) Using a damp corner (less than 10 m across) of a mostly baked-dry pool bed about 50 m across, one of a group of four up to 100 m apart, separated by belts of forest. The wet areas of these four pools were a mixture of rocks, mud trampled heavily by domestic water buffalo, water up to 10 cm deep and sparse, heavily grazed grass. There was no emergent vegetation.

(6) Along a stretch which included both sluggish reaches about 20 m across and narrower, more turbulent stretches with many boulders. Both types had thick bankside vegetation of shrubs and bamboo but no emergent aquatic plants.