

Status and habitat of the White-winged Duck *Cairina scutulata*

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Summary

The endangered White-winged Duck *Cairina scutulata* was formerly widely recorded from north-east India, Bangladesh, Union of Myanmar (Burma), Thailand, Laos, Vietnam, Cambodia, Malaysia (peninsular) and Indonesia (Java and Sumatra). It was found to be “common” by British ornithologists in areas of India, Myanmar and Thailand in the early part of this century. Since then, deforestation and hunting have caused a major decline to perhaps less than 5% of its original population size. Since 1980 the species has been reliably recorded from 55 sites in seven countries, with a minimum combined population of 336 individuals. A conservation plan has been produced and implementation has begun.

Introduction

The White-winged Duck *Cairina scutulata* (King *et al.* 1975, Collar and Andrew 1988, Sibley and Monroe 1990), often known as the White-winged Wood Duck (King 1978–1979, Madge and Burn 1988), is dependent on small wetlands amidst areas of tropical moist forest in South-East Asia. It is one of the largest duck species, with males slightly larger than females (Madge and Burn 1988). The birds feed in shallow, stagnant or slow-flowing streams, ponds, swamps or ricefields, and roost and nest in nearby forest trees. *C. scutulata* has long been recognized as a species threatened with extinction primarily by lowland deforestation (e.g. Gee 1958, Mackenzie and Kear 1976, King 1978–1979). Increasing concern over its status recently led to a major review of current and historical data, building up a picture of its decline, habitat needs and biology (Green 1992). This information was used to make a comprehensive conservation plan for each range country (Green 1992). The work was conducted by The Wildfowl and Wetlands Trust in association with the Asian Wetland Bureau and ICBP.

This paper is based on Green (1992) and contains a condensed review of the status, habitat use and conservation needs of *C. scutulata*. It also includes an update on status information, based on data received since the publication of Green (1992). A companion paper (Green 1993) contains a comprehensive review of the biology of *C. scutulata* in the field.

Methods

From the beginning of 1990 onwards, data on *C. scutulata* were gathered through an extensive literature search of published and unpublished sources, correspondence with an informal network of about 50 contacts working in the range countries, and by circulation of drafts to these contacts for comments, corrections and additional information. The reliability of each record was assessed, and only records considered sound were mapped and used for habitat analyses. Descriptions given by authors and correspondents of habitats frequented by *C. scutulata* were collated to study habitat use. The positions of many additional records from unknown habitats were overlaid on vegetation maps (MacKinnon and MacKinnon 1986) to establish the likely vegetation type in the localities in question. Full details of records of the species (date, precise location, geographical coordinates, number of birds, etc.) are given in Green (1992) along with the data and literature sources for the review of habitat use. The number of *C. scutulata* recorded is always small with the great majority of sightings being of one or two birds (Green 1993).

This study has established centralized monitoring of the status and distribution of *C. scutulata*. This needs to be continued as an aid to international conservation action, and information is therefore sought by The Wildfowl and Wetlands Trust on all further records (past or future) of *C. scutulata*, to be addressed to the Threatened Species Officer.

Former distribution and population (1840–1980)

Numerous records since the species's discovery in 1840 (Muller 1842) show that *C. scutulata* formerly had a widespread distribution in South-East Asia, with confirmed records from nine countries (Figure 1) as summarized below.

India

Formerly widespread in North-East India. Recorded in Lower Assam (Hume and Marshall 1880, Baker 1897, 1929, Savage and Mackenzie 1967), Upper Assam (Baker 1908, Stevens 1914, Gee 1958, Mukherjee 1961, Scott and Mackenzie 1970, Pirie and Choudhury 1976), Arunachal Pradesh (Ali and Ripley 1948, Mukherjee 1961), Nagaland (Hume 1890, Hutchinson 1946), Manipur (Huggins 1913, 1933, Abdulali 1968), Meghalaya (Hume 1890) and Tripura (Mitra 1957). Possible records from Madhya Pradesh (Young 1900), Chota Nagpur (Baker 1897) and West Bengal (Inglis *et al.* 1920). Formerly "common" in Lakhimpur and Dibrugarh Districts, Upper Assam (Hume and Marshall 1880), and the fourth commonest wildfowl species in forest jheels of the Sadiya Frontier Tract (Upper Assam) during the Palaearctic winter when this area is visited by large numbers of migrants (Parsons 1940).

Bangladesh

Present in the Chittagong Hill Tracts (Husain 1977) with possible records in the Ganges-Brahmaputra Delta of Central Bangladesh (Hume and Marshall 1880, Simson 1882, Alexander 1948)

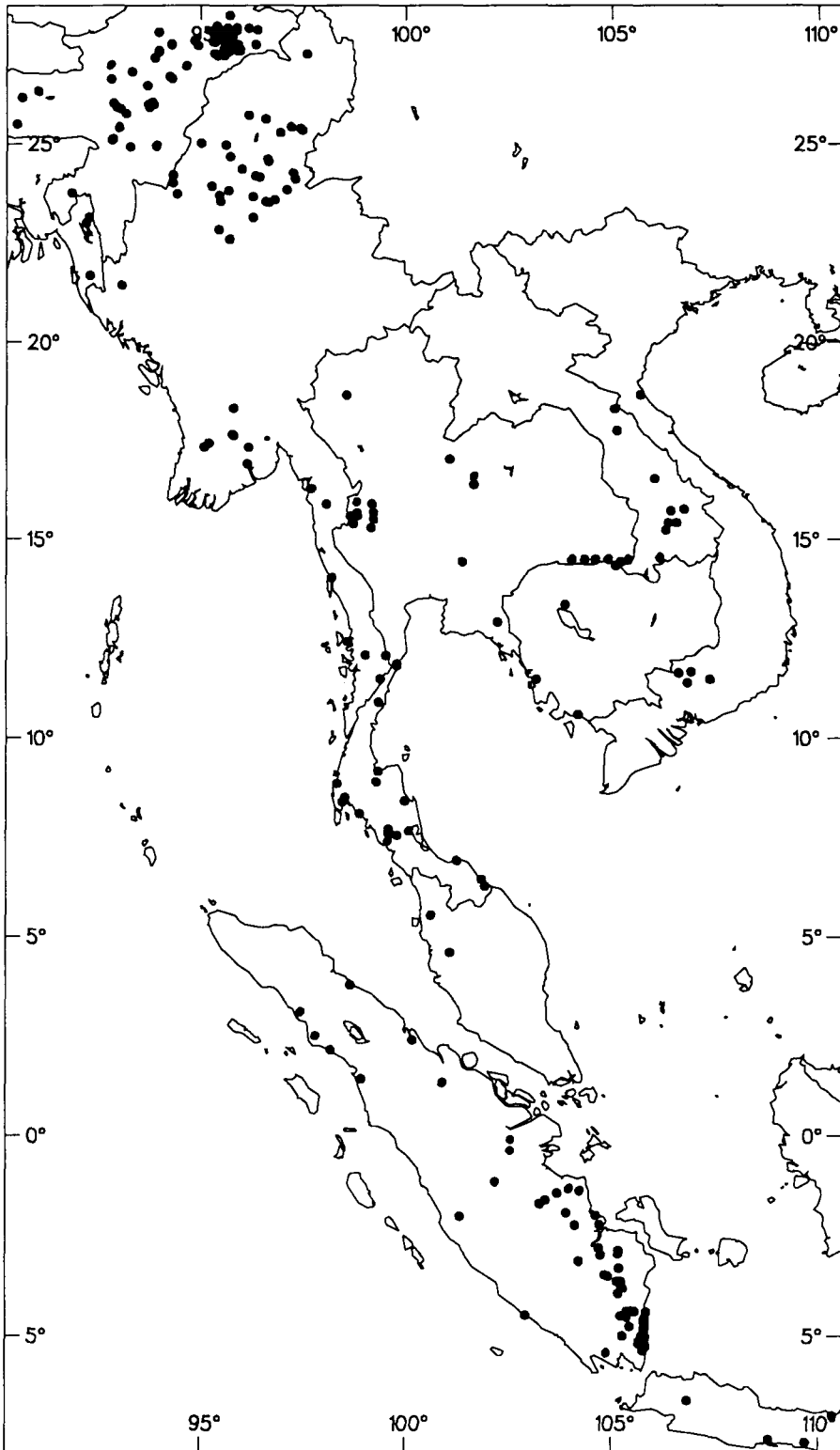


Figure 1. Former distribution of *C. scutulata*, showing all records from 1840 to the present day.

Union of Myanmar (Burma)

Using the 14 regions in current usage (U Saw Han *in litt.* 1990), recorded from Kachin State (Evans 1901, Stanford and Ticehurst 1939, Smith 1942, Milton and Estes 1963, Tun Yin 1960, 1977), Sagaing Division (Hopwood 1908, Stanford and Ticehurst 1931, 1939, Huggins 1933, Smith 1942, Tun Yin 1960, 1977), Shan State (Smith 1942, Tun Yin 1977), Chin State (Hopwood 1912), Bago State (Stanford and Ticehurst 1931, Tun Yin 1960), Ayeyawady Division (Smith 1942), Yangon Division (Stanford and Ticehurst 1931, Stanford 1935), Mon State (Macdonald 1909, Smith 1942) and Taninthayi Division (Gould 1859, Oates 1883). Recorded from eight of the thirteen regions used by Smythies (1953): North-east Myanmar, Upper Chindwin, Northern Shan States, Central Myanmar, Arakan, Arakan Yomas, Pegu Yomas and Tenasserim. Formerly "common" in Pidaung Sanctuary, along the Mogaung River and in Upper Chindwin (Stanford and Ticehurst 1939). Also "often seen" on the Mu River and "one of the most characteristic birds of the Shweli river" (Smith 1942).

Thailand

Recorded from four of six zoogeographic regions used by Round (1988): the Peninsula (Hume 1879, Hume and Marshall 1880, Bonhote 1901, Annandale Meyer and Robinson 1906, Robinson 1909, 1915, Robinson and Kloss 1910–1911, 1918, Gyldenstope 1916, Meyer de Schauensee 1946, Gibson-Hill 1949, Medway and Wells 1976), South-west (Barton 1914), North (Deignan 1945), North-east (Deignan 1963) and South-east (S. Singhapant *per* P. D. Round *in litt.* 1990). Particularly widespread in Peninsular Thailand with records from nine provinces; "very abundant" in Trang Province (Robinson and Kloss 1910–1911) and "fairly common" in Surat Thani Province (Robinson 1915).

Laos

Recorded from Central Laos and South Laos up to 1943 (Delacour *et al.* 1928, Delacour 1929, Delacour and Jabouille 1931, Engelbach 1932, David-Beaulieu 1949, Dickinson 1970).

Vietnam

Recorded from North Annam and Cochinchina (Delacour *et al.* 1928, Delacour 1929, David-Beaulieu 1932).

Cambodia

Recorded from Kampot Province, Koh Kong, Siem Reap and Ratanakiri up to 1947 (Engelbach 1947, 1952, Thomas c. 1961).

Malaysia (Peninsular)

Only one confirmed record, from Ipoh in Perak State before 1900 (Robinson 1909). Possible records from Kedah (Gibson-Hill 1949) and Taman Negara (Mohammad Khan bin Momin Khan *per* J. G. Corder verbally 1990).

Indonesia

Formerly widespread in Sumatra and Java. Recorded in seven of eight Sumatran provinces (Aceh, Sumatra Utara, Riau, Jambi, Sumatra Selatan, Lampung, Bengkulu) and in the Kerinci region, and possible record from Siberut Island west of Sumatra (Fisher 1981, Holmes 1990, Green and Crosby 1992). Recorded from West and Central Java (Green and Crosby 1992), and possible record from Sempu Island along the south coast of Java (Appelman 1940). The Indonesian population is worthy of being treated as a distinct race (Mackenzie 1990, Green 1993).

Current distribution and population (since 1980)

Records since 1980 (Figure 2) show that *C. scutulata* is still widespread in that it survives in at least seven countries, but its distribution is now highly fragmented. Some 53–63 populations have been located since 1980 in the sites listed in Table 1. There is currently no evidence that any of these sites holds more than 30 birds, but most sites have not been surveyed in detail.

India

Recent records from Dibrugarh, Lakhimpur, Nowgong, Silchar and Sonitpur Districts in Assam (Mackenzie 1985, B. K. Talukdar *in litt.* 1990, P. C. Bhattacharjee *in litt.* 1990, A. K. Singh *in litt.* 1991, R. P. Neog *in litt.* 1991, M. P. S. Sidhu *in litt.* 1990, W. Oliver *in litt.* 1990, P. Singh and J. T. Mathew *in litt.* 1992, Choudhury 1993a,b, H. S. A. Yahya *in litt.* 1993) and Tirap, Siang and Dibang Valley Districts in Arunachal Pradesh (Scott 1989, Singh 1989, Choudhury 1990, Ripley *et al.* 1991, R. P. Neog *in litt.* 1991, N. P. Pandya *in litt.* 1991, K. D. Choudhury *in litt.* 1991, A. S. Dehingia *in litt.* to R. B. Magor 1992). The report of a flock of over 200 by Ripley *et al.* (1991) is completely inconsistent with the biology of the species (Green 1993), and is likely to be an error.

Bangladesh

Recent records from the northern (Khan 1986) and southern Chittagong Hill Tracts (S. M. A. Rashid *in litt.* 1990).

Union of Myanmar (Burma)

Birds recently collected from Taninthayi Division just across the border with Prachuap Khiri Khan Province, Thailand (B. Stewart-Cox verbally 1991). Also a possible record from Bago State (U Saw Han *in litt.* 1991).

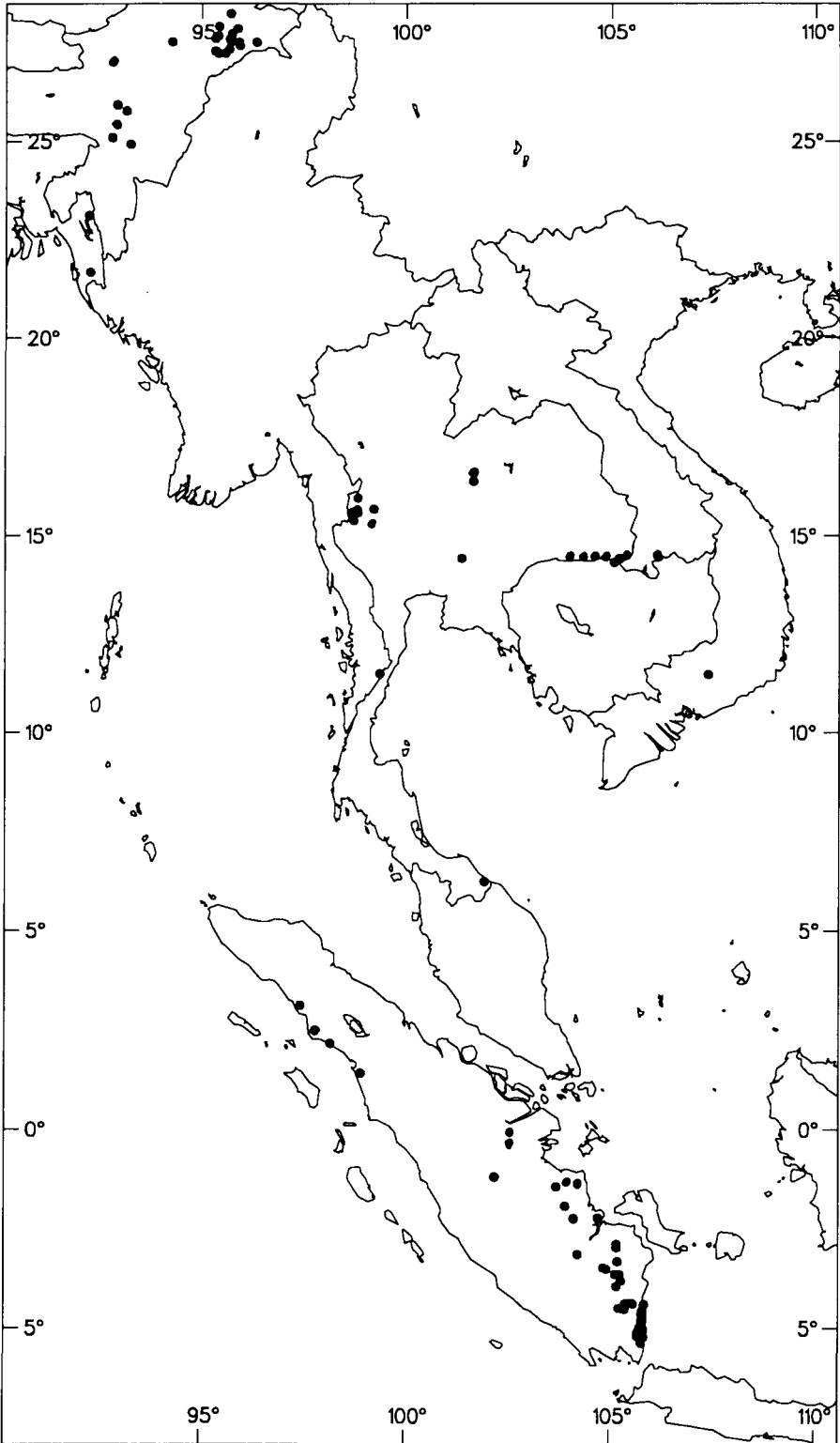


Figure 2. Current distribution of *C. scutulata*, showing all records from 1980 to the present day.

Table 1. Sites where *C. scutulata* has been recorded since 1980 with minimum estimates of adult population size at each site (number of individuals seen or field workers' own minimum estimates).

INDIA	
1. Dibru-Saikhowa WS, Assam	20
2. Nam Dapha NP, Arunachal Pradesh	7
3. D'Ering Memorial WS, Arunachal Pradesh	4
4. Nameri WS, Assam	2
5. Doom Dooma RF, Assam	9
6. Joypur RF, Assam	4
7. Kumsong RF, Assam	1
8. Lumding/Kopili river, Assam	2
9. Phillobari RF, Assam	1
10. Jiri RF, Assam	2
11. Subansiri river, Assam	2
12. Bogapani, Assam	3
13. Namchick RF, Assam	2
14. Kukurmara RF, Assam	1
15. Duarmara RF, Assam	2
16. Buridihing RF, Assam	2
17. Dihangi, Assam	1
18. Dangori RF, Assam	3
19. Dirok, Arunachal Pradesh	5
20. Dhulajan, Assam	4
[North Cachar Hill and Barail RF, Assam]	
[Mahao WS, Arunachal Pradesh]	
BANGLADESH (Chittagong Hill Tracts)	
1. Pablakhali WS	28
2. Sanga-Matamuhuri Valley RF	2
MYANMAR	
1. Taninthayi Division, next to Thai border	0
[Proposed Bago Yomas NP, Bago State]	
THAILAND	
1. Thung Yai WS-Huai Kha Khaeng WS, SWT	12
2. Umphang WS, SWT	4
3. Phu Khieo WS, NET	20
4. Nam Nao NP, NET	4
5. Huai Sala WS, NET	20
6. Phu Jong Na Yoy NP, NET	20
7. Khao Phanom Dongrak WS, NET	10
8. Yot Dom WS, NET	10
9. Pa Phru WS, PT	4
10. Khao Yai NP, NET	1
11. Khao Phra Vihan, NET	4
[Khao Soi Dao WS, SET]	
[Ao Phang-nga NP, PT]	
[Thaleban NP, PT]	
[Sanambin NHA, NET]	
LAOS (South)	
1. Xe Pian proposed protected area	1
VIETNAM (Cochinchina)	
1. Nam Bai Cat Tien NP	2
CAMBODIA	
[Preah Vihea kouprey reserve]	
MALAYSIA (Johore State)	
[Kota Tingii Waterfalls]	

INDONESIA (Sumatra)

1. Way Kambas NP, Lampung	30
2. Padang Sugigan WS, Sumatra Selatan	4
3. Berbak NP, Jambi	5
4. Kerumutan reserve, Riau	4
5. Kluet extension, Gunung Leuser NP, Aceh	5
6. Sungai Tulang Bawang, Lampung	18
7. Cabang / Sungai Seputih, Lampung	9
8. Jepara, Lampung	2
9. Kayu Agung, Sumatra Selatan	9
10. Sungai Lalang, Sumatra Selatan	4
11. Sungai Mesuji, Sumatra Selatan	3
12. Sungai Lematang, Sumatra Selatan	4
13. Banyuasin Musi River Delta, Sumatra Selatan	1
14. Sungai Gelumpangkecil, Jambi	1
15. Kumpeh, Jambi	4
16. Rengat, Riau	9
17. Rianiate, Sumatra Utara	2
18. Sungai Tapus, Sumatra Utara	1
19. Runding, Aceh	2
[Sungai Lumpur, Sumatra Selatan]	

WS, wildlife sanctuary; NP, national park; RF, reserve forest; NHA, non-hunting area; PT, peninsular Thailand; NET, north-east Thailand, etc; [], possible sites where *C. scutulata* has recently been reported but there exists reasonable doubt over the reliability of the report.

Thailand

Recent records from the south-west, north-east and the Peninsula (Boonchai *et al.* 1986, Robson 1988, B. Stewart-Cox *in litt.* 1988, Round 1988, 1990, Scott 1989, Gretton 1990, Nakhasathien and Stewart-Cox 1990, P. D. Round *in litt.* 1990, P. Laothong *in litt.* 1990, 1991, B. Amget *in litt.* 1990, P. Hottola *in litt.* 1991, J. W. K. Parr verbally 1992, Parr *et al.* 1993). Possible record from the south-east (P. Laothong *in litt.* 1991).

Laos

Recent record from Champassak State in South Laos (Anderson 1993).

Cambodia

Recently reported by Thai villagers entering the part of northern Cambodia contiguous with the Khao Phanom Dongrak hills of North-east Thailand (J. W. K. Parr *in litt.* 1992).

Vietnam

Recent records from Cochinchina (C. R. Robson *in litt.* 1990, Eames and Robson 1991).

Malaysia (Peninsular)

Possible recent record from Johore (J. G. Corder *in litt.* 1990).

Indonesia

Recent records from six Sumatran provinces: Lampung, Sumatra Selatan, Jambi, Riau, Sumatra Utara and Aceh (Lambert 1988, Holmes 1990, Green and Crosby 1992, Rudyanto *in litt.* 1992, Burn and Brickle 1992, C. P. van Schaik *in litt.* to M. J. Silvius 1993).

Reduction in population size and distribution

All the records of *C. scutulata* fall within a broad range of about 3,000,000 km² (Figure 1). Available data suggest *C. scutulata* populations have variable densities of one adult bird per 50–500 ha, with densities at the lower end of this range in areas with significant hunting pressure and/or degraded habitat (Green 1992, 1993). This suggests that the original total population size of *C. scutulata* is likely to have been in the range of 50,000–500,000 individuals.

Records since 1980 suggest a current known world population of at least 336 individuals split between Indonesia, India, Thailand, Bangladesh, Vietnam and Laos (Table 1). In most sites the population size estimated in Table 1 is the minimum number of individuals seen. These estimates only provide a very approximate guide to the real number of birds present, and there are several sources of error.

In some sites, the pressures from habitat destruction and hunting are so great that the *C. scutulata* populations are likely to have declined further or may have been eliminated. This is particularly true of Pabla Khali Wildlife Sanctuary (Bangladesh), Padang Sugihan Wildlife Sanctuary and Sungai Tulang Bawang (Indonesia). Some reports of *C. scutulata* may refer to records of the domestic Muscovy *C. moschata domestica*, which is widely kept in South-East Asia. Those localities where this is considered a serious likelihood are listed as possible sites in Table 1.

For many sites (e.g. Thung Yai Wildlife Sanctuary in Thailand and Berbak National Park in Sumatra) the numbers given in Table 1 are likely to underestimate the actual numbers of *C. scutulata* present. Being a retiring and dispersed bird of forest wetlands that is largely crepuscular and nocturnal (Green 1993), *C. scutulata* is difficult to survey and census. Only a few sites have been surveyed in a systematic way, notably Pabla Khali Wildlife Sanctuary in Bangladesh and Way Kambas National Park in Sumatra (Husain and Haque 1982, Rudyanto *in litt.* 1990). Additional populations of *C. scutulata* probably still survive in parts of the former range where areas of suitable but recently unsurveyed habitat still exist. In Myanmar, Cambodia and Laos, suitable habitat is known to survive in various locations that previously held *C. scutulata*. There are also extensive tracts of apparently suitable habitat remaining in Sumatra (Holmes 1990) in areas where the presence of the species has yet to be confirmed (Figure 3).

Taking the above factors into account, the current world population of *C. scutulata* may be as high as several thousand individuals. Nevertheless, the

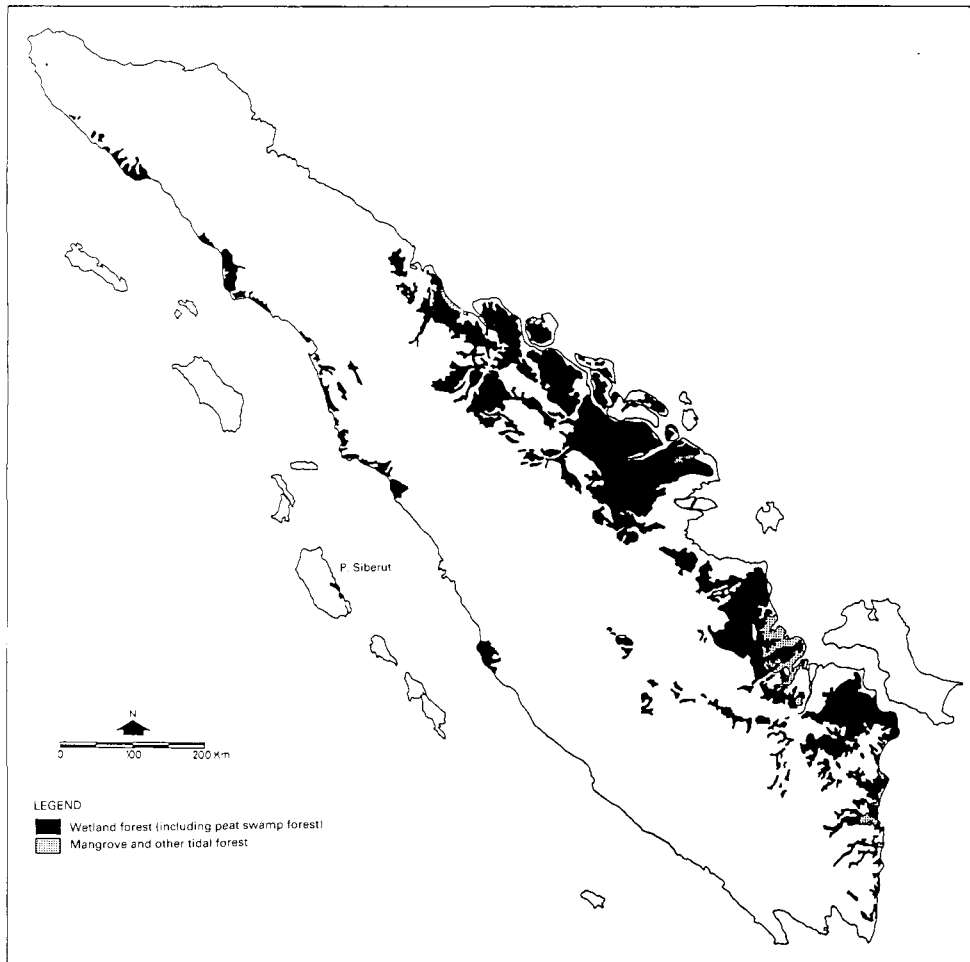


Figure 3. Current distribution of wetland forest in Sumatra (based largely on RePPPOT 1988).

world population has declined markedly, possibly to less than 5% of its original size. The major change in the distribution of the species has been in the form of a marked fragmentation and a reduction in the total area actually occupied. The geographical extent of the species has probably not changed very much, and many of the differences in the current and former distributions (Figures 1 and 2) are probably due to the species being overlooked in recent years. Nevertheless, it is likely to be extinct in Java (D. A. Holmes *in litt.* 1990) and Malaysia (D. R. Wells *in litt.* 1990).

Habitat

C. scutulata has invariably been recorded from areas containing moist tropical forest (essential for nesting and roosting) holding or providing access to stag-

nant or slow-moving wetlands (essential for feeding). As man's impact on habitats in Asia has increased, there have been many changes to the habitats of *C. scutulata*. Thus the species is currently recorded from many areas of secondary forest. For example the majority of current known Sumatran sites for the species contain no primary forest (Lambert 1988). Breeding in secondary forest has been confirmed in southern Sumatra and Bangladesh (Husain and Haque 1982, Tim Ekspedisi 1991).

The species currently appears to be using more open, degraded habitats in Sumatra than elsewhere in its range. This is particularly true in south-east Sumatra, where most of the sites have only small patches of forest amongst grasslands and agricultural areas (Lambert 1988). In continental Asia, the great majority of records are still coming from densely forested areas. There are two likely explanations for this difference. First, many of these Indonesian sites are in the coastal plains of south-east Sumatra, and equivalent lowland plain areas on the continent are in a more advanced stage of destruction. Indeed, most have already been almost totally deforested, for example in Peninsular Thailand. In the continental plains, *C. scutulata* may have persisted for some time in similar areas of open forest habitat until the last forest patches were destroyed. Second, *C. scutulata* in south-east Sumatra is thought to be dependent for nesting on rengas trees (family Anonaceae), which have sap that causes skin blistering in humans. Hence these trees are often left standing when other large trees have been felled, perhaps allowing *C. scutulata* to survive in areas that would otherwise have been clear-felled (Lambert 1988).

Topography

The majority of *C. scutulata* records have come from lowland areas of less than 200 m altitude, particularly coastal plains and valley bottoms. Similarly, all the locations in which the species was formerly described as "common" (parts of Upper Assam, Myanmar and Peninsular Thailand) or appears to have been particularly widespread (e.g. south-east Sumatra) are below 200 m. The species has also often been recorded from gentle foothills at medium elevations of 200–500 m (e.g. Garo Hills and Mikir Hills in India; Chittagong Hill Tracts in Bangladesh). There are also records from areas of relatively level terrain at higher altitudes, particularly plateaus holding sluggish sections of upper perennial rivers. Notable amongst these are records at 1,500 m on Doi Inthanon, Thailand (Deignan 1945), 1,250 m at Vijaynagar Station, Arunachal Pradesh (Ripley *et al.* 1991), 900 m in Phu Khieo Wildlife Sanctuary, Thailand (P. D. Round *in litt.* 1990), 900 m in north-west Manipur (Huggins 1913), 810 m at Nam Dapha National Park, Arunachal Pradesh (R. P. Neog *in litt.* 1990), c.700 m at Nape and over 800 m at Bolovens Plateau in Laos (Delacour 1929, Engelbach 1932). The highest breeding record is from over 800 m in Phu Khieo Wildlife Sanctuary (Round 1990). These records suggest that altitude *per se* is not limiting to *C. scutulata*, but rather that its main requirement is level, forested terrain with access to shallow, slow-moving or stagnant water-bodies. However, primary-forested lowlands may still have been more suitable habitat, supporting the species at higher densities, as there is no evidence of *C. scutulata*'s ever being abundant at higher altitudes.

As habitat destruction has been particularly devastating at lower altitudes, *C. scutulata* is now largely restricted to higher altitudes in some parts of its range. In Thailand, the species has been almost extirpated from lowland plains, and the species is currently known at 11 sites, nine of which are wholly above 100 m altitude (Parr *et al.* 1993).

Forest types

Maps of original vegetation (MacKinnon and MacKinnon 1986) were used to approximate the forest types in locations where *C. scutulata* has been recorded (Table 2). This technique only gives a guide to the dominant vegetation in a location, and should not be regarded as confirmation that the species uses forest of that class for feeding, roosting or breeding. Any forest area contains a mosaic of different vegetation types according to local conditions of moisture, soil type, orientation, etc., and *C. scutulata* is likely to depend on forest along wetland corridors that differs from the dominant forest type in the area. In a few cases, authors' descriptions specify the forest types where *C. scutulata* has been recorded (Table 2).

Using the vegetation classification adopted by MacKinnon and MacKinnon (1986), Table 2 shows that *C. scutulata* has been recorded from a variety of tropical moist forest types, but avoids the drier formations (e.g. tropical dry deciduous forest, dry dipterocarp forest, savanna forest, thorn scrub forest). In continental Asia the great majority of records come from tropical wet evergreen and tropical semi-evergreen forest, and both these have been used for nesting in Bangladesh (Husain and Haque 1982, Green 1993). In areas dominated by

Table 2. Forest types where *C. scutulata* has been reliably recorded, following the vegetation classification used by MacKinnon and MacKinnon (1986)

	TWE	TSE	TME	MWT	TMD	MDF	MLO	FSW	PSW	MAN
INDIA	+	+		+	+					
BANGLADESH	X ⁿ	X ⁿ			+					
MYANMAR	+	+				+	+			
THAILAND		X	X			X		?	X	
LAOS		+	+							
CAMBODIA	+	?				?		?		
VIETNAM		+						X		
MALAYSIA	+									
INDONESIA	?	?						X ⁿ	X	X
Total	5	6	2	1	2	2	1	2	2	1

+ record according to vegetation maps (MacKinnon and MacKinnon 1986).

? possible record according to vegetation maps, but location not specific enough or forest types too varied to be certain.

X record confirmed by author's description of habitat use. These refer to recent records (post-1980) with the exception of TME for Thailand.

ⁿ confirmed use for nest sites.

TWE, tropical wet evergreen forest; TSE, tropical semi-evergreen forest; TME, tropical montane evergreen forest; MWT, montane wet temperate forest; TMD, tropical moist deciduous forest; MDF, mixed deciduous forest; MLO, moist lowland forest; FSW, freshwater swamp forest; PSW, peat swamp forest; MAN, mangrove.

deciduous formations, *C. scutulata* appears to depend on narrow bands of gallery evergreen forest flanking watercourses (Nakhasathien and Stewart-Cox 1990).

In Indonesia most *C. scutulata* records have come from freshwater swamp and peat-swamp forest. There is only a handful of records outside swamp forest, and most or all of these are from areas with swamp forest nearby. Some Javan records may have been from evergreen forest, and several Sumatran birds have been recorded flying into mangroves (Lambert 1988, Holmes 1990). Nest-sites have been found in freshwater swamp forest (Holmes 1977). On the continent, there are only confirmed records from swamp forest at two sites (*C. Robson in litt.* 1990, *P. Laothong in litt.* 1991), and no evidence of breeding. These apparent differences in habitat use between Indonesia and continental Asia may simply reflect differences in the availability of the various habitat types. Considerable areas of swamp forest were originally present in parts of the continental range (e.g. Myanmar, Thailand, Cambodia, Vietnam), but most of these have long since been extensively cleared (MacKinnon and MacKinnon 1986).

Nesting occurs in tree holes and hollows, and the tree species used are likely to vary with availability. In Bangladesh *C. scutulata* nests have been found in civit *Swintonia floribunda*, a tropical wet evergreen forest species, and barta *Artocarpus lakoocha*, a tropical semi-evergreen forest species (Husain and Haque 1982, Green 1993). In Assam, a nest has recently been described in the top of a seasonally inundated bher tree *Salix tetrasperma* stump (Choudhury 1993a). In southern Sumatra, *C. scutulata* is thought to breed in rengas, the local name for a complex of trees of family Anonaceae (mainly genera *Melanorrhoea* and *Gluta*) found in freshwater swamp forest (Holmes 1977, Lambert 1988).

Wetland types

C. scutulata has been recorded from a variety of relatively small, shallow, sluggish or stagnant wetlands in forest areas (Table 3). Forest streams, forest pools

Table 3. Wetland types where *C. scutulata* has been reliably recorded

	STR	RIV	OPE	SWA	MAR	LAK	RIC	VAR
INDIA	+	+	X	#		#	+	+
BANGLADESH	#					#		
MYANMAR	+	+		+	+		+	+
THAILAND	#					X	#	
LAOS	+				+	+		
VIETNAM	+			X		+		
INDONESIA		X		#	+	#	X	
Total	6	3	1	4	3	6	4	2

+ former record (pre-1980).

X current record (post-1980).

both former and current records.

STR, forest streams and brooks; RIV, small, sluggish rivers and river pools amongst forest; OPE, wide, open rivers with little forest on banks; SWA, swamps, bheels and flooded forest; MAR, marshes or marshy clearings; LAK, forest pools or small lakes; RIC, ricefields; VAR, a variety of small stagnant wetlands: puddles, water holes, salt licks and tea waste destruction ponds.

and small lakes, small forest rivers, marshes and ricefields are particularly important. Authors in India and Bangladesh have reported that *C. scutulata* prefers wetlands in particularly dense forest (e.g. "the more overgrown and sheltered in dense jungle the pool happens to be, the more likely these birds are to be found": Parsons 1940). Large, open rivers are of little importance (only one confirmed record) and there has never been a confirmed record from a large lake or reservoir even though these often occur adjacent to areas occupied by *C. scutulata* (e.g. Kaptai Reservoir in Bangladesh: Khan 1986). The largest stagnant wetlands where *C. scutulata* has been recorded are swamps several square kilometres in area in Sumatra (Lambert 1988). Swamps used are mainly inland, freshwater and non-acid, including some that were newly formed as forest was flooded by earthquakes or by streams changing course (Parsons 1940). However, *C. scutulata* has recently been recorded from areas of acidic coastal swamps in northern Sumatra (Holmes 1990). Most recent Indonesian records are within 10 km of areas of permanent waterlogged plain, suggesting a degree of dependence on the permanent freshwater swamps that occur in these areas (Lambert 1988).

As man's effect on forest areas has spread, *C. scutulata* is likely to have increased its use of artificial wetlands such as ricefields. Regular use of ricefields was recorded as early as 1910 (Robinson and Kloss 1910–1911). In south-east Sumatra most of the grassy swamps where *C. scutulata* has recently been recorded are probably man-made by logging and burning of swamp forest in seasonally inundated areas (Lambert 1988). Forest ponds in Way Kambas National Park used regularly by *C. scutulata* are also man-made where logging tracks have dammed small streams (Chambers 1990).

Threats

Deforestation

The destruction of forest habitat is the single major cause of the drastic decline in the *C. scutulata* population this century. Deforestation in South-East Asia has accelerated in recent decades owing to a rapid increase in economic development and local human population (Collins *et al.* 1991). Total forest cover in the nine *C. scutulata* range countries varies from 49% in Sumatra down to only 6% in Bangladesh (Collins *et al.* 1991). Over the whole range, about 33% of the land area remains forested and about 27% of land area is covered with forests below 900 m altitude. However, these figures understate the extent of destruction of *C. scutulata* habitat. Deforestation has been most extensive in lowland forests in coastal plains and along valley bottoms that comprise the major habitat of *C. scutulata*, as these are the first to be converted to agriculture and other uses. For example, in Peninsular Thailand, total forest cover is estimated at 22%, but less than 4.7% of the original forest below 200 m remains, with no surviving extensive forest blocks (Round 1988). Similarly, in Java only 3% of non-montane forest remains (D. A. Holmes *in litt.* 1991). In Peninsular Malaysia, the widespread clearance of forest in river valley floodplains may explain the extinction of both *C. scutulata* and the Green Peafowl *Pavo muticus* (J. C. Eames *in litt.* 1993).

Most of the remaining lowland forests in the *C. scutulata* range are secondary forests that have been felled or selectively logged at some stage. Selective logging removes many of the large, old trees used by *C. scutulata* for nesting (Khan 1986), and recently logged areas may not be able to support the species. As development pressure has intensified, rotation cycles in forest reserves and in shifting agriculture have been shortened (Collins *et al.* 1991), giving less chance for the forest to regenerate to a mature stage. In addition, the continuing fragmentation of remaining forests into small forest blocks may lead to the isolation of *C. scutulata* populations and may result in their elimination. An isolated forest block may not be large enough to support a demographically or genetically viable population of the species, and if a severe drought, epidemic or other disaster eliminates the duck population there may be little chance of recolonization. However, a limited area of open country is not a barrier to dispersal between forest areas since *C. scutulata* is a strong flier and birds in Way Kambas National Park, Sumatra, travel at least 6 km from the nearest forest across open, populated terrain to reach ricefields (Chambers 1990).

Over the whole *C. scutulata* range, deforestation is continuing at about 15,000 km² per annum, about 1.5% of remaining forest (Collins *et al.* 1991). Again, this is particularly affecting lowland forests of importance for *C. scutulata*, and all known populations outside protected areas (and many of those inside) are at risk of being eliminated by habitat destruction within the next 25 years if no preventative action is taken. Figure 4 demonstrates this situation in Sumatra, where all forest outside protected areas is forecast to be destroyed within the next 15–25 years (M. J. Silvius *in litt.* 1991), leaving a small number of totally isolated protected areas of which only five are currently known to hold *C. scutulata*. This prediction assumes that areas of "Production Forest" logged under licence will be lost as, once they have been selectively logged, they are generally logged further and claimed for other uses (M. J. Silvius *in litt.* 1991). Deforestation and fragmentation of remaining habitat is already further advanced in continental range countries. Ongoing deforestation through illegal logging is even commonplace in many of the protected areas where *C. scutulata* is currently found (Khan 1986, Round 1989).

Holmes (1990) suggested that, in Sumatra, the first phase of forest clearance may actually have benefited *C. scutulata* by the creation of more feeding habitat in seasonal swamps where swamp forest was cleared. Similarly, initial deforestation in continental lowlands may conceivably have benefited the birds when there were ricefields surrounded by still vast areas of suitable forest habitat. Indeed, *C. scutulata* was "fairly common on ricefields" in Thailand in 1913 (Robinson 1915).

Inappropriate forest management

Deliberate burning of forest by local people during the dry season is a widespread problem affecting large areas in Thailand and elsewhere (Round 1988). It causes a gradual conversion of dense evergreen forests into drier, open deciduous forests less suitable for *C. scutulata*. Burning is concentrated at the end of the dry season when *C. scutulata* is thought to nest. In India, reserve forests have until recently been managed systematically by foresters in ways

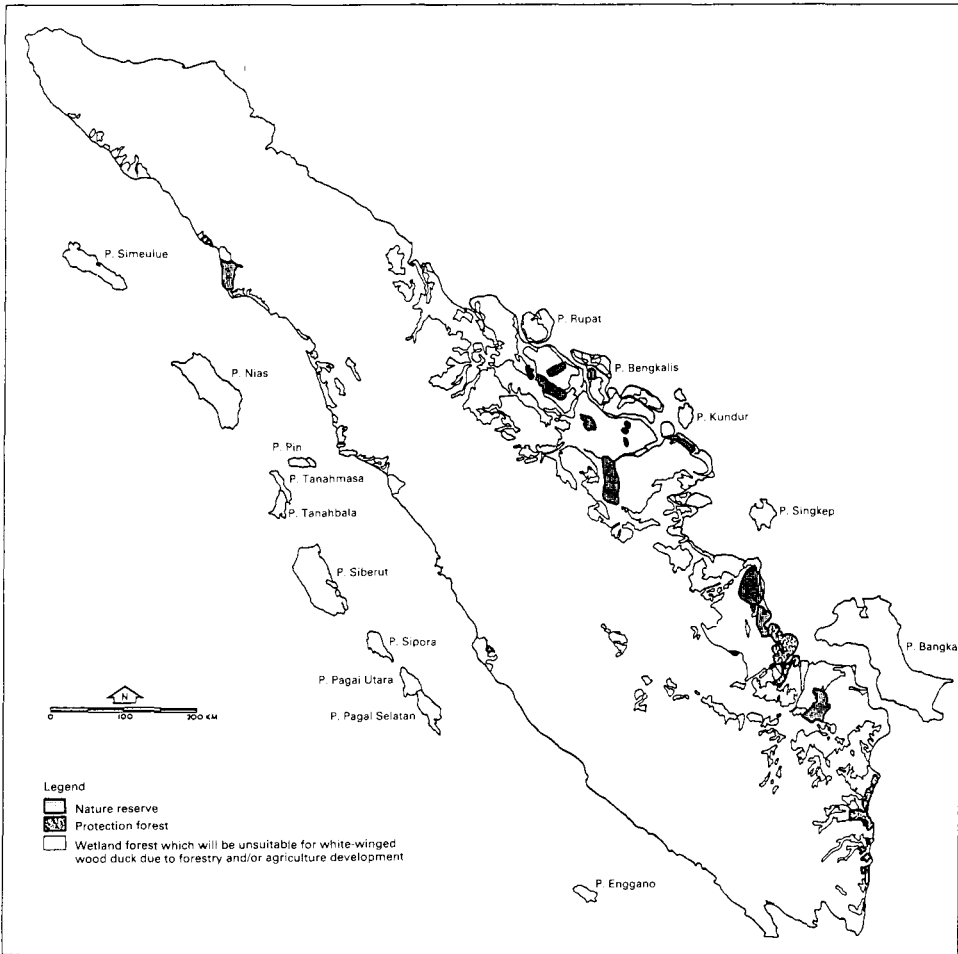


Figure 4. Future distribution of wetland forest in Sumatra, predicted to be reality by 2015 (based largely on RePPProT 1988).

harmful to *C. scutulata*: old or dead trees likely to provide nest-sites were removed, and forest marshes or swamps were drained and planted with trees (S. K. Mukherjee verbally 1991).

Drainage

There has been widespread destruction of wetlands used by *C. scutulata*. Swamps, marshes and other wetlands have been extensively drained, largely for agricultural use. Drainage of swamps in areas frequented by *C. scutulata* has been widespread in Sumatra, and there are plans to drain many more (Holmes 1990). Drainage of permanent swamps is likely to be the most serious threat, as it reduces the area of feeding habitat during the dry season when there is least available.

Hunting and trade

The opening up and fragmentation of forests leads increasingly to encounters between *C. scutulata* and man. Being a large bird that sometimes uses ricefields and boundary areas between forest and agricultural land, *C. scutulata* is an obvious target for hunting by the rural human population. Fledged birds or ducklings have been recorded being caught by various methods: in fishing nets, with baited fishing line, tracked with dogs, shot or taken using a variety of traps and nets (Husain and Haque 1982, Lambert 1988). Eggs are also taken from the nest (Holmes 1977, Choudhury 1993a). Hunting of *C. scutulata* is known to occur in India, Bangladesh and Indonesia, and is a major problem within the protected areas of Thailand (Round 1988, Parr *et al.* 1993).

Even though most hunting of the species goes unrecorded, data from India and Bangladesh suggest that it can be intense enough to eliminate the species from forest where it would otherwise be able to survive. In Pablakhali Wildlife Sanctuary, 74% of 31 ducklings in eight broods located by Husain and Haque (1982) in 1977 and 1978 were later taken by local hunters, and two adults were taken by fishermen in the same year. The whole population of fledged birds in this area at the time was estimated at only 26. In Dibrugarh District, Assam, in 1969, at least 26 *C. scutulata* were collected for food (M. J. S. Mackenzie *in litt.* to F. Vollmar 1969; 13 of these birds were diverted for captive breeding) when the total fledged population in the district may have been less than 100.

There is evidence that trade in *C. scutulata* is also a local problem in some areas, but one nowhere near as widespread and significant as hunting. In Thailand four *C. scutulata* were obtained by a Thai policeman from Myanmar in the 1980s for keeping as pets (B. Stewart-Cox verbally 1991). In Sumatra a villager was paid by a westerner for a bird and eggs in 1985 (Lambert 1988), while L. Kuah (*in litt.* 1991) saw four birds on sale at a Java market in 1991.

Disturbance

Whilst *C. scutulata* is a shy forest bird generally sensitive to disturbance, it has been recorded in ricefields close to villages during the day (Holmes 1977). *C. scutulata* sites (including protected areas) suffer from regular encroachment by people living in or around the site and extracting logs or other forest products (bamboo, etc.), hunting, grazing cattle, fishing, etc. Whilst logging and hunting have a direct impact on *C. scutulata*, other activities may cause harm through disturbance, preventing the birds from feeding or breeding effectively. *C. scutulata* has been regularly recorded at Lake Lakatu in Thung Yai Wildlife Sanctuary, Thailand, but this site is now a regular helicopter landing site for border police who fish in the lake (B. Stewart-Cox verbally 1991). Way Kambas National Park, Sumatra, is being developed as a major tourist attraction. A new road runs alongside several forest ponds where *C. scutulata* has been regularly recorded since 1988, and causes much disturbance (Rudyanto *in litt.* 1991).

Pesticides

When feeding in ricefields in recent decades, *C. scutulata* is certain to have encountered persistent pesticides, which are used in large quantities in South-East Asia. There is evidence that pesticides have played a role in major declines in storks and other wetland birds in range countries (Round 1988, P. C. Bhattacharjee verbally 1990), and they may be having a negative impact on *C. scutulata*. The persistent pesticides DDT and Dieldrin were found in water samples collected from two protected areas holding *C. scutulata* in Thailand (Nakhasathien and Stewart-Cox 1990). In Sumatra, fishermen use pesticide cocktails to kill fish in streams and rivers that flow into Way Kambas National Park (Chambers 1990).

Pollution

In Assam, *C. scutulata* occurs in forest areas adjacent to tea plantations. Some wetlands in these areas are polluted with tea waste dumped with lime. *C. scutulata* has been seen using tea waste destruction ponds, especially during drought periods. A bird netted from such a pond died three days later from aspergillosis, possibly caused by the tea waste (M. J. S. Mackenzie *in litt.* to F. Vollmar 1969). Oil drilling and open-cast mining occur in Assam and other forested areas in the *C. scutulata* range and may cause significant pollution. Forestry activity is widespread, and effluent from timber mills may have harmful effects.

Conservation measures taken

Species protection

C. scutulata is granted legal protection from hunting, collection, etc., in five countries: Bangladesh, India, Myanmar, Thailand and Indonesia. However, there is little if any attempt to enforce this protection or to educate hunters about the law. *C. scutulata* is also listed on Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

Habitat protection

A network of protected areas exists or is planned in all range countries, but lowland forest systems suitable for *C. scutulata* are relatively under-represented. However, at least 21 populations of the species currently occur in wildlife sanctuaries and national parks (Table 1). Dibru-Saikhowa Wildlife Sanctuary in Assam is the only protected area established because of its importance to *C. scutulata* (Mukherjee 1961). In theory, these sites give protection from habitat destruction, hunting and other forms of disturbance. In practice, poaching, illegal logging and other forms of encroachment are widespread problems. A further 11 *C. scutulata* populations occur in reserve forests in which hunting is forbidden but extraction of timber and other forest products is permitted. In

practice this means that many of these sites will become unsuitable for the species in the near future.

Captive breeding programmes

Captive breeding has led to a captive population now totalling c. 280 birds spread between several countries (N. R. Hewston verbally 1991), although these are derived almost entirely from Assamese stock (Mackenzie and Kear 1976). There are currently considerable problems of disease and lack of genetic diversity in the captive population (Tomlinson *et al.* 1991, Cromie *et al.* 1992).

Conclusions and recommendations

The White-winged Duck is currently listed in the IUCN Red List as Vulnerable (WCMC 1990). Using new quantitative criteria proposed for IUCN categories by Mace *et al.* (1992) *C. scutulata* qualifies for Endangered status on the grounds that the total population is likely to be below 2,500, there are no known subpopulations with more than 250 individuals and there is a continuing decline in both the number of individuals and the area of suitable habitat.

C. scutulata has undergone a drastic decline in population size this century, and action is urgently required to reduce or prevent future declines and to allow local populations to increase. Adequate protection from habitat destruction and hunting must be provided, and habitat must be improved through appropriate management in protected areas. More data on current distribution and size of known populations are required in order to clarify which populations are largest and of highest conservation priority. Field surveys are urgently required in known sites and in other areas where *C. scutulata* may still survive. Our knowledge of the species's ecology needs to be improved. The following points give an overview of the conservation action recommendations that are presented in full in Green (1992).

- (1) The following sites should be granted protection immediately, owing to their known importance to *C. scutulata*: Doom Dooma Reserve Forest (India), Sungai Tulang Bawang, Cabang/Sungai Seputih, Kayu Agung and Rengat (Indonesia). Following field surveys, other important sites should be granted protected status.
- (2) All logging concessions granted in protected areas containing *C. scutulata* (e.g. Pablakhali Wildlife Sanctuary, Bangladesh) should be revoked. Tourist development in Way Kambas National Park should be carefully managed to prevent disturbance to the species.
- (3) Protected area boundaries should be extended to incorporate adjacent lowland forest areas of value to *C. scutulata*. Such extensions should be considered in Dibru-Saikhowa Wildlife Sanctuary and Nam Dapha National Park in India and Phu Khieo Wildlife Sanctuary in Thailand.
- (4) Old trees suitable for nesting in and around *C. scutulata* sites should be protected by law and left standing during any selective logging operations. In Sumatra, logging of rengas trees should be made illegal and they should

be excluded from any legal concessions. Nest-boxes should be put up on a trial basis in secondary or degraded forest sites.

- (5) Long-term field research is required into *C. scutulata* biology (Green 1993). A thorough understanding of the factors limiting population density or breeding success (e.g. limited availability of nest-sites, hunting or predation, limited dry season feeding habitat or territoriality) will identify management actions that will increase the size of populations.
- (6) Known sites require systematic field surveys to establish the size and distribution of the *C. scutulata* populations. Green (1992) provides a full list of additional sites with suitable habitat in need of survey.
- (7) Local education campaigns should be centred around *C. scutulata* sites to encourage protection and discourage hunting, using the species as a "flag-ship" to encourage protection of the forest ecosystems.
- (8) In view of the endangered status of the species in the wild, the maintenance of a captive population must currently remain a key element in *C. scutulata* conservation. There is a need for improved international coordination of captive breeding to ensure that the captive population functions effectively as a reserve. The Wildfowl and Wetlands Trust is seeking data from all breeding centres to establish an international studbook as an aid to genetic management.
- (9) *C. scutulata* should be granted full specific legal protection in Vietnam, Laos and Myanmar.

The Wildfowl and Wetlands Trust and Asian Wetland Bureau are already working to implement these recommendations, but anyone who may be in a position to assist (e.g. by undertaking fieldwork) is urged to consult Green (1992) or apply to the author.

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