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The Status and Conservation of the White-winged Wood Duck *Cairina scutulata*

A.J. Green

A report undertaken by The Wildfowl & Wetlands Trust, Slimbridge, in cooperation with the International Waterfowl and Wetlands Research Bureau, the International Council for Bird Preservation and the Asian Wetland Bureau

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(FIRST PAGE)

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SUMMARY

This report contains a thorough investigation into the status and conservation of the endangered White-winged Wood Duck *Cairina scutulata*, an unusual species of waterfowl which is dependent on small wetlands amidst lowland tropical moist forest in South-east Asia. Former and current status is reviewed on a national basis, along with the causes of decline, a review of conservation measures taken to date and detailed conservation recommendations for future action. The species's habitat and biology are also reviewed along with a detailed inventory of all sites where it occurs, with threats and conservation recommendations listed for each site.

Since its description in 1840 the species has been widely recorded in nine countries: North-east India, Bangladesh, Union of Myanmar (Burma), Thailand, Lao PDR, Viet Nam, Cambodia, Peninsular Malaysia and Indonesia (Java and Sumatra). It was found to be "common" by eminent British ornithologists in areas of India, Myanmar and Thailand in the early part of this century. Since then, the species has undergone a major decline to perhaps less than 5% of its original population size. This decline has accelerated in recent decades due to more extensive loss of lowland tropical forests and increased hunting pressure.

Since 1980 the species has been reliably recorded from 41 sites in six countries, with a minimum total population of 211 individuals. Most of these sites are in Sumatra, India and Thailand, and there have been no confirmed records from Lao PDR, Cambodia, Malaysia or Java since 1943. Thirteen of the 41 sites are protected areas. These figures are likely to underestimate the number and size of surviving populations as *C. scutulata* is a shy forest bird and few areas of the former range have recently been surveyed in detail. Taking these factors into account, there could be up to several thousand birds surviving in total. It is unclear whether any of the known populations are large enough to be viable in the long term, and many of them are under imminent threat of extinction from further habitat destruction and hunting.

On the basis of current knowledge, the species qualifies for the highest IUCN category of threat: **Critical**. Even allowing for the margin of error in current data, the species is likely to qualify as **Endangered**. Conservation action is urgently required if extinction of the species in the wild is to be prevented, and key recommendations include education programmes, improved habitat protection, further surveys and field research.

1. INTRODUCTION

1.1 Background

The White-winged Wood Duck *Cairina scutulata* of South-east Asia has long been recognised to be one of the rarest wildfowl species in the world. Its dependency on lowland tropical moist forests has led to an inevitable decline as these forests have been cleared, but also presents the opportunity to use *C. scutulata* as a "flagship" to promote the conservation of these vital ecosystems. The Wildfowl & Wetlands Trust first took an interest in the species in 1968, when concern over its rapid decline in India and elsewhere led to the Trust's establishment of a successful captive breeding programme (Mackenzie & Kear 1976) now divided between WWT, Jersey Wildlife Preservation Trust and various centres in India, Thailand, Hong Kong and elsewhere.

In order to clarify the worldwide status and ecology of *C. scutulata*, and to identify appropriate actions for its conservation, WWT decided to commission this report, prepared between January 1990 and July 1991.

1.2 Objectives

The goal of this report is to promote the conservation of *C. scutulata* in the wild through the following objectives.

1.2.1 Former and Current Status

All available information on former and current distribution of the species is listed and summarised. This identifies the extent of the species's decline and the location and known size of surviving populations. This information is used to estimate the total world population and to locate those sites that are most important for the conservation of the species (Key Sites). Furthermore, former records and current data on remaining forest distribution are used to identify further sites where the species may still survive. These sites are high priorities for future surveys.

1.2.2 Habitat Use and Ecology

To review all information available on former and current habitat use (forest types, wetland types, altitude etc.) and on ecology (breeding behaviour, diet, population density etc.) in order to identify the ecological niche and requirements of *C. scutulata*.

1.2.3 Threats

To identify the causes of former and continuing declines of the species.

1.2.4 Conservation Measures Taken

To identify the measures taken to conserve the species and to assess their effectiveness.

1.2.5 Action Plan

To recommend and prioritise realistic "next step" conservation actions necessary to move towards securing the survival of viable wild populations of *C. scutulata*.

1.2.5 Site Directory

To describe all the sites of current importance to *C. scutulata* and list threats, action recommendations etc. on a site by-site-basis. Many of these sites are already listed in the Asian Wetland Directory by Scott (1989). A cross reference is given for these sites (BA5, BU2, CA3, INDI56, INDO1, TH19, VN22 etc.) and the reader can obtain more information by consulting Scott (1989). Similarly, cross references are also given for the Indonesian Wetland Directory (e.g. SU51) by Silvius *et al.* (1987).

1.3 Methodology

The above information was gathered through an extensive literature search of published and unpublished sources, the establishment of an informal network of contacts in the range countries and conservation organisations with an interest in these countries, and the circulation of draft chapters to these contacts for comments, corrections and additional information.

1.4 Report follow up

1.4.1 Conservation Action

The conservation recommendations made in the report are directed to the reader and to the conservation world at large, and help is urgently sought from all organisations and individuals able to assist in their implementation. The organisations sponsoring the production of this report will not be able to implement these recommendations on their own.

1.4.2 Monitoring

The production of this report has established centralised monitoring of the current status and distribution of *C. scutulata*. This needs to be continued as an aid to international conservation action. Information is therefore sought by WWT on all further records (past or future) as detailed in Appendix 1.

1.5 Glossary of terms and abbreviations used in this report

Rawa = swamp

S. = Sungai = River

NHA = Non-hunting Area

NP = National Park

RF = Reserved Forest

TE = Tea Estate

TG = Township Group

TS = Township

WS = Wildlife Sanctuary

BMNH = British Museum of Natural History, Tring, UK

NMNH = National Museum of Natural History, Leiden, Netherlands

2. THE STATUS AND CONSERVATION OF THE WHITE-WINGED WOOD DUCK *CAIRINA SCUTULATA*

2.1 Former distribution and population (From 1840)

Numerous records since the species's discovery in 1840 (Muller 1842, 1866) show that *C. scutulata* formerly had a widespread distribution in South-east Asia, with confirmed records from nine countries (Fig. 1) as summarised below.

2.1.1 India

Formerly widespread in North-east India. Recorded in Lower Assam, Upper Assam, Arunachal Pradesh, Nagaland, Manipur, Meghalaya and Tripura. Possible records from Madhya Pradesh, Chota Nagpur and West Bengal. Formerly "common" in Lakhimpur and Dibrugarh Districts, Upper Assam (Hume & Marshall 1880), and the fourth commonest wildfowl species in forest bheels of the Sadiya Frontier Tract (Upper Assam) during the palaearctic winter when this area is visited by large numbers of migrants (Parsons 1940).

2.1.2 Bangladesh

Present in the Chittagong Hill Tracts with possible records in the Ganges-Brahmaputra Delta of Central Bangladesh.

2.1.3 Union of Myanmar (Burma)

Widespread. 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. Using regions in current usage, recorded from Kachin State, Sagaing Division, Shan State, Chin State, Bago State, Ayeyawady Division, Yangon Division, Mon State and Taninthayi Division. Formerly "common" in Pidaung Sanctuary, along the Mogaung River and in Upper Chindwin (Stanford & Ticehurst 1939). Also "often seen" on the Mu River and "one of the most characteristic birds of the Shweli river" (Smith 1942).

2.1.4 Thailand

Widespread. Recorded from four of six zoogeographic regions used by Round (1988): the Peninsula, South-west, North, North-east and South-east. Particularly widespread in Peninsular Thailand with records from nine provinces; "very abundant" in Trang Province (Robinson & Kloss 1910-1911) and "fairly common" in Surat Thani Province (Robinson 1915).

2.1.5 Lao People's Democratic Republic

Recorded from Central and South Lao PDR up to 1943.

2.1.6 Viet Nam

Recorded from North Annam and Cochinchina.

2.1.7 Cambodia

Recorded from Kampot Province, Koh Kong, Siem Reap and Ratanakiri up to 1947.

2.1.8 Peninsular Malaysia

Only one confirmed record, from Ipoh in Perak State before 1900. Possible records from Kedah, Tanam Negara and Johore. There is a possibility that the species only ever occurred as a vagrant.

2.1.9 Indonesia

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. Recorded from West and Central Java, and possible record from Siberut Island west of Sumatra.

2.1.10 Original population size

All the records of *C. scutulata* fall within a broad range of about 3,000,000 km^2. If 5% of this area offered suitable habitat to *C. scutulata*, and the birds had an average density of one bird per 100 ha within this habitat (for estimates of density see section 3.8), the original population size of *C. scutulata* would have been about 150,000 individuals. This is a rough estimate, but the minimum population must have numbered some tens of thousands.

PRINTER: PLEASE INSERT FIGS. 1 & 2 HERE

2.2 Current distribution and population (From 1980)

Records since 1980 (Fig. 2) show that *C. scutulata* is still relatively widespread in that it survives in at least six countries, but its distribution is now highly fragmented. Some 41-51 small populations are known to survive in isolated forest areas that have so far escaped destruction. Sites currently holding *C. scutulata* are listed in Table 1, based on locations with records of the species since 1980. The current distribution is summarised below. Local Estimates (LEs) are made of the size of known populations on a site-by-site basis in the national chapters, based either on the number of birds seen or on minimum estimates provided by field workers. These figures refer only to fledged birds and are summed below to produce estimates of the known population at a national level.

2.2.1 India

Recent records from four districts in Assam (Dibrugarh, Nowgong, Silchar, Lakhimpur) and three districts in Arunachal Pradesh (Tirap, Siang and Dibang Valley). Known population 65.

2.2.2 Bangladesh

Recent records from the northern and southern Chittagong Hill Tracts. Known population 30.

2.2.3 Union of Myanmar (Burma)

Birds recently collected from Taninthayi Division just across the border with Prachuap Khiri Khan Province, Thailand. Also a possible record from
Bago State. Known population 0.

2.2.4 Thailand

Recent records from South-west, North-east and the Peninsula. Possible record from the South-east. Known population 27.

2.2.5 Lao PDR

No records since the 1940s.

2.2.6 Viet Nam

Recent records from Cochinchina. Known population 2.

2.2.7 Cambodia

No records since the 1940s.

2.2.8 Peninsular Malaysia

Possible recent record from Johore but no confirmed records this century.

2.2.9 Indonesia

Recent records from five Sumatran provinces: Lampung, Sumatra Selatan, Jambi, Sumatra Utara and Aceh. Extinction likely in Java, as no confirmed records since 1907 and almost all suitable habitat destroyed. Known population 87.

PRINTER: PLEASE INSERT TABLE 1 HERE

2.2.10 Total Population Size

The available data suggest a known world population estimate of 211 individuals split between Indonesia, India, Thailand, Bangladesh and Viet Nam. This estimate is only a very approximate guide, based on LEs that have several sources of error.

Causes of overestimation In some areas where the species was recorded in the 1980s, the pressures from habitat destruction and hunting are so great that the populations are likely to have declined or may have been eliminated. This is particularly true of Pablakhali WS (Bangladesh), Padang Sugihan WS and Sungai Tulang Bawang (Indonesia), with a total known population of 50 individuals.

Causes of underestimation In many sites the LE is likely to underestimate the actual numbers of *C. scutulata* present. Being a retiring forest bird usually seen in ones and twos, *C. scutulata* is very difficult to survey and census. Only two sites have been surveyed in a systematic way: Pablakhali WS, Bangladesh, by posting observers simultaneously to many observation sites (Hussain & Haque 1982) and Way Kambas NP, Sumatra, by discriminating between individuals on the basis of plumage variation (Rudyanto *in litt.* 1990). LEs are conservative in the following ways: they are based merely on the actual number of birds seen rather than some estimate of the number of birds the habitat in the area could potentially hold; all records with reasonable doubt over identification are excluded; when birds have been seen in different but neighbouring locations it is assumed they are the same birds, but this is unlikely to be true in every case; if the number of birds seen by observers is not specified, it is assumed to be one.

In some cases, isolated individuals or pairs of birds have been seen hundreds of kilometres away from the nearest known population in poorly- known regions where considerable areas of suitable habitat remain (e.g. in Viet Nam or North Sumatra), and there is probably a higher population in some of these areas than is presently known.

2.2.11 Potential for Undiscovered Populations

There are likely to be areas of the former range where currently unknown populations of *C. scutulata* still survive. Such populations are most likely to occur where areas of suitable habitat still exist but have not recently been surveyed. Such areas occur in all range countries, but particularly in Myanmar, Cambodia and Lao PDR where ornithological surveys have been rare or non-existent in recent decades, and where suitable habitat is known to survive in various locations that previously held *C. scutulata*. There are also extensive areas of apparently suitable habitat remaining in Sumatra in areas where the presence of the species has yet to be confirmed (Fig. 12). Some of these areas are currently inaccessible (e.g. Cambodia, northern Myanmar), but the others should be high priorities for future surveys since most of them are likely to be deforested within the next few decades if current trends continue (2.4.1).

2.2.12 Extent of Population Decline

Taking the above factors into account, *C. scutulata* is likely to survive in six to eight countries with an actual total population size exceeding the known 211 individuals. There are insufficient data to produce a meaningful estimate of total size, but the extent of remaining habitat indicates that the population could number up to several thousand individuals. This suggests that the world population size of *C. scutulata* has declined to less than 5% of its former size. The extent of decline is demonstrated to some extent by comparing former and current records in Figs. 1 and 2.

2.3 Habitat

Few authors have described the habitat occupied by *C. scutulata* in detail, but the nature of the habitat can be inferred to a large extent by studying the location of records.

2.3.1 General features

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

As man's impact on habitats in Asia has increased, there have inevitably been many changes to the habitats of *C. scutulata*. Thus the species is currently recorded from many areas of secondary forest with no surviving primary forest; the majority of current Sumatran sites contain no primary forest (Lambert 1988). Breeding in secondary forest is confirmed in southern Sumatra and Bangladesh, and a nest was found in Bangladesh by Husain & Haque (1982) in a mature Barta tree *Artocarpus lakoocha* in a secondary reserve forest of Teak trees *Tectona grandis*.

As a result of widespread habitat destruction, many of the sites currently occupied by *C. scutulata* are areas of open, degraded forest. This is particularly true in South-east Sumatra, where most of the current sites are considerably degraded, with only small patches of forest amongst grasslands and agricultural areas. At Way Kambas NP, Sumatra, the birds are known to travel at least 6 km from the nearest forest across open, populated terrain to reach ricefields, suggesting that a limited area of open country may not be a significant barrier to dispersal between forest areas. Whilst *C. scutulata* is a shy forest bird generally sensitive to disturbance, at times it seems tolerant of a considerable degree of disturbance and has been been recorded in rice fields both during the day and at night.

The species currently appears to be using habitats in Sumatra that are more open than those used elsewhere in its range, where the great majority of records are still coming from densely forested areas. There is, however, no evidence that this indicates a biological difference between the Indonesian and continental populations, and there are two possible alternative explanations. Firstly, 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, e.g. 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. Secondly, *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.

2.3.2 Altitude

The majority of records have come from lowland areas of less than 200 m altitude. Similarly, all the locations in which the species has formerly been described as "common" (e.g. Upper Assam; Shweli, Mogaung, Mu and Upper Chindwin rivers in Myanmar; Trang and Surat Thani Provinces in 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 such as plateaux 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 WS, Thailand (Round *in litt.* 1990), 900 m in North-west Manipur (Huggins 1913), 810 m at Nam Dapha NP, Arunachal Pradesh (Neog *in litt.* 1990), c.700 m at Nape (Delacour 1929) and over 800 m at Bolovens Plateau in Lao PDR (Engelbach 1932). The highest breeding record is from over 500 m in Phu Khieo WS (Round 1990). These records suggest that altitude *per se* may not be limiting to *C. scutulata*, but rather that their 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, allowing the species to occur 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, e.g. in the Peninsula, and the species is currently known at six sites, five of which are wholly above 250 m altitude. Birds are being recorded from high plateaus e.g. at 700 m in Thung Yai WS and 900 m in Phu Kheio WS.

2.3.3 Forest types

Maps of original vegetation (Mackinnon & Mackinnon 1986) were used to approximate the forest types in locations where *C. scutulata* has been recorded. 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 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 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, Savannah 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. In areas of deciduous formations, *C. scutulata* may perhaps depend on narrow bands of Gallery Evergreen Forest flanking watercourses.

---PRINTER: PLEASE INSERT TABLE 2 HERE

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. Nest sites have been found in Freshwater Swamp Forest. On the continent, there are only confirmed records from swamp forest at two sites (both recent), and no evidence of breeding. These apparent differences in habitat use between Indonesia and Continental Asia are difficult to interpret, and 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, Viet Nam), but most of these have long since been extensively deforested (Mackinnon & Mackinnon 1986).

Data on tree species used for nesting are limited, but they are likely to vary somewhat as the species available change across the wide range of *C. scutulata*. *C. scutulata* is likely to use those tree species that grow in an appropriate position with cavities suitable for nesting. 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 & Haque 1982). 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.

2.3.4 Wetland Types

C. scutulata uses a variety of relatively small, shallow, sluggish or stagnant wetlands in forest areas (Table 3). Forest streams, forest pools and small lakes, small forest rivers, marshes and ricefields are particularly important. Many authors in India and Bangladesh have reported that *C. scutulata* prefers wetlands in particularly dense forest (e.g. Parsons 1940 "the more overgrown and sheltered in dense jungle the pool happens to be, the more likely these birds are to be found"). 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). The largest stagnant wetlands where *C. scutulata* has been recorded are swamps of several km^2 in area in Sumatra (Lambert 1988). Swamps used are mainly inland, freshwater, non-acid swamps including some newly formed where 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 water-logged plain suggesting a degree of dependence on permanent freshwater swamps that occur in these areas (Lambert 1988).

PRINTER: PLEASE INSERT TABLE 3 HERE

As man's effect on forest areas has spread, *C. scutulata* is likely to have increased its use of artificial wetlands such as rice fields. Regular use of rice fields was recorded as early as 1910 in Thailand (Robinson & 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 important in Way Kambas NP and possibly other areas are also man-made where logging tracks have dammed small streams (Chambers 1990).

2.4 Threats

2.4.1 Deforestation

The destruction of suitable forest habitat is the single major cause of the drastic decline in the *C. scutulata* population this century. Deforestation has being going on for centuries in South-east Asia and has become very extensive in recent decades. This follows an acceleration in deforestation associated with a rapid

increase in local human population and economic development (Collins *et al.* 1991). The causes of deforestation in areas where *C. scutulata* was formerly recorded are complex and include a range of activities: forestry, shifting and large scale agriculture, construction of reservoirs for hydro-electricity and irrigation and warfare. Forest conversion for rice production has been particularly widespread, with tea also a major crop in North-east India. Warfare has been a major factor in Indochina, destroying 2,000,000 ha of forest between 1945 and 1975 in Viet Nam alone. At least 17 hydro-electric dams have destroyed lowland forest in Thailand (Round 1988) and the proposed Nam Choan dam would flood all the lowland riverine forest in Thung Yai WS, a major site for *C. scutulata*. The project was shelved in 1988. Kaptai reservoir in Bangladesh flooded forest where *C. scutulata* occurred (Husain & Haque 1982).

Total forest cover is now less than 50% of land area in all nine countries in the *C. scutulata* range (Fig. 3). Total forest cover ranges from 49% in Sumatra and 47% in Myanmar and Peninsular Malaysia down to under 8% in India and only 6% in Bangladesh (Collins *et al.* 1991). Over the whole range, there are some 1,000,000 km^2 of forest remaining, about 33% of land area. About 27% of land area is covered with forests below 900 m in altitude. These figures understate the extent of destruction of *C. scutulata* habitat for a number of reasons. The figures for forest cover include vast areas with forest types or terrain that are totally unsuitable for *C. scutulata*; they also include large areas of degraded forests and plantations. Furthermore, deforestation has been most rapid and extensive in lowland forests in coastal plains and along major waterways or 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, where *C. scutulata* was formerly "common" in some lowland areas, 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). There has been only one confirmed record of *C. scutulata* in Peninsular Thailand in the last 50 years. Similarly, in Java only 3% of non-montane forest remains and *C. scutulata* is probably extinct.

----------PRINTER: PLEASE INSERT FIGURE 3 HERE----------

Of the remaining forest areas quantified in the above figures, some have been clear-felled and replaced with plantations not likely to be suitable to *C. scutulata*. Most of the other lowland areas are secondary forests that have been partially felled or selectively logged at some stage. Selective logging removes most large, old trees from a forest area and, since *C. scutulata* depends on such trees for breeding, some heavily logged areas of former habitat may not be able to support the species unless the trees are allowed to regenerate for a considerable period. In Bangladesh old softwood trees used by the ducks are particular targets for selective felling for plywood and other uses (Husain & Haque 1982). In Assam regeneration of some secondary forest areas has been prevented by the spread of introduced *Makinia* vine (Mackenzie *pers. comm.* 1990). As development pressure has intensified, rotation cycles in forest reserves and in shifting agriculture have been shortened, giving less chance for the forest to regenerate to a mature stage at which sufficient tree cavities are likely to be available for *C. scutulata* to breed effectively. In Sumatra Production Forest areas logged under licence usually end up being clear-felled as, once they have been selectively logged, they are generally logged further and reclaimed for other uses (Silvius *in litt.* 1991).

Estimates of ongoing annual deforestation rates range from 80 km^2 in Bangladesh to 6,000 km^2 in Myanmar (Collins *et al.* 1991). Over the whole *C. scutulata* range, deforestation is continuing at about 15,000 km^2 per annum, about 1.5% of remaining forest. Again this is particularly affecting lowland forest areas likely to support *C. scutulata*, and all known populations outside protected areas (and many of those inside) are at risk of being eliminated by habitat destruction over the next 20-30 years if no preventive action is taken. Fig. 13 demonstrates this situation in Sumatra, an area still holding considerable amounts of lowland habitat suitable to *C. scutulata*. In Sumatra all forest outside protected areas is forecast to be destroyed within the next 15-25 years, leaving a small number of totally isolated protected areas of which only two are known to hold *C. scutulata*. Thus of 14 Sumatran *C. scutulata* populations identified, only two are forecast to have

a chance of survival. This process of extensive deforestation and fragmentation of remaining habitat is already further advanced in other range countries such as Bangladesh, Thailand and Viet Nam. Ongoing deforestation through illegal logging is even commonplace in many of the protected areas where *C. scutulata* is currently found. Many (e.g. Pablakhali WS in Bangladesh, Padang Sugihan WS and Way Kambas NP in Sumatra) have been severely degraded after the area was officially declared protected, although protection in Way Kambas NP is now much more effective. In Thailand deforestation has been slowed down since a logging ban imposed in December 1988. This is only partially effective and illegal logging is still widespread, even in protected areas (Round 1989). Furthermore, there is evidence that the ban has accelerated deforestion in neighbouring countries, where Thai timber merchants have begun operating (BBC Wildlife Magazine, October 1989).

Deforestation rates are particularly high in areas where the local human population is increasing very rapidly through migration. In Sumatra large numbers of spontaneous and government-sponsored migrants from Java are accelerating habitat destruction in the south-east corner that is the source of most recent *C. scutulata* records. Owing to its intense population pressure, Lampung has recently had the highest deforestation rate of any Indonesian province. Since 1969 about 750,000 people have been moved to Sumatra in official programmes and perhaps 3.7 million people have moved spontaneously, two million of them to Lampung. Consequently, Holmes (1990) considered it likely that all remaining forest in the four areas of Lampung where he observed *C. scutulata* in 1976-1977 have now been cleared. In and around Pablakhali WS, Bangladesh, large numbers of people from the plains have been resettled since the mid 1980s, greatly accelerating deforestation (Khan 1986; Scott 1989). In Assam the population has been greatly increased since 1950 by the rehabilitation of refugees from surrounding areas, particularly Bangladesh (Mukherjee 1961).

Holmes (1990) suggested that, in Sumatra, the first phase of forest clearance may have actually 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 rice fields surrounded by still vast areas of suitable forest habitat. Indeed, they were "fairly common on ricefields" in Peninsular Thailand in 1913 (Robinson 1915). Deforestation has now become so extensive as to go well beyond this point in most regions, with so little forest remaining that it is difficult for the birds to roost and breed securely.

2.4.2 Effects of Habitat Fragmentation

The fragmentation of remaining forests into small, isolated forest blocks is a growing phenomenon across South-east Asia (Collins *et al.* 1991). This fragmentation may result in the eventual elimination of *C. scutulata* from remaining forest areas that currently hold the species, for several reasons. Firstly, an isolated forest block may not be large enough to support a viable population of the species. Secondly, a severe drought, epidemic or other disaster may eliminate secluded populations without a chance of recolonisation from neighbouring areas. Thirdly, isolation may prevent local or seasonal movements vital to the survival of a population. While *C. scutulata* does not generally migrate long distances and may be resident in relatively small forest areas, nothing is known of individual movements. Breeding has been confirmed in very few locations, and some records may refer to vagrant birds. Thus regular local or seasonal movements cannot be ruled out. When forest coverage was more continuous, birds may conceivably have moved around in response to environmental variation, e.g. in rainfall or availability of feeding habitat. Thus birds may sometimes have moved up to wetter, higher altitude areas in the height of the dry season and moved down again to lowland areas in the wet season. Similarly, during local droughts they may have deserted areas where they were normally resident. However, it is worth noting that *C. scutulata* has been recorded from high altitudes both during the dry season (e.g. 1,500 m on Doi Inthanon, Thailand in January 1935) and wet season (e.g. 900 m in North-west Manipur in July 1913).

2.4.3 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 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 *pers. comm.* 1991).

2.4.4 Drainage

As well as destruction of their forest breeding and roosting habitat, 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). Many swamps have been drained in inappropriate ways: e.g. many Cambodian swamp forests have been converted to highly acidic, treeless plains by misguided efforts to convert them for agriculture (Collins *et al.* 1991). 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.

2.4.5 Hunting and Trade

Whilst deforestation is the primary cause of decline in *C. scutulata*, the opening up and fragmentation of forests lead increasingly to encounters between the ducks and man. Being a large bird that sometimes uses rice fields and boundary areas between forest and agricultural land, *C. scutulata* is an obvious target for hunting by the increasing 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. Eggs are also taken from the nest. Hunting of *C. scutulata* is known to occur in India, Bangladesh, Thailand and Indonesia, and poaching is routine in many of the protected areas, such as all those in Thailand (Round 1988).

Various parts of the range are suffering security problems through insurgency (e.g. northern and eastern Myanmar) or civil war (Cambodia). In these areas, firearms are widely available and likely to be used for indiscriminate hunting. Furthermore, the presence of armed soldiers and guerrillas in remote forests may threaten the ducks in areas where they would otherwise by safe. In other countries such as Thailand and Viet Nam, security problems have almost ceased but firearms are still abundant and in widespread use. 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 (Stewart Cox *pers. comm.* 1991). Three of these birds were later taken into the Thai captive breeding programme. In Sumatra a villager was paid by a westerner for a bird and eggs in 1985 (Lambert 1988), while Kuah (*in litt.*) saw four birds on sale at a Java market in 1991.
Even though most hunting of the species goes unrecorded, data from India and Bangladesh suggest that, in areas with a dense human population, it can be intense enough to eliminate the species from forest where it would otherwise be able to survive. In Pablakhali WS, Bangladesh, 74% of 31 ducklings in eight broods located by Husain & Haque (1982) in 1977 and 1978 were 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 (WWF Yearbook 1969; 13 juveniles were diverted for captive breeding) when the total fledged population in the district may have been less than 100.

2.4.6 Disturbance

Most, and possibly all, *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 in the wetlands 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. There are various other sources of disturbance that may be significant.
C. scutulata has recently been recorded on several occasions at Lake Lakutu in Thung Yai WS, Thailand, but this site is now a regular landing site for border police helicopters. Some of the protected areas containing *C. scutulata* are open to tourist use, possibly causing disturbance. This is particularly true in Way Kambas NP, Sumatra which is being developed as a major tourist attraction. A new road has been developed that runs alongside several forest ponds where *C. scutulata* has been regularly recorded since 1988, causing much disturbance.

2.4.7 Pesticides

In four countries, *C. scutulata* has been recorded feeding in rice-fields (Table 3), where in recent decades it is likely 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 several countries (e.g. Round 1988), and they may be having a negative impact on *C. scutulata* in some areas. The persistent pesticides DDT and Dieldrin were found in water samples collected from two protected areas in Thailand where *C. scutulata* is found (Nakhasathien & Cox 1990). In Sumatra, fishermen use pesticide cocktails to kill fish in streams and rivers that flow into Way Kambas NP, a major site for *C. scutulata* (Chambers 1990).

2.4.8 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. This causes pollution, and *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 (Mackenzie *in litt.* 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.

2.5 Conservation measures taken

2.5.1 Species Protection

C. scutulata is granted legal protection from hunting, collection etc. in five countries: Bangladesh, India, Myanmar, Thailand and Indonesia. This protection is, however, ineffective as there is little if any attempt to enforce it or to educate hunters about the law. *C. scutulata* is also listed on Appendix 1 of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

2.5.2 Habitat Protection

A network of protected areas exists or is planned in all range countries with the exception of Cambodia, and is most effective in India, Thailand and Indonesia. Whilst high altitude areas are relatively well represented in these systems, lowland forest systems suitable for *C. scutulata* are relatively under-represented. However, at least 13 populations of *C. scutulata* currently occur in protected areas (Wildlife Sanctuaries and National Parks) in India, Bangladesh, Thailand, Viet Nam and Indonesia (Table 1). These areas have a combined known population of 122 birds, 58% of the known world total. Dibru-Saikhowa WS 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 Wildlife Sanctuaries in India and Bangladesh, forestry and other concessions are still granted whilst certain wildlife needs have priority,

particularly those of large mammals. In practice poaching, illegal logging and other forms of encroachment are widespread problems, and are particularly common in the low-lying fringes of protected areas likely to be of particular importance to *C. scutulata*. These problems are so extreme in Pablakhali WS, Bangladesh, and Padang Sugihan WS, Sumatra, that their *C. scutulata* populations are under immediate threat of extinction. The other 28 populations of *C. scutulata* identified are not in protected areas, although 11 of them occur in Reserve Forests or Non-hunting Areas 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 *C. scutulata* in the near future.

2.5.3 Captive Breeding Programme

In view of the critical status of the species in the wild, the maintenance of a captive population is a key element in *C. scutulata* conservation. Captive breeding has led to a population now totalling c.280 birds spread between several countries but derived almost entirely from Assamese stock. There are currently considerable problems of disease and lack of genetic diversity in the captive population (Tomlinson *et al.* 1991).

2.6 Evaluation

2.6.1 Viability

There are 41 known populations of *C. scutulata* with an average size of only 5.1 fledged adults per area. The largest population estimate is 30 in Way Kambas NP, Sumatra. If the populations really are as small as this, they are all likely to be non-viable in the long term. Such small populations are likely sooner or later to be eliminated by some natural disaster such as a forest fire, epidemic or extreme drought. Furthermore, a population of 50 to 500 individuals has been suggested as the minimum effective size of a population of any bird species which can maintain short-term fitness and long-term genetic adaptability (Franklin 1980; Soule 1980).

2.6.2 Classification of Status

C. scutulata is listed on the IUCN Red List as Vulnerable ("Taxa believed likely to move into the Endangered category in the near future if the causal factors continue operating", WCMC 1990). However, IUCN categories are currently being revised to incorporate more objective criteria. Since the known world population is only 211 individuals divided between 41 small, isolated populations, *C. scutulata* qualifies for the highest category of threat, Critical on the basis of the new qualititative criteria proposed by Mace & Lande (1991). Even assuming the best case scenario in which the current world population is greatly underestimated, the species still seems likely to qualify for the Endangered category on the basis that the total population is below 2,500 and there are fewer than three subpopulations with more than 1,250 individuals.

2.6.3 Conclusions

C. scutulata is now one of the most endangered species of Anatidae in the world, having undergone a drastic decline in population size this century. *C. scutulata* now has a highly fragmented but fairly widespread distribution across at least five countries in South-east Asia. The species survives in a number of small populations in isolated forest areas, mainly in Indonesia, India, Bangladesh and Thailand. Its decline is continuing and little direct action has so far been taken to prevent it. Habitat destruction is undoubtedly the main cause of decline, and the majority of former habitat has been totally destroyed. In addition, most remaining habitat has been degraded to a large extent and is forecast to be destroyed within the next few decades if current trends continue. Over-hunting is a second major problem with extreme hunting pressure in some areas.

Action is urgently required to prevent a further decline and to allow local populations to increase. Adequate protection from habitat destruction and hunting must be provided for more populations, and habitat must be improved through appropriate management in protected areas to allow *C. scutulata* populations to increase. Improving protection of *C. scutulata* habitat will not be easy because of the enormous economic pressures for the development of tropical forests, but this makes the conservation of this species all the more important since it will further the conservation of these highly complex ecosystems. It is not, however, likely to be politically possible to protect the species adequately in all its known sites.

Conservation action must begin immediately because of the extremely threatened status of the species. More data on current distribution and size of known populations are required in order to clarify which populations are largest and thus 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 (Chapter 3) needs to be improved. 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 *C. scutulata* populations.

2.7 Conservation action

Full details of conservation action recommendations are given on a country by country basis in the national chapters. An overview of the main recommendations is given below.

2.7.1 Education and Awareness

Local awareness campaigns should be centred around all *C. scutulata* Key Sites to encourage protection and discourage hunting. These campaigns should particularly target decision makers, forestry staff and local people. *C. scutulata* can be used as a "flagship" species to encourage protection of the ecosystems it shares with many other species, and should be included in any general threatened species education campaigns in range countries.

2.7.2 Species Protection

C. scutulata should be granted full specific legal protection in Viet Nam, Lao PDR and Myanmar. In Thailand, it should be made a "nationally reserved animal" to make possession of the species illegal.

2.7.3 Surveys

Known sites in South-east Sumatra are the only ones that have received detailed surveys for *C. scutulata* in recent years. All other sites (Table 1) require field surveys to establish the size and distribution of the *C. scutulata* population. See Appendix 2 for advice on survey techniques. In addition, the following sites are high priorities for surveys, because there is a good chance that they still hold the species:

i. India: Pabha WS, Itanagar WS, Intanki WS, Dampa WS, Digboi RF, Tinkhopani RF, Hollongapohar RF, Desangmukh RF, Mikir Hills RF, Dhansiri RF, Tirap Evergreen RF, Inner Line Forest RF.

ii. Bangladesh: Rangkheong RF.

iii. Myanmar: Chatthin WS, Yin Ke RF, Paunglin RF, Hlaing Yoma RF.

iv. Thailand: Nam Nao NP, Tab Lan NP, Pang Sida NP, Phu Jong Na Yoi NP, Khao Phanom Dongrak WS, Khao Ang Ru Nai WS, Mae Wong NP, Umphang WS, Kaeng Krachan NP.

v. Lao PDR: Nakai Plateau, Tha Teng, Dong Khan Thung.

vi. Viet Nam: Ma Da, Yok Don.

vii. Peninsular Malaysia: Jemalaung RF.

viii. Indonesia: Bentayan, Sembilang, Berbak, Singkil Barat, Bukit Batu, Siak Kecil, Danau Bawah-Pulau Besar, Bakau Muara Kaupas, Kerumutan Baru, Muara Sungai Guntung.

2.7.4 Improving Policing in Protected Areas

All logging concessions granted in protected areas containing *C. scutulata* (e.g. Pablakhali WS, Bangladesh) should be revoked. Illegal logging, hunting and other disturbance are threatening *C. scutulata* in all the protected areas. Where resources allow, policing should be improved to control these problems. This could be done by improving staffing or equipment or by improving the effectiveness of existing staff, e.g. by training or incentives. Tourist development in Way Kambas NP should be carefully managed to prevent disturbance to *C. scutulata*.

2.7.5 Extending Protected Areas

Protected area boundaries should be extended to incorporate any adjacent lowland forest areas of value to *C. scutulata*. Such extensions should urgently be considered in Dibru-Saikhowa WS, Nam Dapha NP (India) and Phu Khieo WS (Thailand). Buffer zones should be established around all protected areas to reduce encroachment into the sites.

2.7.6 Creating and Upgrading Protected Areas

Two thirds of known *C. scutulata* sites are unprotected. Following field surveys, the most important of these sites should be granted protected status. The following sites should be granted protection immediately, owing to their known importance to *C. scutulata*: Doom Dooma RF (India), Pa Phru NHA (Thailand), Sungai Tulang Bawang, Cabang/Sungai Seputih and Kayu Agung (Indonesia). In order to improve its protection status, D'Ering Memorial WS (India) should be upgraded to a National Park.

2.7.7 Habitat Management

Habitat management plans for protected areas containing *C. scutulata* should be geared towards improving the habitat for the species. Recommendations for management are provided in Appendix 4.

2.7.8 Protecting Nesting Trees

Old trees suitable for nesting should be left standing in any selective logging permitted in and around *C. scutulata* sites, protecting these trees by law. In Sumatra, logging of Rengas trees should be illegal and they should be excluded from any legal concessions.

2.7.9 Nest Boxes

The low density and small size of *C. scutulata* populations appear to be critical. In forest areas that have been logged, one factor causing this is likely to be a shortage of suitable nesting habitat. Nest boxes for *C. scutulata* should be put up on a trial basis in secondary or degraded forest sites where they can be closely monitored and guarded. See Appendix 4.

2.7.10 Field Research

There is an urgent need for thorough field research into *C. scutulata* biology. For conservation purposes, detailed information is required on a range of topics: habitat requirements for breeding, feeding and roosting; extent of home ranges or territories; seasonal movements and changes in habitat use; factors limiting density and breeding success of the population. Long term field projects are required to address these questions. Such a project would be suitable for an Asian PhD student and should begin as soon as possible in at least one site in India, Thailand or Indonesia. As there are major differences between the Indonesian and continental populations, there should be at least one study in each. Way Kambas NP, Sumatra, would be the most suitable site in the short term, as detailed field survey work has already been carried out there in recent years and there is a known sizeable population of at least c.30 birds. Other sites with great potential include Dibru-Saikhowa WS, India, and Thung Yai WS, Thailand. Long-term research should follow detailed surveys of these sites. See Appendix 3 for field projects that can be conducted in short-term field studies.

2.7.11 Reintroductions

Reintroductions of *C. scutulata* have been considered for some time. However, the preconditions necessary for a successful reintroduction have not yet been met for the species (see Appendix 5). There are 41 populations identified in the wild, and the biggest conservation problem is their small size rather than their number. Rather than attempting to establish new populations, the highest priority for the immediate future is to improve protection and habitat for existing populations to allow them to recover.

2.7.12 Captive Breeding Programme

There is a need for improved international coordination of captive breeding to ensure that the captive population functions effectively as a reserve population. The Wildfowl & Wetlands Trust is seeking data from all breeding centres to establish an international studbook as an aid to genetic management. A meeting of institutions involved in captive breeding should be held to agree detailed objectives for the programme.

2.7.13 Taxonomic Research

Molecular studies should be conducted to investigate the differences between the continental and Indonesian populations (see 3.10). Enough skins exist in museums to begin such an analysis.

Table 1. Sites where *C. scutulata* has been recorded since 1980, listed by region with Local Estimates of population size based on sightings or field workers' minimum estimates. WSs and NPs offer protection from habitat destruction and hunting. RFs and NHAs offer protection from hunting. PT = Peninsular Thailand, NET = North-east Thailand, etc. * = Key Sites particularly important to the conservation of *C. scutulata*. [] = Possible Sites, where *C. scutulata* has recently been reported but there exists reasonable doubt over the reliability of the report.

INDIA			
1.	Dibru-Saikhowa WS, Assam	20	*
2.	Nam Dapha NP, Arunachal Pradesh	7	*
3.	D'Ering Memorial WS, Arunachal Pradesh	4	*
4.	Mahao WS, Arunachal Pradesh	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	
	[North Cachar Hill & Barail RF, Assam]		
	[Hansara, Assam]		
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.	Phu Khieo WS, NET	2	*
3.	Lam Dom Yai/Yot Dom WS, NET	10	*
4.	Pa Phru NHA, PT	2	
5.	Khao Yai NP, NET	1	
	[Ampoe Khun Han, NET]		
	[Khao Soi Dao WS, SET]		
	[Ao Phang-nga NP, PT]		
	[Ampoe Khongchiam, NET]		
	[Sanambin NHA, NET]		

VIET NAM (Cochinchina)

1. Nam Bai Cat Tien NP	2	*

PENINSULAR MALAYSIA (Johore State)

[Kota Tingii Waterfalls]

INDONESIA (Sumatra)

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

	TWE	TSE	TME	MWT	TMD	MDF	MLO	FSW	PSW	MAN			
INDIA		+		+		+		+					
BANGLADESH		X[n]		X[n]				+					
MYANMAR		+		+					+	+			
THAILAND				X		X			X		?	X	
LAO PDR				+		+							
CAMBODIA		+		?					?		?		
VIET NAM				+							X		
MALAYSIA		+											
INDONESIA		?		?							X[n]	X	X
Total		5		6		2		1	2		2	2	1

Table 2. Forest types where *C. scutulata* has been reliably recorded, following the vegetation classification used by Mackinnon & Mackinnon 1986.

+ = record according to vegetation maps (Mackinnon & 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.

Total = number of countries with records from each forest type.

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 Forest.

	STR	RIV	OPE	SWA	MAR	LAK	RIC	VAR
INDIA	+	+	X	#		#	+	+
BANGLADESH	#					#		
MYANMAR	+	+		+	+	+	+	+
THAILAND	#					X	#	
LAO PDR	+				+	+		
VIET NAM	+			X		+		
INDONESIA		X		#	+	#	X	
Total	6	3	1	4	3	6	4	2

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

+ = former record (pre 1980).

X = current record (post 1980).

= both former and current records.

Total = number of countries with records from each wetland type.

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 = rice fields.

VAR = a variety of small stagnant wetlands: puddles, water holes, salt licks and tea waste destruction ponds.

3. *C. SCUTULATA* ECOLOGY AND BEHAVIOUR

The most thorough field study of *C. scutulata* to date is that of Husain & Haque (1982) in the Chittagong Hill Tracts, Bangladesh, from 1976 to 1978. Their observations were concentrated in the wet season, when birds were easier to observe. The second most detailed study is that of Chambers (1990) in Way Kambas NP, Sumatra, from August 1988 to July 1989, when birds were observed on 104 of the 300 days that the research team was present.

3.1 DIEL RHYTHMS

C. scutulata has peaks of locomotory and feeding activity at dawn and dusk, and birds are most often seen in flight at these times. Many authors describe birds as being seen regularly at dawn or dusk. For example, of seven sightings in Myanmar when the time of day is mentioned, five refer to flying at dusk and the other two refer to flying at dawn and dusk. Hutchinson (1946) refers to a drake seen flying down the Dhansiri river, North-east India, every night at dusk (around 1830 h) in July 1945. Evans (1901) describes how a pair of *C. scutulata* visited a jheel near Bhamo, Myanmar, every evening but was never present during the day. When one bird was shot, the other continued to visit the jheel and was shot two nights later. In the Jade Mines of Myitkyina district, Myanmar, Stanford & Ticehurst (1939) saw *C. scutulata* "flighting regularly at dusk to feed on wet stubble where streams ran out into the fields". Smith (1942) stated that *C. scutulata* was regularly observed flying along the Shweli river, Myanmar, at dawn and dusk singly or in pairs.

Reports on how the birds spend the nights and days vary somewhat. Many authors have suggested that birds are relatively inactive in the middle of the day but remain close to feeding sites, while at night they roost farther away in the forest. Mitra (1957) and Gee (1958) observed that in the middle of the day the ducks remain in the shade of a tree on the water or on a branch. Mackenzie & Kear (1976) found that they sometimes roost "on driftwood or on low branches over the water" at this time. In captivity, Baker (1908) found that, all year round, birds stayed in the shade from 1000 to 1400 hours. In southern Sumatra, Hoogerwerf (1950) reported that *C. scutulata* sleeps at night on broad branches of high trees, and that it sometimes roosts in the same place for months in succession. In Thung Yai WS, South-west Thailand, birds are thought to roost in trees at night and forage during the day in meandering streams in the forest (Round *in litt.* 1990). A pair seen at Lake Lakutu in an undisturbed part of Thung Yai WS on 1.4.88 flew into the lake in the late afternoon, perched in the crown of a 27 m high tree and roosted there overnight before flying out before first light the next day.

Husain & Haque (1982) found that breeding birds outside the breeding season and non-breeding birds throughout the year flew singly or in pairs to feeding grounds at a ditch or stream around dawn and spent the whole day there. At dusk, they flew away to roost in trees in the forest, either at the edge of the stream or creek where they fed, or deeper into the forest. While at the feeding site, feeding was concentrated in the morning and evening. The middle of the day was spent sitting on a log in water or on the bank, or floating under the shade of a Jarul tree *Lagerstroemia speciosa*. During 55 h of observations of an unknown number of birds over 13 days, feeding was more intense in the morning than in the evening. In the morning, 57% of the time was spent feeding and 43% resting and preening. In the evening, only 35% of the time was spent feeding. Preening bouts were conducted on the bank, a low tree overhanging the water or on a log.

Some authors report an even stronger crepuscular pattern in which birds only visit wetlands at dawn and dusk times. Husain & Haque (1982) found that breeding pairs in Bangladesh only left the nest site to feed around dawn and dusk (see below). Robinson & Kloss (1910-1911) found that in Trang province, Thailand, *C. scutulata* came "down to the partially flooded rice fields to feed in the early morning and late afternoon. In the evening, after feeding, it went off to roost in the patches of jungle growing on small and steep hills rising from

the general level of the rice-fields."

Other authors have reported the birds feeding throughout the night, suggesting a nocturnal rhythm. Ali & Ripley (1968) state that the birds fly at dusk to feed in more open waters and marshes during the night, returning at dawn to secluded forest pools. Choudhury (*in litt.* 1990) found that captive birds in India are most active at night and Mukherjee (1961) found that wild birds made nocturnal visits to standing crops around Assamese villages. Scott (1989) reports that in Lam Dom Yai, North-east Thailand, "a few individuals are believed to flight out of the forests at night to feed in rice paddies". Delacour & Jabouille (1931) describe *C. scutulata* in Laos and Vietnam as spending the day roosting on large trees in the forest, and flying to marshy clearings in the forest at night to feed. Smith (1942) proposed that birds on the Shweli river in Myanmar spent the day on small inaccessible water bodies in the middle of the forest, and flew down to the main Shweli river at dusk to spend the night there, returning to the forest at dawn.

Way Kambas study Chambers (1990) obtained numerous data on activity in daylight hours between 0500 h and 1900 h. These reveal a strong dawn and dusk peak to activity with most sightings being made in early morning and evening (Fig. 4). These crepuscular peaks occur for each month in the year, but beyond this there is considerable variation in the timing of duck activities. Sometimes birds showed a nocturnal feeding pattern: at forest ponds, birds were usually observed to arrive in the evening to feed, stay the whole night and leave the following morning. However, on two occasions a duck remained on a pond the whole day and fed in direct sunlight in the middle of the day. At rice paddies, birds flew in late in the afternoon and returned to forest either at dusk or the following morning, presumably after feeding through the night. Chambers made no direct behavioural observations at night, but locals reported hearing birds flying over fields at night. At Rawa Gajah on the Way Kanan, where birds were regularly seen in December and January, they were seen flying into or out of the swamp or feeding in it at all times of the day, whilst still having a crepuscular peak in sightings. At 1415h on 17.12.88 a pair of ducks was found asleep under a bush in a well-vegetated part of the swamp, suggesting that they were roosting alongside their feeding habitat.

----------**PRINTER: PLEASE INSERT FIGURE 4 HERE**----------

Conclusions The diel rhythm of *C. scutulata* is rather variable but has a strong crepuscular peak in activity. Whether birds feed through the day, through the night or just at crepuscular times, their movements between feeding, roosting or nesting sites are concentrated at dawn and dusk. Such peaks in activity just after dawn and just before dusk are rather typical of tropical forest birds, and have been observed e.g. in the Salmon-crested Cockatoo *Cacatua moluccensis* (Bowler pers. comm.). Various observations suggest that *C. scutulata* adjusts its diel rhythm opportunistically, perhaps according to the timing of food availability or of habitat disturbance. Thus a nocturnal feeding pattern may be a response to hunting pressure and general human disturbance, particularly in rice fields. Activity is also likely to vary according to food availability and the breeding cycle: birds are likely to spend longer at feeding sites if foraging intake rates are low or if they are putting on energy reserves prior to nesting. Diel rhythms are also adjusted in response to breeding activity and, during incubation, pairs only feed at dawn and dusk. Tim Ekspedisi (1991) found that the ducks in Way Kambas NP only feed at night when sufficient moonlight is available, and rest on moonless nights. On 6.8.90 one duck was observed feeding at night by a full moon, but birds were seen roosting throughout darker nights. On 22.8.90 a duck was seen roosting by a pond at night but became active when a torch was switched on and began feeding in the torch beam.

3.2 SEASONALITY

Most records of *C. scutulata* from Continental Asia come from North-east India, Myanmar and Thailand where the climate is monsoonal with a rainy season from around May to October and a pronounced dry season from around

November to April (Mackenzie & Kear 1976; Smythies 1986; Round 1988; Bhattarcharjee 1990). In the literature, sightings of *C. scutulata* in each of these countries are most frequent in the dry season (Fig. 5). A likely explanation for this is that ornithologists are less active in the wet season because the rains make travel unpleasant and difficult. However, this pattern might also indicate a change in the behaviour of the birds during the wet season that makes them less apparent to man, e.g. a movement from forest edges to deep in the forest associated with breeding. Evidence against this hypothesis comes from Husain & Haque (1982) who found that birds in Bangladesh were easier to observe in the wet season because they were using more open wetlands. During the dry season from December to March, most streams dried up, and the ducks concentrated in the few ditches deep inside the forest that still contained water.

----------PRINTER: PLEASE INSERT FIGURE 5 HERE.----------

The climate encountered by *C. scutulata* in Indonesia is rather variable. In southern Sumatra and Java there is typically a pronounced dry season centred around July and a pronounced wet season centred around December/January, e.g. the dry season in Lampung runs from May/June to October. In northern Sumatra, the climate is wet for 10-12 months of the year with no pronounced dry season in some areas (Silvius *et al.* 1987). The north-west coast of Sumatra has more or less opposite rainfall peaks to the south-east coast (Holmes *in litt.* 1991). In South-east Sumatra, Lambert (1988) and Chambers found that birds were easier to observe in the wet season of November to March when they were using more open, seasonal swamps. During the early dry season, birds were seen most often on small forest ponds, whilst towards the end of the dry season they were hardly seen at all. Local reports suggest that at this time they may move to permanent swamps less accessible to humans.

3.3 BREEDING BIOLOGY

3.3.1 Breeding season

In Bangladesh, Husain & Haque (1982) found the breeding season lasted from March to the end of July, with a wet season from April to November. They found three nests in use: in April 1977 with three eggs, in April 1978 with seven eggs and in June 1977 with four eggs. In mid July 1976, two groups of ducklings that had already fledged were seen at different places (Husain 1977). In captivity, eggs have an incubation period of about 33 days, and chicks take about 14 weeks to fledge (Mackenzie & Kear 1976). This suggests that laying begins in March at the very end of the dry season, and continues until May or June, whilst hatching occurs from April onwards to coincide with the early wet season.

Baker (1908, 1929) referred to a nest with one egg found on 30 June in the hills of North Cachar, India, which was assumed to be of *C. scutulata*. The size of ducklings taken from the wild in Assam for captive breeding in 1969-1975 suggests that laying occurs up to the end of June or early July (Mackenzie 1975). Gee (1958) stated that breeding is believed to occur from May to August. In captivity in Assam, laying begins between 18 March and 4 June (Mackenzie & Kear 1976). A pair of adults with four chicks was seen in Phu Khieo WS, Thailand, on 20.7.90 (Round 1990). A female adult with six ducklings was seen in June 1959 at Pidaung sanctuary, Myanmar (Milton & Estes 1963). Again, these data suggest that breeding in India, Thailand and Myanmar is timed so that hatching occurs in the early phase of the wet season, which begins in May (Fig. 45. Food availability for this duck species that specialises in feeding in shallow water is likely to peak in the wet season when floods increase the area of available habitat.

Information on breeding in Indonesia comes from southern Sumatra and Java. Hoogerwerf (1949, 1950) suggested that *C. scutulata* breeds in the wet season, laying from December to February. He referred to two clutches of unknown size collected in Central Java in February, and unspecified numbers of clutches found in southern

Sumatra in December, January and February. Hoogerwerf received local reports from Lampung that eggs are laid at the height of the wet season when rivers are most flooded. Holmes (1977) was shown a clutch of eight eggs in S. Tulang Bawang on 15.1.77, but these were probably eggs of the domestic muscovy duck *C. moschata* (Lambert 1988).

Local reports of young birds in southern Sumatra are: adult with two young and family of seven young in S. Tulang Bawang, January 1977 (Holmes 1977); pair with young one October in Way Kambas NP (Ounsted 1985); pair with four young October 1985, and pair with two young September-November 1985 in Way Kambas NP (Lambert 1988). Confirmed reports are: Adult with two young on 29.3.88 in Way Kambas (Robson 1988), one adult with four young on 18.7.90 and one adult with five young on 20.7.90 in Way Kambas (Tim Ekspedisi 1991). No information is available on the age or size of the ducklings seen. These data suggest a very prolonged breeding season in southern Sumatra, with young seen from October to July. Nesting must extend at least from September to March. As the dry season in southern Sumatra extends from about May to October, these data suggest that breeding is concentrated in the wet season, but can begin in the last months of the dry season. The timing of the breeding seasons of tropical birds is typically variable (e.g. Medway & Wells 1976), and perhaps the October sightings were made in years when the wet season started particularly early. The timing of breeding by *C. scutulata* is likely to be somewhat different in northern Sumatra with its wetter climate.

3.3.2 Clutch and brood sizes

Husain & Haque (1982) found three, four and seven eggs in nests. Two clutches found in southern Sumatra in December had six and nine eggs, although this may not be the total clutch size as incubation had not yet begun. Locals in Lampung reported that clutches often contained more than 10 eggs (Hoogerwerf 1949, 1950). In captivity, clutch sizes vary from six to 13 with a mode of 10 (Mackenzie & Kear 1976).

From eight broods of ducklings observed by Husain & Haque, the mean brood size prior to fledging was 3.9 ducklings. Similarly, nine broods of ducklings seen in Indonesia, Thailand and Myanmar (seven in Indonesia) ranged in size from two to seven with a mean of 4.0 and Standard Deviation of 1.8.

3.3.3 Nest sites

Husain & Haque (1982) observed three nesting pairs. In addition, "several other trees used by the duck for nesting" were located. The nests were in tree holes "generally 2-2.5 feet deep and the entrance is 1 sq. feet to 3 sq. feet about 1 foot wide" (sic). The nests were lined with straw, leaves, grasses and roots of water hyacinth. In all but one case, the nest tree was a Civit tree *Swintonia floribunda* (fam. Anacardiacae) that was the tallest tree in the middle of a forest area, with a hole situated well above the tree canopy allowing easy access for the ducks. One Civit tree nest hole was 12 m high in a 37 m Civit tree, above a canopy 6 m high. A second hole was 23 m high in a hollow branch of a 38 m Civit tree in primary forest. A third nest was found in a Barta tree *Artocarpus lakoocha* by the side of a stream in the middle of a secondary reserve forest of Teak trees *Tectona grandis* of about 12 m high. This nest hole was well below the canopy, 4 m above the ground, and the ducks used the course of the stream for access. Khan (1983) also stated that other softwood trees such as Chapalish *Artocarpus chaplasha* and Uriam *Mangifera longipes* are used for nesting, although he did not cite any evidence for this.

The nest found in Assam by Baker (1908, 1929) was on the bank of a stream in dense forest where he had seen a pair of adults. The nest was in a deep hollow caused by decay, 6m above the ground in the fork of a thick tree where three boughs branched out from the main trunk. The nest was a mass of grass and other rubbish with a lining of feathers and down.

Hoogerwerf (1950) described a nest in southern Sumatra as lying 3m above the ground at the top of a Rengas tree stump, surrounded by new, leafy shoots from the stump. A second nest was found in a bowl-shaped cavity

between three large branches of a "Boengoer" tree in flower. Both nests consisted of dried leaves, grasses and a few down feathers. Locals from Lampung reported that nests are generally 6-8 m above the ground in cavities between large forks or in large tree holes. Holmes (1977) was shown four reputed nest holes in Rengas trees. One was 4 m up in a deep hollow in a tree fork, in a dense grove of forest. Another was a hole 8m up in the straight trunk of a tree, in the open in a deep swamp. A third was 5 m up in a large hole in the decaying trunk of an old tree standing in tall grass in an open swamp. The fourth was not described.

3.3.4 Courtship behaviour

Chambers (1990) observed a possible courtship display on at least two occasions in December. A pair of ducks swam in an irregular zig-zag manner with one behind the other. Both birds threw their heads back to the shoulder and then forwards in a high arc and down to skim the water. The leader, thought to be the male, initiated the display. This possible courtship display was observed in Rawa Gajah, a swamp used by *C. scutulata* only for an intense period of activity from November to January, when groups of three to six birds were regularly present. This timing and behaviour pattern suggests that this swamp may have been a congregation site for courtship and pair formation.

Copulation was observed twice by Husain & Haque (1982) on shallow water. On 18.4.77 at 1130 h, copulation occurred for 45 seconds, with little display before or after. On 14.3.78 a pair arrived at a ditch at 1630 h and began feeding. At 1720 h, the male stopped feeding and approached the female while head bobbing "up and down a couple of times". They copulated for 60 seconds, then the male gave a loud "kick" call and both birds began preening. They then returned to feeding and flew away at 1818 h.

3.3.5 Incubation Behaviour and Parental Care

Continuous observations of three breeding pairs for 15 days by Husain & Haque (1982) revealed that the female did all the incubation, while the male remained in a tree 180 - 270 m away. The pairs only left the nest site to feed around dawn and dusk. In the morning they left between 0430 h and 0530 h, and returned between 0730 h and 0830 h. In the afternoon they left between 1530 h and 1615 h and returned around 1818 h. The male attended the female closely, initiating the feeding trips by flying to the nest hole. He also escorted the female to the hole on their return, either sitting by the hole or flying around the nesting tree until the female settled down. These behaviours suggest males show mate guarding to ensure paternity of the eggs or to allow the female to increase her foraging rate and fecundity (Owen & Black 1990).

Husain & Haque (1982) found that as soon as the chicks left the nest they moved onto water in ditches, creeks and streams. Parental behaviour after the chicks leave the nest is unclear, as there are six records of one adult being seen with a brood (four from Sumatra) and four records of two adults with a brood (two from Sumatra). This suggests that both adults show at least partial brood attendance.

3.4 GROUP SIZE AND MATING SYSTEM

All the observations of breeding activity by Husain & Haque (1982) indicated a monogamous mating system, with three pairs being closely studied. Robinson, Gee, Mukherjee, Mackenzie & Kear and other authors state that birds are usually seen singly or in pairs, with occasional larger groups being seen. This is confirmed by quantifying the sightings of adult *C. scutulata* in the literature from India, Myanmar, Thailand and Indonesia. These indicate that single birds and pairs are the most common group size, whilst groups of three or more are rarely seen (Fig. 6). This suggests a monogamous mating system and, since most continental sightings occur in the dry season of November to April, is consistent with a possible long term or even continuous pair bond through most of the dry season followed by breeding around the beginning of the wet season.

----------PRINTER: PLEASE INSERT FIGURE 6

HERE.

Eleven is the largest group reliably recorded (Parsons 1940). Hoogerwerf (1950) reported that from December to February in southern Sumatra *C. scutulata* was usually seen in pairs, but sometimes in loose groups of up to ten. The character of these larger groups is unknown, but some are thought to be families that have not split up. Delacour & Jabouille (1931) stated that *C. scutulata* lives in pairs or in families. In Bangladesh Khan (*in litt.* 1991) saw both parents together with fledglings. In India Mackenzie & Kear (1976) suggest that large groups are usually family parties seen after the breeding season from about June to October. However, groups of up to nine were also seen later in the dry season feeding together in wetlands but arriving and leaving in pairs. These may be unrelated groups involved in courtship activity or formed by necessity because of the shortage of feeding habitat at that time of year. Husain & Haque found that one to six birds roosted or fed together in the same area outside the breeding season. In 1976 five adult birds were once seen in the same tree (Husain 1977).

Chambers found that about 95% of their sightings were of one or two *C. scutulata* (Table 4). Over 60% of all sightings were of single ducks and 67% of all ducks found feeding on ponds or swamps were single. Only in Rawa Gajah in December to February were groups of three or more birds regularly seen together. Forest ponds used mainly for feeding during the dry season were never found to contain more than two ducks. There is evidence of a seasonal change in group size, as December is the one month when the number of pairs exceeds the number of single birds (Table 4). This is possibly the time of pair formation, either for all breeders or for young birds breeding for the first time. However, such field data may not reflect the true distribution of group sizes as only a fraction of the population is sampled. For example, breeding birds may spend most of their time at nest sites and be seen less often than non-breeders.
---PRINTER: PLEASE INSERT TABLE 4 HERE.

3.5 FEEDING

C. scutulata is omnivorous, and diet is certain to vary with feeding site and seasonal availability. The main feeding technique observed by Husain & Haque (1982) was dabbling in very shallow water, taking mainly aquatic snails (*Vibira* spp.) but also pondweed (*Hydrilla* spp.), small fish, aquatic spiders and insects. Occasionally the birds dived under water to catch fish. In Assam, Oates (1899) found that dissected stomachs revealed "principally vegetable matter with a few small pieces of pebble". Stevens (1914) found shells (presumably molluscs) in the gullet of one bird. A drake shot by Hutchinson (1946) in July 1945 had its crop filled with "small black pyramidical seeds of an aquatic plant which abounds in the jheels in Assam". Robinson (1909) examined the gut of two birds shot in December while feeding in rice fields in Trang province, Thailand, and found their crops and gullets full of large freshwater snails of genus *Ampullaria*, accompanied by "one or two" freshwater mussels. Delacour & Jabouille (1931) reported that *C. scutulata* feeds on seeds, insects, worms, little fishes, frogs etc. The source of this information was not given, and it may have been based on the observations in captivity of previous authors such as Baker.

In Sumatra, Hoogerwerf (1950) found stomachs of several dozen birds to contain only vegetable matter: algae, grasses, small tubers of rushes and "teki tubers" (a type of grass). Chambers (1990) found the birds to eat animal matter, including a grasshopper. In May, a bird was flushed from a log where it left a tadpole and half a dragonfly. In June, a small fish was seen to be taken. In deeper water, ducks swam around and changed direction rapidly, stabbing the bill into the water as if taking food from just below the surface. The head was rarely immersed. In water of a few inches depth, ducks waded around with beak immersed, occasionally twisting and thrusting the head forward as if chasing prey.

3.6 VOCALIZATIONS

C. scutulata is often heard calling in flight or while stationary. Chambers (1990) found that birds gave honking calls when in flight or when flushed. 51% of single birds (N=70) and 91% of paired birds (N=34) called. There are likely to be seasonal differences in the frequency of vocalizations, but these are not known.

There is considerable ambiguity in the literature about the nature of *C. scutulata* calls and the extent of sexual dimorphism. Baker (1908) referred to the ringing, trumpet-like flight call of *C. scutulata*, and said that ducks in captivity made a very low quacking note with head held low and bill wide open, as well as an aggressive hissing. Hutchinson (1946) described the main call used by single birds in flight and that used by pairs when together as a "low whistle" and the call given when alarmed as a "loud goose-like 'honk'". Parsons (1940) refers to "their peculiar whistling call" while Stevens (1914) describes it as "an unmistakeable long drawn 'honk'". Engelbach (1952) described the call of *C. scutulata* as resembling the trumpet call of geese. Hoogerwerf (1950) stated that *C. scutulata* has a flight call sounding as "tatta-tatta-tatta" repeated every three to five seconds. When feeding and landing at roosting sites, they utter a weaker call of "tietieta-tietieta-tietieta".

Stanford (1931) states that the flight calls of *C. scutulata* are sexually dimorphic. He describes that of the male as "a low 'cronk', 'cronk'" and that of the female as "a whistle". Delacour & Jabouille (1931) liken the male call to a trumpet call, and describe that of the female as a quiet crowing. Holmes (1976) stated that birds called more or less continuously in flight, producing a goose or crane-like honk, which was often heard simultaneously with a high whistle when two birds were flying together. Thus he suggested that the male and female produce separate, distinct calls.

Mackenzie & Kear (1976) described the flight call as a "prolonged, vibrant, wailing honk sometimes breaking to a nasal whistle at the end" and were uncertain as to whether the male made the honk and the female the whistle. They also described a shorter honk produced on the water "often sounding as though the bird were losing its voice or there were two calling simultaneously in different keys", and an aggressive hiss made while holding the head low. Loud calls made by pinioned birds in captivity vary considerably in their duration and number of syllables, and are often accompanied by a head-bobbing display (personal observation).

3.7 PREDATORS AND MORTALITY

Apart from hunting and habitat destruction by man, there is very little information available about causes of *C. scutulata* mortality. Gee (1958) reported two sightings of *C. scutulata* being attacked by unidentified hawks while flying. One was struck down into the reeds but managed to fly away. In Bangladesh, an adult was killed by an otter in 1978 (Husain & Haque 1982). However, this bird may first have been trapped in a fishing net.

3.8 POPULATION DENSITY

There are some data on the densities at which *C. scutulata* is found, measured as birds per unit land area. Since the species is dependent on both forest and wetlands, it may be more relevant to relate the numbers of birds to the area of wetlands available in the forest, or to the length of forest-wetland interface, but such data do not exist. Husain & Haque (1982) found that all the known feeding, roosting and breeding sites of *C. scutulata* in the Pablakhali area fell within an area of 15,200 ha. The maximum number of birds recorded by surveys in this area was 28. This gives a *C. scutulata* density of one adult per 540 ha, including both breeding and non-breeding birds. The maximum number of breeding pairs recorded in this area was five in 1977,

giving a maximum density of one breeding pair per 3,040 ha. In 733 ha of mature forest in Duamara RF, Assam, in 1969-1970 there was a known population of eight adults (one adult per 92 ha) with an estimated peak of 14 birds (one bird per 52 ha including two family parties, Mackenzie & Kear 1976). Assuming that two breeding pairs of adults were present, this gives a density of one breeding pair per 370 ha. Mackenzie & Kear suggest that in ideal habitat the maximum density of *C. scutulata* is likely to be no more than one adult per 50 ha. These data suggest that the density of birds was approximately ten times higher in Duamara RF than in Pablakhali WS, probably because the Pablakhali population was living in more disturbed secondary habitat and was subjected to considerable hunting pressure.

In Sumatra, Holmes (1977) estimated that in densely populated areas of Lampung, or in extensive coastal swamps, *C. scutulata* may have a density of no more than one adult per 250 ha, whilst unconfirmed local information suggested that in the less populated Menggala area of Lampung there may have been eight adults in an area of 500 ha (i.e. one per 63 ha), although some of the villagers' information may have been duplicated. Tim Ekspedisi (1991) estimated 20-30 birds for the Way Kanan/Kali Biru/Kali Batin area (c. 7,600 ha of habitat) of Way Kambas reserve in 1990, giving a density of approximately one bird per 300 ha, including non-breeders. Tim Ekspedisi (1991) give a lower density figure of one per 1,000 ha, but this is an average figure for the whole reserve.

Thus there is evidence that recent densities of the two largest known surviving populations of *C. scutulata* (Way Kambas NP and Pablakhali WS) are much lower than those formerly attained in areas less affected by habitat degradation or hunting.

3.9 MOULTING

Baker (1908) observed that captive *C. scutulata* in Assam moulted rapidly in September or early October, undergoing a flightless period of two weeks. Chambers (1990) observed an adult bird in moult on 2.5.89, standing on a log in a forest pond, while preening and flapping its wings for at least 15 minutes. Whether the feathers being shed were wing or body feathers is not known. Even in captivity, it is not known whether *C. scutulata* moults its wing and body feathers together. This limited evidence suggests that a flightless moult occurs at the end of the breeding season as in most Anatidae (Owen & Black 1990).

3.10 LEUCISM

Indonesian *C. scutulata* have long been known on average to be much whiter than Continental Asian birds. Blyth (1867) wrote "two mostly white [Javan] specimens in the British Museum look very like a domesticated race of this species". Since then, many authors have suggested that the whiteness is a result of either domestication or inbreeding in the wild (e.g. Hume & Marshall 1880; Salvadori 1895; Mackenzie & Kear 1976), but there is no evidence for either theory. The whiter pigmentation is more likely to have evolved through natural selection, and to suggest that the Indonesian population is whiter because it is more inbred has no more basis than to suggest that the white morphs of the Lesser Snow Goose *Anser caerulescens caerulescens* are simply inbred versions of blue morphs, which is not the case (Cooke *et al.* 1985).

Hoogerwerf (1950) and Chambers (1990) described the leucism on the body and found that males tend to be whiter than females. There is however much variation in the extent of white on the head, back, belly, tail coverts, rump and wing coverts in both sexes and some birds also have two or three white primaries. There is apparently a continuous variation in Indonesian birds from dark continental type birds to birds that are almost entirely white (Mackenzie 1990). What remains unclear is whether this variation exists because a) birds change with age, perhaps becoming more white as they get older or b) there is a genuine polymorphism, with different colour morphs in the same population. In other wildfowl, there is a development of more extensive white plumage

in older individuals of Laysan teal, *Anas laysanensis*, whilst there is a sympatric mixture of dark and white morphs in the Snow Goose. The available evidence supports the ageing hypothesis because there appears to be a continuous variation of white extension in *C. scutulata* (as in *A. laysanensis*), and Baker (1908) found that Indian drakes in captivity became more white with age on the head and neck, especially around the eye.

The morphological difference between the Indonesian and continental
C. scutulata is likely to stem from a considerable genetic difference, and the two populations should perhaps be regarded as separate subspecies: *C. scutulata leucoptera* for Indonesia (following Blyth 1849; Hume & Marshall 1880; Hoogerwerf 1950) and *C. scutulata scutulata* for the continent. Indeed, two races would have been notified in the last century were it not for the suggestion that the Indonesian birds were a domesticated race (Hume & Marshall 1880). There is no evidence that *C. scutulata* was ever present in continental Malaysia in the areas closest to Indonesia, the nearest record being over 120 km across the sea from the Sumatran coast. This suggests that the two populations have been isolated at least since the end of the Pleistocene (Holmes *in litt.* 1991), 10-12,000 years ago. Since there is little evidence that *C. scutulata* was ever well established in Malaysia, the two populations may have been isolated for considerably longer.

Table 4. Group sizes of *C. scutulata* recorded by Chambers (1990) in Way Kambas National Park.

	SINGLES	PAIRS	THREES	GROUPS OF > 3 DUCKS
AUG/SEPT	11	2	-	-
OCTOBER	3	1	1	-
NOVEMBER	10	5	-	-
DECEMBER	10	15	3	-
JAN/FEB	10	5	1	1
MARCH	9	3	-	-
APRIL	7	6	-	-
MAY	13	3	1	-
JUNE/JULY	17	7	1	-
TOTALS	93	47	7	1

Continuous observations from Rawa Gajah are excluded because birds were continuously arriving and leaving, changing the group size.

4. INDIA

4.1 LOCAL NAME

"Deo Hans" (Spirit Duck, Mackenzie & Kear 1976).

4.2 FORMER DISTRIBUTION

C. scutulata was originally confined to North-east India (Fig. 7) and mainly to Assam and Arunachal Pradesh, where in parts the species was abundant. There are occasional records from other, neighbouring states. Details of all records are given in section 4.10, and summarised below. The majority of records have been from Assam, where *C. scutulata* was particularly abundant in the Brahmaputra valley of Upper Assam in what are now Dibrugarh and Lakhimpur Districts.

4.2.1 Lower Assam

In Sanitpur District one shot in Tezpur before 1880 (Hume & Marshall 1880) and pair or two present in Behali RF in 1958 (Gee 1958). Pair seen in Barpeta District in 1886 (Baker 1897). Before 1897, pair seen in North Cachar District, and another heard on border of Cachar and Nowgong Districts (Baker 1897). Rare in Goalpara District (now Goalpara, Kokrajhar and Dhubri Districts) before 1929 (Baker 1929). Rare in Sibsagar District (now Sibsagar, Golaghat and Jorhat Districts) in 1929 (Baker 1929); pair caught on Majholi bheel, Moriani range, Jorhat District in 1953 (Mukherjee 1961); three shot at Duklingia TE, Jorhat District in the 1950s (Emmett *pers. comm.* 1991). In Karbi Anglong District pair seen on the Kaliani river (Mikir hills) about 1958 (Gee 1958), and birds present at Bokajan on the Dhansiri river near Nagaland in 1964 (Mackenzie *in litt.* undated). In Nowgong District, present near Lumding on the Kopili river at Dulahar in 1967 (Savage & Mackenzie 1967), and in Doboka RF in 1979-1980, when a pair captured (Oliver *in litt.* 1990). Still present in the area in the 1980s (see below). In Silchar District, reported from Jiri RF in 1990 (see below).

4.2.2 Upper Assam

C. scutulata was described as "common" in Lakhimpur and Dibrugarh Districts in 1880 (Hume & Marshall 1880) and when Baker lived there from 1900 to 1905, he acquired 30-40 wild birds and kept them as pets (Baker 1908). A measure of their abundance in the "Himalayan foot-hills" (foot-hills to the North of the Brahmaputra river in Lakhimpur) in this period is that in a good day's shooting, a man "would return with three, four or even five birds, and have seen possibly twice as many again, although the getting of them might have entailed a walk of 20 miles or more" (Baker 1908). Baker also obtained "a great number of birds and skins" from Sadiya from 1900 to 1905, and the species was the fourth commonest dry-season wildfowl in forest bheels of the Sadiya Frontier Tract (now in Dibrugarh District) in 1940 (Parsons 1940), after Common Teal *Anas crecca*, Mallard *A. platyrhynchos* and Gadwall *A. strepera*. This is significant because many species of wildfowl migrate to the area at this time of year, the northern winter. Two *C. scutulata* were reported from Sadiya Station RF in 1976 (Pirie & Choudhury 1976) and at least one in 1978 (Talukdar *in litt.* 1990).

Also in Dibrugarh District *C. scutulata* has been regularly recorded from sites now in Dibru-Saikhowa WS from 1900 to the present day (Dibru river up to 1905, Rungagora, Gurrung Jan, Paropara Jan up to 1911, Laikajan river up to 1930, Digholi and Colomy bheels up to present day, Dangri river up to 1976, Guijan up to 1970, former Saikhowa RF up to 1976, former Dibru RF up to 1986). Elsewhere in Dibrugarh District, found in Dollah near Saikhowa in 1877 (BMNH specimen); Noadehing up to 1967 (Savage & Mackenzie 1967); Sookerating-Digboi area up to 1968 (WWF Yearbook 1968); Mohong proposed RF up to 1970 (Scott & Mackenzie 1970); Pengari RF up to 1970, Dirok RF and Dehing West RF up to 1975 (Mackenzie 1975); Kakojan RF, Tirap RF, Makati RF, Namphai

RF, Kundil Kalia RF and Upper Dehing East RF up to 1976 (Pirie & Choudhury 1976); Mesaki RF up to 1978 (Talukdar *in litt.* 1990); reported from Doom Dooma RF, Phillobari RF, Kukurmara RF, Duarmara RF, Buridihing RF, Kumsong RF, Joypur RF, Namchick and Bogapani areas since 1980 (see below).
Elsewhere in Lakhimpur District *C. scutulata* has been recorded from: Laluk, Joyhing, Dejoo and Derpai from 1901-1911 (Stevens 1914); common on the Jonai river around 1930 (Mukherjee 1961); from Jamjing/Jiadabl/Buri Suti area up to 1956 (Scott & Mackenzie 1970); Tikeri in 1956-1957, Kampung bheel and Singpho in 1961 (Mukherjee 1961); Ranga RF in 1958 (Gee 1958); Kobachopri/Poba river mouth up to 1967 (Savage & Mackenzie 1967); Subansiri river in the 1980s (see below).

4.2.3 Arunachal Pradesh

Pair seen at Tezu and Brahmakund, Lohit District, 1947 (Ali & Ripley 1948). In 1975, S.N. Barua (*in litt.* 1975) reported them present in good numbers in Namsai RF, Lohit District and Koriapani RF, Tirap District, and also present in Siang, Subansiri and Karreng Districts. These reports are unconfirmed, and thrown into question by Barua's groundless population estimate of 500 for the whole state. One seen in the Namsai area of the Tirap river around 1956 (Mukherjee 1961). Since 1980, birds reported from Nam Dapha NP, Injan, Vijaynagar, Mahao WS and D'Ering Memorial WS (see below).

4.2.4 Nagaland

Breeding in Dimapur area, Dhansiri river on Assam border before 1874 (Godwen-Austen 1874) and recorded there in 1900 (BMNH) and 1945 (Hutchinson 1946).

4.2.5 Tripura

Mitra (1957) reported *C. scutulata* as "a local resident in the deepest part of the densest forest of the hilly areas of Tripura".

4.2.6 Meghalaya

One seen in the Garo hills before 1874 (Godwen-Austen 1874, Hume 1890).

4.2.7 Manipur

Three seen on a tributary of the Iril river, North-west Manipur, in 1913 (Huggins 1913); probable sighting of one in the eastern hills in 1925, and of a single bird and pair on a chain of bheels South-east of Imphal in 1931-1932 (Huggins 1933).

4.2.8 Madhya Pradesh

Unreliable report ("probably incorrect", Baker 1908) of one in a tank in Bilaspur District before 1900 (Young 1900). This location is 500 miles South-west of the confirmed sightings in North-east India.

4.2.9 Chota Nagpur

Possible sighting of four at Sini, Singbhum before 1897 (Baker 1897), 300 miles South-west of the confirmed sightings in North-east India.

4.2.10 West Bengal

Probable sighting of one on the Neora river, Jalpaiguri District, before 1920 (Inglis *et al.* 1920).

4.2.11 Unidentified locations

C. scutulata was seen twice on Borjan-Digboi road, some unidentified location (presumably Dibrugarh District, Assam), in 1943-1947 (Mukherjee 1961).

PRINTER: PLEASE INSERT FIGURE 7 HERE.

4.2.12 Population trends

There has been a strong decline in the distribution and density of *C. scutulata* in India this century. This is shown by the absence of sightings from many areas for at least three decades (e.g. Manipur, Meghalaya, Nagaland, Assamese districts of Barpeta, Sanitpur, Golaghat, Jorhat and Cachar), and by decline in numbers within areas. In the Dibrugarh and Lakhimpur Districts of Assam, numbers declined from the abundance around 1900 described by Baker, to a total population estimate of only 44 for Dibrugarh District in an extensive survey by the Assam Valley Wildlife Society in 1976 (Pirie & Choudhury 1976). In 1958, Gee already found a consensus that the species had become "much rarer" within the previous 20 years, but reported that it was found on all forest streams in Dibru RF. Mackenzie estimated a population of 30 for Dibru RF in 1960 (unpub. data), yet by 1975 he estimated only 4. Along the Buridihing river, the species was described as common in 1930 (Mukherjee 1961), yet by 1976 only two birds were thought present in Buridihing RF (Pirie & Choudhury 1976).

4.3 FORMER HABITAT

4.3.1 Forest types

According to the vegetation maps of Mackinnon & Mackinnon (1986), *C. scutulata* was recorded from the following forest types:

a) Tropical Wet Evergreen Forest in the areas where the species was most abundant i.e. in Dibrugarh and Lakhimpur Districts, Sadiya Frontier Tract (Assam) and neighbouring areas of Arunachal Pradesh. Also Nagaland and possibly Manipur.

b) Tropical Semi-evergreen Forest in Golaghat, Jorhat and Sanitpur Districts, and possibly Karbi Anglong District, Nowgong District and North Cachar (Assam).

c) Tropical Moist Deciduous Forest in Barpeta and Goalpara Districts, Meghalaya and possibly Nowgong and North Cachar Districts. Also possibly in Manipur, West Bengal, Chota Nagpur and Madhya Pradesh.

d) Montane Wet Temperate Forest. 1988 record from Arunachal Pradesh (see below).

Figures for the original area of these forest types in North-east India are not available, although there was at least 20,000 km^2 of each in the *C. scutulata* range. Baker (1897) suggested that *C. scutulata* was more abundant in Upper than Lower Assam because the forest is more dense and extensive.

The only information about the use of particular tree species by *C. scutulata* is that Mukherjee (1961) found a pair perching on a dead branch of a Hollock tree *Terminilia myriocarpa* by the side of a bheel.

4.3.2 Wetlands

Early authors state that *C. scutulata* mainly frequented small wetlands in remote areas of dense, virgin forest. These wetlands were sluggish forest streams ("jans"), pools and swamps ("bheels") (Oates 1899, Baker 1908). They could be found on similar wetlands within small forest patches, but never on large, open lakes or swift rivers or streams (Baker 1908). Parsons (1940) found them abundant in swamps made in areas where forest had been flooded by earthquakes or by streams changing course. The swamps were full of cane brake, elephant grass and dead trees. Parsons added, "the more overgrown and sheltered in dense jungle the pool happens to be, the more likely these birds are to be found".

C. scutulata has also been recorded from other wetland types. There are various records from sluggish rivers and river pools in forest, e.g. the Dibru, Dhansiri and Kaliani. In December 1968 up to five birds were seen at a tea waste destruction pond, Bogapani TE (WWF Yearbook 1968). Mukherjee (1961) reported that *C. scutulata* made nocturnal visits to standing crops around forest villages, and one was captured from a paddy field at night in January 1961 at Singpho, Lakhimpur District. Mackenzie & Kear (1976) suggested that birds stay within the forest for most of the year, feeding in streams and pools, but visit larger open swamps at periods of the dry season when there are no suitable feeding sites in the forest.

4.3.3 General terrain

Most records of *C. scutulata* have been from low elevations (below 200 m) in the plains of the Brahmaputra valley in Assam, and from medium elevations (200-500 m) in the foothills flanking this valley on each side (the Garo hills in Meghalaya, Mikir hills in Karbi Anglong District, Assam and various ranges in Arunachal Pradesh). The highest record is from North-west Manipur in July 1913, where Huggins (1913) found three ducks at over 900 m on a pool (70 m long, 30 m wide) in a narrow ravine flanked by steep cliffs with forest on one side. There is a recent record from 1,250 m (see below).

4.4 CURRENT DISTRIBUTION

Since 1980 all sightings of *C. scutulata* have come from Assam and neighbouring lowland parts of Arunachal Pradesh (Fig. 7). Sightings have been made in the following 18 areas and have been used to extract estimates of the local population size. These local estimates (LEs) are minimum figures that may underestimate the actual numbers.

4.4.1 Dibru-Saikhowa Wildlife Sanctuary KEY SITE

Dibrugarh District, Assam. Two were taken for food in 1989 (Bhattarcharjee *pers. comm.* 1990). Four were seen in February 1990 at Colomy bheel (Talukdar *in litt.* 1990), and four in June 1990 at Dighali bheel (Singh *in litt.* 1991). A pair was observed in February 1991 (Bhattarcharjee *in litt.* 1991) and one bird at Saikhowa in May 1991 (Singh *in litt.* 1991). Talukdar (*in litt.* 1991) estimates the population as at least 20 birds. LE = 20.

4.4.2 Nam Dapha National Park KEY SITE

Tirap District, Arunachal Pradesh. Seven were seen in 1988 (Singh 1989), probably along the Noa Dihing river at the lowest elevations in the Park (Scott 1989). One seen further up the Upper Noa Dihing valley, flying over Vijaynagar Field Station on 13.3.88 (Ripley *et al.* 1991). A pair seen at Ranijheel on 29.11.90 (Neog *in litt.* 1991). Also recorded from Injan in 1982 (unlocated but in Miao Sub-division). LE = 7.

4.4.3 D'Ering Memorial (Lali) Wildlife Sanctuary KEY SITE

Siang District, Arunachal Pradesh. Recorded here regularly in the 1980s, with the most recent record on 11.4.90 (Pandya 1990, Choudhury *in litt.* 1991). Pandya (*in litt.* 1991) estimates the population to be 4 birds. LE = 4.

4.4.4 Mahao Wildlife Sanctuary KEY SITE

Dibang Valley District, Arunachal Pradesh. Scott (1989) reported that small numbers are present along the lower Dri river. LE=2.

4.4.5 Doom Dooma Reserve Forest KEY SITE

Dibrugarh District, Assam. Birds have regularly been seen in the RF and in the adjacent Bordubi and Phillobari TEs since 1985. A flock of up to nine was seen on a pool in the RF in 1985 (Sidhu *in litt.* 1985), and a flock of eight in the south east of the RF the same year (Mackenzie 1985). Five were seen at Litong in the RF in 1988 and four at Ghotajan in 1991 (Singh *in litt.* 1991). A group of five was seen in the RF and a group of four in nearby Dhulajan on 23-29.5.91 (Talukdar *in litt.* 1991). There is a captive population of *C. scutulata* at Bordubi TE, and wild birds have often been seen roosting in a tree above the aviary: up to five were seen together in 1986 and three to four seen quite regularly in c.1990 (Sidhu *in litt.* 1986, 1991). LE = 9.

4.4.6 Joypur Reserve Forest/Naharkutia

Dibrugarh District, Assam. Four were seen in Joypur RF in winter 1985 (December to February, Bhattarcharjee *pers. comm.* 1990), and two on the Tipam river in the RF on 5.3.86 (Das *in litt.* 1986). The species was still present in 1990 (Oliver *in litt.* 1990), when a pair was seen in October (Talukdar *in litt.* 1990) and several wild-caught birds were sold at a market in Naharkutia (Bhattarcharjee *pers. comm.* 1990). LE = 4.

4.4.7 Kumsong Reserve Forest

Dibrugarh District, Assam. An unknown number of birds was seen here in 1986 (Das *in litt.* 1986). LE = 1.

4.4.8 Lumding/Kopili river area

Nowgong District, Assam. In 1979-1980, two were captured from Doboka RF (Oliver *in litt.* 1990). In 1982, another two were captured from Lanka, and on separate occasions in 1988 two single individuals were seen in the area (Bhattarcharjee *pers. comm.* 1990). LE = 2.

4.4.9 Phillobari Reserve Forest

Dibrugarh District, Assam. One bird was reported here in June 1989 (Talukdar *in litt.* 1990). LE = 1.

4.4.10 Lower and Upper Jiri Reserve Forest

Silchar District, Assam. A pair was reported in both RFs on opposite sides of the Jiri river in January 1990 (Talukdar *in litt.* 1990). LE = 2.

4.4.11 Subansiri river

Assam/Arunachal Pradesh. In 1986-1987 birds were seen at least twice in this area (Oliver *in litt.* 1990). LE = 2.

4.4.12 Bogapani

Dibrugarh District, Assam. Two to three birds seen c.1990 at Bogapani TE, near forests around Digboi (Sidhu *in litt.* 1991). Perhaps from Upper Dehing RF. LE = 3.

4.4.13 Namchick Reserve Forest

Dibrugarh District, Assam. A pair was seen on 6.10.90 (Neog *in litt.* 1991). LE = 2.

4.4.14 Kukurmara Reserve Forest

Dibrugarh District, Assam. *C. scutulata* was reported calling here in 1981 (Talukdar *in litt.* 1990). LE = 1.

4.4.15 Duarmara Reserve Forest

Dibrugarh District, Assam. Reported in 1981 (Talukdar *in litt.* 1990). Four were taken from Kathalguri Pathar by villagers in October 1988. Two of them escaped and two were taken into captivity (Singh *in litt.* 1991). LE = 2.

4.4.16 Buridihing Reserve Forest

Dibrugarh District, Assam. A female with a young duckling was reported in 1980 (Talukdar *in litt.* 1990). LE = 2.

4.4.17 Dihangi

North Cachar District, Assam. One bird was recorded in late September 1983 (Talukdar *in litt.* 1990). LE = 1.

4.4.18 North Cachar Hill and Barail Reserve Forests

Silchar District, Assam. Villagers reported *C. scutulata* as present here in 1990 (Talukdar *in litt.* 1990).

4.4.19 Hansara

Sibsagar District, Assam. Possible record in early 1990 (Dehingia *pers. comm.* 1991).

4.4.20 Total population estimate

The above figures produce a total estimate of 65 for the known Indian population, with 45 of these in Dibrugarh District, Assam.

4.4.21 Potential for other populations

There may be additional surviving *C. scutulata* populations in remaining areas of suitable forest habitat. There have been no widespread surveys of *C. scutulata* in India since 1975, when a survey of forests in Dibrugarh District was made (Pirie & Choudhury 1976). Hence there is a reasonable chance that *C. scutulata* persists in some locations where it was recorded before 1980. In addition, there are potentially suitable forest areas where *C. scutulata* has never to date been recorded, but that are worth surveying. One such area is Dampa WS in Mizoram State, adjacent to the Chittagong Hill Tracts, Bangladesh, where *C. scutulata* occurs.

4.5 CURRENT HABITAT

4.5.1 Forest types

At sites where *C. scutulata* occurs there are a variety of forest types, including Tropical Wet Evergreen, Tropical Semi-evergreen, Tropical Moist Deciduous Forest, Mixed Deciduous Forest and riparian and swamp formations, and it is not known which of these are used by *C. scutulata*. Whilst the great majority of recent records are from lowland forests, Ripley *et al.* (1991) recorded one bird in flight at 1,250 m at Vijaynagar Station, Arunachal Pradesh, on 13.3.88, in an area dominated by Montane Wet Temperate Forest. This shows that the species uses high altitude forests at times. On 29.11.90 a pair was seen at 810 m at Ranijheel in nearby Nam Dapha NP (Neog *in litt.* 1991).

C. scutulata is now present in both primary and secondary forests. In Nam Dapha NP and Mahao WS, *C. scutulata* is reported from areas of lowland primary forests (Scott 1989). In Doom Dooma RF, Kumsong RF and possibly other sites, *C. scutulata* occurs in degraded, secondary habitats with no remaining primary forest. Birds have often been seen at the captive aviary on Bordubi TE, showing that they are able to fly across agricultural land to move between forest areas, although tea plantations retain some trees to provide shade. Baker (1908) recorded a pair of birds flying over tennis courts.

4.5.2 Wetlands

In Dibru-Saikhowa WS, birds have recently been seen in open swamps (Colomy bheel and Digholi bheel). Birds have been seen on ponds in Nam Dapha NP (Ranijheel) and Namchick RF (Neog *in litt.* 1991). In the secondary forests of Doom Dooma, birds have been seen flying along the Doom Dooma river and feeding in forest pools. In D'Ering Memorial WS, Pandya (*in litt.* 1991) recently recorded a bird on the open Siang River, feeding in shallow water near a mud island covered with grass clumps. The river was calm and about 70 m wide at this point.

4.6 THREATS

4.6.1 Deforestation

Deforestation has been the major cause of the decline in the North-east Indian population. As early as 1914 Stevens wrote of Upper Assam, "the deforestation and the opening up of large areas of land by the tea industry has been in progress many years; each succeeding year also results in a great increase of low-lying land brought under cultivation by the immigrant labourer". Forestry, agriculture (particularly the "Green revolution"), population increase and rehabilitation of refugees has accelerated deforestation since 1950 (Mukherjee 1961; Mackenzie *pers. comm.*). Increased population size has shortened the cycles in shifting agriculture, adding to forest degradation. Remaining forest areas are often encroached upon by cane cutters, hunters and grazing cattle. Many felled areas are replaced by plantations of e.g. Simul *Salmalia malabericum* or Hollong *Dipterocarpus macrocarpus* unlikely to be of value to *C. scutulata*. Forests in the upper Brahmaputra valley, particularly on the north bank, were also badly damaged by an earthquake in 1950 that raised the river bed by 7 m, and by subsequent extensive flooding of forests from 1951-1962 (Mackenzie & Kear 1976).

By 1971, forest cover was reduced to 36% in Assam and 27% in Manipur (anonymous forestry document). By 1982-1983, forest cover in Assam was 22% (Singh *in litt.* 1991). More recent figures are not available, but total forest cover for India is now less than 8% (Collins *et al.* 1991). In Dibrugarh District in 1985 Mackenzie (1985) found that Doom Dooma RF, Kumsong RF, Duarmara RF and Upper Dehing East and West RFs, all of past or present importance for *C. scutulata*, had been selectively or clear felled over their whole area. An introduced

Makinia vine has spread into many secondary forest areas of Assam, preventing forest regeneration (Mackenzie *pers. comm.* 1990).

4.6.2 Forest management

Until recently Reserve Forests were managed by foresters in ways that were harmful to *C. scutulata*. Old or dead trees likely to provide nesting sites were systematically removed, whilst forest marshes or swamps likely to provide feeding sites were drained and then planted with trees (Mukherjee *pers. comm.* 1991).

4.6.3 Hunting

Hunting of wildfowl for food with nets, guns, traps, by robbing nests etc. has intensified with the population increase in North-east India (Mukherjee 1961, Bhattarcharjee 1990). In 1969 at least 13 *C. scutulata* were killed for food in Dibrugarh District and another 13 juveniles captured that would have been eaten if they had not been sold for captive breeding (WWF Yearbook 1969). This represents a high annual mortality, as the total population for the District may have been less than 100 at the time. Pirie & Choudhury (1976) estimated the population for Dibrugarh District as 44 in 1976. The hunting problem continues as, in 1989, two birds were killed in Dibru-Saikhowa WS and several more in the Joypur RF area in 1990 (Bhattarcharjee *pers. comm.* 1990). Hunting may be an even greater threat than these data suggest, as most captures of *C. scutulata* probably remain unreported. Hunting has perhaps eliminated the species from some accessible forest areas that would otherwise provide suitable habitat. Some forest areas have recently been occupied by insurgents who may hunt *C. scutulata* (Singh *in litt.* 1991)

4.6.4 Pollution

Pesticide use in North-east India is largely unrestricted, and has been implicated in the decline of several stork species (Bhattarcharjee *pers. comm.* 1990). If *C. scutulata* feeds in rice fields or other wetlands in agricultural areas, it will encounter pesticides that may affect breeding success. Other pollution is caused by tea waste dumped with lime in waterways, especially during the dry season. Such polluted wetlands are used by *C. scutulata* during drought periods, and may cause disease. A male netted at a tea waste destruction pond in Bogapani TE, Dibrugarh District, in December 1968 died three days later from Aspergillosis (Mackenzie *in litt.* 1969). Oil drilling and open-cast mining also occur in forested areas (e.g. around Digboi, Dibrugarh District) and are likely to cause some pollution of forest wetlands, as is effluent from timber mills.

4.7 CONSERVATION MEASURES TAKEN

4.7.1 Habitat Protection

Most of the *C. scutulata* populations occur in Reserve Forests, Wildlife Sanctuaries or National Parks, which provide varying degrees of protection. In a Reserve Forest (e.g. Doom Dooma) hunting is banned, but commercial forestry, fishing, livestock grazing, thatch grass and cane cutting concessions are all granted. In a Wildlife Sanctuary (e.g. Dibru-Saikhowa) commercial forestry and other concessions can still be granted, but certain wildlife needs have priority, particularly those of large mammals. In a National Park (e.g. Nam Dapha) habitat is strictly protected (Mukherjee *pers. comm.* 1991; Oliver *in litt.* 1990).

Dibru-Saikhowa WS was declared primarily to protect its population of *C. scutulata* (Talukdar *pers. comm.* 1991). Proposals have recently been made to improve and extend the protected area system in Assam, Arunachal Pradesh and other states (Rodgers & Panwar 1988), and this offers an excellent opportunity to improve conservation of *C. scutulata*.

4.7.2 Species Protection

C. scutulata has been a protected species in India since 1937 and on the special protected list since 1952. It has been protected in Assam under the Wildlife Protection Act 1972 (Pirie & Choudhury 1976). Hunting is therefore illegal, although it still continues. The government of Assam has created a Forest Protection Force to help enforce regulations about hunting and habitat destruction (Singh *in litt.* 1991).

4.7.3 Education Programmes

The State Wildlife Department and Assam Valley Wildlife Society have distributed leaflets and posters and held film shows to generate public awareness of *C. scutulata* and the need for its conservation (Sidhu *in litt.* 1991; Singh *in litt.* 1991).

4.8 EVALUATION

India has a small known population of *C. scutulata*, but one larger than that identified in any other country on mainland Asia. This population is under continuing threat from deforestation, hunting and possibly pollution. There have been no thorough surveys within its range since a questionnaire survey of Dibrugarh District in 1976 (Pirie & Choudhury 1976), and there may be other populations surviving that are currently unknown. Furthermore, the above estimates for the size of the known populations are based on limited data, and may be underestimates.

There is an urgent need for surveys to clarify the status and distribution of *C. scutulata* in North-east India. It is also vital to improve the protection status of the populations already located.

4.9 ACTION

4.9.1 Surveys

i. First priority, key sites: Dibru-Saikhowa WS, Nam Dapha NP, D'Ering Memorial WS, Mahao WS, Doom Dooma RF.

ii. Second priority, other known *C. scutulata* sites: Joypur RF, Koomsang RF, Lumding/Kopili river, Phillobari RF, Lower and Upper Jiri RF, Subansiri river, Bogapani, Namchick, Kukurmara RF, Duarmara RF, Buridihing RF, Dihangi, North Cachar Hills and Barail RF.

iii. Third priority, other existing or proposed protected areas in the known former range. Existing areas: Pabha WS (Upper Assam), Itanagar WS (Arunachal Pradesh), Intanki WS (Nagaland) and Dampa WS (Mizoram). See 4.9.2 for proposed areas.

iv. Fourth priority: other forested areas in the known former range.

4.9.2 Creating new protected areas

Rodgers & Panwar (1988) proposed a number of new protected areas in the known former *C. scutulata* range, as follows.

In Assam: Tinkhopani NP, Digboi WS, North Cachar Hill and Barail WS, Hollongapar WS, Desangmukh WS, Dhansiri-Kaki WS, Dhansiri-Kaki NP, Mikhir Hills WS, Inner Line Forest WS.

In Arunachal Pradesh: Tirap Evergreen NP. Suitable forest areas within the vicinity of these sites should be surveyed for *C. scutulata*, and any occupied areas included within the boundaries. Tinkhopani NP and Digboi WS are highest priority, as they are located in the evergreen forests of Dibrugarh District where *C. scutulata* has often been recorded in recent decades.

4.9.3 Extending Dibru-Saikhowa Wildlife Sanctuary

Extend the boundary to the north to include Kobochopri, where *C. scutulata* were formerly recorded and may still occur (Talukdar *in litt.* 1990).

4.9.4 Upgrading D'Ering Memorial Wildlife Sanctuary

Upgrade this key site to a National Park to increase its protection status, as proposed by Rodgers & Panwar (1988).

4.9.5 Extending Nam Dapha National Park

Extend the park boundary to protect more lowland forest, and develop a buffer zone around this area, as proposed by Rodgers & Panwar (1988).

4.9.6 Protecting Doom Dooma Reserve Forest

As a key site for *C. scutulata*, Doom Dooma RF should be declared a Wildlife Sanctuary and given full protection.

4.9.7 Enforcing protection from hunting

Illegal hunting of *C. scutulata* continues in Dibru-Saikhowa WS, Joypur RF and probably other sites. Poaching should be controlled by increasing the effectiveness of forestry staff and other officials, and through local awareness programs, especially at key sites.

4.9.8 Education

An education campaign to improve local awareness of the plight of *C. scutulata* and to discourage hunting should be launched, particularly around key sites.

4.9.9 Biological Research

A research project into *C. scutulata* ecology is urgently required. India offers an excellent opportunity to do a comparative study in both a degraded, secondary habitat (e.g. Doom Dooma) and in primary forest (e.g. Nam Dapha). This should concentrate on how the birds adapt to habitat change and disturbance, and what limits population size in each habitat.

4.9.10 Nest boxes

In Doom Dooma RF, Kumsong RF and probably other areas, *C. scutulata* lives in degraded habitats in which many old, large trees have been removed. The reduced availability of nesting sites is therefore likely to be a factor limiting the reproductive success and size of the population. Nest boxes should be provided for *C. scutulata* in these sites, and their use closely monitored.

4.10 ALL RECORDS IN INDIA

Location	Coordinates	Date	Source	Numbers	Notes
Dollah, near Saikhowa, Assam	27.46 N, 95.36 E	17.5.1877	British Museum Specimen	1	Female, shot.
Dimapur, Dhansiri river, Nagaland	25.55 N, 93.45 E	before 1874	Godwen-Austen 1874/ Hume 1890	+	Shot on sluggish stream in dense forest.
Dhansiri river, Nagaland/ Assam	26.00 N, 93.51 E Reported to breed, with	before 1874	Godwen-Austen 1874/ Hume 1890	+	some young shot.
Interior of Garo hills, Meghalaya	25.30 N, 90.30 E Flushed from a sluggish	before 1874	Godwen-Austen 1874/ Hume 1890	1	stream in forest.
Tezpur, Sanitpur Dist., Assam	26.38 N, 92.49 E Shot while perching on	before 1880	Hume & Marshall 1880/ Oates 1899	1	a tree.
Lakhimpur & Dibrugarh Dists., Assam	27.29 N, 94.56 E Common.	1880	Hume & Marshall 1880	+	
Barpeta Dist., Assam	26.20 N, 91.02 E	1886	Baker 1897	2	Pair, flushed from a swamp at forest edge.
Dibrugarh, Dibrugarh Dist., Assam	27.29 N, 94.55 E	18.3.1895	British Museum Specimen	1	Male.
Dibrugarh, Dibrugarh Dist., Assam	27.29 N, 94.55 E	c.1895	British Museum Specimen	1	Male.
Sini, Singbhum, Chota Nagpur	22.48 N, 85.58 E Flock flying over dense	before 1897	Baker 1897	4	forest. 1 male shot. ?
Border of Cachar and Nowgong Dists., Assam		before 1897	Baker 1897	2	Pair, heard but not seen.

North Cachar Dist., Assam	25.07 N, 92.51 E	June pre 1897	Baker 1897	2	Pair calling in trees along stream in dense forest.
Dibrugarh, Dibrugarh Dist., Assam	+	27.29 N, 94.55 E	Resident on weedy pathars	before 1899	Oates 1899 in dense forest.
Bilaspur Dist., Madhya Pradesh	22.05 N, 82.13 E	before 1900	Young 1900	1	Shot in a tank a few miles from forest-covered hills.
?					
Dimapur, Dhansiri river, Nagaland	25.55 N, 93.45 E	8.2.1900	British Museum specimen	2	
Dibrugarh, Dibrugarh Dist., Assam	2	27.29 N, 94.55 E	Pair flying over tennis courts.	1900	Baker 1908
Rungagora, Dibrugarh Dist., Assam	1	27.34 N, 95.20 E	Female, shot.	23.2.1902	Stevens 1914
Dibru river, Dibrugarh Dist., Assam	27.35 N, 95.17 E	1900-1903	Baker 1903	2	Single birds flying down-river in dry season.
Dibrugarh and Lakhimpur Dists., Assam	Total number shot,	Jan-Apr 1901-04	Stevens 1914	10	5 males, 5 females.
Lakhimpur and Dibrugarh Dists., Assam	27.29 N, 94.56 E	1900-1905	Baker 1908	30-40	Wild caught and kept by Baker in a tealery.
Sadiya, Assam	27.49 N, 95.38 E	1900-1905	Baker 1908	+	Great many birds and skins obtained.
Dibru river, Dibrugarh Dist., Assam	7	27.35 N, 95.17 E	Flushed from forest in dry season. Largest flock seen.	1897-1908	Baker 1908
Dejoo, Lakhimpur Dist. Assam	27.20 N, 93.58 E	10.8.1908	Stevens 1914	4	Flock flying over bhils.
Joyhing, R. Dejoo, Lakhimpur Dist., Assam	27.21 N, 93.58 E	20.1.1909	Stevens 1914	+	Observed.
Laluk, Lakhimpur Dist.,	27.10 N, 93.52 E	10.4.11	Stevens 1914	+	Observed.

Assam

Gurrung Jan, Dibrugarh Dist., 27.36 N, 95.20 E 1901-1911 Stevens 1914
5 Flock in deep forest.
Assam

Paropara Jan, Dibrugarh Dist., 27.37 N, 95.20 E 1901-1911 Stevens 1914
+ 1 or more shot.
Assam

Digiltarung, R. Dangari, 27.38 N, 95.26 E 1901-1911 Stevens 1914 + 1
or more shot.
Dibrugarh Dist., Assam

Buri bhil, Derpai, 27.30 N, 94.17 E 1901-1911 Stevens 1914 + 1
or more shot.
Lakhimpur Dist., Assam

Laishan, tributary of 24.7.13 Huggins 1913 3 Group flushed from wooded
Iril river, NW Manipur pool at over 3,000 feet.

Neora river, Jalpaiguri Dist., 26.30 N, 88.50 E before 1920 Inglis *et al.* 1920
1 Probable record. # ?
W. Bengal

Eastern hills, Manipur 25.08 N, 94.24 E 15.07.25 Huggins 1933 1
Probable record. # ?

Goalpara, Kokrajhar & 26.10 N, 90.38 E before 1929 Baker 1929 + Rare.
Dhubri Dists., Assam

Sibsagar, Golaghat & 26.58 N, 94.39 E before 1929 Baker 1929 + Rare.
Jorhat Dists., Assam

Buri-Dihing river, Dibrugarh 27.19 N, 95.37 E c. 1930 Mukherjee 1961
+ Common. #
Dist., Assam

Laikajan river, Dibrugarh 27.41 N, 95.20 E c. 1930 Mukherjee 1961
+ Common. #
Dist., Assam

Jonai (Murkog-Selek) river, 27.51 N, 95.12 E c. 1930 Mukherjee 1961
+ Common. #
Lakhimpur Dist., Assam

Chain of bhils SE of Imphal, 24.40 N, 93.58 E July 1931 Huggins 1933
1 Probable record. # ?
Manipur

Chain of bhils SE of Imphal, Manipur	24.40 N, 93.58 E		June 1932	Huggins 1933	2 Pair. Probable record. # ?
Sadiya Frontier Tract, Assam	27.49 N, 93.58 E		c. 1940	Parsons 1940	+ Found on most forest bhils in pairs.
Sadiya Frontier Tract, Assam	27.49 N, 93.58 E		c. 1940	Parsons 1940	11 Largest flock ever seen by Parsons.
North bank of Brahmaputra Assam	27.45 N, 95.19 E		c. 1940	Mukherjee 1961	+ Not uncommon.
Bokajan, Manipur Road, Dhansiri river, Assam	26.03 N, 93.49 E	1944-1945	Mukherjee 1961	+	
Dimapur, Dhansiri river, Nagaland	25.55 N, 93.45 E		Feb 1945	Hutchinson 1946	2 Pair seen several times, flying, swimming or feeding.
Dimapur, Dhansiri river, Nagaland	25.55 N, 93.45 E		31-7-45	Hutchinson 1946	1 Male of the above pair, flying downstream at 1830 h.
Dimapur, Dhansiri river, Nagaland	25.55 N, 93.45 E		1-8-45	Hutchinson 1946	1 Above male shot while flying downstream at 1830 h.
Hilly areas of Tripura	23.45 N, 91.51 E		1940-1947	Mitra 1957	+ Resident in deepest part of densest forest. #
Borjan-Digboi Road, Assam			1943-1947	Mukherjee 1961	+ Seen on two occasions.
Tezu, Lohit Dist., Arunachal Pradesh	27.55 N, 96.10 E		Jan 1947	Ali & Ripley 1948	2 Pair in stagnant stream in lowland primary forest.
Brahmakund, Lohit Dist., Arunachal Pradesh	27.52 N, 96.23 E		Jan 1947	Ali & Ripley 1948	2 Pair in stagnant stream in lowland primary forest.
Tirap river, Dibrugarh Dist., 1975	27.21 N, 95.53 E		1950s	Walker *in litt.*	+ On an ox-bend of

Assam				river.	
Duklingia TE, near Mariani, Jorhat Dist., Assam	26.42 N, 94.15 E	1950s	Emmett *pers. comm.* 1991	3	Single birds shot in dense forest in monsoon season.
Majholi bhil, Moriani range, Jorhat Dist., Assam	26.39 N, 94.18 E	1953	Mukherjee 1961	2	Pair caught.
Tirap river, Namsai area, Arunachal Pradesh		c.1956	Mukherjee 1961	1	
Jamjing and Jiadabl/Buri Suti, Lakhimpur Dist., Assam	27.36 N, 94.51 E	1956	Scott & Mackenzie 1970	+	
Phillobari, (Doom Dooma RF), Dibrugarh Dist., Assam	27.36 N, 95.42 E	1956	Allen *in litt.* 1956	3	Captured and given to E.P.Gee.
Tikeri, E. Lakhimpur Dist., Assam		1956-1957	Mukherjee 1961	+	Pair or two.
Behali RF, Sanitpur Dist., Assam	26.50 N, 93.20 E	1958	Gee 1958	2-4	Resident pair or two. #
Ranga RF, Lakhimpur Dist., Assam		1958	Gee 1958	+	A few pairs. #
Dibru RF, Dibrugarh Dist., Assam	27.36 N, 95.20 E	1958	Gee 1958	+	Found in all forest streams. #
Phillobari, (Doom Dooma RF), Dibrugarh Dist., Assam	27.36 N, 95.42 E	1958	Gee 1958	+	A few pairs. #
Forest near Digboi, Dibrugarh Dist., Assam	27.22 N, 95.34 E	1958	Gee 1958	1-2	Single bird or pair seen occasionally. #
Kaliani river, Mikir hills, Golaghat Dist., Assam	26.28 N, 93.42 E	c.1958	Gee 1958	2	Pair on a long, still river pool. #
Dibru RF, Dibrugarh Dist., Assam	27.36 N, 95.20 E	1960	Mackenzie unpub.	30	PE
Dibru RF, Dibrugarh Dist.,	27.36 N, 95.20 E	1946-1961	Mukherjee 1961		

	+	Seen on several occasions.			
Assam					
Kampung bhil, Lakhimpur		c.1961	Mukherjee 1961	2	
	Pair.				
Dist., Assam					
Singpho, Lakhimpur Dist.,	27.58 N, 95.23 E	Jan 1961	Mukherjee 1961	1	
	Caught in rice field in				
Assam			cleared forest at night.		
Namchick stream, Namphai RF		27.25 N, 95.55 E*	Feb-Mar 1961	Mukherjee	1961
	1	Flushed from water.			
Dibrugarh Dist., Assam					
Digholi bhil, near Puma Pathar,		27.40 N, 95.20 E*	Feb-Mar 1961	Mukherjee	1961
	2	Perching on dead Hollock			
Dibru RF, Dibrugarh Dist.			tree branch at dawn.		
North bank of Brahmaputra 1km		27.48 N, 95.24 E	Feb-Mar 1961	Mukherjee	1961
	+	Heard calling, not seen.			
from Poba river mouth					
Forest at Bokajan, Dhansiri		26.00 N, 93.43 E	1964	Mackenzie	unpub.
	+				
river, Assam					
Sookreting-Digboi, Dibrugarh		27.29 N, 95.37 E	1966	Savage & Mackenzie	1967
	+	A few killed by villagers.			
Dist., Assam					
Kobochopri/Poba river,	27.48 N, 95.20 E	1967	Savage & Mackenzie 1967 +		
Lakhimpur Dist., Assam					
Dangri river, Dibrugarh Dist.,		27.38 N, 95.26 E	1967	Savage & Mackenzie	1967
	+	A few present.			
Assam					
Noadehing, Dibrugarh Dist.,		27.42 N, 95.46 E	1967	Savage & Mackenzie	1967
	+				
Assam					
Dulahar, near Lumding, Nowgong		26.01 N, 92.52 E	1967	Savage & Mackenzie	1967
	+				
Dist., Assam					
Bokajan, Dhansiri river,		26.00 N, 93.43 E	1967	Savage & Mackenzie	1967
	+				
Assam					

Duarmara area, Dibrugarh Dist., Assam	27.29 N, 95.37 E	30.8.1968	WWF Yearbook 1968	2	6 wk old ducklings taken for captive breeding.
Sookerating area, Dibrugarh Dist., Assam	27.30 N, 95.37 E	Aug-Sep 1968	WWF Yearbook 1968	4	Young birds taken for captive breeding.
Tea waste destruction pond, Bogapani, Dibrugarh Dist.	27.20 N, 95.40 E	Dec 1968	WWF Yearbook 1968	+	Group often visited pond, 1 male netted.
Forest near Pengarii TE, Dibrugarh Dist., Assam	27.27 N, 95.45 E	10.9.1969	WWF Yearbook 1969	4	Young birds taken for captive breeding.
Bogapani area, Dibrugarh Dist., Assam	27.20 N, 95.40 E	Sep-Dec 1969	WWF Yearbook 1969	3	Young birds taken for captive breeding.
Doom Dooma RF, Dibrugarh Dist., Assam	27.36 N, 95.42 E	27.9.1969	WWF Yearbook 1969	6	Young birds taken for captive breeding.
Dibrugarh Dist., Assam		1969	WWF Yearbook 1969	13	No. of birds known to be killed for food by locals.
Duarmara RF, Dibrugarh Dist., Assam	27.29 N, 95.37 E	late 1969	Mackenzie & Kear 1976	14	LE, including two family groups.
Duarmara RF, Dibrugarh Dist., Assam	27.29 N, 95.37 E	Mid Jan 1970	Mackenzie & Kear 1976	8	
Duarmara RF, Dibrugarh Dist., Assam	27.29 N, 95.37 E	May 1970	Mackenzie & Kear 1976	4	2 pairs.
Guijan area of Dibru RF, Dibrugarh Dist., Assam	27.34 N, 95.20 E	1969-1970	Mackenzie 1975	4	2 pairs.
Bogapani side of Dehing East, Dibrugarh Dist., Assam	27.20 N, 95.40 E	1969-1970	Mackenzie 1975	8	4 pairs.
Pengari RF, Dibrugarh Dist., Assam	27.27 N, 95.45 E	1970	Mackenzie 1975	6	3 pairs.

Doom Dooma RF, Dibrugarh Dist., Assam	27.36 N, 95.42 E	1970	Scott & Mackenzie 1970	+	Up to 10 seen at once.	
Phillobari RF, Dibrugarh Dist., Assam	27.31 N, 95.42 E	1970	Scott & Mackenzie 1970	+		
Mohong proposed RF, Dibrugarh Dist., Assam		1970	Scott & Mackenzie 1970	+	A number seen.	
Dibru RF, Dibrugarh Dist., Assam	27.36 N, 95.20 E Largest no. seen over several years.	Nov. 1973	Anon. 1975			5
Namsai RF, Lohit Dist., Arunachal Pradesh	27.45 N, 95.56 E Good numbers. # ?	1975	Barua *in litt.* 1975	+		
Koriapani RF, Tirap Dist., Arunachal Pradesh	27.28 N, 95.54 E Good numbers. # ?	1975	Barua *in litt.* 1975	+		
Siang Dist., Arunachal Pradesh	28.09 N, 95.01 E # ?	1975	Barua *in litt.* 1975	+		
Subansiri Dist., Arunachal Pradesh	27.31 N, 93.51 E # ?	1975	Barua *in litt.* 1975	+		
Kameng Dist., Arunachal Pradesh	27.19 N, 92.21 E # ?	1975	Barua *in litt.* 1975	+		
Central and E. Dibru RF, Dibrugarh Dist., Assam	27.38 N, 95.25 E	1975	Mackenzie 1975	4	2 pairs.	
Doom Dooma RF, Dibrugarh Dist., Assam	27.36 N, 95.42 E	1975	Mackenzie 1975	4	2 pairs.	
Upper Dehing West RF, Dibrugarh Dist., Assam	27.24 N, 95.33 E	1975	Mackenzie 1975	6	3 pairs.	
Duarmara RF, Dibrugarh Dist., Assam	27.30 N, 95.54 E 1 family group.	1975	Mackenzie 1975			12
Duarmara RF, Dibrugarh Dist.,	27.30 N, 95.54 E	29.9.75	Mackenzie	1975		

		3	2 males 1 female taken for captive breeding.			
Assam						
Dirok RF, Dibrugarh Dist., Assam	27.15 N, 95.35 E	1975	Mackenzie 1975	2	Pair.	
Namchick area, (Namphai RF) Dibrugarh Dist., Assam	27.25 N, 95.55 E	1975	Mackenzie 1975	2	At least a pair.	
Dibrugarh Dist. (Dibrugarh/ Doom Dooma/Digboi RFs) Assam		1975	Mackenzie 1975	60	PE for whole area.	
Doom Dooma RF, Dibrugarh Dist., Assam	27.36 N, 95.42 E	1976	Pirie & Choudhury 1976	4	PE.	
Doom Dooma RF, Dibrugarh Dist., Assam	27.36 N, 95.42 E	26.4.76	Pirie & Choudhury 1976	2	Pair seen on water and in flight.	
Dangri river, Dibrugarh Dist., Assam	27.38 N, 95.26 E	1976	Pirie & Choudhury 1976	2	PE. #	
Dibru RF, N & E, Dibrugarh Dist., Assam	27.40 N, 95.25 E	1976	Pirie & Choudhury 1976	8	PE. #	
Saikhowa RF, Dibrugarh Dist., Assam	27.46 N, 95.30 E	1976	Pirie & Choudhury 1976	4	PE. #	
Kakojan RF, Dibrugarh Dist., Assam	27.29 N, 95.39 E	1976	Pirie & Choudhury 1976	4	PE. #	
Upper Dehing East RF, Dibrugarh Dist., Assam	27.25 N, 95.42 E	1976	Pirie & Choudhury 1976	4	PE. #	
Mesaki and Makati RFs, Dibrugarh Dist., Assam	27.43 N, 95.40 E	1976	Pirie & Choudhury 1976	2	PE. #	
Kumsong RF, Dibrugarh Dist., Assam	27.44 N, 95.44 E	1976	Pirie & Choudhury 1976	2	PE. #	
Buridihing RF, Dibrugarh Dist., Assam	27.28 N, 95.49 E	1976	Pirie & Choudhury 1976	2	PE. #	

Duarmara RF, Dibrugarh Dist., Assam	2	27.30 N, 95.54 E	1976	Pirie & Choudhury	1976		PE. #
Namphai RF, Dibrugarh Dist., Assam	2	27.23 N, 95.57 E	1976	Pirie & Choudhury	1976		PE. #
Tirap RF, Dibrugarh Dist., Assam	2	27.21 N, 95.57 E	1976	Pirie & Choudhury	1976		PE. #
Sadiya Station RF, Dibrugarh Dist., Assam	2	27.56 N, 95.39 E	1976	Pirie & Choudhury	1976		PE. #
Kundil Kalia RF, Dibrugarh Dist., Assam	2	27.56 N, 95.53 E	1976	Pirie & Choudhury	1976		PE. #
Kukurmara RF, Dibrugarh Dist., Assam	2	27.51 N, 95.52 E	1976	Pirie & Choudhury	1976		PE. #
Dibrugarh Dist., Assam			1976	Pirie & Choudhury	1976	44	PE for whole region.
Sadiya Station RF, Dibrugarh Dist., Assam		27.56 N, 95.39 E	1978	Talukdar *in litt.*	1990	+	Seen on a Hollong tree. #
Mesaki RF, Dibrugarh Dist., Assam	2	27.43 N, 95.40 E	1978	Talukdar *in litt.*	1990		Pair killed for food. #
Doboka RF, near Lumding, Nowgong Dist., Assam		25.53 N, 93.03 E	1979-1980	Oliver *in litt.*	1990	2	Taken for captive breeding at Guwahati Zoo.
Buridihing RF, Dibrugarh Dist., Assam	2	27.28 N, 95.49 E	1980	Talukdar *in litt.*	1990		Female and young duckling. #
Duarmara RF, Dibrugarh Dist., Assam		27.30 N, 95.54 E	1981	Talukdar *in litt.*	1990	+	Seen at night in full moon in Summer. #
Kukurmara RF, Dibrugarh Dist., Assam		27.51 N, 95.52 E	1981	Talukdar *in litt.*	1990	+	Heard calling. #

Lanka wetlands, near Lumding, Nowgong Dist., Assam	25.55 N, 92.57 E	1982	Bhattarcharjee *pers. comm.* 1990	2	Captured. #	
Injan village, Miao sub-Division, Arunachal Pradesh		1982	Patriot, 16-9-82	+	#	
Dihangi, lower Haflong, North Cachar Dist. #	25.27 N, 92.59 E	late Sep 1983	Talukdar *in litt.* 1991	1	Seen in forest at 1200 h.	
Doom Dooma RF, Dibrugarh Dist., Assam	27.36 N, 95.42 E	4.4.85	Mackenzie 1985	4	3 and 1 flying along Doom Dooma river.	
Doom Dooma RF, Dibrugarh Dist., Assam	27.36 N, 95.42 E	6.4.85	Mackenzie 1985	3	2 males and 1 female flying and roosting 50ft up a tree.	
Doom Dooma RF, Dibrugarh Dist., Assam	27.36 N, 95.42 E	1985	Mackenzie 1985	8	Flock seen in the South-east of the RF	
Doom Dooma RF, Dibrugarh Dist., Assam	27.36 N, 95.42 E	1985	Sidhu *in litt.* 1985	up to 9	Flock seen on a pool over several days.	
Joypur RF, Dibrugarh Dist., Assam	27.14 N, 95.34 E	winter 1985	Bhattarcharjee *pers. comm.* 1990	4	Two pairs. #	
Tipam river, Joypur RF, Dibrugarh Dist., Assam	27.14 N, 95.24 E	5.3.86	Das *in litt.* 1986	2	Pair. #	
Bordubi TE, Dibrugarh Dist., Assam	27.35 N, 95.41 E	26-27.3.86	Sidhu *in litt.* 1986	5	Roosting in tree above captive birds in aviary.	
Dibru RF, Dibrugarh Dist., Assam	27.36 N, 95.20 E	c.1986	Das *in litt.* 1986	+	Recent sighting. #	
Koomsang RF/Kumsong RF, Dibrugarh Dist., Assam	27.44 N, 95.44 E	c.1986	Das *in litt.* 1986	+	Recent sighting. #	
D'Ering Memorial WS, Arunachal Pradesh	27.55 N, 95.25 E	April/May 1986	Choudhury *in litt.* 1991	+		
D'Ering Memorial WS, Arunachal Pradesh	27.55 N, 95.25 E	April/May 1987	Choudhury *in litt.* 1991	+		

Subansiri river on border of Assam/Arunachal Pradesh		27.31 N, 94.17 E Seen at least twice.	1986-1987	Oliver *in litt.* 1990	+
Bordubi TE, Dibrugarh Dist., Assam		27.35 N, 95.41 E Roosting in tree above captive birds in aviary.	1987	Anon. *in litt.* 1987	+
D'Ering Memorial WS, Arunachal Pradesh	27.55 N, 95.25 E	April/May 1988	Choudhury *in litt.* 1991		+
Litong, Doom Dooma RF, Dibrugarh Dist., Assam	27.36 N, 95.42 E Seen by D.C. Kalita.	1988	Singh *in litt.* 1991	5	
Lumding area, Nowgong Dist., Assam		25.46 N, 93.10 E	1988	Bhattarcharjee *pers. comm.* 1990	1 #
Nam Dapha NP, Tirap Dist., Arunachal Pradesh	7	27.30 N, 96.20 E Flock.	13.2.88	Singh 1989	
Gandhigram, Upper Noa Dihing, Arunachal Pradesh	>200	27.16 N, 96.54 E Flock in inundated rice fields. ?	8.3.88	Ripley *et al.* 1991	
Vijaynagar Station, Upper Noa Dihing, Arunachal Pradesh	27.09 N, 97.02 E Flying over station.	13.3.88	Ripley *et al.* 1991		1
Lumding area, Nowgong Dist., Assam		25.46 N, 93.10 E Flushed from open forest floor.	9.10.88	Bhattarcharjee *pers. comm.* 1990	1
Kathalguri Pathar, Duarmara RF, Dibrugarh Dist., Assam		27.28 N, 95.49 E Recovered from villagers by B.B. Borah & E. Ali.	Oct 1988	Singh *in litt.* 1991	4
Dibru-Saikhowa WS, Dibrugarh Dist., Assam		27.40 N, 95.24 E Captured for food. #	1989	Bhattarcharjee *pers. comm.* 1990	2
Dri river, Mehao sanctuary, Arunachal Pradesh		28.15 N, 95.42 E Small numbers along the lower river. #	1989	Scott 1989	+
Phillobari RF, Dibrugarh Dist., Assam	27.31 N, 95.42 E	June 1989	Talukdar *in litt.* 1990	1	Single bird. #
Naharkutia, Dibrugarh Dist.,		27.17 N, 95.20 E	1990	Bhattarcharjee	+

Several killed for food. #
Assam *pers. comm.* 1990

Joypur RF, Dibrugarh Dist., 27.14 N, 95.24 E 1990 Oliver *in litt.* 1990
+
Assam

Bogapani TE, Dibrugarh Dist., 27.20 N, 95.40 E c.1990 Sidhu *in litt.* 1991
2-3
Assam

Bordubi TE, Dibrugarh Dist., 27.35 N, 95.41 E c.1990 Sidhu *in litt.* 1991
3-4 Seen quite regularly near
Assam captive birds in aviary.

D'Ering Memorial WS, 27.55 N, 95.25 E 1990 Pandya *in litt.* 1991 4 PE
Arunachal Pradesh

D'Ering Memorial WS, 27.55 N, 95.25 E 1990 Choudhury *in litt.* 1991 10
PE
Arunachal Pradesh

Dibru-Saikhowa WS, Dibrugarh 27.40 N, 95.24 E 1990 Talukdar
in litt. 1991 20 PE. Maximum PE of 30. #
Dist., Assam

Mehao WS, Arunachal Pradesh 28.15 N, 95.42 E 1990 Talukdar *in litt.* 1991
10-16 Maximum PE. #

Nam Dapha NP, Arunachal 27.30 N, 96.20 E1990 Talukdar *in litt.* 1991 10 PE. #
Pradesh

North Cachar Hill and Barail 25.06 N, 92.50 E 1990 Talukdar *in litt.* 1990
+ Reported by villagers. # ?
RFs, Silchar Dist., Assam

Hansara, Sibsagar Dist., early 1990 Dehingia *pers. comm.* 1991 + Reported by
locals. #
Assam

Lower Jiri RF, 24.55 N, 93.16 E Jan 1990 Talukdar *in litt.* 1990 2
Pair near the Jiri river. #
Silchar Dist., Assam

Upper Jiri RF, 24.55 N, 93.16 E Jan 1990 Talukdar *in litt.* 1990 2
Pair near the Jiri river. #
Silchar Dist., Assam

Dibru-Saikhowa WS, Dibrugarh 27.40 N, 95.24 E 2.2.90-4.2.90 Talukdar
in litt. 1990 4 Group seen near Colomy bhil.

Dist., Assam

D'Ering Memorial WS, 27.55 N, 95.25 E17.4.90 Pandya 1990 & *in litt.* 1 Floating on Siang River in
Arunachal Pradesh 1991 calm water at 1640 h.

Nahoronijan, Dibru-Saikhowa 27.40 N, 95.24 E May 1990 Singh *in litt.* 1991
1 Seen by A.K. Barbora.
WS, Dibrugarh Dist., Assam

Dighali beel, Dibru-Saikhowa 27.40 N, 95.20 E June 1990 Singh *in litt.* 1991
4 Seen by A.K. Barbora.
WS, Dibrugarh Dist., Assam

Namchick RF, Dibrugarh Dist., 27.25 N, 95.55 E 6.10.90 Neog & Choudhury *in litt.*
2 Pair on small pond at 1230 h.
Assam 1991
Joypur RF, Dibrugarh Dist., 27.14 N, 95.24 E October 1990 Talukdar *in litt.*
1990 2 Pair. #
Assam

Ranijheel pond, Nam Dapha NP, 27.30 N, 96.20 E 29.11.90 Neog *in litt.* 1991
2 Pair seen morning and midday
Arunachal Pradesh at 810 m in area of high
forest.

Dibru-Saikhowa WS, Dibrugarh 27.40 N, 95.24 E 15.2.91
Bhattarcharjee *in litt.* 2 Seen at 1530 h in Dibru area.
Dist., Assam 1991

Doom Dooma RF, Dibrugarh 27.36 N, 95.42 E 23-29.5.91 Talukdar *in litt.* 1991 5
Group flew past in evening.
Dist., Assam

Dhulajan, Dibrugarh Dist., 27.44 N, 95.35 E 23-29.5.91 Talukdar *in litt.*
1991 4 Group flew past in evening.
Assam

Saikhowa, Dibru-Saikhowa 27.46 N, 95.30 E May 1991 Singh *in litt.* 1991 1
Seen by Das & Das.
WS, Dibrugarh Dist.

Ghotojan, Doom Dooma RF, 27.35 N, 95.42 E June 1991 Singh *in litt.* 1991 4
Seen by J. Burhagohain.
Dibrugarh Dist., Assam

PE = population estimate.

RF = Reserved Forest.

TE = Tea Estate.

WS = Wildlife Sanctuary.

NP = National Park.

= local report, unconfirmed.

? = clear possibility of wrong identification.

* = coordinates precise. All others are rough approximations.

4.11 SITES IN INDIA

4.11.1 Dibru-Saikhowa Wildlife Sanctuary KEY SITE

Location 27.31-27.49 N, 95.16-95.37 E. Flanking the Brahmaputra river from the confluence of the Dibang and Lohit Rivers downstream towards Dibrugarh, Dibrugarh District, Assam.

Description 64,000 ha at 90-100m altitude. A complex of wide river channels, sand banks, riverine marshes, oxbow lakes, bheels, vast reed-beds and seasonally flooded grassland and forest on the alluvial flood plain of the Brahmaputra River. The northern boundary is just beyond the north Brahmaputra bank, and the southern boundary is the Dibru river. Formerly a densely forested area, much of the forest was destroyed by the 1950 earthquake and subsequent floods, being replaced by reed beds. The whole area is extensively flooded during the monsoon, and there is a good supply of surface and subterranean water throughout the year. There are tracts of permanent swamp forest and seasonally flooded forest with dryland forest on the highest ground. Frequent changes in the course of the rivers and the earthquake have created a patchwork of transitional wetland and forest types. There are large areas of tall reed salix swamps. There are mixed deciduous forests, tropical wet evergreen forest, swamp forest and tropical moist deciduous forest. Species found include Hollock *Terminalia myriocarpa*, Gondroi *Cinamomiun* sp., Jarul *Lagestroemia* sp., Nahor *Mesua ferrea* and Hingori *Castanopsis* sp. There are forest villages on site, and the southern boundary is highly populated with villages and tea estates. Adjacent areas are under cultivation, chiefly for rice.

Status of *C. scutulata* Present in all the forest streams in 1958, and Mackenzie (*in litt.* undated) estimated the population as 30 in 1960. Numbers are now thought to be lower, but Talukdar (*in litt.* 1991) estimates the population as at least 20, with birds seen most often at Colomy and Digholi bheels. Two captured for food in 1989. Four seen in February 1990, one in May 1990, four in June 1990, a pair in February 1991 and one in May 1991. Estimated population 20.

Threats

i. Habitat destruction. Most of the forest has been heavily exploited for timber or destroyed by heavy floods, and little dense forest remains. The remaining forest is under threat because of a natural shift in the course of the Brahmaputra River. Peripheral areas are being reclaimed for agriculture, and there has been much encroachment at the southwestern side, where there is heavy grazing pressure from domestic livestock. Thatched grass *Imparata cylindrica* and cane collection is still permitted.

ii. Fishing and poaching. Two *C. scutulata* were taken for food in 1989. The same year, fishing leases were granted but after a public protest, the leases were cancelled from April 1990. Poaching and fishing were formerly intense, but are no longer permitted.

Conservation Measures Taken Declared as a Wildlife Sanctuary in 1986, principally to protect *C. scutulata*.

References Mukherjee 1966, MacKenzie 1985, Scott 1989, Bhattarcharjee *in litt.* 1990.

Action

i. Conduct a survey to establish the size and distribution of the *C. scutulata* population, and to evaluate the nature and extent of remaining habitat.

ii. Control poaching and illegal encroachment.

iii. Extend the north boundary to include Kobochopri, where *C. scutulata* has formerly been recorded.

4.11.2 Nam Dapha National Park KEY SITE, INDI 57

Location 140 km east of Dibrugarh on the Myanmar border in Tirap District, Arunachal Pradesh. 27.23-27.39 N, 96.15-96.58 E.

Description 180,782 ha at 200 - 4,580 m altitude. The habitat ranges from riverine forest at the lowest elevations, through tropical wet evergreen forest, moist evergreen forest, mixed deciduous forest and hill evergreen formations, to alpine barrens at over 4,500m. Wetlands include the Noa Dihing River, its tributaries, associated marshes and riparian forests.

Status of *C. scutulata* Occurring along the Noa Dihing River at the lowest elevations in the Park, where seven seen in February 1988. Two recorded at 810 m at Ranijheel in November 1990. One bird recorded further up the valley at Vijaynagar Station, 1,250 m, in March 1988. Estimated population 7.

Threats A proposal for a hydro-electric scheme has recently been stopped.

Conservation Measures Taken Declared a Wildlife Sanctuary in 1972 and a National Park in 1983. A Project Tiger Reserve.

Action

i. Conduct a survey to establish the size and distribution of the *C. scutulata* population.

ii. Extend the park boundary to the west to incorporate more lowland forests, and set up a buffer zone.

4.11.3 Mahao (Mehao) Wildlife Sanctuary KEY SITE, INDI 56

Location 28.05-29.15 N, 95.40-96.03 E. 100 km northeast of Dibrugarh in Dibang Valley District, Arunachal Pradesh.

Description 28,150 ha at 200-300 m altitude. Located around the valley of the Dri River which flows to join the confluence of the Dihang and Lohit Rivers at 27.55 N, 95.40 E. Mainly primary tropical wet evergreen and semi-evergreen forest, but there are some areas of grassland and seasonally inundated valley floors with riverine formations.

Status of *C. scutulata* Said to persist in small numbers along the lower course of the Dri River. Estimated population 2.

Threats Lowland forests were probably damaged by the 1950 earthquake and subsequent flooding.

Conservation Measures Taken Declared a Wildlife Sanctuary in 1980.

Action Conduct a survey of the WS and neighbouring lowland areas to establish the size and location of the *C. scutulata* population, and to identify any threats.

4.11.4 D'Ering Memorial (formerly Lali) Wildlife Sanctuary KEY SITE, INDI 55

Location 27.55-28.10 N, 95.23-95.30 E. 80 km north-east of Dibrugarh in East Siang District, Arunachal Pradesh on the Assam border.

Description 19,000 ha at 250 m altitude incorporating the lower reaches and flood plain of Siang (Dihang) River. Bound by this river to the west and Cibia River to the east. Wetlands include riverine marshes,

seasonally flooded grassland, riparian forest, a stream retaining water from May to December and two permanent ponds/swamps. There is Tropical Moist Deciduous Forest with riverine forest and grasslands in the valley bottoms. Alluvial grasslands occupy 65 % of the area. The principal forest species are Hollock *Terminalia myriocarpa*, Hingori *Castanopsis* sp., Simul *Bombax ceiba* and Koroi *Albizia procera*. A reserve forest occurs to the west across the Siang and Unclassed State Forest to the east across the Cibia.

Status of *C. scutulata* Seen regularly since 1986 with last record on 11.4.90 on the open Siang river. Estimated population 4.

Threats

i. Habitat destruction. Grazing of livestock and collection of thatch grasses within the sanctuary by neighbouring villagers. Fires are set by neighbouring villagers to drive out mammals for hunting.

ii. Hunting. Locals use guns and a variety of traps to obtain food.

Conservation measures taken Declared a sanctuary in 1978.

References Pandya 1990 & *in litt.* 1991, Choudhury *in litt.* 1990

Action

i. Conduct a survey to clarify the size and distribution of the *C. scutulata* population.

ii. Upgrade the WS to a National Park to increase the habitat protection.

4.11.5 Doom Dooma Reserve Forest KEY SITE

Location 27.36 N, 95.42 E. Doom Dooma Division, Dibrugarh District, Assam.

Description 2,880 ha at 100-150 m altitude, on the north bank of Doom Dooma river with Phillobari TE to the South and Bordubi TE to the South-west. The forest has been heavily logged and partly replaced by plantations, but there remains some dense secondary forest adjacent to the river and TEs. The forest is dominated by Hollong *Dipterocarpus macrocarpus* and Nahor *Mesua ferrea*. There are two adjacent villages.

Status of *C. scutulata* Up to nine seen in 1985. Five seen in 1988, five in May 1991 and four in June 1991. Four seen in nearby Dhulajan in May 1991. In 1986-1987 up to five were roosting in a tree above the aviary at Bordubi containing captive birds. Three to four seen quite regularly above the aviary c.1990. Estimated population 9.

Threats

i. Habitat destruction. Ongoing logging and encroachment. Forest is under a 'selective fell/replant' logging concession. Many logged areas of forest have been converted to scrub, and others have been infested with *Makinia* vine, preventing regeneration.

Conservation Measures Taken None known.

References Scott & Mackenzie 1970; Mackenzie 1975, 1985; Oliver *in litt.* 1990.

Action

i. Conduct a survey to establish size and distribution of the *C. scutulata* population.

ii. Declare the site as a Wildlife Sanctuary to provide proper habitat protection.

4.11.6 Joypur Reserve Forest

Location 27.14 N, 95.34 E. South-east of Naharkutia, Dibrugarh Division, Dibrugarh District, Assam.

Description 10,869 ha at 330-530 m altitude. Mainly wet evergreen forest surrounding the Tipam river, dominated by Hollong *D. macrocarpus*, Nahor *M. ferrea* and Kakai.

Status of *C. scutulata* Four seen in the reserve in winter 1985 and two on the Tipam river on 5.3.86. A pair was seen in October 1990. Estimated population 4.

Threats

i. Habitat destruction. Under logging concession by the forestry department.

ii. Hunting. In 1990, several wild caught birds were sold at a market in Naharkutia.

Conservation Measures Taken None known.

References Mackenzie 1975, Bhattarcharjee *in litt.* 1990.

Action

i. Conduct a survey to establish the size and distribution of the *C. scutulata* population.

ii. Control poaching.

4.11.7 Kumsong Reserve Forest

Location 27.44 N, 95.44 E. South of Lohit river, Doom Dooma Division, Dibrugarh District, Assam.

Description 2,252 ha at 100-150 m altitude. Grasslands and swamps occupy a large area. The forest is partly subjected to floods, and is mixed deciduous forest with evergreen patches.

Status of *C. scutulata* Seen in 1986. A pair was thought present in 1976. Estimated population 2.

Threats The site has been extensively logged for timber extraction by the forestry department and rural population. Some logged forest areas have become infested with "Makinia", preventing regeneration.

Conservation Measures Taken None known.

References Mackenzie 1975, 1985; Bhattarcharjee *in litt.* 1990.

Action Conduct a survey to establish the size and distribution of the *C. scutulata* population.

4.11.8 Lumding/Kopili river

Location 25.46-25.55 N, 92.57-93.10 E. North-west of Lumding town, Nowgong District, Assam.

Description A partly-forested area extending for 30 km along the North bank of the Kopili river, including

Doboka RF, Lumding RF and wetlands around Lanka. Forests are evergreen and semi-evergreen.

Status of *C. scutulata* In 1979-1980, 2 captured from Doboka RF In 1982, another 2 captured from Lanka, and on separate occasions in 1988, 2 individuals were seen in the area. Estimated population 2.

Threats

i. Habitat destruction. The forests are exploited for timber.

ii. Hunting. In 1982, two birds were taken for food from Lanka.

Conservation Measures Taken None known.

Action Conduct a survey to establish the distribution and size of the *C. scutulata* population.

4.11.9 Phillobari Reserve Forest
27.31 N 95.42 E, Doom Dooma Division, Dibrugharh District, Assam. 318 ha, with one *C. scutulata* reported in June 1989. Estimated population 2. Survey required.

4.11.10 Lower and Upper Jiri Reserve Forest

c.24.55 N 93.16 E, Silchar District, Assam near the Manipur border. Lower RF 3,643 ha; Upper RF 6,326 ha. Evergreen forest with altitude up to 630 m. A pair of *C. scutulata* was reported in January 1990 near the Jiri river. Estimated population 2. Survey required.

4.11.11 Subansiri river

27.31 N, 94.17 E. A forested area of Lakhimpur District, Assam and Arunachal Pradesh bordering the Subansiri, a major tributary of the Brahmaputra. Includes Subansiri RF, 17,645 ha at 100-330m altitude. *C. scutulata* were seen at least twice here in 1986-1987. Estimated population 2. Survey required.

4.11.12 Bogapani

Two to three *C. scutulata* seen near Bogapani TE, Dibrugarh District, Assam c.1990. Close to Upper Dehing RF. Estimated population 3. Survey required.

4.11.13 Namchick Reserve Forest

Digboi Forest Division, Dibrugarh District, Assam. Pair seen on 6.10.90. Close to Namphai RF (2,117 ha). Estimated population 2. Survey required.

4.11.14 Kukurmara Reserve Forest

27.51 N 95.52 E, Dibrugarh District, Assam. 365 ha. *C. scutulata* heard calling in 1981. Estimated population 2. Survey required.

4.11.15 Duarmara Reserve Forest

27.30 N 95.54 E, Doom Dooma Division, Dibrugarh District, Assam. 653 ha. *C. scutulata* seen in 1981. Four captured by villagers in October 1988, and two later escaped. Estimated population 2. Survey required.

4.11.16 Buridihing Reserve Forest

27.28 N 95.49 E, Doom Dooma Division, Dibrugarh District, Assam. 2,295 ha. A female and duckling *C. scutulata* seen in 1980. Estimated population 2. Survey required.

4.11.17 Dihangi

25.27 N, 92.59 E, Lower Haflong, North Cachar District, Assam. Forest area. One bird seen in September 1983. Estimated population 1. Survey required.

4.11.18 North Cachar Hill and Barail Reserve Forests

c.25.06 N 92.50 E. Silchar District, Assam. 30,000 ha of altitude up to 2,000 m, with moist deciduous and evergreen forests. A proposed WS, with villagers reporting *C. scutulata* as present. Survey required, especially in the lower forests along the Dhaleswari river.

4.11.19 Pabha Wildlife Sanctuary

Lakhimpur District, Assam. 4,900 ha with proposed extension of 4,100 ha. c.100 m altitude, with main habitat Tropical Wet Evergreen Forest. *C. scutulata* previously recorded from the area in the 1960s. Survey required.

5. BANGLADESH NATIONAL SECTION

5.1 LOCAL NAME

"Bhadi hansh" or "Shetapakkha balaka" (Khan 1986).

5.2 FORMER DISTRIBUTION

5.2.1 Chittagong Hill Tracts

All confirmed records of *C. scutulata* are from the Chittagong Hill Tracts region (CHT) of southeastern Bangladesh (Fig. 7). Originally the species was probably widespread in this region, which had an estimated 15,000 km^2 of suitable habitat. The earliest precise record is from Husain & Haque (1982) who reported that a former Chief Conservator of Forests saw and shot a couple of specimens "a few decades ago" in the Mainimukh area of the CHT, now flooded by Kaptai Reservoir, completed in 1963, inundating 76,600 ha of former *C. scutulata* habitat (Mountfort 1969; Scott 1989).

Most other records come from the vicinity of Pablakhali WS in the north CHT, with one record from the Matamuhuri river area in the south (see below).

5.2.2 Chittagong Revenue Division

C. scutulata may originally have been widespread in the Chittagong Revenue Division (CRD) of eastern Bangladesh which contained similar habitat to the CHT. This area comprises the CHT, Chittagong, Cox's Bazaar and Jhoom Control Forest Divisions (Khan 1986). Mitra (1957) saw *C. scutulata* in "in the deepest part of the densest forest of the hilly areas of Chittagong" during the 1940s and 1950s. It is unclear where he is referring to, but it may be the CHT (Khan *in litt.* 1991). Rashid (1967) reported it as possibly present in Moulvi Bazar District (formerly Sylhet).

5.2.3 Central Bangladesh

Hume & Marshall (1880) refer to a letter from Jerdon who reported several flocks of 10 to 40 *C. scutulata* on "the lower part of the Brahmaputra where it joins the Ganges, not far above Dacca, where Simson had seen it". However, Simson (1882) never saw such flocks, and only "heard of a large flock of dark ducks in these waters". Hume & Marshall state that *C. scutulata* was never seen by "dozens of people" who later surveyed this area, and suggest that Jerdon saw flocks of Comb Ducks *Sarkidiornis melanotos* regularly observed by others.

Alexander (1948) reports a similar sighting of a flock of about 30 suspected *C. scutulata* (split between two parties) on the open Padma river, somewhere 0-100 km downstream of Jerdon's sightings. These locations are over 100 km from the CRD. The occurrence of flocks on these large, open rivers in the Ganges-Brahmaputra Delta would be very untypical of the habitat and behaviour of *C. scutulata*, and these records are likely to be misidentifications.

5.3 FORMER HABITAT

The CRD was formerly covered with a mixture of Tropical Wet Evergreen, Tropical Semi-evergreen and Tropical Moist Deciduous Forests at less than 300 m altitude. The forests had three distinct strata (Khan 1986). The moist deciduous upper stratum, reaching 30-50 m, does not form a closed canopy. The tallest trees are Civit *Swintonia floribunda*, Chundul *Tetrameles nudiflora*, Uriam *Mangifera longipes*, Chapalish *Artocarpus chaplasha*,

Barta or Lakooch *A. lakoocha*, Garjan *Dipterocarpus* spp., Surujbed or Toon *Toona ciliata*, Buddha Narikel *Pterygota alata* and Shimul *Bombax ceiba*. The second stratum consists of high evergreens forming a closed canopy at 20-30 m, with jam *Syzygium* spp., batna *Quercus* spp., Telshur *Hopea odorata*, Pitraj *Aphanamixis polystachya* and Nageshwar *Mesua ferrea*. The third stratum (7-15 m) is the saplings of the above strata mixed with *Vitex glabrata*, *Saraca india*, *Mallotus philippensis*, *Macranga* sp., *Castanopsis indica*, *Garcinia* spp. and *Elaeocarpus* spp. The undergrowth is bamboo, cane or palm in pure stands or mixed with ferns, ground orchids, vines and lianas.

Mackinnon & Mackinnon (1986) give this mixture of forest types a broad classification of Tropical Moist Deciduous Forest. If *C. scutulata* was recorded from the Padma and Brahmaputra rivers, the nearest forest would either have been Sal forest of the Madhupur Tract, or Freshwater Swamp Forest separating this tract from coastal mangrove forests. Rashid (1967) lists *C. scutulata* as possibly present in the Madhupur Tract. Sal forest is a moist deciduous forest dominated by Sal *Shorea robusta* (Scott 1989) and again is given a classification of Tropical Moist Deciduous Forest by Mackinnon & Mackinnon (1986).

5.4 CURRENT DISTRIBUTION

All recent records of *C. scutulata* have come from two populations in the CHT (Fig. 7). Access to the entire CHT area has been prohibited since 1982.

5.4.1 Pablakhali Wildlife Sanctuary KEY SITE

Husain & Haque (1982) conducted a thorough survey of the whole Kassalong Valley area of the northern CHT by interviewing local people. This located 61 places where ducks were observed in and around Pablakhali WS between Gatarchara and Tanguma. Posting volunteers simultaneously in each place, counts were made from 1976 to 1979. There were 20 *C. scutulata* in August 1976, and 28 in March 1979. Local reports indicated that the population had declined in recent years, and the last record was made in 1981. LE = 28.

5.4.2 Sanga-Matamuhuri Valley Reserve Forest

Khan (1986) suggested that *C. scutulata* may survive in this forested area in the southern CHT, and two birds were reported from the Matamuhuri river area between Lama and Alikadam in October 1988 (Rashid *in litt.* 1990). LE = 2.

5.4.3 Total population estimate

The two populations give a total estimate of 30 birds. This may be an overestimate, as the pressures identified in the Pablakhali population in the late 1970s are so great that it is likely to have declined and may even be extinct.

5.4.4 Potential for undiscovered populations

Khan (1986) suggested that *C. scutulata* may also be found in Rangkheong RF in the central CHT. Like the Sanga-Matamuhuri Valley RF, this is an isolated, relatively inaccessible forest area that has never been fully surveyed ornithologically. There are no other areas of suitable habitat remaining in Bangladesh.

5.5 CURRENT HABITAT

5.5.1 Forest type

The Pablakhali area consists of numerous hills and valleys containing creeks and streams that feed into the river Kassalong and then into Kaptai Reservoir. Three forest types occur together, as described above for the CRD (Scott 1989). All the forest is secondary, having been selectively or clear-felled, and/or the bamboo having been removed (Khan 1986). Tropical Wet Evergreen Forest is dominant in valleys and on shaded slopes with a plentiful water supply, and has taller emergent trees with a dense but irregular canopy. This forest contains Civit *Swintonia floribunda*, a tree species that provided two of the three confirmed *C. scutulata* nest sites (Husain & Haque 1982). Tropical Moist Deciduous Forest is dominant in new alluvial areas alongside rivers and streams, and has scattered trees with large open spaces of grasses and wild Banana. Tropical Semi-evergreen Forest dominates other areas, mainly of hilly ground, with the tree species including Barta or Lakooch *Artocarpus lakoocha* which has provided a confirmed *C. scutulata* nest site (Husain & Haque 1982). Other species include Uriam *Mangifera longipes* and Chapalish *Artocarpus chaplasha*, both of which are listed as nesting trees by Khan (1983). However, the Barta tree used as a nest site was in fact within a secondary reserve forest of Teak trees *Tectona grandis* of about 12 m high. Khan (1983) identified three regular roosting trees in the Pablakhali area as a 10 m Shimul tree *Bombax ceiba*, a 12 m cCakua Koroi *Albizia chinensis* and a 45 m Civit tree *Swintonia floribunda*. The forest habitat in Sanga-Matamuhuri Valley RF is very similar to that in the Pablakhali area, but no details are available.

5.5.2 Wetlands

The forest in the Pablakhali area contains water bodies throughout the year where *C. scutulata* feeds. In the wet season, there are slow flowing rivers and streams, pools and flooded areas of forest. In the dry season (December to March) many of the streams and pools dry up, whilst others are reduced to stagnant ditches. *C. scutulata* feeds in shallow water in lakes, streams, small ox-bow lakes and ditches, but never in Kaptai Reservoir (Husain & Haque 1982, Khan 1983). Husain & Haque (1982) found that, in the dry season, the ducks concentrated in the few ditches that still contained water. These ditches were deep in the forest, and birds were more easy to observe during the wet season when they were using more open wetlands.

5.6 THREATS

5.6.1 Deforestation

Since the second world war most of the native forests have been cleared, reducing forest cover to about 6%, with annual deforestation of 8,000 ha (1981-1985, Collins *et al.* 1991). In the CHT, construction of Kaptai Reservoir in the 1960s and associated developments accelerated systematic clear-felling of primary forest. Some forest has been replaced by forestry plantations, but most land has not been replanted. Shortened rotation cycles in forest reserves, and increasing encroachment by shifting cultivators have added to forest degradation. Soil erosion in many areas is causing siltation of river beds and of Kaptai Reservoir (Howlader 1989, Collins *et al.* 1991).

Husain & Haque (1982) identified the clear-felling of remaining natural forest and extension of cultivation along creeks and streams as threats to *C. scutulata* in the Pablakhali area. Furthermore, the selective logging of old softwood trees was destroying their nesting sites. Old Civit, Uriam, Chapalish and Barta trees are logged for making tea-chests, plywood, packing-boxes, match-boxes and match-sticks. The Rangkheong and Sangu-Matamuhuri Valley RFs have been badly damaged by excessive shifting cultivation. In the forest inventory of 1963, 97% of Rangkheong RF was timber and/or bamboo. By 1983 this was reduced to 51% (Howlader 1989).

5.6.2 Hunting

Even in the early 1980s, senior forest and other officials shot *C. scutulata* in Pablakhali WS (Khan 1986).

Husain & Haque (1982) found that almost all duck mortality in this area was caused by man. In 1977 and 1978 a total of 31 ducklings were located, in eight broods. Of these, 23 (74%) were captured by local people using dogs to locate them in ditches and streams in the forest. They were then reared in captivity before being eaten or sold. In addition, in 1977 two adults were killed after becoming entangled in the gill-nets used by locals and settlers for fishing. These nets are 10-15 m in length, and stretched under the surface of pools or small lakes. Adult ducks become entangled while swimming under water (Khan 1986).

5.6.3 Settlement

In 1982 the CHT was made a prohibited zone due to hostilities between the military and tribal people protesting at the loss of their autonomy and traditional lands following the influx of Bengali settlers (Survival International 1988). Since the mid 1980s the Government of Bangladesh has been leasing out forest in and around the Pablakhali WS to settlers at 2.5 ha per family. By 1986 about ten thousand families had been resettled in the CHT (Khan 1986; Scott 1989), accelerating deforestation and increasing the levels of hunting and fishing. The Pablakhali *C. scutulata* population seems unlikely to survive the levels of mortality from hunting and fishing encountered by Husain & Haque (1982) in combination with further habitat destruction.

5.7 CONSERVATION MEASURES TAKEN

5.7.1 Species Protection

Husain & Haque (1982) recovered three of the ducklings captured by locals in the Pablakhali area and returned them to the wild. *C. scutulata* is protected under the Bangladesh Wildlife Preservation Act of 1973, but this is not effective in practice.

5.7.2 Habitat Protection

Pablakhali WS is a protected area, but one under extreme pressure from encroachment.

5.8 EVALUATION

In Bangladesh, *C. scutulata* is under extreme pressure from habitat destruction and hunting, and is likely to be on the verge of extinction. Action is required immediately to secure the survival of the species. A number of proposals for action have been made by Husain & Haque (1982) and Khan (1986), but none has been taken up. The present political situation in the CHT prevents immediate conservation action. However, the following actions are required when possible.

5.9 ACTION

5.9.1 Surveys

i. First priority: the Pablakhali area to establish where *C. scutulata* still survives.

ii. Second priority: Sanga-Matamuhuri Valley RF to establish the distribution of *C. scutulata*.

iii. Third priority: Rangkheong RF, thought to contain suitable habitat.

5.9.2 Habitat protection

In areas populated with *C. scutulata*, further clear-felling of natural forest should be suspended and remaining old softwood trees (particularly Civit and Barta) should be protected from selective logging to secure nesting sites.

5.9.3 Protection from hunting and fishing

In areas populated with *C. scutulata*, hunting should be discouraged through an education campaign. The use of invisible mist-nets for fishing should be reviewed, if possible replacing them with a technique that does not endanger the birds.

5.10 ALL RECORDS IN BANGLADESH

Location	Coordinates	Date	Source	Numbers	Notes
River Brahmaputra, not far above Dacca	23.47 N, 90.33 E	before 1864	Hume & Marshall 1880	+	Several flocks of 10-40 ?
Open Padma River between Chandpur and Goalundo	23.24 N, 90.19 E	2.2.47	Alexander 1948	c.30	Flock in two parties ?
Hilly areas of Chittagong deepest		1940-1957	Mitra 1957	+	Local resident in the part of the densest forest
Mainimukh area, CHT #	22.59 N, 92.12 E	before 1963	Husain 1977	+	Couple shot in an area now flooded by Kaptai reservoir
Pablakhali area, CHT	23.08 N, 92.16 E	1969 or 1970	Husain & Haque 1982	2-4	1-2 pairs
Pablakhali area, CHT	23.08 N, 92.16 E	March 1975	Husain & Haque 1982	6	3 pairs
Pablakhali area, CHT	23.08 N, 92.16 E	August 1976	Husain & Haque 1982	20	PS 12 adults, 8 young
Pablakhali area, CHT	23.08 N, 92.16 E	1976	Husain 1977	5	5 adults in one tree
Pablakhali area, CHT	23.08 N, 92.16 E	30.8.77	Husain & Haque 1982	20	PS
Pablakhali area, CHT	23.08 N, 92.16 E	1977	Husain & Haque 1982	26	PE 18 adults, 8 young
Pablakhali area, CHT	23.08 N, 92.16 E	15.3.78	Husain & Haque 1982	26	PS
Pablakhali area, CHT	23.08 N, 92.16 E	15.4.78	Husain & Haque 1982	25	PS
Pablakhali area, CHT	23.08 N, 92.16 E	15.5.78	Husain & Haque 1982	25	PS
Pablakhali area, CHT	23.08 N, 92.16 E	3.7.78	Husain & Haque 1982	28	PS plus 3 ducklings in captivity
Pablakhali area, CHT	23.08 N, 92.16 E	18.3.79	Husain & Haque 1982	28	PS

Pablakhali area, CHT	23.08 N, 92.16 E	1981	Khan 1986	+	
Between Lama and Alikadam, Bandarban District, CHT	21.40 N, 92.18 E	October 1988	Rashid *in litt.* 1990	2	#

All coordinates are rough approximations.

+ = recorded as present.

? = clear possibility of wrong identification.

= local report, unconfirmed.

PS = detailed survey of the whole population.

PE = estimate of the whole population.

5.11 SITES IN BANGLADESH

5.11.1 Pablakhali Wildlife Sanctuary KEY SITE, BA 5

Location 70 km north of Rangamati in the Chittagong Hill Tracts. 23.08 N, 92.16 E.

Description 42,087 ha in the southeastern part of the Kassalong Valley RF (170,000 ha). A region of secondary-forested hills and valleys (100-300 m altitude) with perennial rivers, riverine forest, ox-bow lakes and forest pools. 3,885 ha of lowlands in the south were submerged by Kaptai Reservoir. Tropical Moist Deciduous Forest occurs in new alluvial areas along rivers and streams. Tropical Wet Evergreen Forest occurs in the valleys and on wet, sheltered slopes. Elsewhere, Tropical Semi-evergreen Forest dominates.

Status of *C. scutulata* All but one Bangladesh record since 1971 are from this area. In 1979 there were 28 individuals. Last recorded in 1981. Estimated population 28.

Threats

i. Hunting. In 1977-1978, hunting with dogs caused 74% mortality of ducklings. Adults are caught in gill-nets set by fishermen.

ii. Habitat destruction: by general forest clearance and selective logging of old softwood trees vital for nesting. In the mid 1980s, the Government began leasing out forested lands in and around the WS to settlers who clear the forest given to them and encroach on the reserved forest. The narrow strip of natural forest which runs north-south through the WS is being encroached and replaced with commercial forestry plantations. In many places, the strip has gone, isolating the smaller southern part of the WS from the rest.

Conservation measures taken Established as a Game Sanctuary in 1962, and as a Wildlife Sanctuary in 1983. Under the working plan that expired in 1988/1989 the sanctuary was divided into two. In Unit I (25,900 ha), the emphasis was on wildlife protection, with forestry operations supposedly prohibited. In Unit II, the natural forest was steadily being converted to forestry plantations.

Action

i. Survey to establish the current distribution of *C. scutulata*.

ii. Suspension of clear-felling of natural forest and selective logging of old softwood trees to secure nesting sites.

iii. Local education campaign to stop hunting, and review use of gill-nets for fishing, replacing with a technique that does not endanger the ducks.

5.11.2 Sanga-Matamuhuri Valley Reserve Forest

74,000 ha in Bandarban District, southern Chittagong Hill Tracts, 21.20 N, 92.20 E. Similar habitat to Pablakhali, but over-intensive shifting cultivation has reduced forest cover. Two *C. scutulata* were reported from the Alikadam area in October 1988. Requires survey.

5.11.3 Rangkheong Reserve Forest

76,000 ha in central Chittagong Hill Tracts, 22.10 N, 92.20 E. Similar forest habitat to Pablakhali, but

over-intensive shifting cultivation has reduced forest and bamboo cover from 97% in 1963 to 51% in 1983. Requires survey for *C. scutulata*.

6. UNION OF MYANMAR (BURMA)

6.1 LOCAL NAME

"Taw-be" (Forest Duck) or "Mandali" (Tun Yin 1960). "Mandali" is also the name of a breed of domestic Muscovy Duck *C. moschata*.

6.2 FORMER DISTRIBUTION

There are widespread records of *C. scutulata* in Myanmar, and it was originally present in at least nine of the fourteen regions into which the country is now divided (Fig. 8). A regional summary of past records is given below in a roughly North to South order.

6.2.1 Kachin State

Recorded from throughout the region. Found at a jheel (swamp) 2 km from Bhamo town in 1900 (Evans 1901); Nanyaseik on the Mogaung Chaung in 1900 and Nauyu yan in Myitkyina District in 1901 (BMNH specimens); the Kaukkwe chaung, Bhamo District in 1929 (Smith 1942); the Mali Hka near Putao in the 30s (Stanford & Ticehurst 1939); the Mogaung chaung and the Jade mines of Myitkyina District in the 30s (Stanford & Ticehurst 1939); Pidaung WS up to 1959 (Stanford & Ticehurst 1939; Smith 1942; Tun Yin 1960; Milton & Estes 1963); the Mansi tract and Sikaw area, Bhamo District up to 1970 (ICBP 1970; Tun Yin 1977).

6.2.2 Sagaing Division

Recorded from locations throughout the region. Recorded as "common" in the Upper Chindwin to 1939 (Tun Yin *in litt.* 1976; Stanford & Ticehurst 1931, 1939). The Kabaw valley and forest streams in Kindat District are the only specific locations in the Upper Chindwin cited in the literature (Hopwood 1908; Huggins 1933), but BMNH has specimens shot at Thamao Shi and Kelata in 1903 and at Tamu in the Kabaw valley in 1905. Also recorded from the Uyu side of Mansi (Blanford *in litt.* 1935).

In Katha District, recorded from the Meea chaung (Blanford *in litt.* 1935); near Kawlin in 1903 (Tun Yin *in litt.* 1976); the Kaukkwe chaung and Hintha in the 20s; Nyaungbinhla in 1931 (Smith 1942); the Wai chaung, in 1974 (Tun Yin 1977). "Often seen flying up and down the Mu river" in Shwebo and Katha Districts before 1942 (Smith 1942). Recorded from Chatthin (Kyatthin) WS, Shwebo District up to 1955 (Tun Yin 1960).

6.2.3 Shan State

Considered as "one of the most characteristic birds of the Shweli river" by Smith (1942) with records up to 1927; found near Shwe-U-Daung WS, Momeik Township in 1974 (Tun Yin 1977).

6.2.4 Chin State

Recorded from the larger streams in Paletwa Township Group (Northern Arakan) in 1912 (Hopwood 1912).

6.2.5 Bago (Pegu) State

"Not uncommon" in Tharrawaddy District before 1914 (Stanford & Ticehurst 1931), with record from Yetho (Blanford *in litt.* 1935). Recorded from Shwe-laung-Kodugwe Reserve in the 1920s (Tun Yin 1960). Possible record from the Yenwe chaung in the proposed Bago Yoma NP in 1981 (Saw Han *in litt.* 1990).

6.2.6 Ayeyawady (Irrawaddy) Division

Recorded from the Pyinma chaung and other streams in the Bassein District in 1929 ("frequently flushed from pools in these streams", Smith 1942).

6.2.7 Yangon (Rangoon) Division

Recorded from the Paunggyi valley, Insein District in 1925 (Stanford & Ticehurst 1931; Stanford 1935). Possible record from Hlawga Reservoir in 1982 (Sayer *in litt.* 1990).

6.2.8 Mon State

In Amherst District, seen between the Haungtharaw and Ataran rivers in 1908 (Macdonald 1909), and in Pakabo Reserve, Ataran valley in 1923 (Smith 1942).

6.2.9 Taninthayi (Tenasserim) Division

Recorded from Myeik (Mergui) in 1850 (Blyth 1850); Dawe (Tavoy) before 1860 (Gould 1859); Taninthayi (Tenasserim) and Thagyet in 1913-1914 (Tun Yin *in litt.* 1976).

6.2.10 Unknown locations

Recorded at "Kauti near Mandalay" in 1904 (BMNH Specimen).

----------PRINTER: PLEASE INSERT FIGURE 8 HERE.----------

6.3 FORMER HABITAT

6.3.1 Forest types

C. scutulata has been widely recorded from moist forests in Myanmar, but there is an absence of records from the drier, central part of the country (Fig. 8). According to the vegetation maps of Mackinnon & Mackinnon (1986), *C. scutulata* was recorded in the following forest types.

a) Mixed Deciduous Forest in Shan State, Kachin State, probably Sagaing Division and possibly the proposed Bago Yoma NP. Originally 16,079,300 ha of Myanmar was covered with this forest, 22% of the land area.

b) Tropical Semi-evergreen Forest in the Pidaung WS and other parts of Kachin State, probably in Chin State, Taninthayi Division and Sagaing Division, and possibly in Bago State. Originally 9,877,100 ha was covered with this forest, 13% of the land area.

c) Tropical Wet Evergreen Forest in Ayeyawady Division, Yangon Division, Mon State and possibly Bago State and Taninthayi Division. Originally 11,439,700 ha of Myanmar was covered with this forest, 15% of the land area.

d) Moist Lowland Forest along the Mali Hka in Kachin State and possibly in Sagaing Division. Originally 5,819,600 ha of Myanmar was covered with this forest, 8% of the land area.

The species may perhaps also once have occurred in Freshwater Swamp Forest that covered 2,449,100 ha of the Ayeyawaddy (Irrawaddy) and Thanlwin (Salween) deltas.

6.3.2 Wetlands

Sightings of *C. scutulata* were made from a variety of stagnant and slow-moving wetlands, as follows:

a) Rivers, e.g often seen flying along the Shweli and Mu rivers by Smith (1942). Seen on the Mali Hka river by Stanford & Ticehurst (1939).

b) Streams/chaungs, e.g. found on forest streams in Kindat District by Hopwood (1908). Smith (1942) flushed two pairs from the Pyinma chaung in Bassein District.

c) Swamps/jheels, e.g. Evans (1901) reported a pair at a jheel near Bhamo.

d) Marshes, e.g. Smith (1942) saw four birds on the ground in a small marsh near the Shweli river.

e) "Ins" (extensive open wetlands edged with grasses and shrubs), e.g. Smith (1942) flushed a bird from an "in" in the Pakabo Reserve, Ataran valley.

f) Flooded forest, e.g. Smith (1942) saw a pair land in thick flooded forest at Singan on the Shweli river.

g) A variety of pools, water holes and salt licks, e.g. seen on Manaw salt lick and Changnam water hole, Pidaung WS (Smith 1942; Milton & Estes 1963). One flushed from a pond at Webaung village near Shwe-U-Daung WS (Tun Yin 1977).

h) Puddles, e.g. Smith (1942) flushed a bird from a puddle in a cart track at Thayetta, Katha District.

i) Flooded paddy fields, e.g. seen feeding in such fields in the Jade Mines of Myitkyina District (Stanford & Ticehurst 1939).
There are no confirmed reports from large lakes or reservoirs, although Sayer (*in litt.* 1990) saw a possible *C. scutulata* on Hlawga Reservoir, Yangon Division in 1982.

6.3.3 General Terrain

C. scutulata has only been recorded from areas of relatively level terrain, with most records coming from under 200 m altitude. The highest recorded location is the Mali Hka near Putao at over 400 m altitude. This area originally contained a forested plain of 51,800 ha (Smythies 1986).

6.4 CURRENT DISTRIBUTION

Since 1980, there have been confirmed records from only one site in Myanmar, with no other confirmed records since 1974 (6.10, Fig. 8). However, few ornithological surveys of suitable habitat have been conducted in recent decades, and other populations are likely to survive. *C. scutulata* has been reported from five other areas since 1970, and may still be present in some of these locations.

6.4.1 Taninthayi Division

At least four *C. scutulata* have been acquired by a policeman in Thap Sakae, Prachuap Khiri Khan Province, Thailand, from just across the border in Myanmar. Two were obtained about 1983 and two about 1990. Three of these birds have been taken into captivity in Chiang Mai Zoo (Kamolnorranath 1991; Stewart Cox pers. comm. 1991). Further North in Thailand, *C. scutulata* occurs in Thung Yai WS, which runs along the Myanmar border. Taninthayi borders onto both these areas of Thailand.

6.4.2 Proposed Bago Yomas National Park

Bago State. A single possible *C. scutulata* was seen along the Yenwe Chaung, in November 1981. This area is still extensively forested, and there have been no recent changes to the area where the bird was seen (Saw Han *in litt.* 1990).

6.4.3 Yin Ke Reserve Forest

Katha Township Group (District). A pair was seen here in December 1974, and one was shot with a photograph confirming the identification (Tun Yin *in litt.* 1976). Another four were seen elsewhere in Katha Township Group the same month (Tun Yin 1977). Suitable forest still remains here (Saw Han *in litt.* 1990).

6.4.4 Webaung, near Shwe-U-Daung Wildlife Sanctuary

Shan State. A single bird was seen in April 1974 (Tun Yin 1977). This area was heavily logged in the 1950s and 60s, but suitable habitat still remains (Saw Han *in litt.* 1990).

6.4.5 Mansi Tract

Bhamo Township Group (District). Recorded as breeding in unknown numbers in 1970 (Tun Yin 1977). Suitable forest still remains here (Saw Han *in litt.* 1990).

6.4.6 Sikaw area

Bhamo Township Group (District). Reported by U Htang Wa to U Tun Yin in 1970 (ICBP 1971). Present status of forest here unknown.

6.4.7 Potential for other populations

Owing to security problems, much of northern and eastern Myanmar has not been surveyed for many years. This applies to areas such as the Pidaung WS, where *C. scutulata* was still breeding in 1959 (Milton & Estes 1963) and may still be found. Half of the Sanctuary has since been deforested (Saw Han *in litt.* 1990).

Other populations of *C. scutulata* may survive in the remaining blocks of suitable forest in the species's former range. According to Mackinnon & Mackinnon (1986), the following areas of appropriate forest types remain, expressed as percentages of the original area:

4,663,000 ha (29%) of Mixed Deciduous Forest;

4,247,000 ha (43%) of Tropical Semi-evergreen Forest;

1,487,000 ha (13%) of Tropical Wet Evergreen Forest;

1,978,000 ha (34%) of Moist Lowland Forest;

50,000 ha (2%) of Freshwater Swamp Forest.

6.5 CURRENT HABITAT

No information.

6.6 THREATS

6.6.1 Deforestation

Deforestation by agricultural and forestry activities is likely to have extirpated *C. scutulata* from large areas of Myanmar. Collins *et al.* (1991) estimate remaining forest cover at 47.4%, including 8.3% degraded forest and 37.7% lowland forest (below 900 m). In 1990, Myanmar Forest Department estimated total forest cover at 50% (Saw Han *in litt.* 1990). Current deforestation rates are estimated at 600,000 ha *per annum* (2% of remaining forest, Collins *et al.* 1991) or 220,000 ha *per annum* (Myanmar Forest Department 1990, Saw Han *in litt.* 1990). Deforestation is thought to have accelerated since Thailand imposed a logging ban in 1989, when Thai timber merchants began operating in Myanmar (BBC Wildlife Magazine, October 1989).

6.6.2 Hunting

Hunting is likely to be a threat, particularly in northern and eastern Myanmar where firearms are widely available due to security problems, and indiscriminate hunting is likely (Scott 1989).

6.7 CONSERVATION MEASURES TAKEN

6.7.1 Habitat protection

At present, no areas of Myanmar likely to be populated by *C. scutulata* are well protected against habitat destruction or hunting. Only 1.07% of Myanmar is covered by protected areas (Thein Lwin *et al.* 1990). In practice most of these are inadequately protected against hunting and logging, and some of them have lost their conservation importance. In 1981, further areas were proposed for the establishment of national parks and nature reserves that would increase the area protected to 2.6% (Mackinnon & Mackinnon 1986).

6.7.2 Species protection

C. scutulata is protected from hunting, capture, trade etc. under Section 9 of the Wildlife Protection Act, 1936, which gives blanket protection to all "wild ducks", although this protection is not enforced.

6.8 EVALUATION

The current status of *C. scutulata* in Myanmar is very unclear. Although the only recent confirmed records are from one location in Taninthayi Division, there is good reason to expect the continued existence of further populations. Historical records show that the species was once widespread in Myanmar, considerable areas of lowland forest survive, and few potentially suitable areas of habitat have been surveyed in recent decades. In particular, large areas of northern and eastern Myanmar in the former range have been inaccessible for many years due to insurgency problems. Conservation work must begin by surveying for surviving populations in accessible forest areas.

6.9 ACTION

6.9.1 Surveys

i. First priority: Taninthayi Division adjacent to Thap Sakae, Thailand and Proposed Bago Yoma NP, concentrating along the Yenwe Chaung and the wetter eastern side.

ii. Second priority: Chatthin WS, Yin Ke RF, Paunglin RF, Hlaing Yoma RF.

iii. Third priority: other accessible existing or proposed protected areas in the former range that contain suitable lowland forests; Mu-Chindwin watershed, proposed Pakchan NP, proposed Kyaukpandaung NP, Tonlwe Ma-e Chaung and Taungup Poss Thandwe Chaung (Mackinnon & Mackinnon 1986; Thein Lwin *et al.* 1990).

iv. Fourth priority: other accessible lowland forest areas in the former range. Most important are forests of Taninthayi Division adjacent to Thung Yai WS, Thailand, and forests of the Upper Chindwin, particularly Kabaw Valley.

v. Fifth priority: if opportunities arise, presently inaccessible areas in the former range; Mansi Tract and Sikaw in Bhamo Township Group, Shwe-U-Daung WS, Pidaung WS, Tamanthi WS.

6.9.2 Improving Species Protection

C. scutulata should be granted specific full legal protection in Myanmar, replacing the ineffective blanket protection for all duck species.

6.9.3 Others

During future reconnaissance surveys of proposed protected areas, special efforts should be made to survey for *C. scutulata*, and the species should be included in any education campaign for threatened species.

6.10 ALL RECORDS IN UNION OF MYANMAR

Location	Coordinates	Date	Source	Numbers	Notes
Myeik (Mergui), Taninthayi (Tenasserim) Div.	12.26 N, 98.34 E	1850	Blyth 1850	+	Pair sent to London in 1851.
Dawe (Tavoy), Taninthayi (Tenasserim) Div.	14.02 N, 98.12 E	before 1860	Gould 1859	1	Shot.
Upper Chindwin TG, Sagaing Div.	25.00 N, 95.00 E	1895	Tun Yin *in litt.* 1976		1 Shot.
Bhamo, Kachin State	24.15 N, 97.15 E	7.2.1900	Evans 1901	2	Pair visiting a swamp each evening; shot.
Nanyaseik, Myitkyina Dist., Kachin State	25.37 N, 96.35 E	1.12.1900	British Museum	1	"In moult", shot.
Nauya yan, Myitkyina Dist., Kachin State		1.1.1901	British Museum	1	Shot.
Kawlin, (Katha Dist.), Sagaing Div.	23.48 N, 95.41 E	Dec. 1903	Tun Yin *in litt.* 1976		1 Shot.
Thamao Shi, Upper Chindwin TG, Sagaing Div.		8.12.1903	British Museum	1	Shot, female.
Kelata, Upper Chindwin TG, Sagaing Div.		13.12.1903	British Museum	1	Shot, male.
Kauti, near Mandalay		27.12.1904	British Museum	4	Shot, 3 males 1 female.
Tamu, Upper Chindwin, Sagaing Div.	24.12 N, 94.20 E	1905	British Museum	1	Shot, female.
Kindat Dist., , Upper Chindwin, Sagaing Div.	23.43 N, 94.25 E		1908	Hopwood 1908	+ Found sparingly in pairs in forest streams.
Myitkyina Dist., Kachin State	25.24 N, 97.25 E		1908	Anon. 1908	2 Shot.
Between Haungtharaw and Ataran rivers, (Amherst Dist.), Mon State	16.16 N, 97.42 E		Nov. 1908	Macdonald 1909	3 Group of 3, 1 shot (male).

Bhamo TG (Dist.), Kachin State	24.15 N, 97.15 E		before 1909	Harington 1909	+	Several specimens shot.
Shwebo TG (Dist.), Sagaing Div.	22.35 N, 95.42 E		1911	Anon. 1911	2	Shot.
(Northern Arakan) Paletwa TG, Chin State	21.26 N, 93.04 E		1912	Hopwood 1912	+	Found on larger streams.
Tharrawaddy TG (Dist.), Bago (Pegu) Div.	17.37 N, 95.48 E		before 1914	Stanford & Ticehurst 1931	+	Not uncommon.
Taninthayi (Tenasserim), Taninthayi (Tenasserim) Div.	12.05 N, 99.00 E	Dec. 1913-Apr. 1914	Tun Yin *in litt.* 1976		1	Shot.
Thagyet, Taninthayi (Tenasserim) Div.	12.05 N, 99.30 E	28.3.14	Tun Yin *in litt.* 1976		1	Shot.
Small marsh near Shweli river, Shan State (Mongmit State)	23.30 N, 96.39 E		1916	Smith 1942	4	On the ground.
Upper Chindwin TG, Sagaing Div.	25.00 N, 95.00 E	1920s	Stanford & Ticehurst 1931		4	Two pairs, one shot.
Shwe-laung-Kodugwe Reserve, Bago (Pegu) Div.	18.19 N, 95.48 E		1920s	Tun Yin 1960	+	Seen once.
Pakabo Reserve, Ataran valley, (Amherst Dist.), Mon State	15.53 N, 98.04 E		13.4.23	Smith 1942	1	Flushed from an "in".
Paunggyi valley, Insein TG (Dist.), Yangon (Rangoon) Div.	17.19 N, 96.10 E	Dec. 1925	Stanford & Ticehurst 1931 Stanford 1935		2	Pair. Several other records in this District.
Hintha, Katha TG (Dist.), Sagaing Div.	23.39 N, 96.16 E	14.1.27	Smith 1942		1	Flying at dusk.
Shweli river between Mabein and Kota, Shan State (Mongmit State)	23.31 N, 96.35 E		26.1.27	Smith 1942	2	Pair in flight.
Singan village, Shweli river,	23.34 N, 96.48 E		3.2.27	Smith 1942	2	Pair that landed in very

Shan State (Mongmit State)					thick flooded forest.
Pyinma chaung, (Bassein Dist.), Ayeyawady Div.	17.26 N, 95.12 E	18.2.29	Smith 1942	2	Pair flushed just below mouth of Tharapi chaung.
Pyinma chaung, (Bassein Dist.), Ayeyawady Div.	17.26 N, 95.12 E	21.2.29	Smith 1942	2	Pair flushed 4 miles from mouth of the chaung.
Kunphe, Kaukkwe chaung, Katha TG (Dist.), Sagaing Div.	24.36 N, 96.38 E	May 1929	Smith 1942	1	Flushed from a small pool at Chitgale salt lick.
Thayetta, Kaukkwe chaung, Katha TG (Dist.), Sagaing Div.	24.33 N, 96.39 E	May 1929	Smith 1942	1	Flushed from a puddle in a cart track.
Mongnaka sakan, Kaukkwe chaung, Katha TG (Dist.), Sagaing Div.	24.33 N, 96.39 E	19.5.29	Smith 1942	3	Flushed from a swamp.
Mongnaka sakan, Kaukkwe chaung, Katha TG (Dist.), Sagaing Div.	24.33 N, 96.39 E	May 1929	Smith 1942	+	Often observed flying in mornings and evenings.
Pidaung Game Sanctuary, Kachin State	25.25 N, 97.12 E	7.9.29	Smith 1942	+	On the Manaw salt lick.
Streams in Evergreen forests, (Bassein Dist.), Ayeyawady Div.	17.19 N, 95.05 E	1929	Smith 1942	+	Single birds and pairs often seen in stream pools.
Nyaungbinhla "in", Katha TG (Dist.), Sagaing Div.	23.41 N, 95.27 E	11.12.31	Smith 1942	2	
Mali Hka river, near Putao, Kachin State	27.16 N, 97.35 E	1932-36	Stanford & Ticehurst 1939	+	
Pidaung Game Sanctuary, Kachin State	25.25 N, 97.12 E	1932-36	Stanford & Ticehurst 1939	+	Common.
Mogaung chaung, Kachin State	25.17 N, 96.56 E	1932-36	Stanford & Ticehurst 1939	+	Common.
Jade mines, Myitkyina TG (Dist.), Kachin State	25.43 N, 96.10 E	1932-36	Stanford & Ticehurst 1939	+	Regularly seen at dusk flying to feed in rice fields.
Kabaw Valley, Upper Chindwin	24.00 N, 94.19 E	before 1933	Huggins 1933	+	Found occasionally.

TG, Sagaing Div.						
Pidaung Game Sanctuary, Kachin State	25.25 N, 97.12 E	Dec. 1933	Smith 1942	+	Often observed flying across the railway at dusk.	
Uyu side of Mansi, Sagaing Div.	24.58 N, 95.36 E	before 1935	Blanford *in litt.* 1935	+	#	
Mansi, Kachin State	24.06 N, 97.18 E	before 1935	Blanford *in litt.* 1935	+	#	
Upper Meea Chaung, Katha TG (Dist.), Sagaing Div.	24.21 N, 96.00 E	before 1935	Blanford *in litt.* 1935	+	#	
Yetho, Karen area in Tharrawaddy, Bago (Pegu) Div.	17.39 N, 95.47 E	before 1935	Blanford *in litt.* 1935	+	#	
Insein Dist., Yangon (Rangoon) Div.	16.54 N, 96.08 E	before 1935	Blanford *in litt.* 1935	2	Pair. #	
Pidaung Game Sanctuary, Kachin State	25.25 N, 97.12 E	2.4.36	Smith 1942	2	Came to feed at Manaw salt lick at dusk.	
Upper Chindwin TG, Sagaing Div.	25.00 N, 95.00 E	1939	Stanford & Ticehurst 1939	+	Common.	
Namse reserve, Kachin State Pidaung game sanctuary	25.21 N, 97.28 E	1939	Tun Yin 1960	+		
Chatthin (Kyatthin) Wildlife Sanctuary, Sagaing Div.	23.32 N, 95.29 E	1941	Tun Yin 1960	+	Breeding. #	
Mu river, Katha & Shwebo (Dist.), Sagaing Div. TG	22.49 N, 95.26 E	before 1942	Smith 1942	+	Often seen flying up and down the river.	
Auk Singwe, Mu river, Sagaing Div.	23.55 N, 95.16 E	before 1942	Smith 1942	1	Shot.	
Chatthin (Kyatthin) wildlife sanctuary, Sagaing Div.	23.32 N, 95.29 E	1955	Tun Yin 1960	+	Seen on pools Sep-Feb, no evidence of breeding. #	
Changnam water hole, Pidaung	25.25 N, 97.12 E	Jun 1959	Milton & Estes 1963	7	Female with 6 ducklings.	

Game Sanctuary, Kachin State						
Sikaw area, Bhamo TG (Dist.), Kachin State	23.49 N, 97.06 E		1970	ICBP 1970+		#
Mansi tract, Bhamo TG (Dist.) Kachin State	24.40 N, 95.43 E	Breeding. #	1970	Tun Yin 1977	+	
Webaung village, near Shwe-U-Daung sanctuary, Shan State	23.07 N, 96.16 E	Flushed from a pond.	Apr. 1974	Tun Yin 1977	1	
Yin Ke forest reserve, near Wai Chaung, Sagaing Div.	24.09 N, 96.26 E	Pair, one shot.	29.12.74	Tun Yin 1977	2	
Katha TG (Dist.), Sagaing Div.	24.11 N, 96.20 E	Includes pair at Yin Kha.	Dec. 1974	Tun Yin 1977	6	
Putao, along Ayeyarwady (Irrawaddy; presumably Mali Hka)	27.22 N, 97.24 E	before 1977	Cushing Po *in litt.* 1977		+ # ?	
Mogaung chaung, Kachin State	25.17 N, 96.56 E	before 1977	Cushing Po *in litt.* 1977		+ # ?	
Maha Nanda lake, Shwebo TS (Dist.), Sagaing Div.	22.34 N, 95.42 E	before 1977	Cushing Po *in litt.* 1977		+ # ?	
Shwebo TS (Dist.), Sagaing Div.	22.35 N, 95.42 E	before 1977	Cushing Po *in litt.* 1977		+ 3-4 shot. # ?	
Mandalay Div.	21.58 N, 96.06 E	before 1977	Cushing Po *in litt.* 1977		+ Seen flying at sunset. # ?	
Sagaing Div.	21.55 N, 95.56 E	before 1977	Cushing Po *in litt.* 1977		+ # ?	
Yenwe chaung, Bagu (Pegu) Yoma	18.08 N, 96.20 E	10-27 Nov 81	Saw Han *in litt.* 1990		1 Flew upstream just above the surface. ?	
Hlawga reservoir, Yangon (Rangoon) Div.	17.00 N, 96.07 E	late 1982	Sayer *in litt.* 1990	1	Possible sighting. ?	
Taninthayi Division, adjacent to Thap Sakae, Thailand	11.30 N, 99.22 E	2 Pair taken into Chiang Mai 1991	c.1983	Stewart Cox *pers. comm.* Zoo, Thailand.		
Taninthayi Division, adjacent to Thap Sakae, Thailand	11.30 N, 99.22 E	2 Pair, female in Chiang Mai 1991	c.1990	Stewart Cox *pers. comm.* Zoo, Thailand.		

+ = recorded as present.

? = clear possibility of wrong identification.

= local report, unconfirmed.

All coordinates given are rough approximations.

A "chaung" is a small river. An "in" is an extensive open wetland with grasses and shrubs along the edges.

TS = Township; TG = Township Group; Dist. = District; Div. = Division.

() = Old names no longer in use cited within brackets. Districts were replaced by Townships in 1988-89.

6.11 SITES IN UNION OF MYANMAR

6.11.1 Taninthayi Division

Forest area adjacent to Thap Sakae, Prachuap Khiri Khan province, Thailand. Approximately 11.30 N, 99.22 E. Four *C. scutulata* have been taken from the area since about 1983. Urgently requires survey.

6.11.2 Proposed Bago Yoma National Park

146,000 ha at 50-800 m altitude at 18.05-18.12 N, 96.15-96.25 E, Bago State. Covered with Mixed Deciduous Forest dominated by Teak *Tectona grandis* and Pyinkado *Xylia dolabriformis*. There are numerous streams bordered by evergreen gallery forests. There are confirmed records of *C. scutulata* in the Bago Yomas from the 1920s and small numbers may still occur in this area (FAO 1982). A possible *C. scutulata* was seen along Yenwe Chaung in November 1981. Most of Yenwe Chaung will soon be flooded by a new reservoir of 8,000 ha. Urgently requires survey.

6.11.3 Yin Ke Reserve Forest

Katha Township Group, Sagaing Division, 24.09 N, 96.26 E. A pair of *C. scutulata* seen in 1974. Forest habitat still remains, and survey required.

6.11.4 Shwe-U-Daung Wildlife Sanctuary

32,700 ha in Mandalay Division and Shan State at 22.49-23.05 N, 96.12-96.21 E. In 1974, a single *C. scutulata* was seen nearby at Webaung nearby (23.07 N, 96.16 E). Forest habitat still remains, but the sanctuary is no longer effectively protected and access is restricted.

6.11.5 Bhamo Township Group

C. scutulata reported in 1970 from the Mansi Tract 24.40 N, 95.43 E and the Sikaw area 23.49 N, 97.06 E in Kachin State. Forest habitat still remains, but this area is now inaccessible.

6.11.6 Chatthin Wildlife Sanctuary BU4

26,820 ha at 180-240 m altitude in Sagaing Division at 23.30-23.42 N, 95.24-95.40 E. Protection of the site was greatly improved in 1986. A flat to undulating area of grassland and open, dry, deciduous, dipterocarp forest with streams that retain some water in isolated pools throughout the dry season. *C. scutulata* was reported as present up to 1955. Requires survey.

6.11.7 Pidaung Wildlife Sanctuary BU2

70,502 ha at 148-1,362m altitude in Kachin State at 25.15-25.35 N, 97.04-97.20 E. Originally covered with Tropical Semi-evergreen Forest, but the sanctuary is no longer effectively protected and half of the forest has now been cleared. *C. scutulata* was still breeding in the sanctuary in 1959, but the site is now inaccessible.

6.11.8 Hlaing Yoma Reserve Forest

17.21 N, 96.01 E in Taikgyi Township, Yangon Division. *C. scutulata* was recorded nearby in the Paunggyi valley in 1925. Requires survey.

6.11.9 Paunglin Reserve Forest

17.33 N, 96.03 E in Hlegu Township, Yangon Division. *C. scutulata* was recorded nearby in the Paunggyi valley in 1925. Requires survey.

7. THAILAND

7.1 LOCAL NAME

"Pet Kaa" or "Ped Ka" (Round, Laothong & Amget *in litt.* 1990).

7.2 FORMER DISTRIBUTION

C. scutulata has been recorded from four of the six zoogeographic regions into which Round (1988) divides Thailand (Fig. 9). Unlike neighbouring countries, Thailand was never occupied by a colonial european power. As a result, ornithological expeditions in the last century and early part of this century were largely restricted to the peninsula, and most records from other parts of Thailand are from the past 30 years (Fig. 9).

7.2.1 Peninsular Thailand

Before 1880, recorded from Takua Thung (Kussoom), Ban Talat Nua (Kopah) and Phang-nga in Phang-nga Province (Hume 1879; Hume & Marshall 1880). Recorded from Phatthalung Province in 1899 (Bonhote 1901). Recorded as "common" in Trang Province in 1902, and "very abundant" here in 1909-1910, when more than 12 were collected from Khao Kachong (Chong), Ban Lamphu La (Lam ra), Ban Khuan Khan (Ko Klau) and other locations (Robinson 1909; Robinson & Kloss 1910-1911). Recorded as "fairly common upcountry and almost down to the coast" in Surat Thani Province in 1913 (Robinson 1915). In Prachuap Khiri Khan Province, recorded from Hue Sai and Hat Sanuk creeks in 1914-1915 (Gyldenstolpe 1916) and from Huey Sak in 1917 (BMNH specimen). Four collected from Nong Kok, near Krabi, Krabi Province in 1918 (Robinson & Kloss 1918). Present in Pattani Province before 1949 (Gibson-Hill 1949). Undated record from Nakhon Si Thammarat Province (Medway & Wells 1976). Locals claimed to be familiar with *C. scutulata* up to about 20 years ago in Narathiwat Province" (Round unpublished). Recent records from Narathiwat and Phang-nga Provinces (see below).

7.2.2 South-West Thailand

Recorded from Mae Wong in 1912 (Barton 1914), a location now within Mae Wong NP. Recorded from Huai Kha Khaeng WS since 1970 and Thung Yai WS in the 1980s (see below).

7.2.3 Central Thailand

No records.

7.2.4 North Thailand

A flock of five or six seen at Doi Inthanon in Chiang Mai Province in 1935 (Deignan 1945).

7.2.5 North-east Thailand

One collected by R.E. Elbel at Phu Lom Lo, Loei Province in Feb 1955, a site now in Phu Hin Rong Kla NP (Round *in litt.* 1990). This is the record cited by Deignan (1963) as from "the northwestern portion of the eastern plateau". Recently records from various areas (see below).

7.2.6 South-East Thailand

Said by Mr. Suvat Singhapant, currently Director of the National Parks Division, to have been formerly known from the lowlands around Khao Soi Dao WS, Chanthaburi Province, where he last saw them in 1964 (Round & Laothong *in litt.* 1990) with recent, unconfirmed reports from this area (see below).

7.2.7 Unlocated records

In 1955, 10 wild caught birds were sent to Slimbridge by Phra Abhaivonge. The date and place of capture are not known.

----------PRINTER: PLEASE INSERT FIGURE 9 HERE.----------

7.3 FORMER HABITAT

7.3.1 Forest types

According to the vegetation maps of Mackinnon & Mackinnon (1986), *C. scutulata* was recorded from the following forest types:

a) Tropical Semi-evergreen Forest for records from peninsular Thailand with the exception of Narathiwat Province and possibly Pattani Province. Possibly also in South-west, North-east and South-east Thailand. Originally, 8,879,900 ha of Thailand was covered with this forest, 18% of the land area.

b) Tropical Montane Evergreen Forest on Doi Inthanon in North Thailand. This type replaces Tropical Semi-evergreen Forest above 1,000 m altitude (Round 1988). Originally, 888,100 ha of Thailand was covered with this forest, 2% of the land area.

c) Tropical Wet Evergreen Forest possibly in South-east Thailand and the peninsula (Narathiwat and Pattani Provinces). Originally, 1,202,700 ha of Thailand was covered with this forest, 2% of the land area.

d) Mixed Deciduous Forest possibly in South-west and North-east Thailand. Originally, 14,450,000 ha of Thailand was covered with this forest, 28% of land area.

According to Mackinnon & Mackinnon (1986), both Peninsular and Continental Thailand originally contained large amounts of Tropical Semi-evergreen Forest. Round (1988) uses a different forest classification, treating the peninsular forest as Tropical Rainforest and not making the division between peninsular Semi-evergreen and peninsular Wet Evergreen Forest made above.

C. scutulata may also have occurred in Freshwater Swamp Forest that covered 1,972,000 ha of inland depressions and riverways in Thailand (Mackinnon & Mackinnon 1986; Round 1988). The only possible past record from this forest in Thailand is one at Ban Kok Klap, Surat Thani Province, in the peninsula in 1913. *C. scutulata* has recently been recorded from Peat Swamp Forest in Narathiwat Province (see below).

7.3.2 Wetlands

Robinson & Kloss (1910-1911) and Robinson (1915) recorded *C. scutulata* from ricefields in Trang and Surat Thani Provinces. Gyldenstolpe (1916) saw a pair on the upper course of the Hue Sai, a small creek in dense evergreen forest in Prachuap Khiri Khan Province. He suggested that the birds fed in the numerous small ponds found alongside the creek. He saw two pairs on another small creek nearby at Hat Sanuk. Deignan (1945) flushed *C. scutulata* from a small brook in

dense evergreen forest on Doi Inthanon.

7.3.3 General terrain

The majority of *C. scutulata* records are probably from plains below 200 m altitude, particularly in the peninsula where the species seems to have been particularly abundant. However, the species has been recorded at higher altitudes: in January 1935, Deignan (1945) found five or six *C. scutulata* at about 1,500 m on Doi Inthanon. Records from Mae Wong and Phu Lom Lo are probably from over 500 m.

7.4 CURRENT DISTRIBUTION

Since 1980 *C. scutulata* has been reported from the Peninsula, North-east, South-west and possibly South-east Thailand (Fig. 9). The sightings have been used to extract estimates for the local population size. These local estimates (LEs) are minimum figures that may underestimate actual numbers of birds.

7.4.1 Thung Yai Wildlife Sanctuary-Huai Kha Khaeng Wildlife Sanctuary KEY SITE

South-west Thailand. Most confirmed *C. scutulata* records since 1980 have come from these adjacent sanctuaries. One bird was seen at Bor Nam Rorn in northern Huai Kha Khaeng WS in February 1987. In Thung Yai WS, confirmed records come from Mae Kasart stream, where up to four were seen in early 1987 (Stewart Cox *in litt.* 1988), and Lake Lakatu, where a pair was recorded in April 1988 (Round *in litt.* 1990) and six in November 1989 (Gretton 1990). At least three birds were seen on the plateau between Huai Mae Chan and Huai Mae Klong in February and March 1988 (Stewart Cox *in litt.* 1988, Robson 1988, Robson *in litt.* 1990). There are records from Huai Greung Peung and unconfirmed reports from two other areas of Thung Yai along Huai Mae Chan and Huai Mae Klong (Stewart Cox *in litt.* 1988). The site contains large areas of little-known primary habitat, and *C. scutulata* is likely to occur in further areas (Nakhasathien & Stewart Cox 1990). LE = 12

7.4.2 Phu Khieo Wildlife Sanctuary KEY SITE

North-east Thailand. Mackenzie (1985) heard of a reported sighting in the south east of the WS in February 1984. In November 1986, a single bird was found dead (Round 1988). A sighting was made at Thung Kamang plateau in December 1988 (Round *in litt.* 1990). On 19.7.90, a pair was seen at a lake around dusk, and a pair with four ducklings at the same location the following day (Round 1990). LE = 2

7.4.3 Lam Dom Yai KEY SITE

North-east Thailand. This river rises from the Cambodian border. Local Wildlife Division officials report the presence of 10-20 *C. scutulata* in the forested upper reaches of the river around Yot Dom WS (Round 1988; Scott 1989). Two birds were reported from the area in December 1984 (Laothong *in litt.* 1990). In November 1985 ten birds were seen at Nong Sim, a swamp among rice fields near Dome Pradit where four out of a group of seven were captured on 1.12.85 (Bangkok Post 4-1-86; Scott 1989; Laothong *in litt.* 1990). In May 1986 eight were reported from a nearby swamp (Nong Bok). Reports of one bird in November and one carcass in December 1985 in Buntharik District (Amget & Laothong *in litt.* 1990) probably refer to the Yot Dom WS area. Kamolnorranath (1991) cited Boonchai *et al.* (1986) as giving a population size of 30 for Yot Dom WS, with six eggs taken from the wild in 1984. The presence of Khmer Rouge has prevented a thorough survey of the area. LE = 10

7.4.4 Pa Phru Non-hunting Area

Peninsular Thailand. Three birds were seen at Klong (river or canal) Nam Baeng on 28.12.86 and one shot. A single bird was reported from the same location on 15.11.90 (Laothong *in litt.* 1991). LE = 2

7.4.5 Khao Yai National Park

North-east Thailand. One bird seen flying over the pond near headquarters on 26.1.89 by P. Hottola (pers. comm. to Round *in litt.* 1991). LE = 1

7.4.6 Ampoe Khun Han

North-east Thailand. Unconfirmed reports of four birds in forest of the Phanom Dong Rak hills, Sisaket Province in 1984 (K. Boonchai pers. comm. to Laothong *in litt.* 1990).

7.4.7 Khao Soi Dao Wildlife Sanctuary

South-east Thailand. Unconfirmed report of two flying over a captive flock of *C. scutulata* at Khao Soi Dao Wildlife Centre in 1990 (Laothong *in litt.* 1991).

7.4.8 Ao Phang-nga National Park

Peninsular Thailand. One bird reported flying past the headquarters in March 1991 (Round *in litt.* 1991). The surrounding habitat appears unsuitable for the species.

7.4.9 Ampoe Khongchiam

North-east Thailand. One bird was reported from Ampoe Khong Chiam District in December 1985 (Amget & Laothong *in litt.* 1990), but this area is not thought to contain suitable habitat.

7.4.10 Sanambin Non-Hunting Area

North-east Thailand. Unconfirmed reports of two to four *C. scutulata* in April 1986 (Scott 1989). These reports seem unreliable, as the habitat appears unsuitable for the species.

7.4.11 Unlocated records

Prayuth Intarapanich (*in litt.* 1985), chief of Khoa Khieo Nature and Wildlife Education Centre reported *C. scutulata* from two places in the north-east; Ubol (Ubon?) and Sakolnakorn (Muang Sakon Nakhon?).

7.4.12 Total population estimate

The above figures produce a total estimate of 27 for the known Thailand population. Future survey work may prove this figure to be an underestimate, particularly as this total excludes unconfirmed reports from sites with obvious potential for the species, and other sites (e.g. Thung Yai-Huai Kha Khaeng WS and Khao Yai NP) are likely to hold more birds.

7.4.13 Potential for undiscovered populations

There are a number of surviving, little-surveyed areas of lowland forest in Thailand with the potential to hold *C. scutulata*. Consequently, Round (1988) lists *C. scutulata* as probably still present in Northern Thailand despite its extirpation in Doi Inthanon.

According to Mackinnon & Mackinnon (1986), the following areas of appropriate forest types in Thailand still remain, expressed as percentages of the original area:

4,392,600 ha (49%) of Tropical Semi-evergreen Forest,

817,100 ha (92%) of Tropical Montane Evergreen Forest,

192,400 ha (16%) of Tropical Wet Evergreen Forest,

3,323,500 ha (23%) of Mixed Deciduous Forest,

83,200 ha (4%) of Freshwater Swamp Forest.

7.5 CURRENT HABITAT

Information on current habitat use is limited. Round (1988) states that *C. scutulata* "favours denser forests, close to still water bodies in areas of gentle topography". Scott (1989) writes "having been extirpated from wetlands in the plains, *C. scutulata* now appears to be restricted to a very small number of sites where sluggish-flowing reaches of upper perennial rivers are found in plateau country". The following details are available.

7.5.1 Forest types

The dominant forest types in Thung Yai-Huai Kha Khaeng WS are Mixed Deciduous Forest and Tropical Semi-evergreen Forest, with permanent watercourses flanked by Gallery Evergreen Forest, similar to Semi-evergreen Forest (Nakhasathien & Stewart Cox 1990). Most records of *C. scutulata* have come from areas of Thung Yai WS dominated by evergreen forest, but some have come from deciduous areas of Huai Kha Khaeng (Stewart Cox *pers. comm.* 1991). A pair of *C. scutulata* seen in Huai Kha Khaeng WS in 1976 was in low-lying deciduous-cum-gallery evergreen forest just north of the Huai Mae Dee-Huai Kha Khaeng confluence (Nakhasathien & Stewart Cox 1990).

Records from Pa Phru NHA are from primary Peat Swamp Forest, and Sanambin NHA contains a small area of swamp forest (Scott 1989). Other recent records have come from Phu Khieo WS, Yot Dom WS, Khao Yai NP and Khao Soi Dao WS, all dominated by Tropical Semi-evergreen Forest. Ao Phang-nga NP contains mainly mangroves with some semi-evergreen forest (Mackinnon & Mackinnon 1986).

7.5.2 Wetlands

In Thung Yai WS, birds are recorded from gentle upland streams and from Lake Lakutu, 25 ha in area. One to four birds were regularly seen along Mae Kasart stream in 1987. In March a bird was flushed from a pool in the stream, which was "well shadowed by trees, the water no more than 10 m wide, its course very wiggly with lots of deep, still pools and the banks wide, flat and relatively open" (Stewart Cox *in litt.* 1987). A pair and young were seen on a lake in Phu Khieo WS in 1990 (Round 1990). On the Lam Dom Yai, birds have been recorded from swamps in the flood plain, where they are said to feed in rice paddies (Scott 1989). In Pa Phru NHA, birds have been reported from a river or canal (Klong Nam Baeng, Laothong *in litt.* 1991).

7.5.3 Altitude

Minimum altitudes for *C. scutulata* sites are: Huai Kha Khaeng WS 300 m; Thung Yai WS 400 m; Yot Dom WS 300 m; Phu Khieo WS 500 m; Pa Phru NHA 0 m; Khao Yai NP 250 m; Khao Soi Dao WS 200

m; Ao Phang-nga NP 0 m; Sanambin NHA 160 m. Birds occur at Lake Lakatu, Thung Yai WS, at c.700 m altitude, and are reported from Thung Kamang, Phu Khieo WS at c.900 m. Records from Pa Phru NHA are from about sea level. These figures suggest that the species has largely been extirpated from plains below 200 m. Birds appear to be using plateau areas at higher altitude e.g. in Thung Yai WS, Phu Khieo WS and Khao Yai NP.

7.6 THREATS

Round (1988) discussed a number of threats likely to have contributed to a major decline in the range of *C. scutulata* in Thailand.

7.6.1 Deforestation

Deforestation is the major cause of decline. At the close of World War II, Thailand was probably 70-80% forested, but since then there has been a rapid decline caused by both commercial and subsistence activities. In 1961, cover was estimated at 51% (Elliott 1989). Present cover is estimated at 20.9%, including 16.5% lowland forests (below 900m, Collins *et al.* 1991), but this includes degraded forests. For 1985-1988, deforestation continued at 235,400 ha per annum, 2% of remaining forest cover. The lowland forests along major waterways and valley bottoms have been the most affected, being fertile areas highly suitable for agriculture. These lowland forests supported *C. scutulata*'s main habitat, particularly in the peninsula where less than 4.7% of original forest below 200 m now remains, with no extensive areas of plains forest left.

Two recent developments have reduced the current rate of deforestation in Thailand. A logging ban has been imposed on all forests since December 1988, although illegal deforestation continues even in protected areas (Round 1989). In addition, there is a growing awareness in rural communities that their future depends on forest conservation. This has led to the establishment of "community forests" in some areas of Northern Thailand, in which villagers protect the forests while harvesting them sustainably for bamboo, food etc. (Komolphalin *pers. comm.* 1990).

At least 17 hydro-electric dam schemes have also contributed to lowland forest destruction in Thailand. One has flooded the only protected major lowland river system in the peninsula in the adjacent Khao Sok NP and Khlong Saeng WS. The proposed Nam Choan dam would flood all the lowland riverine forest in Thung Yai WS, a major site for *C. scutulata*. The project was shelved in April 1988.

7.6.2 Forest burning

Large areas of standing forest, both outside and inside protected areas, are deliberately burnt every year by rural people. This is causing a gradual decline in forest cover and replacement of dense evergreen forest by drier, open deciduous forests less suitable for *C. scutulata*. In addition, burning is concentrated in the late dry season when most forest birds (possibly including *C. scutulata*) are nesting, destroying many nests.

7.6.3 Hunting

All the *C. scutulata* sites in Thailand are routinely visited by poachers who shoot or trap birds and mammals for food. Most birds are taken for immediate consumption, but some larger ones (e.g. pheasants, pigeons) are sold at market. Hunting is generally indiscriminate and certain to affect *C. scutulata*. Although huntings's relative importance as a threat is unclear, the capture of four birds in rice fields near Lam Dom Yai in 1985 and the shooting of one in Pa

Phru NHA in 1986 shows it occurs. The intensity of hunting varies between regions, and is most extreme in the north due to a high population density of hill tribes. This may have caused the extirpation of *C. scutulata* from Doi Inthanon NP.

7.6.4 Pesticides

Following the "Green Revolution", very large quantities of persistent, toxic pesticides have been in use in agricultural areas. In addition, large amounts are used for malaria control, often around forest margins. Thailand is the largest importer of pesticides in South-east Asia (Ewins & Bazely 1989). Persistent organochlorines such as DDT may have played a major role in the spectacular decline of many large waterbirds and raptors, and is likely to have affected *C. scutulata* through their use of paddy fields for feeding. Water samples taken by Nakhasathien and Cox (1990) in Thung Yai WS and Yot Dom WS contained DDT and Dieldrin, with higher readings from Yot Dom which is bordered by agricultural areas. In rice-growing areas, persistent pesticides have now largely been replaced by non-persistent alternatives, and DDT is only permitted for malaria control.

7.7 CONSERVATION MEASURES TAKEN

7.7.1 Habitat protection

Thailand has the best network of protected areas in Indochina with 90 National Parks and Wildlife Sanctuaries (Round 1988; Nakhasathien & Stewart Cox 1990). However, lowland riverine forest that is most likely to suit *C. scutulata* is under-represented in the protected area system (Round 1988). *C. scutulata* is reliably reported from four Wildlife Sanctuaries (Phu Khieo, Yot Dom, Huai Kha Khaeng and Thung Yai), one Non-hunting Area (Pa Phru). No hunting or capture of any animal, burning, cutting, damming of watercourses or other changes to the environment is permitted in Wildlife Sanctuaries. In Non-hunting Areas, hunting is the only activity restricted. In practice, illegal encroachment into protected areas for timber poaching, "slash and burn" agriculture, forest burning and hunting are very widespread. This has had a particularly bad affect on the low-lying areas of reserves more likely to suit *C. scutulata*.

7.7.2 Species protection

Trade and hunting of most bird species, including *C. scutulata*, is banned across the nation under the Wild Animals Reservation and Protection Act (1960). However, most bird hunting is carried out by rural people who are unaware of the law, and unlicensed firearms are widespread. Furthermore, the law allows anybody to own two *C. scutulata*, a loophole that effectively allows trade in the species to continue (Anon. 1991).

7.8 EVALUATION

Thailand has a small known population of *C. scutulata* and one that is under continuing threat from habitat destruction, hunting and possibly pesticides. However, there are a number of poorly surveyed forest areas that may hold other populations. Furthermore, the above estimates for the size of the known populations are based on very limited data, and some are likely to be underestimates. In particular, the Thung Yai-Huai Kha Khaeng WS holds a considerable area of primary habitat and may well be one of most important sites for the species across its entire range. There is an urgent need for surveys to clarify the status and distribution of *C. scutulata* in Thailand. It is also vital to improve the protection status of the populations already located.

7.9 ACTION

7.9.1 Surveys

i. First priority, key sites: Thung Yai-Huai Kha Khaeng WS, Yot Dom WS, Phu Khieo WS.

ii. Second priority, other sites: Pa Phru NHA, Khao Yai NP, Khao Soi Dao WS, Ao Phang-nga NP, Ampoe Khun Han, Sanambin NHA, Ampoe Khong Chiam.

iii. Third priority: protected areas in the former range thought to contain suitable habitat. North-east Thailand: Nam Nao NP, Tab Lan NP, Pang Sida NP, Phu Jong Na Yoi NP, Khao Phanom Dongrak WS. South-east Thailand: Khao Ang Ru Nai WS. South-west Thailand: Mae Wong NP, Umphang WS, Kaeng Krachan NP (particularly upper reaches of Phetchaburi river).

iv. Fourth priority: areas of suitable habitat outside of protected areas (Round 1988). Salween-Moei River system, Yuam River, Nan River (North Thailand); lower Huai Kha Khaeng (South-west Thailand); Nam Phrom Basin and other areas around Phu Khieo WS, areas around Yot Dom WS and elsewhere along the Thai-Cambodia/Lao PDR border (North-east Thailand).

7.9.2 Increasing protection of sites

Policing and monitoring needs to be strengthened in Thung Yai-Huai Kha Khaeng WS, Phu Khieo WS and Yot Dom WS.

7.9.3 Upgrading Pa Phru Non-Hunting Area

Pa Phru NHA is Thailand's last remaining primary Peat Swamp Forest and is threatened by habitat destruction. It should be upgraded to a Wildlife Sanctuary (Round 1988).

7.9.4 Lake Lakatu, Thung Yai Wildlife Sanctuary

The sighting of two *C. scutulata* at Lake Lakatu on 1.4.88 and six on 15.11.89 suggests it is an important site for the species. The site is now regularly disturbed by border police landing helicopters. An alternative landing site should be found.

7.9.5 Extend Phu Khieo Wildlife Sanctuary

The boundary of the WS and of neighbouring Nam Nao NP should be extended to encompass the lowlands of the Nam Phrom basin which lies between them (Round 1988).

7.9.6 Ecological Research

There is an urgent need for a full ecological study of *C. scutulata*, preferably by a Thai biologist. Thung Yai-Huai Kha Khaeng WS offers a suitable place, as this huge area provides a wide range of natural habitat types with the best opportunity for studying the species's natural ecology and behaviour.

7.9.7 Education

C. scutulata should be included in any local or nationwide education campaigns for threatened species.

7.9.8 Improving Species Protection

C. scutulata should be made a "nationally reserved animal" to make the possession of the species illegal.

7.10 ALL RECORDS IN THAILAND

Location	Coordinates	Date	Source	Numbers	Notes
Khao Kachong (Chong), Trang Province.	7.31 N, 99.48 E	8.12.1869	British Museum	1	Shot.
Takua Thung (Kussoom), Phangnga Province	8.22 N, 98.27 E	before 1879	Hume 1879	+	Seen in the forests.
Phangnga, Phangnga Prov.	8.29 N, 98.31 E	before 1880	Hume & Marshall 1880	+	
Ban Talat Nua (Tankopah/Kopah), Phangnga Prov.	8.50 N, 98.20 E	before 1880	Hume & Marshall 1880	+	
Phatthalung Province	7.38 N, 100.05 E	April 1899	Bonhote 1901	1	Female, shot.
Trang Province	7.35 N, 99.35 E	May 1902	Robinson 1909	+	Common.
Khao Kachong (Chong), Trang Province	7.31 N, 99.48 E	18.12.09	Robinson 1909	2	Shot. 1 male, 1 female.
Khao Kachong (Chong), Trang Province	7.31 N, 99.48 E	9.1.10	Kuah *in litt.* 1991	1	Male. Specimen, University of Singapore.
Ban Khuan Khan (Ko Khau Kong), Trang Province	7.34 N, 99.38 E	9.1.10	Kuah *in litt.* 1991	1	Male. Specimen, University of Singapore.
Ban Lamphu La (Lam ra),	7.41 N, 99.34 E	9.1.10	British Museum	1	Male, shot.

Trang Province				
Ban Lamphu La (Lam ra), Trang Province	7.41 N, 99.34 E 13.1.10	Kuah *in litt.* 1991	1	Female. Specimen, University of Singapore.
Ban Lamphu La (Lam ra), Trang Province	7.41 N, 99.34 E 15.1.10	Kuah *in litt.* 1991	1	Male. Specimen, University of Singapore.
Ban Khuan Khan (Ko Klau), Trang Province	7.34 N, 99.38 E 16-17.1.10	British Museum	2	Shot. 1 male, 1 female.
Trang Province	7.35 N, 99.35 E 1909-1910	Robinson & Kloss 1910-1911	>12	Shot. Includes preceding 9.
Mae Wong, Tak Province	15.53 N, 99.11 EMar 1912	Barton 1914	+	At least 1 shot.
Ricefields, Surat Thani (Ban Don) Province	9.09 N, 99.20 E 1913	Robinson 1915	+	Fairly common upcountry and almost down to the coast.
Ban Kok Klap, Surat Thani Province	8.53 N, 99.17 E 29.6.13	Robinson 1915	1	Male, shot. Specimen in University of Singapore.
Hue Sai creek, Prachuap Khiri Khan Province	11.50 N, 99.47 E1914-1915	Gyldenstolpe 1916	2	A pair, flying along creek, female shot.
Hat Sanuk creek, Prachuap Khiri Khan Province	11.52 N, 99.47 E28.1.15	Gyldenstolpe 1916	4	Two pairs, a male shot.
Huey Sak, Prachuap Khiri Khan Province	10.55 N, 99.20 E8.2.17	British Museum	1	Female, shot.
Nong Kok, near Krabi, Krabi Province	8.04 N, 98.52 E 1-9.1.18	Robinson & Kloss 1918	4	All males, shot.

Doi Inthanon (Doi Ang Ka) mountain, Chiang Mai Province	18.39 N, 98.33 E	1-6.1.35	Deignan 1945	5-6	A flock flushed from a small brook in evergreen forest.	
Peninsular Thailand		before 1937	Kuah *in litt.* 1991	7	6 males, 1 female. Specimens, University of Singapore.	
Pattani Province	6.53 N, 101.15 E	before 1949	Gibson-Hill 1949	+	Fewer than in Trang Province.	
Phu Lom Lo, Loei Province Elbel.	17.01 N, 101.04 E		Feb 1955	Round *in litt.* 1990		1 Specimen collected by
Unknown location		1955	Anon. *in litt.* 1955	10	Sent to Slimbridge by Phra Abhaivonge.	
Lowlands around Khao Soi Dao WS, Chanthaburi Province.		12.55 N, 102.13 E	*in litt.* 1990	1964	Round & Laothong	+ #
Narathiwat Province	6.25 N, 101.51 E	before 1970	Round unpublished	+	Locals claimed to see birds up to c. 1970. #	
Huai Kha Khaeng WS	15.30 N, 99.13 E	c. 1970	Savage *in litt.* 1981	+		
Nakhon Si Thammarat Province		8.24 N, 99.58 E unknown year		29 June	Medway & Wells 1976	1 Museum specimen.
Huia Mae Dee-Huai Kha Khaeng deciduous-confluence, Huai Kha Khaeng WS forest.		15.17 N, 99.09 E*		1976	Nakhasathien & Stewart Cox 1990	2 Pair in low-lying cum-gallery evergreen
Phu Khieo WS, Chaiyaphum Province.	16.23 N, 101.39 E		Feb 1984	Mackenzie 1985	South East. #	+ Reported sighting in

Nam Yun Dist., Ubon Ratchathani Prov.	14.25 N, 105.12 E	1984	Kamolnorranath 1991	+	6 eggs taken from wild.
Nam Yun Dist., Ubon Ratchathani Prov.	14.25 N, 105.12 E	Dec 1984	Laothong *in litt.* 1990	2	#
Khun Han Dist., Sisaket Prov.	14.38 N, 104.26 E	1984	Boonchai *p.c.* to Laothong *in litt.* 1990	4	Seen in forest of Phanom Dong Rak hills #
Ubol [Muong Ubon], North-east Thailand	15.15 N, 104.50 E	1985 *in litt.* 1985	Prayuth Intarapanich	+	# ?
Sakolnakorn [Muang Sakon Nakhon], North-east Thailand	17.10 N, 104.08 E	1985	Prayuth Intarapanich *in litt.* 1985	+	# ?
Tambon Dome Pradit, Nam Yun Dist., Ubon Ratchathani Prov.	14.25 N, 105.12 E*	Nov 1985	Laothong *in litt.* 1990	10	Seen at a swamp (Nong Sim).
Tambon Dome Pradit, Nam Yun Dist., Ubon Ratchathani Prov.	14.25 N, 105.12 E*	1.12.85	Bangkok Post 4-1-86/ Laothong *in litt.* 1990	7	Group seen at a swamp (Nong Sim). 4 captured.
Ampoe Buntharic, Ubon Ratchathani Province	14.46 N, 105.30 E	Nov 1985 *in litt.* 1990	Amget & Laothong	1	#
Ampoe Buntharic, Ubon Ratchathani Province	14.46 N, 105.30 E	Dec 1985 *in litt.* 1990	Amget & Laothong	1	Shot by locals #
Ampoe Khongchiam, Ubon Ratchathani Province	15.20 N, 105.29 E	Dec 1985 *in litt.* 1990	Amget & Laothong	1	#
Lam Dom Yai area, Nam Yun Dist. Ubon Ratchathani Prov.	14.20 N, 105.05 E	1984-1986	Kamolnorranath 1991	30	30 PE.
Sanambin NHA, Buriram	14.38 N, 103.05 E	Apr 1986	Scott 1989 2-4	# ?	

Province					
Nong Bok swamp, Nam Yun Dist., Ubon Ratchathani Prov.	14.25 N, 105.14 E* #	May 1986	Laothong *in litt.* 1990	8	
Phu Khieo WS, Chaiyaphum Province.	16.23 N, 101.39 E	Nov 1986	Round 1988	1	Found dead.
Klong Nam Baeng, Pa Phru NHA, Narathiwat Province.	6.15 N, 101.56 E	28.12.86	Laothong *in litt.* 1990	3 preserved in formalin.	One shot, juvenile,
Northern end of Huai Kha Khaeng WS	15.40 N, 99.13 E*	Feb 1987	Stewart Cox *in litt.* 1988	1	Near Bor Nam Rorn (Hot Water Spring).
Centre of Thung Yai WS	15.23 N, 98.44 E*	1987	Stewart Cox *in litt.* 1988	1-4	Seen "fairly often" on Mae Kasart stream.
Centre of Thung Yai WS	15.23 N, 98.44 E*	Mar 1987	Stewart Cox *in litt.* 1988	1	Flushed from a pool in Mae Kasart stream.
Huai Thi Mu, Thung Yai WS	15.34 N, 98.39 E*	before 1988	Stewart Cox *in litt.* 1988	+	Unconfirmed report. #
Huai Mae Chan, Thung Yai WS	15.35 N, 98.46 E*	before 1988	Stewart Cox *in litt.* 1988	+	Unconfirmed report. #
Umphang WS, Southwest Thailand	16.03 N, 98.50 E	c. 1988	Collar & Andrew 1988	+	# ?
Plateau between Huai Mae Chan and Huai Mae Klong, Thung Yai WS	15.35 N, 98.50 E	Feb 1988	Stewart Cox *in litt.* 1988	3	Pair and single bird seen.

Thung Yai WS	15.35 N, 98.50 E	March 1988	Robson 1988 & *in litt.* 1990	3	Pair and single bird photographed.
Lake Lakatu, Thung Yai WS	15.39 N, 98.49 E*	1.4.88	Round *in litt.* 1990	2	Pair, roosted overnight at the top of a tree.
Thung Kamang plateau, Phu Khieo WS	16.23 N, 101.39 E	Dec 1988	Round 1988	+	#
Lam Dom Yai river, Nam Yun Dist. Ubon Ratchathani Prov.	14.20 N, 105.05 E	1989	Scott 1989	10-20	PE for forested upper reaches. #
Khao Yai NP, North-east Thailand	14.26 N, 101.22 E	26.1.89 to Round *in litt.* 1991	P. Hottola *p.c.*		1 Flying over a pond near Headquarters.
Lake Lakatu, Thung Yai WS	15.39 N, 98.49 E*	15.11.89	Gretton 1990		6
Huai Greung Peung, northern Thung Yai WS	15.35 N, 98.50 E	1990	Nakhasathien & Stewart Cox 1990		+
Khao Soi Dao Wildlife Centre, Chanthaburi Province	12.55 N, 102.13 E	1990	Laothong *in litt.* 1991	2	Flying over captive WWWD near Khao Soi Dao WS #
Phu Khieo WS, Chaiyaphum Province	16.23 N, 101.39 E	19.7.90	Round 1990	2	Pair at a lake around dusk.
Phu Khieo WS, Chaiyaphum Province	16.23 N, 101.39 E	20.7.90	Round 1990	6	Pair with four ducklings at above location.
Klong Nam Baeng, Pa Phru NHA, Narathiwat Province	6.15 N, 101.56 E	15.11.90	Laothong *in litt.* 1991	1	#
Ao Phang-nga NP, Phang-	8.25 N, 98.30 E	March 1991	de Sadeleer *p.c.* to	1	Flying past headquarters

nga Province Round *in litt.* 1991 in the early morning. #

+ = recorded as present.

* = coordinates are precise. All other coordinates are approximate.

= local report, unconfirmed.

? = clear possibility of wrong identification.

WS = Wildlife Sanctuary.

NP = National Park.

NHA = Non-hunting Area.

PE = population estimate.

() = Old names no longer in use cited within brackets.

[] = location uncertain, but presumed to be that cited within square brackets.

Klong = river or canal.

Ampoe = District.

7.11 SITES IN THAILAND

7.11.1 Thung Yai Naresuan Wildlife Sanctuary-Huai Kha Khaeng Wildlife Sanctuary KEY SITE, TH 23

Location 14.56-15.48 N, 98.27-99.28 E in the Dawna Hills of South-west Thailand, in Tak, Uthai Thani and Kanchanaburi Provinces.

Description Total area of 622,200 ha, with 364,700 ha in Thung Yai WS. Altitude ranges from 150 m to 1811 m. The site contains the only intact riverine ecosystem in Thailand, and is the country's most important site for wildlife conservation. Thung Yai WS is bisected by the river Khwae and has extensive, relatively level areas of 500-600 m elevation, with semi-evergreen, mixed deciduous forest and bamboo. The river Huai Kha Khaeng bisects Huai Kha Khaeng WS, which is dominated by a mosaic of dry dipterocarp and mixed deciduous forest in lowlands, with semi-evergreen and hill evergreen forest on the hill slopes. 45% of the combined area is covered with Mixed Deciduous Forest, 25% with Semi-evergreen Forest and 15% with Hill Evergreen Forest. Gallery Evergreen Forest occurs in patches along the rivers, which are permanent but subject to wide seasonal fluctuations. There are also numerous streams, small lakes, ponds and swampy areas, some permanent and others temporary.

Status of *C. scutulata* Since 1985, seen or reported from four areas of Thung Yai and one in Huai Kha Khaeng. One bird was seen at Bor Nam Rorn in northern Huai Kha Khaeng WS in February 1987. In Thung Yai WS, confirmed records come from Mae Kasart stream, where up to four were seen in early 1987, and Lake Lakatu, where a pair was recorded in April 1988 and six in November 1989. At least three birds were seen on the plateau between Huai Mae Chan and Huai Mae Klong in February and March 1988. There are records from Huai Greung Peung and unconfirmed reports from two other areas of Thung Yai along Huai Mae Chan and Huai Mae Klong. Birds are likely to occur in other areas. Estimated population 12.

Threats

i. Development. The Nam Choan Dam Project was shelved in 1988 but may possibly be resurrected in the future. It would have flooded much of the upper Khwae Yai and divided the site into three. In 1988 the National Environment Board pressed unsuccessfully for the commercial development of the site.

ii. Hunting: mainly by villagers living on site but also by trophy hunters and government officials. Many areas are visited more often by poachers than by reserve staff, and several guards have been killed by poachers in recent years.

iii. Habitat destruction. Illegal logging is concentrated along the eastern boundary, where logging roads and the construction of Thap Salao dam have improved access. Fires are deliberately set in the forests every year, and may be gradually changing deciduous and evergreen forests into dry dipterocarp forests.

iv. Disturbance. Border police land helicopters at Lake Lakatu. Mining occurs on the north-west boundary, with access roads crossing Thung Yai WS.

Conservation Measures Taken Huai Kha Khaeng WS was gazetted in 1972 and extended in 1986. Thung Yai WS was gazetted in 1974 and extended in 1990. The combined site is likely to become a World Heritage site. Additional Guard-stations are being established, and boundary extension and buffer zones to the east and south are being considered. The resettlement of 16 villages in Thung Yai is planned. The site is joined to the north and south by further protected forest areas of 586,100 ha.

References Nakhasathien & Stewart Cox (1990).

Action

i Survey to clarify the distribution and population size of *C. scutulata*.

ii Increase patrolling of remote riverine areas used by *C. scutulata*.

iii. Relocate helicopter landing site for border police away from Lake Lakatu.

iv. Establishment of Research Station in Thung Yai that can be used as a base for *C. scutulata* studies.

v. Conduct an ecological study of *C. scutulata*.

7.11.2 Phu Khieo Wildlife Sanctuary KEY SITE

Location 16.23 N, 101.39 E, Chaiyaphum Province, North-east Thailand.

Description 156,000 ha at 500-1310 m altitude. Mostly a huge, steep-sided plateau about 800 m altitude, with small areas of lowland of 500-600 m. Contains 40,000 ha of Dry Dipterocarp forest and 110,000 ha of Tropical Semi-evergreen Forest. Dominated by Dry Dipterocarp Forest and smaller areas of Tropical Semi-evergreen Forest in lowlands, with Semi-evergreen Forest and semi-natural clearings at higher elevations. The Nam Phrom River rises in the sanctuary, and meanders through bamboo forest and secondary forest interspersed with patches of primary forest. At the peak of the dry season, the river is sluggish but deep, and there are a number of permanent small streams. The lowlands of the Nam Phrom basin, which lies between Phu Khieo WS and Nam Nao NP, are partly flooded by the Chulabhorn hydro dam.

Status of *C. scutulata* A reported sighting in the south-east was made in February 1984. A bird was found dead in November 1986. A sighting was made at Thung Kamang plateau in December 1988. On 19.7.90 a pair was seen at a lake around dusk, and a pair with four ducklings at the same location the following day. Estimated population 2.

Threats Hunting: by poachers that regularly enter the site.

References Mackenzie 1985; Mackinnon & Mackinnon 1986; Round 1988.

Action

i. Conduct a survey of the WS and surrounding neighbouring areas to establish the size and location of the *C. scutulata* population.

ii. Extend the boundaries of the WS and of neighbouring Nam Nao NP to encompass the Nam Phrom basin which lies between them.

7.11.3 Lam Dom Yai river and Yot Dom Wildlife Sanctuary
KEY SITE, TH 19

Location 14.15-14.30 N, 105.05 E in Nam Yun District, Ubon Ratchathani Province, North-east Thailand.

Description Approximately 30 km of river at 140-300m altitude, rising in the Phanom Dongrak hills on the Thai-Cambodian border. The fast-flowing upper 20 km of the river flows through evergreen forest, with secondary deciduous formations around the northern edge of the forest towards the plains and foothills. Yot Dom WS (20,300 ha at 300-693 m altitude) abuts onto the west bank, and contains 2,000 ha of Dry Dipterocarp Forest and 18,000 ha of Tropical Semi-evergreen Forest. The new Phu Jong Na Yoi NP lies to the east. The lower 10 km of river is slow-flowing and passes through open, cultivated land (mainly rice) with some patches of degraded scrub woodland. The river is permanent with average depth of 0.5 m and many deeper pools. The river is frequently in spate during the late wet season from July onwards.

Status of *C. scutulata* 10-20 birds are reported to occur in the forested upper reaches of the river around Yot Dom WS. Two birds were reported from the area in December 1984. In November 1985, ten birds were seen at Nong Sim, a swamp among rice fields near Dome Pradit where four out of a group of seven were captured on 1.12.85. In May 1986, eight were reported from a nearby swamp (Nong Bok). Reports of one bird and one carcass in 1985 in Buntharik District probably refer to the Yot Dom WS area. Boonchai *et al.* (1986) give a population size of 30 for Yot Dom WS, with six eggs taken from the wild in 1984. Estimated population 10.

Threats

i. Hunting: from villagers on the plains and Khmer Rouge present in the areas surrounding the upper river.

ii. Pesticides. Water samples taken from Yot Dom WS contained relatively high amounts of DDT and Dieldrin, coming from the surrounding agricultural areas where *C. scutulata* is thought to feed.

Conservation Measures Taken Both banks of the river in its forested upper reaches are fully protected by law. The Yot Dom WS abuts on the west bank and Phu Jong Na Yoi NP lies to the east.

References Mackinnon & Mackinnon 1986; Round 1988; Scott 1989; Nakhasathien and Cox 1990.

Action Conduct a survey to establish the size and location of the *C. scutulata* population.

7.11.4 Pa Phru (Phru To Daeng) Non-hunting Area TH 35

Location 6.03-6.21 N, 101.50-102.03 E. Narathiwat Province, peninsular Thailand.

Description 16,000 ha within a site of 34,636 ha at near sea level. A large depression 7 km from the coast, with 9,684 ha of primary peat swamp forest (the last in Thailand, almost all within the NHA), 14,600 ha of *Melaleuca* woodland and scrub, and 9,800 ha of degraded grasslands. The site is a permanent swamp with an average depth of 1-1.5 m, overlying 5-8 m of peat. The northern part drains into the Bang Nara river. Surrounding areas are densely populated and mainly under cultivation and degraded scrub.

Status of *C. scutulata* Three birds were seen at Klong (river or canal) Nam Baeng on 28.12.86, and one shot (a juvenile). A single bird was seen at the same location on 15.11.90. Estimated population 2.

Threats

i. Hydrological changes. Drainage canals are being dug in some parts to minimize flooding around the site. A barrage project is planned on the Bang Nara river, and may raise the water table in the area.

ii. Habitat destruction. Two thirds of the primary swamp forest has been destroyed since 1981, partly for unsuccessful conversion to agriculture. Direct clearance or fires, occurring more often following drainage of some areas, has increased the area colonized by *Melaleuca cajeputi*, from which succession back to peat swamp forest is impossible.

iii. Hunting: as demonstrated by the shooting of a bird in 1986.

Conservation Measures Taken The NHA was declared in 1985. The site has been proposed as a Biosphere Reserve.

Action

i. Conduct a survey to establish the distribution and population size of *C. scutulata*.

ii. The swamp forest and a surrounding buffer zone should be declared as a Wildlife Sanctuary, with fires and further development activity strictly controlled.

7.11.5 Khao Yai National Park

Location 14.26 N, 101.22 E. Nakhon Nayok, Nakhon Ratchasima, Saraburi and Prachinburi Provinces, North-east Thailand

Description 216,900 ha at 250-1351 m altitude, much of it over 700 m. Mostly covered with primary Tropical Semi-evergreen Forest (150,000 ha) with small areas of Mixed Deciduous Forest (20,000 ha) along the northern margin. Hill Evergreen Forest occurs above 1,000 m. Contains a large plateau criss-crossed by streams that are slow-flowing in parts.

Status of C. scutulata One seen flying over the pond near headquarters on 26.1.89. Estimated population 1.

Threats Encroachment by villagers into lower lying margins, especially in the east.

References Round 1988, *in litt.* 1990; Mackinnon & Mackinnon 1986.

Action Conduct a survey to establish the size and location of the *C. scutulata* population.

7.11.6 Ampoe Khun Han

14.38 N, 104.26 E. Sisaket Province, North-east Thailand, close to the Cambodian border. Locals reported four birds in forest of the Phanom Dong Rak hills in 1984. This area includes Khao Phanom Dong Rak WS, 31,600 ha at 400-600 m with 15,000 ha of Tropical Semi-evergreen forest and 5,000 ha of Mixed Deciduous Forest. Requires survey.

7.11.7 Khao Soi Dao Wildlife Sanctuary

12.55 N, 102.13 E. Chanthaburi Province, South-east Thailand. 74,500 ha at 200-1,670 m altitude. Mainly semi-evergreen forest on hill slopes with small areas of lowland valley forests. Unconfirmed sighting of two *C. scutulata* above captive birds in the neighbouring Wildlife Centre. Requires survey.

7.11.8 Ao Phang-nga National Park TH 40

8.25 N, 98.30 E. Phang-nga Province, Peninsular Thailand. A coastal mangrove area with Tropical Semi-evergreen Forest in surrounding areas, but much of the area has been logged. The park holds 15,000 ha of mangroves and 3,000 ha of semi-evergreen forest, with maximum altitude of 439 m (Mackinnon & Mackinnon 1986). *C. scutulata* was recorded from the area in the last century. Unconfirmed report of one bird flying past the headquarters in March 1991. Requires survey.

7.11.9 Ampoe Khong Chiam

15.20 N, 105.29 E, Ubon Ratchathani Province, North-east Thailand. District centered around Khong Chaim, a settlement lying at the junction of the Mun River and Mekong River. Probably totally deforested and not likely to support *C. scutulata*. One bird was reported from Ampoe Khong Chiam District in December 1985. Requires survey.

7.11.10 Sanambin Non-Hunting Area TH 18

14.38 N, 103.05 E in Prakhon Chai District, Buriram Province, North-east Thailand. 570 ha at c. 160 m altitude. A water storage reservoir with 200 ha of open water surrounded by extensive marsh grass and a small area of swamp forest. Adjacent areas are mainly rice paddy, with patches of dry dipterocarp woodland. Unconfirmed reports that two to four *C. scutulata* were present in April 1986, although the habitat appears

unsuitable. Requires survey.

7.11.11 Umphang Wildlife Sanctuary

15.37-16.29 N, 98.33-99.07 E, South-west Thailand. 254,800 ha adjacent to Thung Yai-Huai Kha Khaeng WS with suitable habitat for *C. scutulata*. Requires survey.

8. LAO PEOPLE'S DEMOCRATIC REPUBLIC

8.1 LOCAL NAME

"Nok-pet-dong" (Delacour & Jabouille 1931).

8.2 FORMER DISTRIBUTION

All records of *C. scutulata* come from ornithological surveys between 1928 and 1944 during the French occupation (Fig. 10). Lao PDR can be divided into three regions, North, Central and South (see e.g King *et al.* 1975), and *C. scutulata* appears to have been widespread in South and Central Lao PDR. Delacour *et al.* (1928) said the species was "probably abundant in all well-wooded localities, with marshy streams and ponds". However, Delacour (1929) called it "rare but widely distributed".

8.2.1 South Lao PDR

Seen along the Se Kong river in c.1930 (Delacour & Jabouille 1931). Observed around the foot of Bolovens Plateau and on the plateau itself in c.1931, where four were shot at Tha Teng (Engelbach 1932). Another one was shot at an unspecified location on the plateau in 1931-1932 (Dickinson 1970). Several were shot at Saravane in c.1928 (Delacour *et al.* 1928; David-Beaulieu 1949).

8.2.2 Central Lao PDR

A group of three was seen 20 km north of Muong-Phine, Savannakhet Province in 1943-1944, where the local people described it as rare (David-Beaulieu 1949). One was shot at Nakai on 11.1.32 (Dickinson 1970). A single bird was seen at Nape at the extreme North of Central Lao PDR in 1928 (Delacour 1929). Nape is only about 50 km from Vinh in Viet Nam where *C. scutulata* was also recorded (Delacour *et al.* 1928).

----------PRINTER: PLEASE INSERT FIGURE 10 HERE ----------

8.3 FORMER HABITAT

8.3.1 Forest type

According to the vegetation maps of Mackinnon & Mackinnon (1986), *C. scutulata* was recorded from the following forest types.
Forest areas are estimated after Salter & Phanthavong (1989).

a) Tropical Semi-evergreen Forest (TSEF) along the Se Kong river, at the foot of Bolovens Plateau, at Saravane, north of Muong-Phine and possibly at Nape. Originally there were about 5,600,000 ha of this forest in Lao PDR, 24% of the total land area.

b) Tropical Montane Evergreen Forest (TMEF) on Bolovens Plateau, Nakai, and possibly at Nape. Originally there were about 3,600,000 ha of this forest, 15% of the total land area.

Records from TMEF are a reflection of the high altitudes at which the species has been recorded in Lao PDR. Specimens were taken at over 500 m altitude at Nakai, at about 700 m at Nape, and at a height of over 800 m at Tha Teng on Bolovens Plateau. Along the Se Kong river, *C. scutulata* has also been recorded at low altitudes (probably below 100 m).

8.3.2 Wetlands

C. scutulata would have used stagnant water bodies present even in the higher altitude areas where the species was recorded, e.g. much of the top of Bolovens Plateau is flat, poorly drained, waterlogged and scattered with small ponds. Nakai plateau has extensive seasonally flooded grasslands with open water persisting well into the dry season (Salter *in litt.* 1990). Delacour (1929) saw a single *C. scutulata* flying across a road along a forested stream near Nape. Engelbach (1932) found them at pools and marshy clearings in dense forest on Bolovens Plateau and at the foot of the plateau. David-Beaulieu (1949) saw a group of three flying across a track near some wooded pools in slightly hilly forest north of Muong-Phine.

8.4 CURRENT DISTRIBUTION

There is little recent information available on forest birds in Lao PDR, and the current status of *C. scutulata* is open to speculation. There are substantial forest blocks remaining in Central and South Lao PDR that may hold significant populations (Collins *et al.* 1991). For example, Bolovens Plateau still contains large areas of dense evergreen forest, degraded evergreen forest and open deciduous forest, whilst seasonally flooded grasslands on Nakai plateau are still surrounded by broad-leaved and pine forests (Salter *in litt.* 1990).

8.5 CURRENT HABITAT

No information.

8.6 THREATS

8.6.1 Deforestation

Deforestation by shifting cultivation, associated fires and uncontrolled or poorly-controlled logging in recent decades is likely to have reduced the range of *C. scutulata* in Lao PDR. Total remaining forest cover has been estimated at 47% for 1980-81 (Salter *in litt.* 1990) and the non-degraded forest cover at 19% (Scott 1989). The deforestation rate is estimated at 100,000 ha per annum (1981-1985, Collins *et al.* 1991). Illegal logging may have increased to supply the Thai market since Thailand imposed a logging ban in 1989 (BBC Wildlife Magazine, October 1989). The forest of Nakai Plateau, where *C. scutulata* were recorded in 1932, is threatened by a major hydropower development being planned (Salter *in litt.* 1990).

8.6.2 Hunting

Hunting pressure on birds is intense in some areas of Lao PDR, particularly urban and densely settled agricultural areas (Salter *in litt.* 1990).

8.7 CONSERVATION MEASURES TAKEN

Neither *C. scutulata* nor its habitat is currently protected by law. However, there are a number of proposed protected areas in the species's former range with the potential for holding the species.

8.8 EVALUATION

C. scutulata was formerly widespread, but as forest birds have been little studied in recent decades, current status is unknown. Areas of suitable habitat remain and there is a good chance that the species is still present. Surveying of such areas is urgently required.

8.9 ACTION

8.9.1 Surveys

i. Highest priority: to survey the proposed protected areas at Nakai Plateau and the Tha Teng area on the north-eastern edge of Bolovens Plateau, where *C. scutulata* was observed in the 1930s. Both these areas are partly affected by development, and Nakai Plateau is highly threatened (Salter & Phanthavong 1989).

ii. Second priority: Dong Khan Thung proposed protected area, close to the Lam Dom Yai area of Thailand where *C. scutulata* occurs.

iii. Third priority: other proposed protected areas containing TSEF or TMEF and found in the former range in Central and South Lao PDR. According to Salter & Phanthavong (1989), these are Phou Xang He, Xe Piane, Dong Ampham, Bolovens Plateau, Dong Hua Sao, Phou Ilang, Dong Khok Pa Dek, Phou Done Khong, Xe Kong Pine Forest, Phou Xiang Thong, Dong Sithuane and Xe Bang Fai.

iv. Fourth priority: other remaining areas of TSEF and TMEF habitat in South and Central Lao PDR.

8.9.2 Legal protection

C. scutulata should be granted legal protection from hunting, trade etc.

8.9.3 Others

A protected area system is currently under consideration, and this would provide opportunities to conserve *C. scutulata*. During reconnaissance surveys of proposed protected areas, special efforts should be made to survey for *C. scutulata*, and the species should be included in any education campaigns for threatened species.

8.10 ALL RECORDS IN LAO PDR

Location	Coordinates	Date	Source	Numbers	Notes
Near Nape, central Laos across road along	18.18 N, 105.04 E		Jan-Feb 1928	Delacour 1929	1 Flew stream in damp forest.
Saravane, South Laos	15.43 N, 106.26 E		c. 1928 /David-Beaulieu 1949	Delacour & Jabouille 1928	+ Several shot, including at least one male.
Sekong river, South Laos	15.45 N, 106.45 E		c. 1930	Delacour & Jabouille 1931	+ Some observed.
Bolovens Plateau, South Laos	15.14 N, 106.18 E		Oct 31-Mar 32	Dickinson 1970	1 Shot.
Nakai, Central Laos shot.	17.45 N, 105.08 E		11.1.32	Dickinson 1970	1 Female,
20km N of Muang Phine, Savannakhet Province	16.32 N, 106.02 E		1943-1944	David-Beaulieu 1949	3 Group of 3 flying and calling near wooded pools.
Foot of Bolovens Plateau, South Laos	15.25 N, 106.34 E		c.1931	Engelbach 1932	+ On ponds and marshy clearings in dense forest.
Tha Teng, Bolovens Plateau, South Laos	15.25 N, 106.22 E		c.1931	Engelbach 1932	4 Shot on ponds and marshy clearings in dense forest.

+ = recorded as present.

All coordinates are rough approximations.

8.11 SITES IN LAO PDR

C. scutulata has previously been recorded in the vicinity of the following three sites, which urgently require surveys (Salter *in litt.* 1990, Salter & Phanthavong 1989).

8.11.1 Tha Teng proposed protected area

Saravane State. 30,000 ha of 50% TSEF, 50% TMEF. 83% dense forest and 17% degraded forest. The site of a small hydropower facility now nearing completion, with an integrated watershed management project. If *C. scutulata* is found, the protected area should be expanded to include more forest and wetlands.

8.11.2 Nakai plateau proposed protected area

Khammouane State. 162,000 ha of 78% dense forest, 6% degraded forest, 17% open vegetation or farmland. Forest is 40% TMEF, 60% dry evergreen forest. Known to contain a number of Red Data Book species, but highly threatened by a proposed major hydropower development.

8.11.3 Dong Khan Thung proposed protected area

Champassak State. 37,900 ha of lowland TSEF, with 60% of the area below 200 m altitude. Adjacent to the Lam Dom Yai area of Thailand where *C. scutulata* still occurs.

9. VIET NAM

9.1 LOCAL NAME

No information

9.2 FORMER DISTRIBUTION

Records from 1924 to 1931 during the French occupation that show *C. scutulata* was present in the North Annam area of northern Viet Nam and the Cochinchina area of southern Viet Nam (Fig. 10). Delacour *et al.* (1928) said that the species was "probably abundant in all well-wooded localities, with marshy streams and ponds". However, Delacour (1929) called it "rare but widely distributed".

9.2.1 North Annam

Recorded from Vinh in c.1926 (Delacour *et al.* 1928), only about 50 km away from Nape in Lao PDR where *C. scutulata* was also found (Delacour 1929).

9.2.2 Cochinchina

Recorded from Hon Quan (Beaulieu 1932), An Binh and Phu Rieng (Delacour *et al.* 1928) between 1928 and 1931. All three locations are within 50 km of each other.

9.3 FORMER HABITAT

9.3.1 Forest type

According to the vegetation maps of Mackinnon & Mackinnon (1986) all the former records of *C. scutulata* are from Tropical Semi-evergreen Forest. Originally 18,600,000 ha, 56% of total land area, contained this forest type. There were also originally 3,900,000 ha of Freshwater Swamp Forest in the Mekong Delta. This forest type provides the major *C. scutulata* habitat in Sumatra, and may have supported the species in Viet Nam. However, there is no historic evidence for this.

9.3.2 Wetlands

According to Delacour *et al.* (1928), *C. scutulata* was found on "marshy streams and ponds surrounded by trees".

9.3.3 General Terrain

All the *C. scutulata* records come from areas dominated by terrain under 200 m altitude.

9.4 CURRENT DISTRIBUTION

The continued existence of *C. scutulata* in Cochinchina has recently been confirmed (Fig. 10).

9.4.1 Nam Bai Cat Tien National Park KEY SITE

Since the 1930s, the only records of *C. scutulata* are from Nam Bai Cat Tien NP, Dong Nai, Cochinchina, where a single bird was seen on 4.1.90 (C. Robson *in litt.* 1990) and locals reported recent sightings of a pair

(Eames & Robson 1991). This location is only about 50 km East of An Binh, where the species was observed in the 1920s. The size and extent of this remaining population is unknown. There is likely to be a breeding population that has survived in the area through the century, but local reports suggest it is small. LE = 2.

9.4.2 Potential for undiscovered populations

The former range indicates that the Tropical Semi-evergreen Forest of Cochinchina and Annam provides suitable habitat, and an estimated 20% of the original area of this forest survives in Viet Nam, a total of 11% of the total land surface (Mackinnon & Mackinnon 1986). There may therefore be populations of *C. scutulata* outside Nam Bai Cat Tien NP.

9.5 CURRENT HABITAT

9.5.1 Forest type

The bird seen on 4.1.90 was flying low over seasonally flooded Freshwater Swamp Forest which occupies about 500 ha in the centre Nam Bai Cat Tien NP (C. Robson *in litt.* 1990) and is mainly a mixture of *Hydrocarpus anthelmintica* and *Ficus benjamica* (Thai Van Trung 1988). This area of swamp forest was probably not much larger historically (Robson *in litt.* 1990) and represents one of the few remaining patches of Freshwater Swamp Forest in Viet Nam, and Mackinnon & Mackinnon (1986) state that none remains. Hence if this *C. scutulata* population is dependent on Freshwater Swamp Forest, it must be very small (no more than 10 individuals based on density data in section 3.8).

Past records suggest that the Tropical Semi-evergreen Forest provides suitable habitat, and Nam Bai Cat Tien NP is dominated by this forest type, which covers 28,000 ha of the Park and extends beyond its boundaries. This suggests that this area has the potential to support a larger *C. scutulata* population. In Nam Bai Cat Tien this forest is a mixture of evergreen Dipterocarps such as *Dipterocarpus alatus*, *D. dyeri*, *D. costata*, *Hopea odorata*, *Shorea guiso*, and deciduous species of families Leguminosae (*Azfelia xylocarpa*, *Dalbergia mammosa*, *Xylia dolabriformis*), Lythraceae (*Lagerstroemia tomentosa*), and Sterculiaceae (*Tarretia cochinchinensis*) (Thai Van Trung 1988).

9.5.2 Wetlands

Nam Bai Cat Tien NP contains freshwater swamps, marshes, ponds and lakes, most of which disappear during the dry season. A shortage of feeding areas in the dry season may limit the size of the *C. scutulata* population.

9.6 THREATS

9.6.1 Deforestation

Deforestation is likely to have reduced the range of *C. scutulata* in Viet Nam in recent decades. By 1943 forest cover was reduced to 43% with extensive areas cleared in coastal regions and in the floodplains of the Mekong and Red Rivers (Le Dien Duc in Scott 1989). Warfare between 1945 and 1975 destroyed a further 2 million ha of forest with bombs, shells, napalm and defoliants. Even more deforestation has occurred since hostilities ceased, due to clearance for slash and burn agriculture, forest fires, extraction of timber and firewood and urban expansion. Annual deforestation is 311,000 ha (1986-1990) and forest cover is now estimated at 17%, including 14% lowland forests (below 900 m altitude, Collins *et al.* 1991).

Viet Nam has recently embarked on a major environmental recovery plan centred on population control, declaration of protected areas and reforestation of the mangroves and *Melaleuca* forests of the Mekong delta that were the most affected by warfare (Mackinnon & Mackinnon 1986; Kemf 1988). In 1987, 160,000 ha was reforested,

while a larger area of Viet Namese forest was destroyed. There are plans to raise the reforestation rate to produce a net increase in forest cover (Kemf 1988). As a result of this program, many waterbird colonies that disappeared from the Mekong delta during the war years are re-establishing themselves and fishery production is returning to former levels (Mackinnon & Mackinnon 1986).

9.6.2 Nam Bai Cat Tien National Park

The major threat to *C. scutulata* here may be disturbance from up to 50 fishermen regularly visiting the wetlands and from communities living within the park. These communities may clear or drain habitat. Illegal logging is thought to be widespread and occurs in the swamp forest where *C. scutulata* was recorded. Illegal hunting also occurs (Robson *et al.* 1990).

9.6.3 Hunting

Hunting may affect *C. scutulata* populations elsewhere in Viet Nam as it is often uncontrolled and intensive due to the general availability of firearms (Le Dien Duc in Scott 1989).

9.7 CONSERVATION MEASURES TAKEN

C. scutulata is not a protected species in Viet Nam, but Nam Bai Cat Tien is a National Park with no legal logging or hunting. A further 82 protected areas are planned in Viet Nam, covering about 3% of the country's total land area (Mackinnon & Mackinnon 1986). Many of these areas contain Tropical Semi-evergreen Forest and some may support *C. scutulata*.

9.8 EVALUATION

Only two sightings have been made in Viet Nam in recent years, and the current status of *C. scutulata* is unclear. Surveys are urgently required in Nam Bai Cat Tien NP and other areas of suitable habitat to clarify the species' status. Protection at Nam Bai Cat Tien NP urgently requires improvement.

9.9 ACTION

9.9.1 Surveys

i. First priority: Nam Bai Cat Tien NP, to assess the distribution and population size of *C. scutulata*.

ii. Second priority: Ma Da, Dong Nai Province and Yok Don, Daklak Province, thought to provide suitable habitat for *C. scutulata* (Robson *pers. comm.* 1991).

iii. Third priority: other protected areas in the known former range that contain Tropical Semi-evergreen Forest. According to Mackinnon & Mackinnon (1986), in and around Cochinchina these are Bao loc, Bu gia map, Chu giang sinh, Duong minh chou, Ho lac, Logo samat and Tay Cat Tien. Around the Vinh area of North Annam and close to the Nape area of Lao PDR these are Phong Nha, Thanh chiung and Vu Quang.

iv. Fourth priority: protected areas with Tropical Semi-evergreen Forest in South and Central Annam, where *C. scutulata* may formerly have occurred. These are Bach Ma Hai van, Deo Ca/Hon ron, Son tra, Tay son, Mom rai Ngoc vin and Nam Luy/Quang Xuyen.

9.9.2 Nam Bai Cat Tien NP

Illegal logging and hunting in Nam Bai Cat Tien should be stopped. Fishing disturbance should also be stopped.

One option for improved protection is to pay forestry staff by results, as practised at Tram Chim Sarus Crane Reserve, Dong Thap Muoi (G.E. Morris *in litt.* 1990). An educational display for visitors at park headquarters should be constructed (Robson *et al.* 1990), and this should include a brief on *C. scutulata*.

9.9.3 Legal protection

C. scutulata should be legally protected from hunting, trade etc. throughout Viet Nam.

9.10 ALL RECORDS IN VIET NAM

Location	Coordinates	Date	Source	Numbers	Notes
Vinh, North Annam	18.40 N, 105.41 E	c.1926	Delacour *et al.* 1928	+	Seen.
An-Binh, Cochinchina	11.24 N, 106.50 E	Mar 1927	Delacour *et al.* 1928	+	A number seen.
An-Binh, Cochinchina	11.24 N, 106.50 E	c.1928	Delacour *et al.* 1928	+	1-2 shot.
Phu-rieng, Cochinchina	11.40 N, 106.55 E	c.1928	Delacour *et al.* 1928	+	1-2 shot.
Hon Quan (An hoc), Phu-rieng. Cochinchina.	11.39 N, 106.37 E	1929-1931	David-Beaulieu 1932	+	Less common than in seasonal swamp forest at 0745 h.
Nam Bai Cat Tien NP, Cochinchina	11.29 N, 107.23 E	4.1.90	Robson *in litt.* 1990	1	1 bird flying low over
Nam Bai Cat Tien NP, villagers. Cochinchina	11.29 N, 107.23 E	1990-1991	Eames & Robson 1991	2	Pair observed by two Considered reliable by authors. #

+ = recorded as present.

= local report, unconfirmed.

Note: coordinates are precise for Nam Cat Tien sighting. Others are approximate.

() = old names no longer in use are cited within brackets.

9.11 SITES IN VIET NAM

9.11.1 Nam Bai Cat Tien National Park KEY SITE, VN 22

Location Dong Nai Province. 11.32 N, 107.23 E.

Description 36,500 ha. Western part hilly and well forested (150-350 m elevation). Eastern part is level lowlands (120-150 m elevation) with degraded and secondary forests. There are 28,000 ha of Tropical Semi-evergreen forest and 500 ha of seasonally flooded Freshwater Swamp forest. Large areas of bamboo, sugar cane and paddy rice result from forest clearance before the area was protected. The southern part (15,000 ha) is the riparian lowlands of the Dong Nai River, 2,500 ha of which flood during the rainy season, creating marshes and three small freshwater lakes. Only one lake (30-50 ha) persists throughout the dry season. A hydro-electric dam has recently been constructed downstream of the reserve and will flood large areas of forest south of the reserve.

Status of *C. scutulata* Frequently observed in this area of Cochinchina in the 1920s and 1930s. A single adult was observed on 4.1.90 flying over the seasonal swamp forest. Locals saw a pair in 1990 or 1991.

Threats

i. Disturbance: from constant and uncontrolled presence of up to 50 fishermen and from sugar cane transportation by heavy trucks along the park's central road.

ii. Habitat destruction: from widespread illegal logging, particularly in the northwest. Thousands of tribespeople live in the west of the park and encroach on the forest. Fires are caused by honey collection in the dry season.

iii. Hunting: with guns and snares. Extensive lines of snares set in rice fields and open country.

Conservation Measures Taken Declared a Forestry Reserve in 1978 and a National Park in the mid 1980s. Logging and hunting are illegal. Forestry staff are mainly concerned with preventing fires and illegal cutting of trees, and are based along the river. There is no patrolling in the western hills. Since 1987 Dong Nai Forestry Department has set aside 10% of its profits from forest exploitation for investment at the park.

Action

i. Control fishing disturbance, logging and hunting by increasing effectiveness of forestry staff. Payment by results is one option.

ii. Construct an educational display for visitors at park headquarters including a brief on *C. scutulata*.

9.11.2 Yok Don

Nature reserve of 57,500 ha in west Dak Lak Province known to contain Green Peafowl and storks. Requires survey for *C. scutulata*.

9.11.3 Ma Da

Planned research forest on Dong Nai west of Nam Bai Cat Tien. Requires survey for *C. scutulata*.

10. CAMBODIA

10.1 LOCAL NAME

No information.

10.2 FORMER DISTRIBUTION

C. scutulata has been recorded in both coastal and inland provinces of Cambodia (Fig. 10).

10.2.1 Coastal provinces

Thomas (c. 1961) reported that *C. scutulata* was most abundant in the coastal provinces of Cambodia before 1960. Engelbach (1947, 1952) saw a pair flying up a valley in Cardomomes mountains, Kampot Province, at sunset on 17.4.44, and the same pair flying down the valley just after sunrise the next day. Thomas (c. 1961) stated that Delacour and Engelbach listed it for Koh Kong (references not traced).

10.2.2 Inland provinces

Thomas (c. 1961) stated that Delacour and Engelbach listed *C. scutulata* for Siem Reap (references not traced). Scott (1989, CA3) reported that the species "may still occur" in the upper Stung Sen river, although there are no known records of *C. scutulata* from here.

10.2.3 Unknown locations

Before the early 1960s, a Mr Ho Tong Lip reported *C. scutulata* from Ratanakiri (Thomas c. 1961).

10.3 FORMER HABITAT

10.3.1 Forest types

According to the vegetation maps of Mackinnon & Mackinnon (1986), the areas of Cambodia where *C. scutulata* were formerly recorded were originally dominated by the following forest types. The original area of each forest type in Cambodia is given in ha and expressed as a percentage of total land area.

a) Tropical Wet Evergreen Forest 1,530,700 8%

At Koh Kong and possibly Kampot. Major forest in coastal provinces.

b) Tropical Semi-evergreen Forest 6,969,200 39%

Possibly in Kampot and Stung Sen.

c) Mixed Deciduous Forest 6,469,600 36%

Possibly at Siem Reap.

d) Freshwater Swamp Forest 556,100 3%

Possibly at Siem Reap.

e) Dry Dipterocarp Forest 1,902,300 11%
Possibly at Stung Sen.

10.3.2 General Terrain

All the *C. scutulata* records come from areas dominated by terrain under 200 m altitude.

10.4 CURRENT DISTRIBUTION

There are no recent records from Cambodia, but ornithological surveys have not been possible in recent decades. Considerable amounts of suitable habitat remain in areas previously occupied by the species, so continued survival is possible. The following estimated remaining areas of potentially suitable forest types come from Mackinnon & Mackinnon (1986), expressed in ha and as a percentage of the original area of that type.

Tropical Wet Evergreen Forest	1,209,300	79%
Tropical Semi-evergreen Forest	766,600	11%
Mixed Deciduous Forest	776,300	12%
Freshwater Swamp Forest	389,300	70%
Dry Dipterocarp Forest	779,900	41%

10.5 CURRENT HABITAT

No information.

10.6 THREATS

10.6.1 Deforestation

Deforestation is likely to have reduced the range of *C. scutulata*. Total forest cover in 1990 was estimated at 37%. This compares with 40% in 1980, 63% in 1971 and 73% in 1960 (Collins *et al.* 1991). Deforestation accelerated during the Indochinese wars, beginning in the 1960s, caused by bombs and herbicides. Under the Khmer Rouge, large areas were then cleared for conversion to agriculture. Since the Viet Nam invasion of 1978, shifting agriculture has been the main cause of deforestation, which has continued at the rate of 30,000 ha per annum (1981-1985). Many swamp forests have been converted to highly acidic, treeless plains following misguided efforts to drain them for agriculture (Collins *et al.* 1991).

10.6.2 Hunting

Direct impact of the current presence of guerrillas in many forest areas on *C. scutulata* is open to speculation, but may have intensified hunting for food (Thouless 1987).

10.7 CONSERVATION MEASURES TAKEN

None known.

10.8 EVALUATION

The current status in Cambodia is unknown and likely to remain so in the near future. Since 1970 Cambodia has suffered prolonged periods of warfare and genocide, and conflict continues. Under the circumstances, wildlife conservation work is impossible. If conflict ends, surveys of many forest areas will be impractical because of land mines, particularly along the Thailand border (Thouless 1987).

If the situation improves, suitable forest areas should be surveyed and included within a protected area system. There are already proposed protected areas that may contain *C. scutulata* (Mackinnon & Mackinnon 1986). These include Kiriom and Phnom aural in the Cardamomes range, which contain large areas of Tropical Wet Evergreen and Semi-evergreen Forests, and Tonle sap in central Cambodia with 100,000 ha of Freshwater Swamp Forest.

10.9 ACTION

None possible at present.

10.10 ALL RECORDS IN CAMBODIA

Location	Coordinates	Date	Source	Numbers	Notes
Cardomomes mountains, Kampot Province	10.36 N, 104.11 E Pair flying up a valley	17.4.44	Engelbach 1947, 1952	2	at sunset.
Cardomomes mountains, Kampot Province	10.36 N, 104.11 E Above pair flying down the	18.4.44	Engelbach 1947, 1952	2	valley just after sunrise.
Siem Reap Province	13.22 N, 103.52 E	1947-1961	Thomas c. 1961	+	
Koh Kong/Kas Kong	11.29, 103.10 E	1947-1961	Thomas c. 1961	+	
Ratanakiri		before 1961	Thomas c. 1961	+	Recorded by Ho Tong Lip.
Coastal provinces		1961	Thomas c. 1961	+	

+ = recorded as present.

All coordinates given are approximate.

11. PENINSULAR MALAYSIA

11.1 LOCAL NAME

No information.

11.2 FORMER DISTRIBUTION

Despite numerous past records from Peninsular Thailand, there is only one definite record of *C. scutulata* from Peninsular Malaysia (Fig. 11). This is cited by Robinson (1909) as "an old and deteriorated mounted specimen from the vicinity of Ipoh in the Kinta District of Perak (State), in the Selangor Museum". *C. scutulata* may also have occurred in Kedah State to the North of Perak, because A.T. Edgar told Gibson-Hill (1949) that the local people in Kedah were familiar with the species.

Given the number of museum collectors and ornithologists formerly in the country, the shortage of records suggests that *C. scutulata* was neither widespread nor abundant in Peninsular Malaysia. Perhaps it was never resident, with sightings being of vagrant birds from Peninsular Thailand. Its scarcity is perhaps related to the poorly seasonal climate in most of Peninsular Malaysia, with the absence of the pronounced dry season found in Peninsular Thailand. Indeed, the Kedah and Perak States are in the north-west corner of the country, the only area with a marked seasonal climate and dry season (from December to March, Scott 1989; Wells *in litt.* 1990). However, *C. scutulata* is present in poorly seasonal areas of northern Sumatra (Chapter 12).

Some further possible sightings of *C. scutulata* have recently emerged. There were unconfirmed verbal reports of sightings from Taman Negara NP in the central Peninsula from the 1930s and 1940s (Mohammad Khan bin Momin Khan *pers. comm.* to J.G. Corder *pers. comm.* 1990). This site is about 100 miles east of Ipoh and 400-2156 m in altitude (Mackinnon & Mackinnon 1986). The lowlands of Taman Negara contain long-established villages amongst paddy fields (Wells *in litt.* 1991). Such an area could attract *C. scutulata* but could also be a site for the spread of feral muscovies *C. moschata*.

At 1530 h on 10.8.81, a possible sighting was made in Johore State about 280 miles to south-east of Ipoh (J.G. Corder *pers. comm.* 1990). A pair of adult birds and two young were observed on a stream in fairly dense forest, two to three miles upstream of Kota Tinggi Waterfalls (north or west of the waterfalls). The stream was slow flowing through fairly gentle terrain, and about six metres wide. The adults had striking white wing flashes and white heads speckled with black. When disturbed by the observer's approaching the bank, the birds swam to the opposite bank, climbed out and walked away into the undergrowth. No calls were heard at any time.

If these reports were mis-identifications, domestic Muscovy Ducks *C. moschata* are the most likely alternative. Muscovies sometimes have a similar head speckling and wing flashes to *C. scutulata*.

11.3 FORMER HABITAT

Unknown. According to the vegetation maps of Mackinnon & Mackinnon (1986), the areas of Perak, Kedah and Johore State where *C. scutulata* may have occurred were originally dominated by Tropical Wet Evergreen Forest. This forest type originally covered about 75% of the land area in Peninsular Malaysia, reflecting the equatorial climate. The 1981 report came from forest thought to be of this type. Taman Negara NP contains this forest type along with Forest on Limestone and Tropical Montane Evergreen Forest. If *C. scutulata* were present in Tropical Wet Evergreen Forest, it would probably have been confined to forest on alluvial terraces along rivers subject to flooding (Davison *in litt.* 1990).

Originally 1,269,300 ha of the east and west coasts were covered with Freshwater Swamp Forest (Mackinnon & Mackinnon 1986), but there are no records of *C. scutulata* from here.

11.4 CURRENT DISTRIBUTION

The unconfirmed 1981 sighting is the only report of *C. scutulata* in Malaysia since 1950, and the species is likely to be extinct in this country. The west coast plain in Perak has been cleared of forest and is no longer suitable habitat. The Kota Tinggi Waterfalls area of Johore is now largely deforested. *C. scutulata* does not occur in Taman Negara NP, which is often visited. The north-west state of Perlis still contains border hills that may conceivably support *C. scutulata*, but the habitat is much degraded. Survival of the species in the hilly, forested interior of Kedah is also possible, as this area has been off-limits since the 1940s. In addition, there are remaining areas of Freshwater Swamp Forest in eastern Johore where survival is possible (Davison and Wells *in litt.* 1990).

11.5 CURRENT HABITAT

No information.

11.6 THREATS

11.6.1 Deforestation

Logging, conversion to agriculture and dam construction reduced forest cover to about 47% by 1985, with only 12% primary forest (Collins *et al.* 1991). Deforestation continues at 95,600 ha per annum (1986-1990). Reservoirs have recently been constructed for irrigation purposes in Kedah, flooding lowland forest (Wells *in litt.* 1990). Around Kota Tinggi Waterfalls, most forest has been cleared since 1981 for conversion to oil palm (Davison and Wells *in litt.* 1990).

11.6.2 Pesticides

Pesticides are extensively used in rice paddies in Kedah where any surviving *C. scutulata* are likely to feed (Wells *in litt.* 1990).

11.7 CONSERVATION MEASURES TAKEN

None known.

11.8 EVALUATION

C. scutulata may never have been resident in Peninsular Malaysia and is now likely to be extinct. However, survival of a small population cannot be ruled out, and surveys are desirable.

11.9 ACTION

11.9.1 Surveys

i. Highest priority: around Kota Tinggi Waterfalls and Endau Kota Tingii protected area.

ii. Second priority: Freshwater Swamp Forest in east Johore State in Jemaluang Forest Reserve and elsewhere.

This habitat is unprotected and disappearing quickly (Mackinnon & Mackinnon 1986).

ii. Third priority: remaining forest patches in Perlis and Kedah States, including Ulu Muda protected area.

11.10 ALL RECORDS IN PENINSULAR MALAYSIA

Location	Coordinates	Date	Source	Numbers	Notes
Ipoh, Kinta Dist., Perak State	4.36 N, 101.05 E	before 1900	Robinson 1909	1	An old museum specimen.
Taman Negara National Park	4.35 N, 102.43 E	1930-1949	MK MK *pers. comm.* to + Corder *pers. comm.* 1990		# ?
Kedah State	5.32 N, 100.37 E	before 1949	Gibson-Hill 1949	+	Locals spoke of it to A.T. Edgar #
Stream near Kota Tingii waterfalls, Johore State	1.45 N, 103.53 E	10.8.81	Corder *in litt.* 1990	4	A pair with two chicks at 1530 h. ?

+ = recorded as present.

? = clear possibility of wrong identification.

= local report, unconfirmed.

Note: All coordinates given are approximate.

12. INDONESIA

12.1 LOCAL NAME

"Serati", "Bebek hutan" (Holmes 1977), "Itik hutan" (Holmes 1976) or "Mentok hutan" (Rudyanto *in litt.* 1990).

12.2 FORMER DISTRIBUTION

C. scutulata has been recorded many times from Sumatra and Java (Fig. 11), but never from other parts of Indonesia. The type specimens of the species were collected from Java by Muller (1842). The records before 1980 are summarised below, divided into regions from North to South.

12.2.1 Aceh Province

Recent record from Runding (see below).

12.2.2 Sumatra Utara (North Sumatra) Province

Frequently shot by Hagen before 1901 in Deli (Medan region) on the eastern side (Hartert 1902; Phillips 1923). Also recorded in Deli before 1905 by C. Waldeck (de Beaufort 1909; Marle & Voous 1988) and one recorded at Telok Pandji on S. Batoen, south of Labuhanbilik (Laboenlilik) on 14.8.37 (University of Singapore specimen, Kuah *in litt.* 1991). Recently recorded on the western side (see below).

12.2.3 Riau Province, Sumatra

One recorded by J.P. Gee on 23.3.79 along the Rokan River or one of its tributaries 40 km west of Duri (oilfield). The bird was in flight in swamp forest with some hillocks bearing drier forest in the area (Andrew *in litt.* 1991).

12.2.4 Jambi Province, Sumatra

A pair seen at Muara Bulian, a swamp on S. Batang Hari (S. = Sungai, or river) on five occasions between 18.1.76 and 1.2.76. Also reported at the same time to be an occasional visitor to a wooded ox-bow lake, Danau Saranglang, near Serasak 20 km from Muara Bulian (Holmes 1976). Recent records from S. Berbak and S. Gelumpangkecil (see below).

12.2.5 Sumatra Selatan (South Sumatra) Province

One was shot before 1891 near Beniawang (Vorderman 1892) and another in 1918 in Talang Betutu (Bogor Museum specimen, Ounsted 1985). Five were collected from Pelambang in different places and different times in 1937 and taken into captivity (Wildfowl Trust Annual Report 1954-1956). Some specimens shot on S. Mesuji, South Pelambang before 1950 (Hoogerwerf 1950). Recent records from several areas (see below).

12.2.6 Lampung Province, Sumatra

One collected in March 1896 by Vorderman (NMNH, Leiden). Two were shot in October-November 1901 at Gunung Sugi (Goenong Soegi, Stone 1902). Up to 30 reported from S. Rasau, Way Kambas NP in 1969 (Lambert 1988). A pair was seen at Lake Jepara on 30.6.76 (Holmes 1976). In January 1977, Holmes (1977) was shown four reputed *C. scutulata* nest holes at Bujung Tenuk, near Menggala on S. Tulang Bawang. An adult was heard in the vicinity, and the locals reported a recent sighting of an adult with two ducklings and capture of another family of seven ducklings. Holmes also recorded birds at Rawa Susuk (Rawa = swamp) on S. Seputih north of Rumbia on

22.9.76 and along S. Ketibung (tributary of lower S. Sekampung) on 25.10.76. Recent records from several areas (see below).

12.2.7 Bengkulu Province, Sumatra

Some specimens shot before 1950 in South Bengkulu (Benkoelen, Hoogerwerf 1950).

12.2.8 Other parts of Sumatra

Robinson & Chasen (1936) refer to specimens in the Raffles Museum collected in Kerinci (Korinchi), presumably indicating an intermontane basin in the Kerinci region. This suggests the former occurrence of the species in the rift valley that runs irregularly up the length of the West Sumatran mountains (Holmes *in litt.* 1990). Whitten obtained local reports on the island of Siberut in 1976 (Whitten *in litt.* 1976), but was unable to confirm these despite repeated searching (Kear 1979).

12.2.9 Java

Muller collected three type specimens from Lake Garang (Gorong), Central Java and one from Bogor (Buitenzorg), West Java, about 1842 (Muller 1842; Schlegel 1866; Phillips 1923). Two specimens collected from unknown locations for the British Museum before 1864 (Blyth 1867; Blanford 1898). Two specimens collected by Diard in 1863 from unknown locations (NMNH Leiden). Two specimens collected from Desa Langen (Langgen), West Java on 24.12.1907 (NMNH, Leiden). Eggs were collected from nests in Kali Pucang (Kalipoetjang), West Java, and Kebumen (Keboemen), Central Java, before 1949 (Hoogerwerf 1950). Possible record from the mouth of the Tjitelang in Ujung Kulon NP in the extreme west of Java in 1932 (Four birds that resembled domestic "manila" ducks flew over, Hoogerwerf 1970), and one bird was reported to be seen at Nyiur (Njur) swamp in Ujung Kulon NP in 1972 (Savage *in litt.* 1975). Hoogerwerf (1970) regarded *C. scutulata* as merely a visitor to Java from Sumatra.

----------PRINTER: PLEASE INSERT FIGURE 11 HERE ----------

12.3 FORMER HABITAT

12.3.1 Forest types

The following original areas of potentially suitable forest types were present, shown in km^2 and expressed as a percentage of the total area of Sumatra or Java (Mackinnon & Mackinnon 1986).

a) Sumatra

Freshwater Swamp Forest	36,948	8%
Peat Swamp Forest	84,952	18%
Mangrove	13,529	3%
Tropical Semi-evergreen Forest	5,280	1%
Tropical Wet Evergreen Forest	229,218	49%

b) Java

Freshwater Swamp Forest	830	0.7%

Mangrove	733	0.6%
Tropical Semi-evergreen Forest	54,537	44%
Tropical Wet Evergreen Forest	43,258	35%

On the basis of evidence from the past two decades (see below), Freshwater and Peat Swamp Forest are regarded as the major habitat of *C. scutulata* in Indonesia. According to maps of original vegetation (Mackinnon & Mackinnon 1986), swamp forest was particularly abundant in eastern Sumatra, and is likely to have been the major terrestial habitat for the birds found in Riau, Jambi, Sumatra Selatan and Lampung Provinces. There were also bands of this forest near other *C. scutulata* records along the east coast of Utara Province in North Sumatra, in Bengkulu and in the valleys of the western mountains.

Owing to its drier climate, Java had less swamp forest, and the Javan *C. scutulata* population was probably not wholly associated with this forest type. Records from Bogor, Lake Garang and Kebumen were probably from Tropical Wet Evergreen or Tropical Semi-evergreen Forest. The most recent reports came from Ujung Kulon NP, which contains only 800 ha of Freshwater Swamp Forest but 40,800 ha of Wet Evergreen Forest.

12.3.2 Wetlands

According to Hoogerwerf (1950), in southern Sumatra *C. scutulata* was found in freshwater marshes and swamp forests in the interior, and was not present along the coast or in brackish wetlands. The first detailed description of wetlands used by *C. scutulata* is given by Holmes (1976; 1977). These sightings were made in degraded habitats, and are discussed below.

12.3.3 General Terrain

The great majority of *C. scutulata* records come from lowland plains of less than 100 m elevation.

12.4 CURRENT DISTRIBUTION

Since 1980 all records of *C. scutulata* have come from Sumatra (Fig. 11) and the species is probably extinct in Java. The last confirmed record from Java was in 1907, and the last local report was from Ujung Kulon NP in 1972, where forest guards say that none has been seen "in recent years" (Chambers *in litt.* 1990). Indeed, there have never been any confirmed records from this location. *C. scutulata* has been seen for sale in a Javan bird market in early 1991 (Kuah *in litt.* 1991), but these birds are likely to have been imported from Sumatra as there is almost no suitable habitat remaining in Java (Bowler *pers. comm.* 1991).

Since 1980 *C. scutulata* has been recorded from the following 16 locations in Sumatra. Local estimates (LEs) are minimum estimates assuming that sightings at neighbouring locations were of the same birds. A major source of information is an extensive survey of Lampung and Sumatra Selatan by Lambert (1988) in February 1987. Lambert interviewed villagers and forest guards, dividing their reports into those of definite and probable reliability, and also made his own observations.

12.4.1 Way Kambas National Park KEY SITE

Lampung Province. Contains the largest known population of *C. scutulata*, although Ounsted (1985) was told that *C. scutulata* became much less common in the reserve area between 1978 and 1985. Most data come from Chambers (1990) who conducted a 12-month study in the reserve from August 1988 to July 1989. Birds were seen on 104 of 300 days that the study team spent there, and up to seven birds were seen together. *C. scutulata* occur in the following areas.

Sungai Rasau Lambert obtained a definite report that "up to 30" were present in grassy swamps in 1969. This area has been little surveyed since. Chambers visited on several occasions and saw two birds flying over on 4.2.89.

Sungai Wako In 1984 forestry staff reported swamps along this river to be the best place to see *C. scutulata* during the dry season (Bowler *pers. comm.* 1991). Lambert obtained definite reports of up to five birds here.

Way Kanan One was seen flying at Upper Way Kanan on 15-16.4.83 (Andrew *in litt.* 1990). In the dry season of 1984 forestry staff reported birds to be occasionally present at Rawa Pasir, along Way Kanan (Bowler *pers. comm.* 1991). Andrew (*in litt.* 1990) flushed four from a swamp beside the river half way between the guard post and the sea on 9.1.85 and saw three on the river by the guard post on 10.1.85. Ounsted (1985) heard of a pair with ducklings on the river one October before 1985, and saw a pair on 13.5.85. Lambert obtained the following definite reports: pairs with young on the river in October 1985 and September- November 1987, one or two birds feeding in four small forest ponds, birds present at Rawa Kerjah. On 5.2.88 Lambert heard birds flying over the ranger post. On 6.2.88 he saw five to eight in Rawa Gajah. Chambers made most of their observations around Way Kanan, and saw up to seven birds at one time (in Rawa Gajah, 16.12.88). Tim Ekspedisi (1991) regularly recorded birds in the area from 12.7.90 to 6.9.90, including a female with four ducklings on 18.7.90 and a female with five ducklings on 20.7.90 at Rawa Pasir.

Way Penet Ounsted (1985) saw two birds flying over Way Penet on 11.5.85 and heard of a pair feeding daily at paddy fields at Tangjung Penet.

Other locations Chambers saw birds at Kali Biru (a tributary of Way Kanan) and at Rawa Meranggi, an intensively cultivated swamp near Rajabasa village, 6 km south-west of the reserve. Tim Ekspedisi (1991) also recorded birds from Kali Biru and from Kali Batin, a tributary of the Way Kambas.

Chambers estimated a minimum total Way Kambas NP population of 30, based on minimum population in the intensively surveyed Way Kanan area extrapolated for the other similar habitat areas. Tim Ekspedisi (1991) estimated 20-30 birds for the Way Kanan/Kali Biru/Kali Batin area, partly based on discriminating 12 individuals by plumage differences. They did not record any birds along S. Rasau, S. Bungur or S. Wako. LE = 30.

12.4.2 Padang Sugihan Wildlife Sanctuary KEY SITE

Sumatra Selatan Province. Nash & Nash (1985) made repeated observations of at least four birds, including one pair, around canal 6 in March-May 1985. Lambert found that most of the forest around canal 6 had been destroyed by illegal logging or burning. He obtained definite reports that birds had been seen around canal 2 and on S. Saleh downriver from the reserve, but was unable to determine when they were last reliably seen. LE = 4.

12.4.3 Sungai Tulang Bawang KEY SITE

Lampung Province. Lambert obtained definite reports of up to six birds at swamps near Bujunk Tenuk near Menggala, and one bird along with an unknown number of eggs was collected in 1985. Other definite reports were of two birds occasionally visiting flooded rice fields near Gunungtapa (last seen January 1988), up to four in a swamp between Bakung and Gedonghadji and two birds near S. Terusan some 9km South of Bakung. On 22.2.88 Lambert saw two birds flying across the river 500 m from the sea. The same day, another two birds were seen flying across the river over 40km away, 10-15 km upstream from Gunungtapa. LE = 18

12.4.4 Cabang/Sungai Seputih KEY SITE

Lampung Province. Lambert found definite reports of two birds regularly flying over Cabang village on S. Seputih in the evenings. Their flight direction (either south-east or north-west) suggests that they spent part of their time in Way Kambas NP south-east of Cabang. One bird was shot at Cabang in 1987. There were definite reports from five swamps nearby, although no birds had been seen "in the recent past". Two birds

were seen at a swamp at Bunut Minyak on S. Terusan. The other four swamps were on S. Terusan tributaries; two birds at S. Sekering in 1985, seven at Lebung Gajah, S. Basung in 1981, unknown numbers at S. Selapan and four birds at S. Kibang in 1983. LE = 9.

12.4.5 Kayu Agung KEY SITE

Sumatra Selatan Province. Lambert obtained definite reports of one to two birds occasionally flying over Sameduck Agung village, S. Bornai, 50 km from Kayu Agung, three to five birds occasionally seen at a lake and two nearby swamps near Danau Teluk Gelam, 30km from Kayu Agung, and two seen at Teluk Pakgrobin swamp near Sungai Komering village on S. Komering. A bird was also shot in 1987 on S. Bornai in an area two days upstream of Sameduck Agung by dugout canoe. LE = 9.

12.4.6 Sungai Lalang

Sumatra Selatan Province. Lambert obtained a definite report of up to four birds occasionally flying over burned swamp forest on S. Pajudian, a tributary of S. Lalang. Also a probable record from a grassy swamp bordering primary forest on S. Bakung, another tributary. LE = 4.

12.4.7 Sungai Mesuji

Sumatra Selatan Province. Lambert obtained definite reports of two birds sometimes flying over Pematang Panggang village, two occasionally feeding 4 km downstream in flooded grassy vegetation fringing the river, and unknown numbers in flight 30-40 km upriver from Pematang Panggang along S. Peras. He also obtained a probable report from S. Pulau Geranggang, 20-30 km up S. Padang. LE = 3.

12.4.8 Sungai Lematang

Sumatra Selatan Province. Lambert obtained definite reports of two to four birds occasionally seen in a grassy swamp, Rawa Keleboran (S. Lipis), 3km west of S. Lematang. LE = 4.

12.4.9 Jepara

Lampung Province. Andrew *in litt.* (1990) saw a pair at Lake Jepara on 24.4.84. Lambert obtained definite reports of a pair flying over agricultural land near Panca Sila village (just north of Jepara and only 2km from Way Kambas NP) in 1987, and another pair in early 1987 somewhere just south of S. Jepara. These birds may be part of the Way Kambas population. LE = 2.

12.4.10 Banyuasin Musi River Delta

Sumatra Selatan Province. In 1986 Silvius (1988) saw a single bird several km inland at S. Bungin, flying over grass and shrub in between Freshwater Swamp Forest and mangroves within Proposed Sembilang Reserve. Silvius *et al.* (1987) concluded that *C. scutulata* "occurs in the swamp forest behind the mangroves" in the delta. Lambert surveyed S. Musi and S. Lalang from the coast to well inland, and found no evidence of the bird's presence despite finding suitable habitat. LE = 1.

12.4.11 Sungai Berbak

Jambi Province. One male was seen flying over the river on 7.4.89 near Kampung Sekambang (Silvius & De Iongh 1989), suggesting that there may be a population in the neighbouring Berbak Game Reserve. LE = 1.

12.4.12 Rianiate

Sumatra Utara Province. Holmes (1990) recorded a pair flying across Rianiate Transmigration Settlement near Lumut on 9.8.90. LE = 2.

12.4.13 Sungai Tapus

Sumatra Utara Province. Locals reported the duck as present in this area in 1990 (Holmes 1990). LE = 1.

12.4.14 Runding

Aceh Province. Van Balen (*in litt.* 1991) flushed a pair from a small pool in a forest clearing just west of Runding village on 27.9.91. LE = 2.

12.4.15 Sungai Gelumpangkecil

Jambi Province. Danielsen & Heegaart (*in litt.* 1991) saw one bird flying over their base camp along this river on seven occasions from 27.7.91 to 8.8.91. LE = 1.

12.4.16 Sungai Lumpur

Sumatra Selatan Province. Lambert obtained a probable report of two birds somewhere on S. Selapan, a tributary of S. Lumpur.

12.4.17 Total population estimate

A total estimate of 87 is reached by summing the above local estimates and subtracting four for birds from areas 12.4.4 and 12.4.9 that may be part of the Way Kambas NP population. Lambert (1988) arrived at a similar total estimate of 66-91 birds for the areas he surveyed. This estimate for the current Sumatran population assumes that no significant changes have occurred to the birds and their habitats since the above observations were made. This assumption is likely to be invalid, since habitat in South-east Sumatra is rapidly being destroyed and some of the above populations may no longer exist. Silvius (*in litt.* 1991) reported that 1991 AWB/PHPA surveys of the Tulang Bawang area found the swamp forest to be seriously affected by numerous recent drainage channels. Verheugt *et al.* (in press) conducted surveys of Padang Sugihan and other areas of swamp forest in Sumatra Selatan from April to June 1989, and failed to find reliable evidence of *C. scutulata*'s continued presence, despite interviewing villagers and forest guards.

12.4.18 Potential for undiscovered populations

The great majority of recent records of *C. scutulata* come from South-east Sumatra in the eastern plains of Jambi, Sumatra Selatan and Lampung Provinces. This may be because the species is concentrated in this area, but the recent discovery of three populations on the north-west coast in Aceh and Sumatra Utara Provinces and uncovering of a 1979 record from Riau Province suggests it may otherwise be a coincidence caused by the concentration of surveys in the south-east.

It now seems certain that other populations of *C. scutulata* survive in areas away from the south-east. Fig. 12 (based on maps of RePPProT 1988) shows the present distribution of suitable swamp forest habitat, showing that considerable amounts persist along both the east and west coast. The Klaru land system that may present ideal habitat for *C. scutulata* (see below) has its greatest extent in the south-east. However, riverine and coastal swamps are widespread on the east coast with local swamps of the Klaru land system, and pockets of quite wide and often deep swamps occur from central Aceh south to Bengkulu on the west coast (Holmes 1990). Few of these areas have been surveyed, although recent surveys of potentially suitable habitat in Riau Province by Holmes (1990) and Asian Wetland Bureau/PHPA (Silvius *in litt.* 1991) failed to find any *C. scutulata*.

----------PRINTER: PLEASE INSERT FIGURE 12 HERE----------

12.5 CURRENT HABITAT

12.5.1 General habitat features

In Indonesia *C. scutulata* seems tolerant of considerable disturbance at times, and Holmes (1977) found that it was reported to breed within shouting distance of large villages. In Jambi, he found birds feeding in daylight within 70 m of three occupied huts.

All recent records of *C. scutulata* are from coastal plains at an altitude of below 100 m Lambert (1988) showed that his sightings and those of Holmes (1976, 1977) in Sumatra are all within 10 km of permanent water-logged plain, suggesting a strong dependence of the species on permanently flooded, non-acid freshwater swamps close to forest. These plains had mostly been mapped as "Klaru Land System" or "Herbaceous Hygrophytic Communities" (Laumonier 1983, 1986; Lambert 1988; RePPProT 1988). However, birds recorded at S. Tapus, Sumatra Utara Province, were in an area of very acidic coastal swamps (Holmes 1990).

12.5.2 Wetlands

As a consequence of an association with water-logged areas, almost all Lambert's and Holmes's records of birds not in flight came from coastal and inland riverine freshwater swamps ranging in size from 0.5 to several km^2. In South-east Sumatra there is a wet season from November to March, and a dry season from May to October, and these swamps are flooded seasonally, reaching a maximum depth of 1-3 m in December and January. Swamps within the permanent water-logged plain are often permanent, but other swamps dry out completely during the dry season. All swamps where *C. scutulata* was reported contain sedges and grasses that grow when indundated, and typically protrude up to 50 cm above the water surface. They often contain a few scattered large trees within the swamp itself (particularly Rengas trees, see below), but these are thought to be remnants of more extensive Freshwater Swamp Forest. More extensive stands of secondary, dryland forest (typically Tropical Wet Evergreen Forest) are usually found bordering these swamps, but these are often degraded, open forest patches. Only along S. Lalang were birds reported from a swamp bordering primary forest.
Holmes also found reports of birds using a wooded ox-bow lake near Serasak, Jambi, and birds have also been reported to feed in swamp rice-fields along S. Tulang Bawang, but only when it is deeply flooded. In Padang Sugihan WS, Nash & Nash (1985) saw birds in swamp forest alongside 10 m wide, slow-moving canals originally constructed to drain the area in preparation for settlement. At Lunding, Aceh, van Balen (*in litt.* 1991) found birds on a small pool on the edge of a clearing in Peat Swamp Forest. The fact that most *C. scutulata* sightings stem from swamps may partly be because they are more easily observed in these open habitats that often receive regular visits from humans (for fishing etc.). Birds may be less likely to be seen on other wetlands of importance, such as forest pools.

12.5.3 Forest types

C. scutulata is strongly associated with Freshwater Swamp Forest (Holmes 1977, Lambert 1988) found within freshwater swamps and, in South-east Sumatra, dominated by Rengas trees thought to be crucial for breeding and roosting. Tim Ekspedisi (1991) found that Way Kambas birds rely on Rengas, other large trees and fallen trunks for resting and perching. Rengas is the local name for a complex of trees from the family Anonaceae, mainly of genera *Melanorrhoea* and *Gluta*. They offer large, horizontal branches for perching and natural cavities for nesting. It is not known whether Rengas trees are typical in swamp areas outside South-east Sumatra. Birds have also often been seen in the dryland forest surrounding freshwater swamps, but there is no evidence that they breed there. However, Holmes (1990) considers it possible that *C. scutulata* can survive in any forest type offering suitable roosting and breeding trees free from disturbance, as he recorded birds flying into mangrove forest, dryland secondary forest and smallholder rubber plantations in Lampung and Jambi. He recorded a bird flying towards mangrove forest at Way Penet on 19.1.77, presumably to roost. Birds have been seen in flight in coastal mangrove areas by others (e.g. at S. Tulang Bawang estuary), and Lambert (1988) suggested that *C. scutulata* may feed in mangroves. The recent record from S. Gelumpangkecil, Jambi, was from an area of Tropical Wet Evergreen Forest not holding swamp forest (Danielsen & Heegaart *in litt.* 1991).

The birds recently seen in Aceh and Sumatra Utara Provinces are thought to roost and breed in Peat Swamp Forest (Holmes 1990). In Padang Sugihan reserve, birds have been reported from secondary Peat Swamp Forest (Nash

& Nash 1985). It is not known where *C. scutulata* breeds in Peat Swamp Forest, but Rengas trees do occur on the shallower peats in South-east Sumatra (Lambert 1988).

12.5.4 Way Kambas NP

Adults with young have been seen on Way Kanan river and in the swamp, Rawa Pasir. Most other sightings of adults not in flight have been from extensive swamps (usually seasonal) similar to those described above, along Way Kanan, S. Wako, S. Rasau and Kali Biru. For example on 6.2.88, Lambert saw *C. scutulata* at Rawa Gajah when this swamp was about 1 km long, 0.5 km wide and 1-2 m deep. Most of the swamp was covered by dense sedges protruding 30-50 cm above the water, with scattered bushes and a few large trees. Three birds were flushed from a more open area of c. 80 m x 50 m, with sparser, shorter sedges protruding 20-30 cm above the water and no bushes or trees.

Ducks have been seen feeding on at least six small ponds surrounded by secondary forest in the Way Kanan area. These ponds are mainly 20-50 m long and 10-20 m wide, although one (Rawa Bening) is 80 m x 20-30 m. Tim Ekspedisi (1991) found that ducks often feed along grassy banks of shallow rivers such as the Way Kanan. *C. scutulata* has also been seen to feed in rice fields to the south-west of the reserve, near Tanjung Penet and at Rawa Meranggi near Rajabas Lama. The ducks travel at least 6 km from the nearest forest over open, populated terrain to reach these fields, suggesting that open country may not be a strong barrier to dispersal between forest areas. This may explain why the species is surviving in degraded habitats containing only small, isolated patches of forest. Chambers never found ducks in dense forest, and they were never seen to fly through it. When flying into a swamp, they usually flew over open land or down a river. When they did fly through forest, they flew above the canopy, between emergent trees.

12.5.5 Seasonal habitat use

Lambert (1988) found that *C. scutulata* is easier to see in the wet season than in the dry season, suggesting a change in habitat use. The prolonged study in Way Kambas NP by Chambers (1990) provides valuable, detailed information on seasonal habitat use. At a seasonal swamp that was intensively monitored (Rawa Gajah on Way Kanan), ducks were only present from the end of November to February in the wet season, with a peak of activity in December. This change in use may depend on water depth, which declined from a peak of 1.5 m in December and January to only a few puddles present in May. It may also depend on vegetation changes, as in the early wet season birds used the open swamp with new, sparse growth of sedge and grass. The birds left before the growth became thick and dense. Paddy fields at Rawa Meranggi were also only used in the wet season, in December and January. These were nursery fields of small rice plants, which are perhaps a good food source. Also, the depth of water in the fields was considerably less than in swamps at that time, which may suit the duck's feeding habits. This may explain why *C. scutulata* feeds in paddy at the time when the most forest wetlands are available.

During the early dry season, Chambers saw birds just as often as in the wet season. Forest ponds were used more often during this period, when swamps were rarely used and often dry. The ponds dry up between late May and August, but then fill periodically whenever it rains. Very few birds were seen at the end of the dry season (October), when their location and habitat use is unclear. Rawa Pasir was the only location where birds were seen. One suggestion is that the birds moved down to permanent open swamps close to the coast, but forestry staff told Bowler (*pers. comm.* 1991) in 1984 that the major site at the end of the dry season (September/October) was the permanent swamps along S. Wako.

12.6 THREATS

12.6.1 Deforestation

The major cause of decline. Java has had very rapid human population growth due to its fertile soils, and only 3% of non-montane forest remains. Sumatra, being the island closest to Java, now has the fastest

deforestation in Indonesia. In 1985 lowland forest (below 300m) occupied 27% of the island, over half of this being wetland forest (RePPProT 1988). Remaining primary forest cover is much less. Deforestation in Sumatra is mainly through timber extraction and the conversion of forest for agriculture. The biggest cause is the relentless encroachment by small-holders along the forest boundary. Spontaneous land settlements which follow in the wake of logging often lead to more severe, irreversible deforestation than the logging itself (Danielsen & Verheugt 1991). Another factor is the transmigration of settlers from Java and elsewhere, both through Government-sponsored programmes and spontaneous movement. Large-scale Government or private sector projects probably account for less than a third of the total area cleared each year.

Unfortunately, the south-east corner of Sumatra is both the source of most recent *C. scutulata* records and the area most affected by transmigration. Owing to intense population pressure, in recent times Lampung has had the highest deforestation rate of any Indonesian province. Consequently, Holmes (1990) considered it likely that all remaining forest in the areas of Lampung where he observed *C. scutulata* in 1976-1977 has now been cleared. In 1985, only 19% of the province was forested, mostly in the western hills. In Sumatra Selatan, the area of primary swamp forest (peat and freshwater) has been reduced to 290,000 ha, or 7% of its original area. By 2000 all primary forest outside conservation areas will be converted or logged (Danielson & Verheugt 1991). Since 1969 about 750,000 people have been moved to Sumatra in official programmes. Over this period, perhaps 3.7 million people moved to Sumatra spontaneously, 2 million of them to Lampung and 500,000 to Sumatra Selatan. In Sumatra's infertile lowlands, riverine areas frequented by *C. scutulata* have been subject to erosion for centuries, being the areas of early settlement. In the 19th century, rubber estates were established in North Sumatra. This century, settlers from Sulawesi cleared wide areas of forest along the swampy east coast. The massive devastation of swampy forest in the south-east is a recent phenomenon.

Deforestation destroys the nesting and roosting habitat of *C. scutulata*. Rengas trees are thought to be the major nesting site and, because their sap causes skin blistering, these trees are often left standing when other large trees are felled (Lambert 1988). This may explain why *C. scutulata* is reported from degraded habitats more often in Sumatra than in mainland Asia. Deforestation may initially have increased the areas of wetlands available to *C. scutulata* during the wet season. Most of the grassy swamps where the birds occur in the south-east are probably man-made by logging and burning of swamp forest in seasonally inundated areas (Lambert 1988). Only areas which are permanently flooded or deeply flooded for most of the year are likely to be natural swamps. The forest ponds important in Way Kambas NP and possibly other areas were also man-made when logging tracks dammed small forest streams (Chambers 1990). Thus human clearance of swamp forest for agriculture may at first be beneficial to *C. scutulata* until the human population grows and forest clearance becomes more extensive (Holmes 1990). Deforestation is already so extensive in the south-east that, within the decade, *C. scutulata* may become extinct outside protected areas. Lambert (1988) recorded *C. scutulata* from degraded and secondary forest on all but one occasion. Logging was occurring in seven of nine areas where the species was found, illegally in three areas. Illegal logging was even extensive within Padang Sugihan WS. In areas of Production Forest (where selective logging is permitted under licence), regulations against cutting trees below a minimum size were ignored, so that no large trees remained. As more and more trees are removed from an area, the reduced availability of nesting sites is likely to limit the size and reproductive success of a *C. scutulata* population.

----------PRINTER: PLEASE INSERT FIGURE 13 HERE----------

The urgency of the situation is illustrated by Fig. 13, which shows the areas of wetland forest habitat that will remain in Sumatra if all recommended development land forest exploitation schemes are implemented. This situation is likely to become reality within 15 to 25 years, and will leave just a handful of isolated protected areas, only two of which are presently known to contain *C. scutulata*. Thus of the 16 current *C. scutulata* populations identified above, only two are forecast to have a chance of survival. This map assumes that Production Forest areas will become unsuitable for *C. scutulata* because, once selectively logged, these areas are often logged further, converted and reclaimed by spontaneous settlers.

12.6.2 Drainage

Drainage canals constructed in Padang Sugihan WS and the Tulang Bawang area are gradually destroying the swamp

forest in these sites. Drainage of coastal swamp areas for development has been widespread in Sumatra, and there are many plans to drain and "reclaim" more wetlands, often in inappropriate terrain. Some of the swamps used by *C. scutulata* are very difficult to drain, especially the deeper swamps of the west coast (Holmes 1990). Nevertheless, reduced availability of wetlands during the dry season following the drainage of permanent swamps may be contributing to the decline of *C. scutulata* in Sumatra. Since many remaining swamps are in very heavily populated areas, high degrees of disturbance may further reduce the areas of wetlands available to *C. scutulata*.

12.6.3 Hunting and trade

Opportunistic hunting for food has often been recorded, and may eliminate *C. scutulata* from some areas. Lambert (1988) found that most hunting is done with air-guns powerful enough to kill Wood Ducks and two birds were shot in this way during 1987. At Cinta Kasih, S. Lematang, the headman told Lambert he had caught a Wood Duck with a bait and fishing line. In January 1977 a family of seven ducklings was caught in Lampung, where villagers used strong lamps at night to net the ducklings of the Lesser Whistling Duck *Dendrocygna javanica* and possibly also *C. scutulata*. Villagers also took the eggs of *C. scutulata* for food (Holmes 1977). Rudyanto (*in litt.* 1990) found that a hunter from near Lahat, Lampung, used nets to catch *D. javanica*, taking the occasional *C. scutulata*.

Lambert found evidence that birds are sometimes caught for trade. At Bujung Tenuk on S. Tulang Bawang, Lampung, a villager reported that a westerner had paid him for one bird and an unknown number of eggs in 1985. Kuah (*in litt.* 1991) saw four birds on sale at a Java bird market in 1991.

12.6.4 Pesticides

Ducks feeding in paddy are at risk from the variety of pesticides in use in Sumatra.

12.6.5 Way Kambas NP

From 1968 to 1974 Way Kambas NP was opened up to commercial forestry. In the next eight years there was much illegal logging by local people who settled in the reserve. In 1984 the reserve became strictly protected and the villagers were evicted. By then, almost all primary forest was gone, and about half the reserve had been overtaken by Alang-alang *Imperata cylindrica*, preventing forest regeneration. Most of the forest destroyed was dryland forest rather than swamp forest, but this habitat destruction has probably contributed to the reputed decline in abundance of *C. scutulata* in recent years. Less than 30% of the reserve area is now suitable for the duck (Silvius *in litt.* 1991). Another probable cause of decline is deforestation around the reserve and drainage of surrounding swamps during the past decade. All the surrounding forest that remains is being clear felled (Chambers 1990).

Chambers (1990) and Tim Ekspedisi (1991) found that there is still illegal logging in the reserve, especially around S. Rasau, and illegal fishing in the swamps and rivers used by *C. scutulata*. Fishing is particularly frequent in the Way Kanan area of most importance to the ducks. A duck was reported to have been eaten after being caught in a fishing net along Way Penet. Fishermen outside the reserve use chemicals to kill fish in streams and rivers that flow through the reserve. A new threat is development of the reserve for tourism. The Indonesian Department of Tourism has recently constructed a road for tourists passing very close to most of the forest ponds known to be used by the birds (Rudyanto *in litt.* 1990). The noise of the vehicles this road carries will cause a high rate of disturbance to the ducks.

12.7 CONSERVATION MEASURES TAKEN

12.7.1 Habitat protection

Of 14 sites known to hold *C. scutulata*, only Way Kambas NP is protected effectively. The only other protected area is Padang Sugihan WS, now damaged to such an extent that it is uncertain whether it can support *C. scutulata*.

Birds have also been found near Berbak Game Reserve (Jambi) and Bentayan reserve (Sumatra Selatan) which may hold the species. They have also been found near proposed Sembilang (Sumatra Selatan) and proposed Seberida (Riau) protected areas. Various other protected areas contain swamp forest habitat and may hold *C. scutulata* populations (Fig. 13).

12.7.2 Species protection

C. scutulata is fully protected under Indonesian law by a government decree in 1972, but inevitably this is ineffective in practice at present.

12.8 EVALUATION

Indonesia contains the largest known *C. scutulata* population of any range country, but one under intense threat. Conservation action is urgently required to prevent the species from disappearing. The demand for timber and a rapidly increasing human population is destroying suitable habitat at an alarming rate, as well as increasing the disturbance and hunting pressure on the birds. *C. scutulata* is able to survive in degraded habitats with few remaining trees, but even these areas are becoming more and more scarce. The present protected area system only protects two known populations of *C. scutulata*.

Way Kambas NP may contain the largest *C. scutulata* population of any site throughout its range, and deserves the highest conservation attention. However, since an isolated population is always vulnerable to extinction, e.g. through an epidemic or natural disaster, it is vital to improve the protection status of the other populations identified. There is also an urgent need for surveys to clarify the status and distribution of *C. scutulata* in Sumatra, particularly in Riau and the west coast of Aceh and Utara Provinces which may hold other surviving populations of *C. scutulata*. There are opportunities for conserving any large populations located, as these areas are less degraded and under less development pressure than the south-east.

12.9 ACTION

12.9.1 Surveying known sites

Thorough surveys are required in the following sites to clarify their importance to *C. scutulata*.

i. S. Rasau, S. Wako and Way Penet areas of Way Kambas NP.

ii. S. Terusan, passing through sites 12.4.3 and 12.4.4.

iii. S. Lalang, site 12.4.6, concentrating on Bentayan reserve.

iv. S. Lumpur in site 12.4.16, a river that is difficult to access and should be surveyed in the early dry season.

v. Rianiate, site 12.4.12 and S. Tapus, site 12.4.13.

vi. Proposed Sembilang Reserve, site 12.4.10.

vii. Runding, site 12.4.14.

viii. S. Gelumpangkecil, site 12.4.15.

12.9.2 Surveying for new populations

The following existing or proposed protected areas require surveys.

i. Aceh: Singkil Barat IND023 SU5.

ii. Riau: Bukit Batu; Siak Kecil IND018 SU17; Danau Bawah-Pulau Besar IND016 SU19; Bakau Muara Kaupas IND014 SU21; Kerumutan Baru IND015 SU23; Muara Sungai Guntung SU24; Seberida.

iii. Jambi: Berbak Wildlife Reserve IND08 SU38.

12.9.3 Protecting Way Kambas National Park

i. Tourism. The number and access of tourists should be carefully controlled, and access to the swamps and ponds in the Way Kanan area restricted. No more roads or paths should be placed where they will cause disturbance to the birds. Since the road already constructed alongside ponds used by the ducks is likely to cause excessive disturbance, its use by vehicles should be prevented. An alternative but less satisfactory measure would be to create similar ponds elsewhere to replace this vital habitat.

ii. Illegal fishing and logging: should be prevented in the reserve by increasing guard patrols, especially in the Way Kanan area.

iii. Nest boxes: suitable for *C. scutulata* should be provided on swamp trees on a trial basis.

iv. Buffer zone: should be established extending 10 km around the boundary. Within this zone, fishing with poisons should be banned, and pesticide use prevented in the paddy fields.

v. Local people: the culture and needs of villagers around the park should be studied to determine how *C. scutulata* conservation can meet their interests.

12.9.4 Protecting Padang Sugihan Wildlife Sanctuary

All unofficial access routes into the reserve (particularly the main canals) should be closed off to prevent illegal logging, wood-cutting, hunting and fishing. All artificial drainage channels should be closed to stop drainage of the peat swamp.

12.9.5 Protecting Key Sites

C. scutulata populations outside protected areas are threatened with rapid destruction, particularly in South-east Sumatra. The three key sites S. Tulang Bawang, Cabang/S. Seputih (Lampung) and Kayu Agung (Sumatra Selatan) should be protected.

12.9.6 Protecting Nesting trees

Logging of Rengas trees in Sumatra should be made illegal, and prevented in legal logging concessions.

12.9.7 Education

There is an urgent need for improved environmental awareness and understanding of the importance of *C. scutulata* at all levels of Indonesian society. *C. scutulata* should be promoted as a "flagship species" alongside the elephant in an education program centred around Way Kambas NP. Such a program could later be spread across Sumatra.

12.9.8 Coordinated land use planning at central Government level

With accelerating destruction of natural habitats and Indonesia's drive for development, it is imperative

that coordinated land use planning is achieved at a national level, encompassing the protection of sufficient natural habitat for the conservation of biodiversity. Uncoordinated planning in the transmigration, public works, estates and forestry sectors is a major factor in the loss of biodiversity. Recent RePPProT and LREP programmes are first attempts to achieve the nationwide data-base required for central land-use planning. There is an urgent need to conduct the surveys of *C. scutulata* and other species required as inputs into such a plan.

12.9.9 Use of provincial planning agencies

All development plans must be ratified by provincial planning authorities (BAPPEDAs) that answer to provincial Governors. Awareness of site specific conservation needs should be instilled at this level. At present, few of these officials have even heard of *C. scutulata*.

12.9.10 Biological Research

There is an urgent need for a full ecological study of *C. scutulata*, and Way Kambas NP offers a very suitable location. This should address such questions as: When and where do the birds breed? Where do they feed at the peak of the dry season? What is the size of an individual's home range? What limits the size and breeding success of the population (e.g competition for nest holes, food supply in the height of the dry season)?

12.10 ALL RECORDS IN INDONESIA

SUMATRA

Location	Coordinates	Date	Source	Numbers	Notes		
Sawahs near Beniawang, Selatan Province	1.59 S, 104.38 E	before 1891			Shot by Goldman.	Vorderman 1892	1
Lampung Province (Lampong)		March 1896	NMNH, Leiden	1	Skin collected by Vorderman.		
Deli, eastern Utara Province	3.48 N, 98.39 E	before 1901			Frequently shot by Hagen.	Phillips 1923/ Hartert 1902	+
Gunung Sugi (Goenong Soegi), Lampung Province	5.00 S, 105.16 E	Oct-Nov 1901				Stone 19022	Shot.
Deli, eastern Utara Province	3.48 N, 98.39 E	before 1905			Specimens collected by C. Waldeck.	Marle & Voous 1988/ de Beaufort 1909	+
Talang Betutu (Talang Betootoc), Selatan Province	2.48 S, 104.42 E	1918	Ounsted 1985	1	Shot, male. In Bogor Museum.		
Kerinci (Korinchi) area	2.00 S, 101.20 E	before 1936	Robinson & Chasen 1936	>1		Raffles Museum specimens.	
Pelambang, Selatan Prov.	2.59 S, 104.45 E	1937				Wildfowl Trust Annual Report 1954-1956	5 Taken into captivity.

Telok Pandji, S. Batoen, south of University Labuhanbilik (Laboenlilik), Utara Prov.	2.25 N, 100.10 E	14.8.37	Kuah *in litt.* 1991		1	Female. Specimen in of Singapore.
South Benkulen (Benkoelen) Province	4.29 S, 102.55 E	before 1950	Hoogerwerf 1950	+		Some specimens shot.
Mesuji river, South Pelambang, Selatan Prov.	3.44 S, 105.15 E	before 1950	Hoogerwerf 1950	+		Some specimens shot.
Grassy swamps at Sungai Rasau, recently. DR Way Kambas NP	4.48 S, 105.47 E	1969	Lambert 1988 B		up to 30	Area not visited
Danau Saranglang, near Serasak, 20 km from Muara Bulian, Jambi Prov.	1.36 S, 103.25 E*	c. 1976	Holmes 1976		+	Occasional visitor to a wooded ox-bow lake. #
Siberut Island, off West coast	1.22 S, 98.52 E	1976	Whitten *in litt.* 1976		+	# ?
Batang Hari River, Muara swamp 5 Bulian, Jambi Province	1.42 S, 103.16 E*	18.1-1.2.76	Holmes 1976		2	Pair flushed from a times (dawn-0900 or 1700-1800).
Lake Jepara, Lampung Province	5.12 S, 105.40 E*	30.6.76	Holmes 1976		2	A pair at dawn.
Rawa Susuk, S. Seputih, midday, flew Lampung Province	4.45 S, 105.27 E*	22.9.76	Holmes 1977		1	Flushed from swamp into secondary dryland forest.
S. Ketibung, tributary of Lower S. Sekampung, Lampung Prov.	5.30 S, 105.39 E*	25.10.76	Holmes 1977		2	Pair calling in flight at dusk, in severely degraded habitat.

Way Kambas NP, near HQ, Lampung Province	5.01 S, 105.46 E	31.10.76	Holmes 1977	1	Heard calling.	
Bujung Tenuk, near Menggala, S. Tulang Bawang, Lampung Prov.	4.30 S, 105.14 E*	15.1.77	Holmes 1977		+ 4 nest holes, 1 with 8 eggs, in a swamp. #	
Bujung Tenuk, near Menggala, S. Tulang Bawang, Lampung Prov.	4.30 S, 105.14 E*	Jan 1977	Holmes 1977	3	Adult and 2 ducklings in a swamp. #	
Bujung Tenuk, near Menggala, S. Tulang Bawang, Lampung Prov.	4.30 S, 105.14 E*	Jan 1977	Holmes 1977	7	Family of 7 ducklings captured from a swamp. #	
Way Penet, Lampung Province	5.13 S, 105.50 E*	19.1.77	Holmes *in litt.* 1990	1	Flew across open swamp at 0900 h towards beach forest.	
Way Kambas NP, Lampung Province	5.01 S, 105.46 E	Oct 1978	Marle & Voous 1988	+		
Rokan river, 40 km W of Duri (Oilfield), Riau Province	1.20 N, 100.54 E	23.3.79	Andrew *in litt.* 1990	1	Recorded by J.P. Gee in flight amidst swamp forest.	
Upper Way Kanan, Way Kambas NP, Lampung Province	5.01 S, 105.46 E	15.4.83	Andrew *in litt.* 1990	1	Flying at 1735 h.	
Upper Way Kanan,Way Kambas NP, Lampung Province	5.01 S, 105.46 E	16.4.83	Andrew *in litt.* 1990	1	Flying at 1735 h.	
Lake Jepara, Lampung Province	5.12 S, 105.40 E*	24.4.84	Andrew *in litt.* 1990	2	Pair at midday, circled	

the						
					lake then landed in swamp.	
Way Kambas NP, Lampung Province	5.01 S, 105.46 E	18.9.84	Nash & Nash 1985	1		
Swamps along Sungai Wako, especially Way Kambas NP, Lampung Prov.	4.53 S, 105.47 E	1984	Bowler *pers. comm.* 1991	+		Major dry season site, in September/October. #
Rawa Pasir along Way Kanan, Way Kambas NP, Lampung Prov.	5.00 S, 105.44 E	1984	Bowler *pers. comm.* 1991	+	Occasionally present in the dry season. #	
Grass swamp beside Way Kanan, way Way Kambas NP, Lampung Prov.	5.01 S, 105.49 E	9.1.85	Andrew *in litt.* 1990	4	Flushed from swamp half between guard post and sea.	
Guard post, Way Kanan, Way Kambas NP, Lampung Prov.	5.01 S, 105.46 E*	10.1.85	Andrew *in litt.* 1990	3	On river.	
Guard post, Way Kanan, Way dusk, Kambas NP, Lampung Prov.	5.01 S, 105.46 E*	11.1.85	Andrew *in litt.* 1990	1	Flew across clearing at landed to drink at a puddle.	
Guard post, Way Kanan, Way dawn at Kambas NP, Lampung Prov.	5.01 S, 105.46 E*	12.1.85	Andrew *in litt.* 1990	1	Flying down track at head height.	
Canal 6, Padang Sugihan Reserve, Selatan Prov.	2.57 S, 105.10 E	3.3.85	Nash & Nash 1985	2	Pair flying and calling over canal 0730-0800 h.	
Canal 6, Padang Sugihan Reserve, Selatan Prov.	2.57 S, 105.10 E	16.4.85	Nash & Nash 1985	1	Flushed from a tree at 0715 h.	
Canal 6, Padang Sugihan	2.57 S, 105.10 E	18.4.85	Nash & Nash 1985	1	Flushed from dead tree, called	

Reserve, Selatan Prov.					once as it flew away, 0535 h.			
Canal 6, Padang Sugihan Reserve, Selatan Prov.	2.57 S, 105.10 E	18.4.85	Nash & Nash 1985	1	Flying along canal at 0802 h.			
Canal 6, Padang Sugihan Reserve, Selatan Prov.	2.57 S, 105.10 E	29.4.85	Nash & Nash 1985	1	Flying over canal at 0625 h.			
Canal 6, Padang Sugihan Reserve, Selatan Prov.	2.57 S, 105.10 E	2.5.85	Nash & Nash 1985	1	Flew between dead trees, calling at 0715 h.			
Way Kanan, Way Kambas NP, Lampung Province	5.01 S, 105.46 E	Oct, pre 1985	Ounsted 1985	>=3	Pair with ducklings on the river. #			
Tanjung Penet, southern border of Way Kambas near coast	5.16 S, 105.51 E		before 1985		Pair visiting rice fields daily at 0800 h. #	Ounsted 1985	2	
Way Kanan, Way Kambas NP, Lampung Province	5.01 S, 105.46 E	11.5.85	Ounsted 1985	+	Heard calling from a distance at 0600 h.			
Way Penet, Way Kambas NP, Lampung Province	5.13 S, 105.50 E	11.5.85	Ounsted 1985	2	Pair in flight from South to North at 1735 h.			
Way Kanan, Way Kambas NP, Lampung Province	5.01 S, 105.46 E	13.5.85	Ounsted 1985	2	Pair in flight, calling at 1800 h.			
South half of Way Kambas NP, Lampung Province	5.01 S, 105.46 E	May 1985	Ounsted 1985	6	PE			
Way Kanan river, Way Kambas NP, Lampung Province	5.01 S, 105.46 E		Oct 1985		4 adults and 4 young. DR	Lambert 1988	6	2
Sungai Bungin,	2.13 S, 104.43 E*		1986		Silvius 1988	1	Flying over a freshwater	

Selatan Province					swamp.		
Way Kambas NP, Lampung Province	5.01 S, 105.46 E	1987	Silvius *et al.* 1987	10	PE		
Panca Sila Village just N of Jepara near Way Kambas NP	5.13 S, 105.43 E	1987	Lambert 1988 D		farmland 2km from Way Kambas forest. DR	2	Pair flying over
Just S of Sungai Jepara near Way Kambas NP	5.22 S, 105.46 E	early 1987	Lambert 1988 E	2	DR		
Way Kanan river, Way Kambas NP	5.01 S, 105.46 E	Sep-Nov 1987				Lambert 1988	4 2 adults and 2 young. DR
Rawa Kerja (Way Kanan), Way Kambas NP	5.00 S, 105.44 E*	c. 1988	Lambert 1988			+	DR
Rawa Bening, small permanent forest lake, Way Kanan	5.01 S, 105.46 E*	c. 1988	Lambert 1988 A		usually 0700-0900 h. DR	2	Often seen feeding,
3 small permanent forest lakes, Way Kanan, Way Kambas NP	5.03 S, 105.44 E	c. 1988	Lambert 1988 A		until 1000 h. DR	+	Sometimes seen feeding
Grassy swamps at Sungai Wako, Way Kambas NP	4.53 S, 105.47 E	c. 1988	Lambert 1988 C			up to 5	DR
Way Kanan ranger post, Way Kambas NP	5.01 S, 105.46 E*	5.2.88	Lambert 1988			+	Heard flying over at 0600 h.
Rawa Gajah (Way Kanan) Way Kambas NP	5.01 S, 105.46 E*	6.2.88	Lambert 1988		at 0730 h.	4	Two pairs flew into the swamp

Rawa Gajah (Way Kanan) Way Kambas NP	5.01 S, 105.46 E*	6.2.88	Lambert 1988	5-8			Including the above 4.
Cabang village, S. Seputih, Lampung Province	4.38 S, 105.47 E	1987	Lambert 1988				1 Shot by a villager. DR
Cabang village, S. Seputih, Lampung Province	4.38 S, 105.47 E	c. 1988	Lambert 1988	F		village in the evening. DR	2 Regularly flying over the
Lebung Gajah, S. Basung near Cabang, Lampung Prov.	4.33 S, 105.48 E	1981	Lambert 1988	G	7	Swamp on an S. Terusan tributary	Not seen "in recent past". DR
Swamp on S. Kibang near Cabang, Lampung Prov.	4.33 S, 105.48 E	1983	Lambert 1988	G	4	S. Terusan tributary. Not seen	"in recent past". DR
Swamp on S. Sekering near Cabang, Lampung Prov.	4.33 S, 105.48 E	1985	Lambert 1988	G	2	S. Terusan tributary. Not seen	"in recent past". DR
Bunut Minyak, S. Terusan, near Cabang, Lampung Prov.	4.33 S, 105.48 E	before 1988	Lambert 1988	G	2	Swamp. Not seen "in recent	past". DR
Swamp on S. Selapan near Cabang, Lampung Prov.	4.33 S, 105.48 E	before 1988	Lambert 1988	G	+	S. Terusan tributary. Not seen	"in recent past". DR
Pematang Panggang, S. Mesuji, over the Selatan Province	3.48 S, 105.17 E	c. 1988	Lambert 1988	H		village. DR	2 Sometimes seen flying
4km down from Pematang Panggang, S. Mesuji, Selatan Prov.	3.48 S, 105.17 E	c. 1988	Lambert 1988	H	2	Occasionally seen feeding in flooded grass. DR	
S. Peras, S. Mesuji, 35 km above Pematang Panggang, Selatan Prov.	3.56 S, 105.10 E	c. 1988	Lambert 1988	I	+	Always seen in flight. DR	

S. Pulau Geranggang, S. Pedang, near S. Mesuji, Selatan Prov.	3.38 S, 105.15 E	c. 1988	Lambert 1988 J	+	Always seen in flight. PR	
Sameduck Agung, S. Bornai, upstream 50 km from Kayu Agung, Selatan Prov.	3.38 S, 105.09 E	1987	Lambert 1988	1	Shot in area 2 days of village by canoe. DR	
Sameduck Agung, S. Bornai, flying over 50 km from Kayu Agung, Selatan Prov.	3.38 S, 105.09 E	c. 1988	Lambert 1988 K	1-2	Occasionally the village. DR	
Danau Teluk Gelam, 30km from Kayu Agung, Selatan Prov.	3.30 S, 104.56 E	c. 1988	Lambert 1988 L	3-5	Seen at 2 swamps and a lake in the area. DR	
Teluk Pakgrobin, 4km from S. Komering, Selatan Prov.	3.28 S, 104.51 E	c. 1988	Lambert 1988 M	2	A swampy area. DR	
Rawa Keleboran, S. Lipis, S. seen in this Lematang area, Selatan Prov.	3.07 S, 104.14 E	c. 1988	Lambert 1988 N	2-4	Occasionally grassy swamp. DR	
S. Pajudian, tributary of S. flying over Lalang, Selatan Prov.	1.55 S, 103.55 E	c. 1988	Lambert 1988 O	up to 4	Occasionally burned swamp forest. DR	
S. Bakung, tributary of S. Lalang, Selatan Prov.	2.14 S, 104.08 E	c. 1988	Lambert 1988 P	+	Seen in a grassy swamp near primary forest. PR	
Canal 2, Padang Sugihan Reserve, Selatan Prov.	2.53 S, 105.10 E	c. 1988	Lambert 1988 Q	+	#	
S. Saleh, near Padang Sugihan Reserve, Selatan Prov.	2.53 S, 105.10 E	c. 1988	Lambert 1988 Q	+	DR	

S. Selapan, tributary of S. Lumpur, Selatan Prov.	3.18 S, 105.12 E	c. 1988	Lambert 1988 R		2	Seen somewhere on the river. PR
Gunungtapa, S. Tulang Bawang rice Lampung Province	4.23 S, 105.34 E	c. 1988	Lambert 1988 S		2	Occasionally seen in fields when flooded. DR
Gunungtapa, S. Tulang Bawang Lampung Province	4.23 S, 105.34 E	Jan 1988	Most recent sighting of above pair. DR		Lambert 1988 S	2
Bakung and Gedonghadji, S. Tulang Bawang, Lampung Prov.	4.23 S, 105.23 E	c. 1988	Lambert 1988 T	up to 4	Seen in a swamp between the 2 villages. DR	
Bujung Tenuk, S. Tulang Bawang Lampung Province	4.30 S, 105.14 E	1985	Lambert 1988 taken for trade. DR		+	One birds and some eggs
Bujung Tenuk, S. Tulang Bawang swamps. DR Lampung Province	4.30 S, 105.14 E	c. 1988	Lambert 1988 U		up to 6	In nearby
Near S. Terusan, South of S. village. DR Tulang Bawang, Lampung Prov.	4.31 S, 105.22 E	c. 1988	Lambert 1988 V		2	9 km from Bakung
S. Tulang Bawang, 500m from sea, Lampung Province	4.24 S, 105.51 E	22.2.88	Lambert 1988 W river at 0700 h.		2	Flying South across the
S. Tulang Bawang, 10-15 km above Gunungtapa, Lampung Prov.	4.22 S, 105.28 E	22.2.88	Lambert 1988 X	2	Flying across the river at dusk.	
South Sumatra		Feb 1988	Lambert 1988	66-91	PE for all sites visited.	

Way Kambas NP, Lampung Province	5.01 S, 105.46 E	29.3.88	Robson 1988	3	Adult with 2 young.	
Berbak River, near Kampung Sekumbang, Jambi Prov.	1.26 S, 103.42 E*	7.4.89	Silvius & De Iongh 1989	1	Male flying across river, 1745 h.	
Way Kambas NP, Lampung Province	5.01 S, 105.46 E	1989	Chambers 1990	30	Minimum PE for the reserve.	
Way Kanan area, Way Kambas NP, Lampung Province	5.01 S, 105.46 E	Jul-Aug 1990	Tim Ekspedisi 1991	20-30	Local PE. No birds seen at S. Wako, S. Bungur, S. Rasau.	
Rianiate Transmigration Settlement, near Lumut, Utara Province	1.25 N, 98.55 E*	9.8.90	Holmes 1990	2	Pair flying over settlement, 0830 h.	
Timber camp on S. Tapus, Utara swamp Province	2.10 N, 98.11 E*	1990	Holmes 1990	+	Occurs in coastal peat forests. #	
Rawa Pasir, Way Kambas NP, Lampung Province	5.00 S, 105.44 E*	24.6.91	Rudyanto *in litt.* 1991	1	Feeding on the river bank at 1430 h.	
Pond Ulung Ulung 3, Way Kambas NP	5.03 S, 105.44 E*	25.6.91	Rudyanto *in litt.* 1991	3	Feeding and swimming together at 1200 h.	
Rawa Pasir, Way Kambas NP, Lampung Province	5.00 S, 105.44 E*	27.6.91	Rudyanto *in litt.* 1991	+	Heard calling at 1100 h.	
S. Gelumpangkecil, Tigahpuluh foothills, Jambi Province	1.08 S, 102.11 E	28.7-8.8.91 *in litt.* 1991	Danielsen & Heegaard	1	Seen flying over river on 4 evenings at 1815 h and 3 mornings at 0615h.	

Runding, Simpang Kiri Dist., in Peat Aceh Province	2.40 N, 97.51 E	27.9.91	van Balen *in litt.* 1991	2	Pair flushed from pool Swamp Forest area at 0710 h.

JAVA

Location	Coordinates	Date	Source	Numbers	Notes
Lake Garang (Gorong), Central Java	7.00 S, 110.20 E	1839-1844	Phillips 1923/ Schlegel 1866	+	Source of type specimens, three in NMNH, Leiden.
Bogor (Buitenzorg), West Java	6.37 S, 106.50 E	1839-1844	Phillips 1923/ Schlegel 1866	+	Source of type specimens, one in NMNH, Leiden.
Java, unknown location		1863	NMNH, Leiden	2	Specimens collected by Diard.
Java, unknown location		before 1864	Blanford 1898	2	British Museum specimens.
Desa Langen (Langgen), West Java	7.36 S, 108.42 E	24.12.1907	NMNH, Leiden	2	Skins collected by Bartels.
Kebumen (Keboemen), Central Java	7.40 S, 109.41 E	before 1949	Hoogerwerf 1950	+	Egg in Bogor museum.
Kali Pucang (Kalipoetjang), West Java	7.36 S, 108.48 E	before 1949	Hoogerwerf 1950	+	Egg in Bogor museum.
Mouth of the Tjitelang, Ujung	6.45 S, 105.20 E	17.9.32	Hoogerwerf 1970	4	Flew over De Kanter's

camp. Kulon NP, West Java			Looked like domestic ducks. ?
Nyiur swamp, Ujung Kulon NP, West Java	6.45 S, 105.20 E	1972	Savage *in litt.* 1975 1	Flying and calling at dusk. #

+ = recorded as present.

* = coordinates are precise. All other coordinates are approximate.

= local report, unconfirmed.

? = clear possibility of wrong identification.

PE = population estimate.

DR = local report considered definite by Lambert (1988).

PR = local report considered probable by Lambert (1988).

NP = National Park.

Sungai (or S.) = river.

Note: Old names or spellings for locations are given in brackets.

A-X after Lambert (1988) refer to sites identified in his report, for ease of cross-referencing.

Observations of *C. scutulata* made by Chambers 1990 and Tim Ekspedisi 1991 in Way Kambas NP.

DATE	LOCATION	NUMBER	BEHAVIOUR
25.08.88	POND 1	1	A
26.08.88	WAY KANAN	1	F
02.09.88	POND 5	1	A
03.09.88	WAY KANAN	1	A
12.09.88	POND 4	1	A
13.09.88	POND 4	1	A
14.09.88	POND 4A	1	A
15.09.88	POND 5	1	A
16.09.88	POND 5	1	A
21.09.88	RIVER	2	A
22.09.88	RIVER	1	A
30.09.88	WAY KANAN	1	A
15.10.88	RAWA PASIR	1	A
21.10.88	RAWA PASIR	1	A
22.10.88	RAWA PASIR	3	A
25.10.88	RAWA PASIR	2	A
05.11.88	WAY KANAN	1	F
15.11.88	RAWA PASIR	1	F
22.11.88	RAWA PASIR	2	F
23.11.88	RIVER	1	A
23.11.88	RAWA PASIR	1	F
24.11.88	RAWA PASIR	1	F
25.11.88	WAY KANAN	1	F
27.11.88	WAY KANAN	1	F
28.11.88	WAY KANAN	2	F
29.11.88	WAY KANAN	2	F
30.11.88	WAY KANAN	2	F
01.12.88	WAY KANAN	2	F
03.12.88	WAY KANAN	2	F
04.12.88	WAY KANAN	2	F
05.12.88	WAY KANAN	3	F
06.12.88	WAY KANAN	1	F
08.12.88	WAY KANAN	1	F
09.12.88	WAY KANAN	1	F
11.12.88	WAY KANAN	1	F
14.12.88	WAY KANAN	2	F
15.12.88	WAY KANAN	2	F
16.12.88	WAY KANAN	2	F
16.12.88	RAWA GAJAH	7+	A
17.12.88	WAY KANAN	2	F
17.12.88	RAWA GAJAH	5+	A
20.12.88	WAY KANAN	2	A
20.12.88	RAWA GAJAH	5+	A
21.12.88	RAWA GAJAH	4+	A
22.12.88	RAWA GAJAH	5+	A
23.12.88	KALI BIRU	1	F
24.12.88	KALI BIRU	2	A
26.12.88	WAY KANAN	1	F
27.12.88	WAY KANAN	2	F
28.12.88	RAWA PASIR	3	F
28.12.88	RAWA GAJAH	4+	A

28.12.88	POND 5	1	A
05.01.89	RAWA MERANGGI	2	A
06.01.89	WAY KANAN	6	F
06.01.89	RAWA GAJAH	3+	A
07.01.89	WAY KANAN	1	F
07.01.89	RAWA MERANGGI	2	A
08.01.89	WAY KANAN	+	F
08.01.89	RAWA MERANGGI	2	A
09.01.89	RAWA MERANGGI	2	A
17.01.89	RAWA PASIR	1	A
18.01.89	POND 1	1	A
22.01.89	WAY KANAN	1-2	F
23.01.89	WAY KANAN	1	F
24.01.89	WAY KANAN	1	F
26.01.89	RIVER	1	A
26.01.89	RAWA GAJAH	1	A
04.02.89	RASAU	2	F
05.02.89	WAY KANAN	1	F
07.02.89	WAY KANAN	1	F
07.02.89	RAWA GAJAH	3	F
07.02.89	KALI BIRU	1	F
08.02.89	WAY KANAN	1	F
11.03.89	WAY KANAN	1	F
12.03.89	WAY KANAN	1	F
13.03.89	WAY KANAN	1	F
14.03.89	RIVER	2	A
15.03.89	WAY KANAN	1	F
15.03.89	RIVER	2	A
22.03.89	RAWA PASIR	1	F
23.03.89	KALI BIRU	1	F
24.03.89	WAY KANAN	2	F
28.03.89	TRANSECT 2	1	F
03.04.89	WAY KANAN	2	F
07.04.89	WAY KANAN	1-2	F
08.04.89	WAY KANAN	2	F
11.04.89	WAY KANAN	1	F
12.04.89	POND TENGAH	2	A
13.04.89	WAY KANAN	1	F
13.04.89	RIVER	2	A
17.04.89	WAY KANAN	1	F
17.04.89	POND TENGAH	2	A
21.04.89	WAY KANAN	1	F
24.04.89	WAY KANAN	2	F
25.04.89	POND 4A	1	A
30.04.89	WAY KANAN	1	A
02.05.89	POND 2	1	A
03.05.89	RAWA PASIR	3	F
04.05.89	TRANSECT 3	2	F
07.05.89	WAY KANAN	1	F
08.05.89	WAY KANAN	1	F
08.05.89	POND 1	1	A
09.05.89	POND 5	1	A
09.05.89	POND 4	2	A
11.05.89	RIVER	1	A

11.05.89	POND 2	1	A
16.05.89	PUDDLE	1	A
19.05.89	POND 4	1	A
22.05.89	PUDDLE	1	A
22.05.89	RAWA GAJAH	2	F
26.05.89	RAWA PASIR	1	A
30.05.89	KALI BIRU	2	F
31.05.89	KALI BIRU	1	F
06.06.89	RAWA PASIR	2	A
14.06.89	WAY KANAN	2	F
15.06.89	RAWA PASIR	1	A
16.06.89	RAWA PASIR	2	A
17.06.89	POND 4B	1	A
23.06.89	RAWA PASIR	1	A
26.06.89	POND 1	1	A
27.06.89	POND 1	1	A
29.06.89	POND 1	2	A
30.06.89	POND 1	1	A
01.07.89	POND 1	1	A
02.07.89	POND 1	1	A
05.07.89	POND 1	2	A
06.07.89	POND 1	1	A
07.07.89	POND 1	1	A
08.07.89	POND 1	1	A
09.07.89	POND 1	1	A

DATE	TIME	LOCATION	NUMBER	BEHAVIOUR	
12.07.90	1425	POND 4B	1	F	
12.07.90	1630	POND	1	F	
17.07.90	0810-0830	RIVER	+	C	
18.07.90	1230	RAWA PASIR	5	W	Female with 4 young
18.07.90	1320	RAWA PASIR	1	A-F	
20.07.90	1520-1532	RAWA PASIR	6	A-R	Female with 5 young
20.07.90	1831-1845	RAWA PASIR	2	A-R	
21.07.90	0507-0550	RAWA PASIR	2	R-F	
21.07.90	1013	RAWA GAJAH	3	F	
02.08.90	1053-1130	RAWA PASIR	1	A-W	
02.08.90	1200-1202	RAWA PASIR	2	W-F	
03.08.90	1105	RAWA PASIR	1	F	
06.08.90	1642-1645	KALI BIRU	1	A-R-F	
06.08.90	1830-2316	KALI BIRU	1	F	
07.08.90	0550-0552	KALI BIRU	+	C	
07.08.90	1732	KALI BIRU	+	C	
07.08.90	1744	KALI BIRU	1	F	
08.08.90	1248-1249	KALI BIRU	2	R-F	
09.08.90	0955-0956	KALI BATIN	1	A-F	
09.08.90	1000	KALI BATIN	1	R-F	

13.08.90	1200	KALI BIRU	1	F
13.08.90	1705	RIVER	+	F
14.08.90	1100	KALI BIRU	1	F
15.08.90	1610	POND 1	1	A
20.08.90	0745	RAWA PASIR	1	W-F
20.08.90	0814	RAWA PASIR	1	R-F
20.08.90	0944	RAWA PASIR	1	R-F
21.08.90	1410	KALI BIRU	1	F
22.08.90	1130-1135	RAWA PASIR	2	R-F
22.08.90	1202-1224	POND ULUNG-ULUNG 1	2	R-F
22.08.90	1920	POND ULUNG-ULUNG 3	2	R-A
05.09.90	0610	GUARD POST	2	F

BEHAVIOURS

A = Active on water/feeding.
C = Heard calling.
F = Flying past.
R = Resting or perching.
W = Walking.
+ = Number not recorded.

LOCATIONS, with approximate coordinates:

Way Kanan = guard post along the river. 5.01 S, 105.46 E
Ponds = forest ponds around Way Kanan. 5.03 S, 105.44 E
Rawa Pasir = swamp along Way Kanan. 5.00 S, 105.44 E
Rawa Gajah = swamp along Way Kanan. 5.01 S, 105.46 E
River = Way Kanan between guard post and Rawa Pasir. 5.01 S, 105.46 E
Kali Biru = tributary of Way Kanan. 5.00 S, 105.48 E
Rawa Meranggi = cultivated swamp South of the reserve. 5.07 S, 105.41 E
Rasau = Sungai Rasau. 4.48 S, 105.47 E
Transect 2 = transect through unburnt forest near Way Kanan. 5.03 S, 105.44 E
Transect 3 = transect through burnt forest near Way Kanan. 5.01 S, 105.46 E
Puddle = on access track to Way Kanan guard post. 5.01 S, 105.46 E
Kali Batin = tributary of Way Kambas. 5.04 S, 105.49 E

Chambers and team were present from 18.8.88 to 30.12.88, 2.1.89 to 8.2.89 and 10.3.89 to 10.7.89.
Tim Ekspedisi team were present from 8.7.90 to 8.9.90 (all dates inclusive).

12.11 SITES IN SUMATRA

12.11.1 Way Kambas National Park KEY SITE, INDO 1; SU 51

Location 4.37-5.06 S, 105.40-105.52 E, East coast of Lampung Province.

Description 123,500 ha at 0-50 m altitude. Contains one of the few protected areas of lowland dipterocarp forest in Sumatra and one of the largest protected areas of Freshwater Swamp Forest. Less than 30% of the area is suitable for *C. scutulata*. Logging destroyed most of the dipterocarp forest between 1968 and 1974. Over 70% of the reserve has been selectively logged creating Alang-alang *Imperata cylindrica* grasslands in some areas. The wildlife is very rich, with over 270 species of birds. Contains 65 km of coast with 1,000 ha of coastal forest vegetation, mangrove and dry beach forest. There are several major rivers, and extensive intertidal mudflats. The swamps are flooded in the wet season (November to March).

Status of *C. scutulata* Declined in recent years according to local reports, but still the most important site in Indonesia and elsewhere. Chambers saw groups of up to seven, and estimated the total population to be at least 30. Tim Ekspedisi (1991) identified at least 12 individuals in the Way Kanan/Kali Biru/Kali Batin area and estimated 20-30 birds for this area. Ducklings seen in July 1990. Estimated population 30.

Threats

i. Logging: continues illegally in the dryland forest of the S. Rasau area. Outside the reserve, in areas used by the ducks, all remaining forest is being destroyed.

ii. Fishing: causes widespread disturbance in the reserve's swamps. One *C. scutulata* is reported to have been caught in a net and eaten.

iii. Pesticides: used outside the reserve in paddy fields and likely to enter the ducks' food chain.

iv. Tourist development: including a new road going past ponds where the ducks feed. It has been proposed that the reserve be divided into three management zones: (a) Sanctuary, (b) Wilderness Zone, and (c) Intensive Use Zone. Tourism and recreation facilities are planned in the Intensive Use and Wilderness Zones.

Conservation Measures Taken Established as a Game Reserve in 1937, but suffered extensive logging and settlement by villagers. Protection increased in 1984, with eviction of villagers. Declared a National Park in 1989.

References Chambers (1990); Silvius *in litt.* 1991; Tim Ekspedisi (1991).

Action

i. Control tourist development to prevent disturbance to sites used by *C. scutulata*. Prevent use of the road alongside the Way Kanan ponds by vehicles.

ii. Improve protection to prevent encroachment for fishing and logging by increasing patrols, especially in the Way Kanan area.

iii. Conduct surveys of the S. Rasau, S. Wako and Way Penet areas.

iv. Conduct a full ecological study of *C. scutulata*.

v. Put up nest boxes for *C. scutulata* on swamp trees on a trial basis.

vi. Conduct an education program in the area to raise awareness of the park's importance to *C. scutulata*.

vii. Create a buffer zone up to 10 km around the reserve in which use of pesticides in rice fields and for fishing is stopped.

12.11.2 Padang-Sugihan Wildlife Sanctuary KEY SITE, INDO 3; SU 46

Location 2.43-3.00 S, 105.00-105.15 E. 45km northeast of Palembang, Sumatra Selatan Province.

Description 75,000 ha at 5-10 m altitude, containing a patchwork of Peat Swamp Forest, swampy grassland, riverine swamp forest and drier *Melaleuca* forest. All habitats are periodically flooded by up to 1.5 m, and the Peat Swamp Forest is flooded for most of the year. The site is transected by 92 km of primary canals (15m wide) and 670 km of secondary canals (2-3m wide) dug to prepare for settlements, before the establishment of the reserve. The east and west borders are formed by the large, acidic, blackwater Sugihan and Padang Rivers. The Peat Swamp Forest is characterized by species of *Shorea*, *Crytostachys*, *Alstonia*, *Dyera*, *Gonostylus* and *Oncosperma*. The understorey is dominated by *Licuala* palms. The forest is degrading and reverting to *Melaleuca*.

Status of *C. scutulata* At least four birds were observed in 1985 in swamp forest around canal 6. In 1988 Lambert found the forest in this area had been felled, but found that ducks probably still occur around canal 2 and downriver on S. Saleh. Estimated population 4.

Threats

i. Logging. The area around the reserve is either already cleared for settlement, or is scheduled for clearance, thus isolating the reserve. There is considerable illegal logging in the reserve swamp forest and cutting of *Melaleuca* trees for poles.

ii. Drainage: by the canals continues, causing the swamp forest to degrade into *Melaleuca* scrub.

iii. Fires: occur frequently in the dry season. Extensive forest fires in 1987 affected 30% of the reserve, mainly along drainage channels, leaving primary forest as isolated patches. Regeneration is extremely slow.

iv. Fishing: with lines, nets and dynamite within the reserve.

Conservation Measures Taken Designated as a Wildlife Sanctuary in 1983.

References Nash & Nash 1985; Lambert 1988; Danielson & Verheugt 1991.

Action

i. Close off all unofficial access routes into the reserve (particularly the main canals) to prevent illegal logging, wood-cutting, hunting and fishing.

ii Close off all artificial drainage channels to stop drainage of the peat swamp.

iii. Survey to assess whether it still has value for *C. scutulata*.

12.11.3 Sungai Tulang Bawang and backswamps KEY SITE, SU 49

Location 4.22-4.30 S, 105.14-105.51 E, Lampung Province.

Description 80 km of river from the coast to the confluence of S. Umpu and S. Rarem. 0-50 m altitude. There are seasonally flooded riverine backswamps and some permanent swamps, with open Freshwater Swamp Forest including *Melanorrhoea* spp. (Rengas). Swamps mainly freshwater, but locally bordering peatswamps. The river is bordered with *Nipah* and degraded mangrove forest near
the estuary. Inland, some stretches are bordered by *Melaleuca*, and others by tall sedges with bushes and occasional Rengas trees. The site lies in a region of heavy transmigration settlement.

Status of *C. scutulata* This area may be the most important for *C. scutulata* after Way Kambas. Holmes was shown four reputed nests in swamps at Bujung Tenuk in January 1977. In 1988 Lambert obtained reports of two birds in rice fields at Gunungtapa, up to four in a swamp between Bakung and Gedonghadji, up to six in swamps at Bujung Tenuk and two near S. Terusan, 9 km south of Bakung. He saw a pair flying over the river 500 m from the sea, and another pair 10-15 km above Gunungtapa. Estimated population 18.

Threats

i Drainage. 1991 surveys by AWB/PHPA found that the swamp forest in this area has been severely affected by new drainage channels, which will eventually destroy the forest.

i Deforestation. Most Rengas trees have been, or are being, cut for timber.

Conservation Measures Taken None.

References Holmes 1977, Lambert 1988, Silvius *in litt.* 1991

Action

i New survey to establish the present status and distribution of *C. scutulata*.

ii The remaining swamp forest should be protected and the drainage channels closed off.

12.11.4 Cabang/Sungai Seputih KEY SITE

Location 4.33-4.45 S, 105.27-105.48 E. Area just north of Way Kambas NP, Lampung Province.

Description Centred around lower reaches of S. Seputih, S. Terusan and tributaries, with various freshwater swamps and some degraded Freshwater Swamp Forest along S. Seputih.

Status of *C. scutulata* In 1976 Holmes found birds at Rawa Susuk 30 km upstream of Cabang on S. Seputih. In 1988 Lambert found reports of two flying over Cabang regularly, probably into and out of Way Kambas NP. Up to seven birds were also reported from five swamps in the area. Estimated population 9.

Threats Deforestation: the remaining forest is being logged.

Conservation Measures Taken None.

References Holmes 1977, Lambert 1988.

Action The Cabang area should be protected.

12.11.5 Kayu Agung KEY SITE

Location 3.28-3.38 S, 104.51-105.09 E, Sumatra Selatan Province.

Description A series of permanent swamps 20-30 km from Kayu Agung, surrounded by agriculture and transmigrant settlements. Danau Teluk Gelam, a large deep open lake, is 9 km from S. Komering with several neighbouring

swamps. This area is surrounded by degraded forest with few large trees. All trees have been cleared in one part of the lake for tourist access.

Status of *C. scutulata* One of the most important known sites in Sumatra. Lambert found reports of one to two birds flying over Sameduck Agung, and up to five seen in Danau Teluk Gelam and connected swamps. Another two seen at a swamp 4 km from Sungai Komering village. Estimated population 9.

Threats Logging of remaining forest in the area.

Conservation Measures Taken None.

References Lambert 1988.

Action Danau Teluk Gelam and neighbouring swamps should be protected.

12.11.6 Sungai Lalang

Location 1.55-2.14 S, 103.55-104.08 E, Sumatra Selatan Province.

Description River bordered by degraded forest, with all large trees gone except for areas immediately surrounding numerous sawmills. The tributary, S. Pajudian, has an area of primary forest 4 km from S. Lalang, behind a 800 m belt of burnt, dead, Freshwater Swamp Forest. To the east of the tributary S. Bakung there is primary forest behind a large grassy swamp (0.5 km wide), 5 km from S. Lalang. Upstream there is primary hill forest in the Bentayan reserve, which is being logged illegally. Many areas of felled forest have been replaced by *Melaleuca* scrub.

Status of *C. scutulata* Lambert found reports that up to four ducks occasionally fly over the burned swamp forest on S. Pajudian, while others were probably seen on the grassy swamp bordering primary forest along S. Bakung. Estimated population 4.

Threats Deforestation: legal and illegal logging of remaining forest areas, partly for transmigration schemes. Two thirds of the forest in Bentayan reserve has been destroyed.

Conservation Measures Taken None.

References Lambert 1988; Verheugt *in litt.* 1990.

Action

i. Survey of S. Bakung, Bentayan reserve and S. Pajudian for *C. scutulata*.

ii. The north boundary of Bentayan reserve should be extended to meet S. Lalang, so protecting the grassy swamps on S. Bakung outside the reserve. A PHPA ranger post should be set up where S. Bakung meets S. Lalang to stop the illegal flow of logs from the reserve.

12.11.7 Sungai Mesuji

Location 3.38-3.56 S, 105.10-105.17 E, Sumatra Selatan Province.

Description Area of severely degraded forest and intense logging. The river vegetation is dominated by *Melaleuca*. The few Rengas trees are rapidly being cut.

Status of *C. scutulata* Lambert obtained reports of two birds at Pematang Panngang, two 4 km downstream and unknown numbers 30-40 km upstream. Another probable report from 20-30 km up the tributary, S. Padang. Estimated population 3.

Threats Deforestation: remaining areas of Rengas trees are under logging concession.

Conservation Measures Taken None.

References Lambert 1988.

12.11.8 Sungai Lematang (Rawa Keleboran)

Location 3.07 S, 104.14 E. Sumatra Selatan Province.
Description A grassy swamp area 3 km west of S. Lematang containing some large Rengas trees, surrounded by degraded forest, agricultural land, overgrown rubber estate and oil fields.

Status of *C. scutulata* Lambert found that two to four birds were occasionally seen in the swamp. Estimated population 4.

Threats Deforestation: the Rengas trees around the swamp are being felled.

Conservation Measures Taken None.

References Lambert 1988.

12.11.9 Jepara SU 50

Location 5.12-5.22 S, 105.40-105.46 E. Lampung Province.

Description Agricultural area south of Way Kambas NP containing a small basalt crater lake (100 m altitude), shallow at one end with very small amount of swamp forest. The lake is a source of irrigation water.

Status of *C. scutulata* Holmes observed a pair on the lake on 30.6.76 and Andrew saw a pair on 24.4.84. Lambert obtained reports that a pair was seen flying in 1987 near Panca Sila just north of Jepara, and another pair flying just south of S. Jepara. Estimated population 2.

Threats Habitat destruction: by conversion of swamp habitat for agricultural use.

Conservation Measures Taken None.

References Lambert 1988; Andrew *in litt.* 1990.

Action Survey to establish importance of the site for *C. scutulata*.

12.11.13 Banyuasin Musi River Delta INDO 5; SU 45

Location 2.00-2.30 S, 104.30-105.15 E. The coastal area between the Sembilang River and Kuala Saleh, Sumatra Selatan Province.

Description Very large delta system of the Banyuasin and Musi Rivers and numerous smaller rivers and mangrove creeks. Comprises 150,000-200,000 ha of mangrove habitat with more than 30 species of mangrove and some extensive swamps of *Nypa ruticans*. Inland, the mangroves and nipa swamps give way to Freshwater and Peat Swamp Forests and grassy marshes where the forest has been burned or logged. There are vast areas of intertidal mudflats along the coast containing many small villages.

Status of *C. scutulata* In 1986, Silvius saw one bird flying over a freshwater swamp several km inland at S. Bungin. The species is therefore presumed to occur in the swamp forest behind the mangroves. Estimated

population 1.

Threats Deforestation: the area is under pressure from reclamation activities, and the swamp forest in the catchment area has been or is being selectively logged and partly reclaimed. Several new areas have been proposed for transmigration and aquaculture projects, which would destroy part of the mangrove forest.

Conservation Measures Taken The area between the Benu and Banyuasin rivers where *C. scutulata* was recorded is the Proposed Sembilang Wildlife Reserve of 250,000 ha, with 140,000 ha of mangroves and 110,000 ha of swamp forest.

References Danielson & Verheugt 1991.

Action Survey for *C. scutulata*, particularly in the Freshwater Swamp Forest in the proposed Sembilang protected area.

12.11.11 Sungai Berbak

1.04 S, 104.06 E, Jambi Province, Sumatra. One *C. scutulata* seen on 7.4.89 flying over the river near Kampung Sekumbang in an area adjacent to Berbak Game Reserve (INDO 8; SU 38) which contains c.170,000 ha of swamp forest. Requires survey.

12.11.12 Rianiate

1.25 N, 98.55 E, near Lumut on the east coast of Sumatra Utara Province. A transmigration settlement with very swampy, frequently flooded ricefields along either side of a former course of the Batang Toro river, adjacent to Peat Swamp Forest. A pair seen flying across Rianiate Transmigration Settlement on 9.8.90. Estimated population 2. Requires survey.

12.11.13 Sungai Tapus SU 10

2.10 N, 98.11 E, on the east coast of Sumatra Utara Province.
An extensive, peat filled coastal lagoon at sea level containing very acid swamps and Peat Swamp Forest drained by S. Tapus. The total swamp area is over 12,000 ha extending north into Aceh Province. Locals reported the duck to be present in 1990. Estimated population 1. Requires survey.

12.11.14 Runding

2.40 N, 97.51 E, Simpang Kiri District, Aceh Province. Area of logged-over Peat Swamp Forest. A pair flushed from a small pool at the edge of a forest clearing immediately west of Runding village on 27.9.91. Estimated population 2. Requires survey.

12.11.15 Sungai Gelumpangkecil

1.08 S, 102.11 E, Jambi Province. An 8-10 m wide, slow forest river in lightly-logged Tropical Wet Evergreen Forest in the Tigahpuluh foothills near the border with Riau Province. 60 m altitude, and near the proposed Seberida protected area. One bird seen flying over on seven occasions from 28.7.91 to 8.8.91. Estimated population 1. Requires survey.

12.11.16 Sungai Lumpur/Sungai Selapan

3.18 S, 105.12 E, Sumatra Selatan Province. Lambert was unable to survey S. Lumpur, owing to difficulty in access. There was a probable record of two birds somewhere on S. Selapan, a tributary of S. Lumpur. Full survey of S. Lumpur required. This is most practical in the dry season.

12.11.17 Muara Bulian INDO 7; SU 39

1.42 S, 103.16 E, 40 km WSW of Jambi, close to the Batang Hari River, Jambi Province. In 1976, a pair of *C. scutulata* was seen in a c.50 ha swamp used for the rice cultivation and supporting marsh grasses, sedges and some floating vegetation. Scattered trees remained, and a grove of open woodland and secondary growth covered part of the swamp. The species was also reported from a wooded ox-bow lake, Danau Saranglang, near Serasak, 20 km from Muara Bulian. Requires new survey.

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APPENDIX 1. CONTINUED MONITORING OF *CAIRINA SCUTULATA*

Continued monitoring of the status and habitat use of *C. scutulata* in the future will assist conservation planning. The Wildfowl & Wetlands Trust, Slimbridge, Glos., GL2 7BT, UK is keen to undertake this monitoring. Those able to assist are encouraged to submit details of all future records to the Threatened Species Officer for entry onto a database. The following details should be submitted when available, but less detailed information is also welcomed:

Date and time of day.

Location. As precise as possible, with geographical coordinates.

Altitude.

Description of birds' number, sex and approximate age if known. Comments on extent of white plumage on the body and wings.

Description of behaviours. Whether calling, in flight, feeding, roosting etc. If flying, at what height and over what habitat.

Description of terrestial habitat. Type of vegetation (e.g. open or dense, deciduous or evergreen, primary or secondary forest).

Description of wetland habitat. Type, size, depth, speed of flow, whether permanent or temporary, whether open or forested on banks.

Disturbances and threats. Comments on any threats to the birds and their habitat at this location.

Reliability of record. What chance is there of a misidentification, e.g. mistaking feral Muscovy Ducks or Comb Ducks.

APPENDIX 2. METHODS OF SURVEYING *CAIRINA SCUTULATA*

Survey work is urgently required across the range of *C. scutulata* to establish the distribution and number of individuals in sites where populations are known to exist, and to locate other surviving populations. The following information should be useful for those planning such surveys.

Using local knowledge

The most practical way to begin the search for *C. scutulata* populations is to interview local people and forestry officers. To ensure that reports are reliable, the interviewees should ideally be asked to give an accurate description of the bird without assistance from the interviewer. If this is not practical, e.g. because the local name for *C. scutulata* is not known, photographs of this and other wildfowl species could be used to establish whether the interviewee knew *C. scutulata*. Particular attention should be made to avoid possible confusion with feral Muscovy Ducks *C. moschata* and Comb Ducks *Sarkidiornis melanotos*.

The interviewers should stress the rarity and importance of *C. scutulata* and emphasise that they do not want eggs or birds to be brought to them. Such interviews can be used to locate areas for surveys.

Using volunteers

Husain & Haque (1982) were able to census a *C. scutulata* population in detail by posting a volunteer in each of 61 different vantage points, thereby monitoring a large area of forest wetlands simultaneously. This technique should be used when a large survey team is available. Even small groups can split up and monitor key areas of habitat simultaneously to reach a minimum population estimate.

Seasons for direct surveillance

In most of *C. scutulata*'s range there is a pronounced dry and wet season. There is conflicting evidence about when *C. scutulata* is easiest to locate. The great majority of records in continental Asia come from the dry season (roughly November to April), but this may simply be because ornithologists are more active at this time when travel in the field is easier and more pleasant. Yet in an intensive study of *C. scutulata* in the Chittagong Hill Tracts of Bangladesh, Husain & Haque (1982) found the birds easier to observe during the wet season as, during the dry season, they were concentrated on permanent streams deep in the forest.

In South-east Sumatra, Indonesia, Lambert (1988) found that *C. scutulata* is most visible in the wet season of November to March. In Way Kambas National Park, Chambers (1990) observed birds all year round, but found them in more open wetlands in the wet season. They were most difficult to locate at the end of the dry season in October.

Time of day for surveillance

C. scutulata is easiest to observe around dawn and dusk, when it is most likely to be seen or heard when feeding on wetlands or flying between feeding and roosting sites. The time of dawn and dusk periods will vary with latitude and season but, e.g. in Sumatra, Chambers (1990) saw ducks mainly from 0500-0900 hours and 1600-1900 hours; in Bangladesh, Husain & Haque (1982) found that breeding pairs were active from 0430-0830 hours and 1530-1830 hours, spending the rest of the time at the nest.

Sometimes ducks remain visible throughout the day at feeding sites, alternating between bouts of feeding and roosting. At other times, particularly in disturbed areas, birds seem to roost in the forest through the day and are particularly difficult to locate. They may then stay at feeding sites during the night when they may be heard calling in flight.

Identifying locations to survey

Surveys should be concentrated along suitable small wetlands amidst moist forest (particularly evergreen or semi-evergreen) in areas of level terrain: shallow and slow-moving or stagnant streams, forest pools and swamps. Large, open and deep rivers, lakes or reservoirs are not suitable for the species. In Indonesia *C. scutulata* has been recorded on shallow, vegetated swamps of up to several km^2 in area. These are the largest wetlands on which the species is recorded.

Flooded rice fields and other shallow wetlands close to suitable forest areas should also be surveyed, as these are sometimes used even when apparently suitable wetlands occur within the forest. Observers can be spaced out at intervals along the forest edge at dawn or dusk to look for birds flying between the forest and such wetlands.

Using vocalizations

C. scutulata has distinctive calls that are often given in flight or when flushed, and birds are frequently heard without being seen, therefore survey teams should familiarise themselves with the calls of the species before beginning work. A cassette of vocalizations recorded in the field and in captivity is available to survey teams from the Threatened Species Officer at The Wildfowl & Wetlands Trust.

For teams able to take a cassette player into the field, this tape should be used as a survey aid. Continuous playback during field surveys is likely to help locate birds by eliciting a vocal response. Playback of *C. scutulata* recordings to captive birds at Slimbridge stimulates a strong vocal response from both males and females at all times of the day and year. Birds roosting in the forest are unlikely to be found without using this method. This also promises to be a valuable technique for locating pairs at the nest, as the male of pairs in captivity responds to playback while the female is on the nest. However, great care should be taken to minimise disturbance to breeding pairs and, if any are located, no more playback should be conducted in their vicinity.

Combining surveys with research

Field surveys offer the opportunity to obtain biological data beyond the simple distribution and number of *C. scutulata*. In particular, they can be combined with some of the research work outlined in Appendix 3.

APPENDIX 3. SOME FIELD RESEARCH PROJECTS ON *CAIRINA SCUTULATA*

Current understanding of *C. scutulata* biology in the field is limited, and there is a need to begin detailed studies as soon as possible. The following outlines a few important studies that could be undertaken by teams spending a few weeks or more in a site occupied by the species.

Vocalizations

The range and function of vocalization types of *C. scutulata* are poorly known. For example, it is unclear whether the flight calls given by wild birds differ from those produced by flightless captive birds. Studying individual variation in call structure (e.g. duration of call components and interval between them) may provide an answer to the problem of estimating population size by discriminating between individuals. Field workers should therefore make tape recordings of vocalizations of as many birds and as many times as possible. These recordings should be clearly annotated with details such as date, precise location, number and behaviour of the birds etc. They can later be used to classify different call types, look at sexual dimorphism, and attempt to identify different individuals from call variation. If possible, please provide copies of recordings to the Threatened Species Officer, The Wildfowl & Wetlands Trust.

Individual plumage variation

Another potential solution to the problem of distinguishing individuals in the field is by noting variation in plumage, particularly in the amount of white and the pattern of black speckling on the head and neck. Through a concerted effort to sketch the markings on the head, neck, body and wings of all birds when they can be observed in detail, it may be possible to distinguish between individuals when birds are seen in different places or repeatedly in the same place. This method allows individual recognition of captive continental Asian birds at Slimbridge, and has already been used with some success on Indonesian birds in the field. The technique is easier to use on Indonesian birds because of the greater variation in the amount of white on the body and wings. During long-term studies, plumage changes are not likely to cause problems as captive individuals at Slimbridge retain very similar markings from one year to the next.

Diet

Little is known about the diet of *C. scutulata*. Useful information could be gained by collecting droppings from sites where birds are seen feeding or roosting. These could be analysed in the field with binocular microscopes, or if necessary preserved in alcohol or by drying for subsequent analysis.

Radio-tracking

Due to the movements of *C. scutulata* over considerable distances and the nature of their habitat, radio-tracking is probably necessary to monitor the movements of individuals in order to establish the size of their home ranges or territories, and to be able to locate them over a long period to monitor their behaviour at different times of the day and year. It may also be a useful way of locating nest sites. Work is in progress with captive birds at Slimbridge to assess the best way of attaching radio-transmitters. Relatively large transmitters are required for a study of this kind to maximise lifespan and range. A back-mounted transmitter on a harness promises to be the best technique. The highest priority is to radio-track mature birds of breeding age. This would assist in breeding studies and studying factors (e.g. territoriality or nest site availability) that may be limiting *C. scutulata* to its low population density.

Several methods may allow capture of birds for transmitter attachment. If individuals return to the same place on a regular basis, it may be possible to catch birds in baited Wainwright traps or clamp nets. If birds fly low into feeding sites and use regular flyways, it may also be possible to catch them in mist nets. Students in Sumatra found a bird at a forest pond on a dark night that they were able to approach close enough to touch, suggesting it may be possible to catch birds by hand under certain conditions. This should be attempted on moonless nights using a bright, dazzling torch, but this technique should not be demonstrated to locals if there is any chance of its being misused as a hunting method.

Studying nest sites

C. scutulata only nests in tree holes in larger trees. The availability of these holes is likely to be a factor controlling the density of the ducks. The logging of these larger trees is possibly a major factor of the decline of the species, and the number of tree holes available has been found to control population size in other hole-nesting wildfowl such as the Carolina Wood Duck *Aix sponsa*. The provision of nest boxes has dramatically increased the population size of *A. sponsa* (Bellrose 1978), and is a possible management measure for *C. scutulata*.

Field workers should assess the availability of potentially suitable tree holes in the vicinity of forest wetlands in their study site. These holes should be described in detail (height of tree and of hole, distance from water, hole size, orientation, nature of surrounding vegetation etc.) and surveyed in the different types of forest present at the site (e.g. primary vs. secondary; evergreen vs. deciduous; freshwater swamp vs peat swamp forest). Any evidence of use by birds or other animals such as snakes or bats should also be noted during these surveys to shed light on the extent of competition for hole use.

During the early wet season, attempts should be made to locate pairs at the nest, both by systematically visiting tree holes that have previously been located and by using playback of *C. scutulata* vocalizations while taking care to avoid disturbance. The nature and position of holes in use should be studied to establish what type of holes the birds prefer. The availability of holes of the preferred type should be assessed, to determine whether this is a key factor limiting density of breeding birds. The extent of competition (e.g. with hornbills) for their use should also be assessed.

NOTE: The Threatened Species Officer, The Wildfowl & Wetlands Trust, can assist with the above field projects if required, e.g. by collaborating over analyses of recordings, droppings or other data.

WARNING: IN INDONESIA, C. SCUTULATA NESTS IN RENGAS TREES. THE LATEX OF RENGAS TREES AND EVEN THE AIR IMMEDIATELY AROUND THEM CAUSE STRONG ALLERGIC REACTIONS IN SOME PEOPLE.

APPENDIX 4. HABITAT MANAGEMENT RECOMMENDATIONS FOR *CAIRINA SCUTALATA*

Some of the protected areas where *C. scutulata* occurs are under existing or scheduled management plans. Habitat management should aim to raise the carrying capacity of the site for *C. scutulata* by alleviating factors that limit the population size of the species. In particular, these are likely to include the availability of nesting sites and of suitable feeding sites throughout the dry season, and illegal hunting.

Halting logging and disturbance

All forestry activities and other disturbance factors should be stopped where possible, particularly in areas most frequented by *C. scutulata* such as suitable forest wetlands.

Providing nesting trees

C. scutulata is an obligate hole nester that probably has to compete for holes with hornbills or other animals, and the availability of nest sites may well be a factor limiting *C. scutulata* distribution and density. Management should maintain old trees containing holes suitable for nesting, especially near forest wetlands. If there is an acute shortage of such nest holes, as is likely in recently logged or degraded forests, nest boxes should be provided with a hole of 15-20 cm diameter. These should be placed below the canopy at a height of 4-8 m above the ground on trees situated on the banks of forest streams or ponds. Alternatively, boxes should be placed on trees which cleare the canopy and are set back from the bank of such a wetland. In this case, the boxes should be placed at a height of 3-6 m above the surrounding canopy. Generally, the nest boxes should face towards the wetland whilst avoiding full exposure to the sun. Nest boxes should first be provided on a trial basis in sites where they can be closely monitored and guarded to prevent poaching of eggs. Nest boxes are used by *C. scutulata* in captivity, but no attempt has yet been made to encourage their use in the wild. However, nest boxes have been very successful in the wild for several other tree-nesting Anatidae.

Providing feeding sites throughout the year

Management should aim to provide suitable shallow and still or slow-moving forest wetlands throughout the year to provide feeding sites even at the height of the dry season. Where there is a shortage of such permanent wetlands, permanent pools could be created e.g. by damming forest streams.

APPENDIX 5. GUIDELINES FOR RELEASES OF *CAIRINA SCUTULATA*

Cairina scutulata is so threatened in the wild that continued maintenance of a healthy captive population is an important conservation measure in itself. There may ultimately come a time when this population will be needed for a release programme, but any such programme should closely follow recent guidelines based on the experiences of a large number of bird recovery programmes worldwide (Black in press). These guidelines include a number of preconditions that must be met if a release program is to have a good chance of success. The most important of these guidelines are considered below. There are two different types of release programmes considered here. **Reintroduction** is the release of individuals of a species within its original range, with the aim of establishing a self-sustaining and viable population. **Restocking** is the release of individuals into an existing population, usually with the aim of enhancing population viability. Releases of either type should meet the following preconditions.

1. The causes of the original decline should first be eliminated. It makes little sense to release birds if the reasons for decline persist. For *C. scutulata* this precondition is likely to require the regeneration of degraded forest habitat or its enhancement through appropriate management (Appendix 4) as well as the elimination of hunting. There is little evidence that the causes of decline have been removed from any current or former *C. scutulata* sites to date.

2. Sufficient protected habitat should be available for release. Any release site must be of adequate size and quality to support a viable population. It is questionable whether present knowledge of *C. scutulata* ecology is sufficient to allow identification of such sites.

3. The original population in the chosen site should be extinct or well below carrying capacity. Release into a near-saturated habitat may cause social disruption or introduce disease or deleterious genetic material. In most *C. scutulata* sites there are insufficient data at the moment to assess whether or not the population is near saturation.

4. Release should only be planned where there is thorough health screening of the birds, and when the genetic diversity of captive stocks is carefully managed with a genetic studbook programme. At present there is a serious risk that releasing *C. scutulata* would infect wild populations with Avian Tuberculosis, which is a serious problem in the captive populations. Research into a diagnostic test to screen for infected birds is currently taking place with some success. There are also potential genetic problems in the captive population (Tomlinson et al. 1991).

5. To allow evaluation of available habitat in potential release sites and of the potential success of a release program, detailed information on the species' ecology is required. Our knowledge of breeding sites, home range sizes, dispersal, seasonal movements and other aspects of *C. scutulata* biology is currently insufficient to satisfy this precondition.

6. Conservation education programmes are required prior to commencing releases to inform the local populace, to gain support for the programme and reduce losses from hunting. Education campaigns have been conducted for *C. scutulata* in India, but more extensive campaigns are required.

7. Knowledge of optimal release methods, including the group size and composition, should be developed prior to actual release in the wild. It is unclear whether appropriate release methods for *C. scutulata* are already known.

8. Releases should only go ahead with close monitoring of the activities and survival rates of released animals. This is essential if problems during release programmes are to be identified and release methods improved. Such monitoring techniques have yet to be perfected for *C. scutulata*.

Consideration of the extent to which the above preconditions are met suggests that release programmes are not currently appropriate for *C. scutulata*. Immediate attention should focus on the conservation of remaining *C. scutulata* populations identified in this report and on ecological field research. Such research will improve our knowledge of how to conserve surviving wild populations and allow more of the above guidelines to be met.

The following table summarises the extent to which necessary conditions for release are currently met for *C. scutulata*.

1. Causes of decline eliminated	NOT YET
2. Sufficient protected habitat available	?
3. Unsaturated, suitable habitat available	?
4. Release animals screened and well managed genetically	NOT YET
5. Good understanding of ecology in the wild	NOT YET
6. Conservation education programmes	NEEDED
7. Release methods well researched	?
8. Resources and methods for monitoring releases	NOT YET
IS REINTRODUCTION OR RESTOCKING CURRENTLY RECOMMENDED?	NO

? indicates areas where further investigation is required before a definite answer can be given.

Fig. 1. Former distribution of *C. scutulata*, showing all records since 1840. From left to right, taking the most westerly record in each country as a reference point, are India, Bangladesh, Myanmar, Sumatra, Thailand, Malaysia, Cambodia, Lao PDR, Viet Nam and Java.

Fig. 2. Current distribution of *C. scutulata*, showing all records since 1980. Some of these records are unconfirmed (see text). See Fig. 1 for countries.

Fig. 3. Remaining tropical forest in the *C. scutulata* range. Adapted from Collins *et al.* 1991.

Fig. 4. Diurnal activity of *C. scutulata* in Way Kambas NP from Chambers 1990. Figures represent the number of days on which at least one duck was observed in each time period. No observations were made at night.

Fig. 5. The timing of dated sightings of *C. scutulata* in the literature for a) Thailand, b) Myanmar and c) India. If several birds were seen together, this counts as one sighting. Dashed line indicates the timing of the wet season.

Fig. 6. Known group sizes of *C. scutulata* sightings in the literature for India, Myanmar, Thailand and Indonesia, excluding unreliable records, those of adults with ducklings and those in Sumatra by Chambers (1990). Where authors give only the maximum group size seen, these data are excluded.

Fig. 7. Records of *C. scutulata* in India (top) and Bangladesh (bottom). Open squares indicate records pre 1940 or undated, open circles 1940-1980 and solid circles post 1980. Unreliable records are excluded, as are some reliable records that lack coordinates (e.g. in Manipur). See 4.10 and 5.10 for details of records.

Fig. 8. Records of *C. scutulata* in Myanmar. Open squares indicate records pre 1940 or undated, open circles 1940-1980 and solid circles post 1980. Unreliable records are excluded, as are some reliable records that lack coordinates. See 6.10 for details of records.

Fig. 9. Records of *C. scutulata* in Thailand. Open squares indicate records pre 1940 or undated, open circles 1940-1980 and solid circles post 1980. Some post 1980 records are based on local reports that have yet to be confirmed (see text). See 7.10 for details of records.

Fig. 10. Records of *C. scutulata* in Lao PDR (top), Viet Nam (bottom right) and Cambodia (bottom left). Open

squares indicate records pre 1940 or undated, open circles 1940-1980 and solid circles post 1980. Some Cambodian records lacking coordinates are excluded. See 8.10, 9.10 and 10.10 for details of records.

Fig. 11. Records of *C. scutulata* in Malaysia (top) and Indonesia (Sumatra left, Java right). Open squares indicate records pre 1940 or undated, open circles 1940-1980 and solid circles post 1980. Unreliable records are excluded, as are some reliable records that lack coordinates. See 11.10 and 12.10 for details of records.

Fig. 12. Present distribution of wetland forest in Sumatra (prepared by M.J. Silvius and based largely on RePPProT 1988).

Fig. 13. Future distribution of wetland forest in Sumatra, predicted to be reality by 2015 (prepared by M.J. Silvius and based largely on RePPProT 1988).

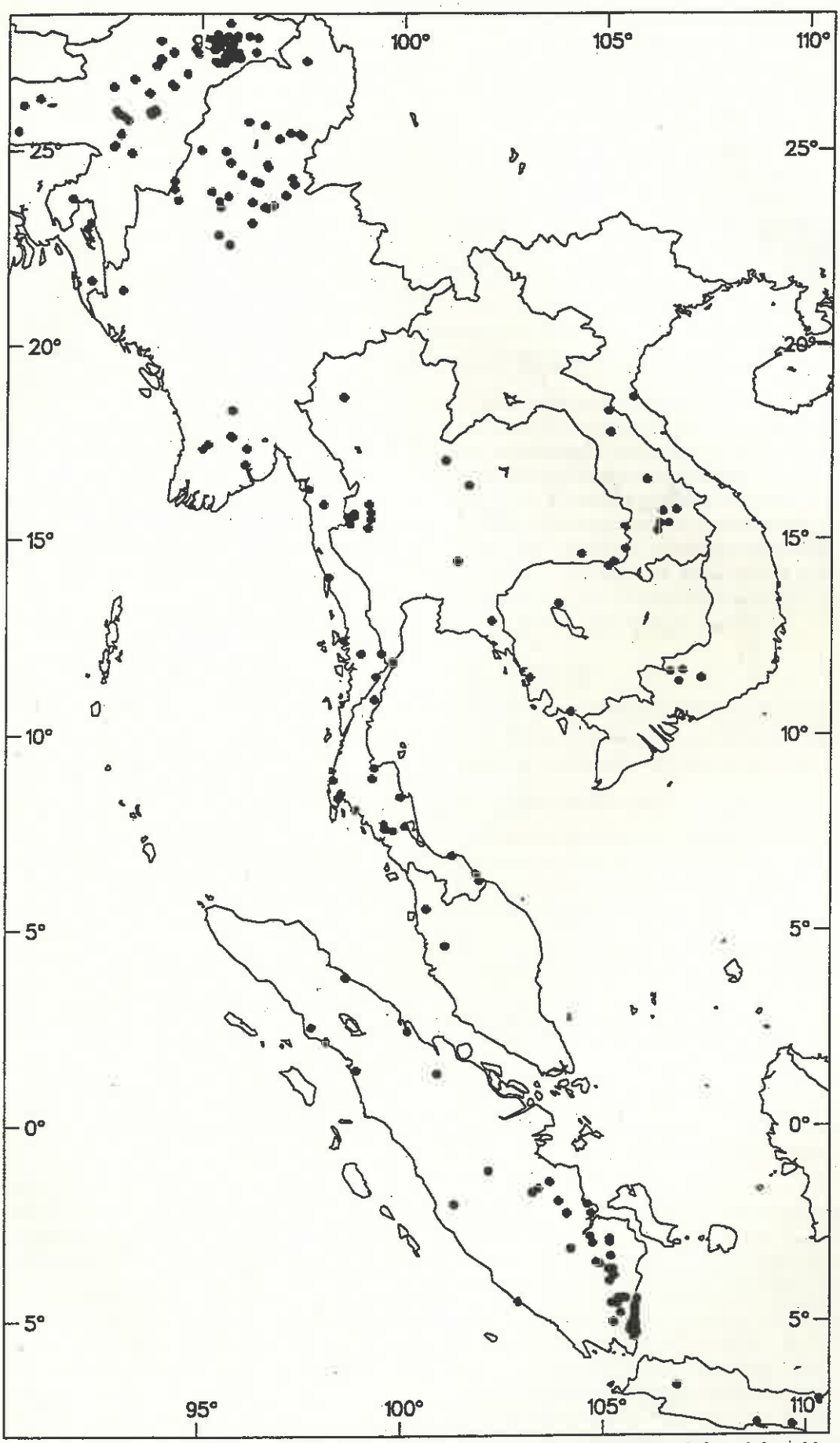

Fig. 1. Former distribution of *C. scutulata*, showing all records since 1840. From left to right, taking the most westerly record in each country as a reference point, are India, Bangladesh, Myanmar, Sumatra, Thailand, Malaysia, Cambodia, Lao PDR, Viet Nam and Java.

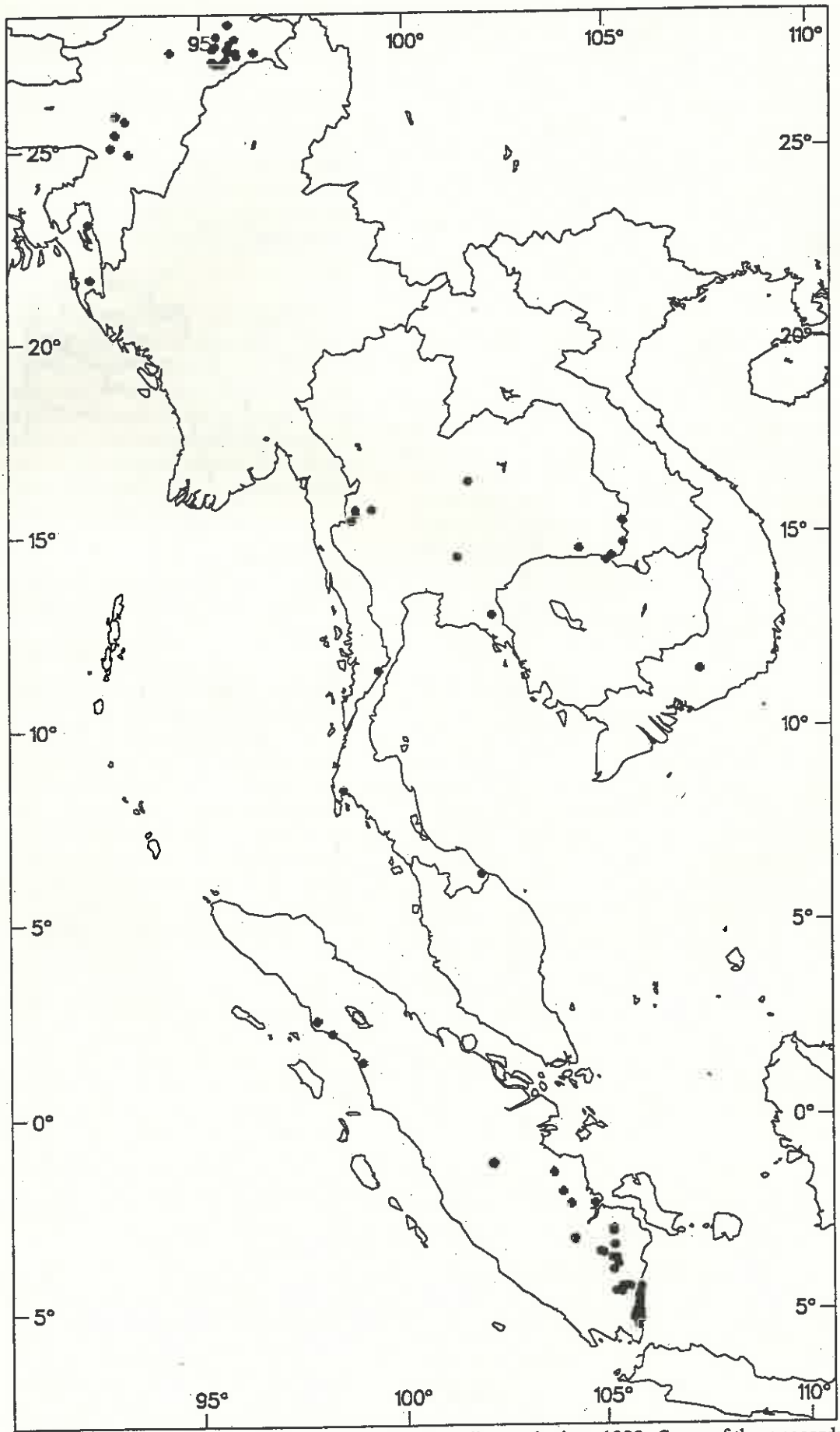

Fig. 2. Current distribution of *C. scutulata*, showing all records since 1980. Some of these records are unconfirmed (see text). See Fig. 1 for countries.

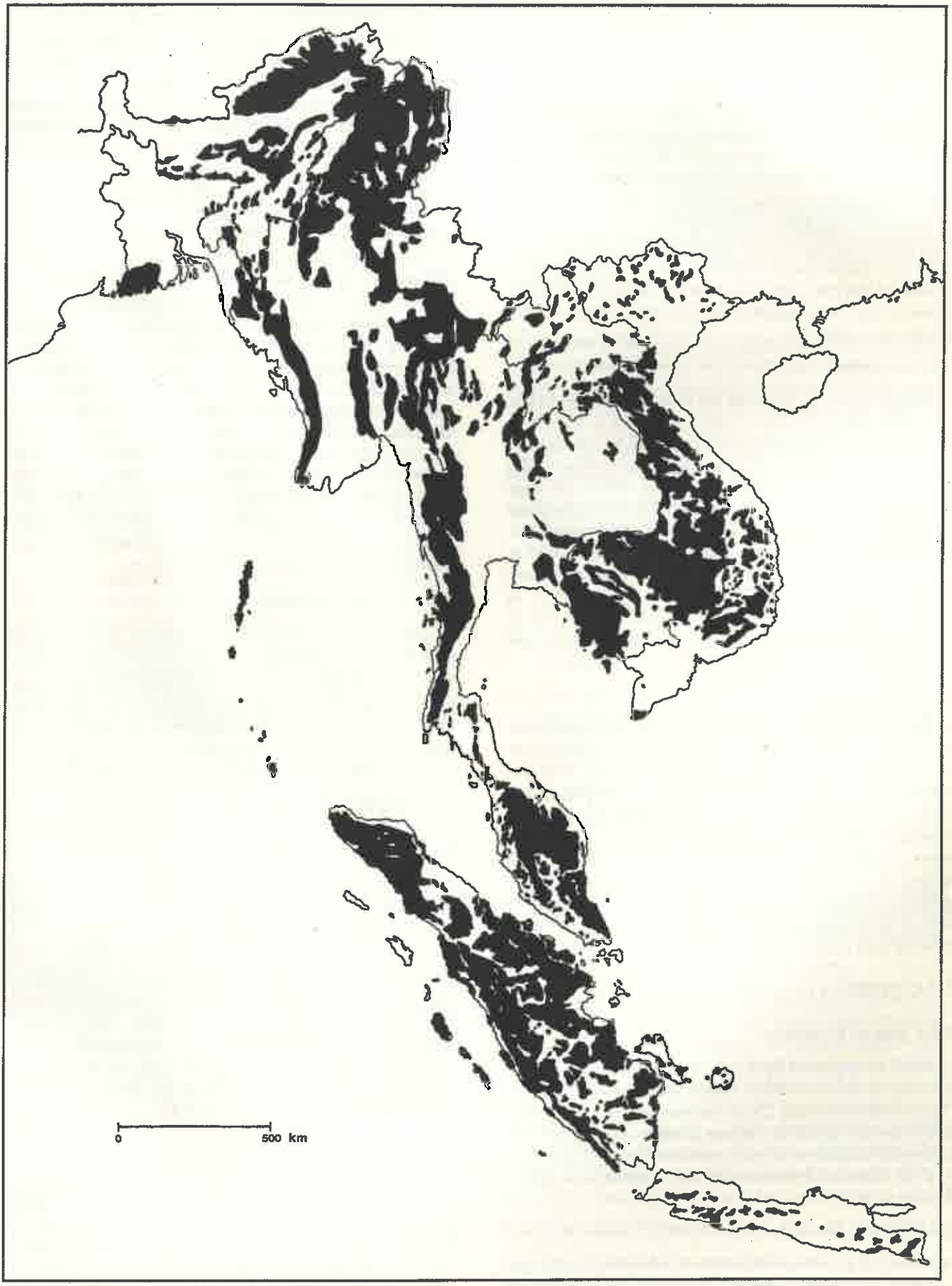

Fig. 3. Remaining tropical forest in the *C. scutulata* range. Adapted from Collins *et al.* 1991.

3. *C. SCUTULATA* ECOLOGY AND BEHAVIOUR

The most thorough field study of *C. scutulata* to date is that of Husain & Haque (1982) in the Chittagong Hill Tracts, Bangladesh, from 1976 to 1978. Their observations were concentrated in the wet season, when birds were easier to observe. The second most detailed study is that of Chambers (1990) in Way Kambas NP, Sumatra, from August 1988 to July 1989, when birds were observed on 104 of the 300 days that the research team was present.

3.1 DIEL RHYTHMS

C. scutulata has peaks of locomotory and feeding activity at dawn and dusk, and birds are most often seen in flight at these times. Many authors describe birds as being seen regularly at dawn or dusk. For example, of seven sightings in Myanmar when the time of day is mentioned, five refer to flying at dusk and the other two refer to flying at dawn and dusk. Hutchinson (1946) refers to a drake seen flying down the Dhansiri river, North-east India, every night at dusk (around 1830 h) in July 1945. Evans (1901) describes how a pair of *C. scutulata* visited a jheel near Bhamo, Myanmar, every evening but was never present during the day. When one bird was shot, the other continued to visit the jheel and was shot two nights later. In the Jade Mines of Myitkyina district, Myanmar, Stanford & Ticehurst (1939) saw *C. scutulata* "flighting regularly at dusk to feed on wet stubble where streams ran out into the fields". Smith (1942) stated that *C. scutulata* was regularly observed flying along the Shweli river, Myanmar, at dawn and dusk singly or in pairs.

Reports on how the birds spend the nights and days vary somewhat. Many authors have suggested that birds are relatively inactive in the middle of the day but remain close to feeding sites, while at night they roost farther away in the forest. Mitra (1957) and Gee (1958) observed that in the middle of the day the ducks remain in the shade of a tree on the water or on a branch. Mackenzie & Kear (1976) found that they sometimes roost "on driftwood or on low branches over the water" at this time. In captivity, Baker (1908) found that, all year round, birds stayed in the shade from 1000 to 1400 hours. In southern Sumatra, Hoogerwerf (1950) reported that *C. scutulata* sleeps at night on broad branches of high trees, and that it sometimes roosts in the same place for months in succession. In Thung Yai WS, South-west Thailand, birds are thought to roost in trees at night and forage during the day in meandering streams in the forest (Round *in litt.* 1990). A pair seen at Lake Lakutu in an undisturbed part of Thung Yai WS on 1.4.88 flew into the lake in the late afternoon, perched in the crown of a 27 m high tree and roosted there overnight before flying out before first light the next day.

Husain & Haque (1982) found that breeding birds outside the breeding season and non-breeding birds throughout the year flew singly or in pairs to feeding grounds at a ditch or stream around dawn and spent the whole day there. At dusk, they flew away to roost in trees in the forest, either at the edge of the stream or creek where they fed, or deeper into the forest. While at the feeding site, feeding was concentrated in the morning

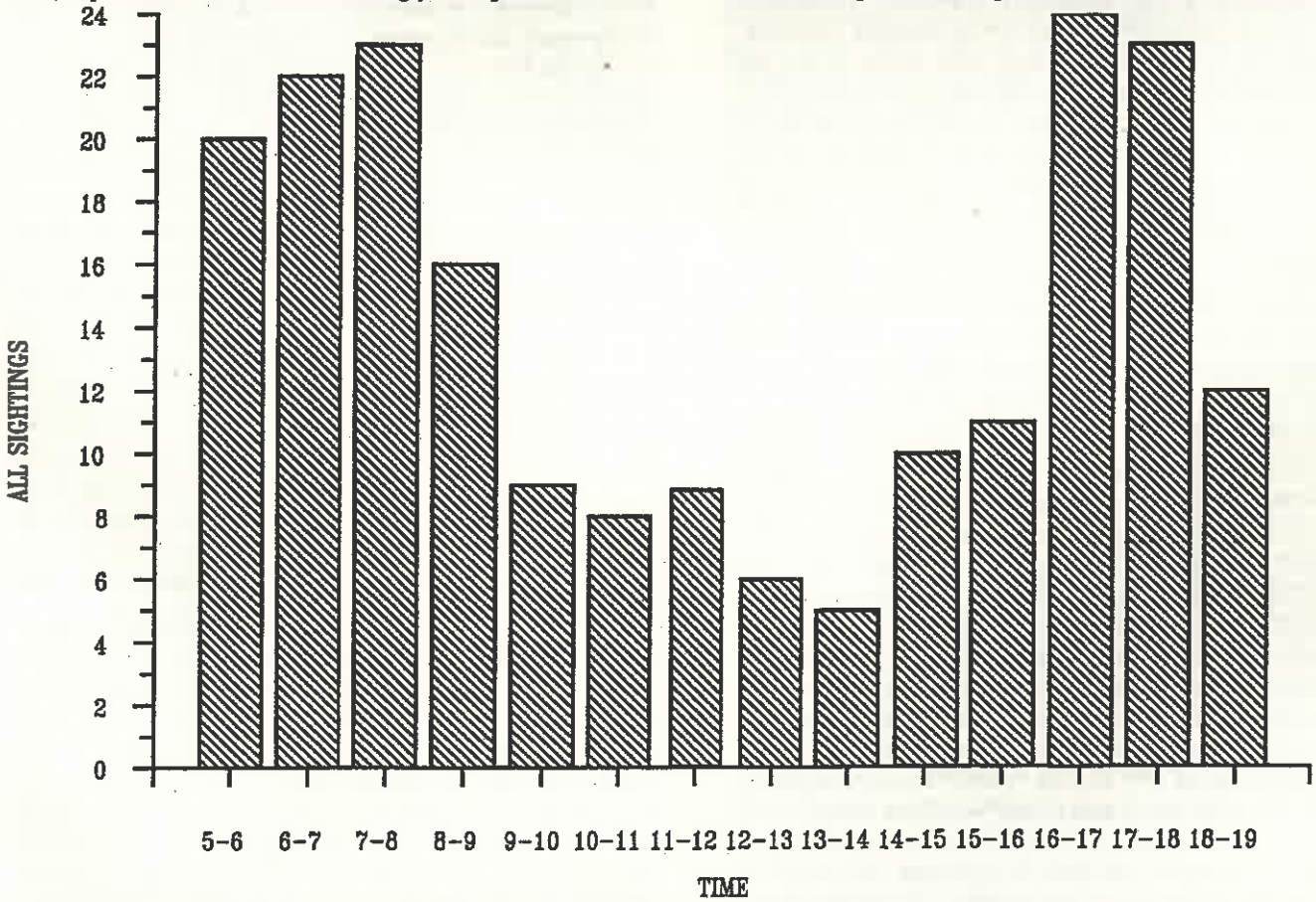

Fig. 4. Diurnal activity of *C. scutulata* in Way Kambas NP, data from Chambers (1990). Figures represent the number of days on which at least one duck was observed in each time period. No observations were made at night.

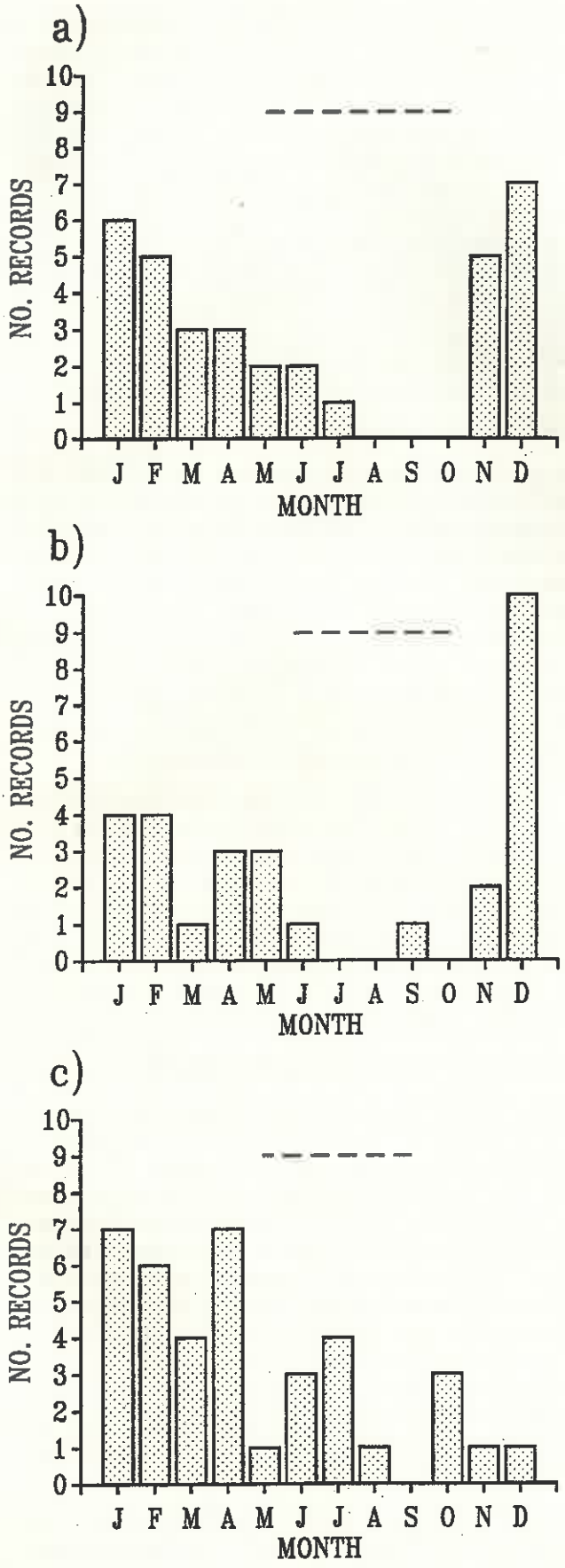

Fig. 5. The timing of dated sightings of *C. scutulata* in the literature for a) Thailand, b) Myanmar and c) India. If several birds were seen together, this counts as one sighting. Dashed line indicates the timing of the wet season.

November to March when they were using more open, seasonal swamps. During the early dry season, birds were seen most often on small forest ponds, whilst towards the end of the dry season they were hardly seen at all. Local reports suggest that at this time they may move to permanent swamps less accessible to humans.

3.3 BREEDING BIOLOGY

3.3.1 Breeding season

In Bangladesh, Husain & Haque (1982) found the breeding season lasted from March to the end of July, with a wet season from April to November. They found three nests in use: in April 1977 with three eggs, in April 1978 with seven eggs and in June 1977 with four eggs. In mid July 1976, two groups of ducklings that had already fledged were seen at different places (Husain 1977). In captivity, eggs have an incubation period of about 33 days, and chicks take about 14 weeks to fledge (Mackenzie & Kear 1976). This suggests that laying begins in March at the very end of the dry season, and continues until May or June, whilst hatching occurs from April onwards to coincide with the early wet season.

Baker (1908, 1929) referred to a nest with one egg found on 30 June in the hills of North Cachar, India, which was assumed to be of *C. scutulata*. The size of ducklings taken from the wild in Assam for captive breeding in 1969-1975 suggests that laying occurs up to the end of June or early July (Mackenzie 1975). Gee (1958) stated that breeding is believed to occur from May to August. In captivity in Assam, laying begins between 18 March and 4 June (Mackenzie & Kear 1976). A pair of adults with four chicks was seen in Phu Khieo WS, Thailand, on 20.7.90 (Round 1990). A female adult with six ducklings was seen in June 1959 at Pidaung sanctuary, Myanmar (Milton & Estes 1963). Again, these data suggest that breeding in India, Thailand and Myanmar is timed so that hatching occurs in the early phase of the wet season, which begins in May (Fig. 45. Food availability for this duck species that specialises in feeding in shallow water is likely to peak in the wet season when floods increase the area of available habitat.

Information on breeding in Indonesia comes from southern Sumatra and Java. Hoogerwerf (1949, 1950) suggested that *C. scutulata* breeds in the wet season, laying from December to February. He referred to two clutches of unknown size collected in Central Java in February, and unspecified numbers of clutches found in southern Sumatra in December, January and February. Hoogerwerf received local reports from Lampung that eggs are laid at the height of the wet season when rivers are most flooded. Holmes (1977) was shown a clutch of eight eggs in S. Tulang Bawang on 15.1.77, but these were probably eggs of the domestic muscovy duck *C. moschata* (Lambert 1988).

Local reports of young birds in southern Sumatra are: adult with two young and family of seven young in S. Tulang Bawang, January 1977 (Holmes 1977); pair with young one October in Way Kambas NP (Ounsted 1985); pair with four young October 1985, and pair with two young September-November 1985 in Way Kambas NP (Lambert 1988). Con-

3.4 GROUP SIZE AND MATING SYSTEM

All the observations of breeding activity by Husain & Haque (1982) indicated a monogamous mating system, with three pairs being closely studied. Robinson, Gee, Mukherjee, Mackenzie & Kear and other authors state that birds are usually seen singly or in pairs, with occasional larger groups being seen. This is confirmed by quantifying the sightings of adult *C. scutulata* in the literature from India, Myanmar, Thailand and Indonesia. These indicate that single birds and pairs are the most common group size, whilst groups of three or more are rarely seen (Fig. 6). This suggests a monogamous mating system and, since most continental sightings occur in the dry season of November to April, is consistent with a possible long term or even continuous pair bond through most of the dry season followed by breeding around the beginning of the wet season.

Eleven is the largest group reliably recorded (Parsons 1940). Hoogerwerf (1950) reported that from December to February in southern Sumatra *C. scutulata* was usually seen in pairs, but sometimes in loose groups of up to ten. The character of these larger groups is unknown, but some are thought to be families that have not split up. Delacour & Jabouille (1931) stated that *C. scutulata* lives in pairs or in families. In Bangladesh Khan (*in litt.* 1991) saw both parents together with fledglings. In India Mackenzie & Kear (1976) suggest that large groups are usually family parties seen after the breeding season from about June to October. However, groups of up to nine were also seen later in the dry season feeding together in wetlands but arriving and leaving in pairs. These may be unrelated groups involved in courtship activity or formed by necessity because of the shortage of feeding habitat at that time of year. Husain & Haque found that one to six birds roosted or fed together in the same area outside the breeding season. In 1976 five adult birds were once seen in the same tree (Husain 1977).

Chambers found that about 95% of their sightings were of one or two *C. scutulata* (Table 4). Over 60% of all sightings were of single ducks and 67% of all ducks found feeding on ponds or swamps were single. Only in Rawa Gajah in December to

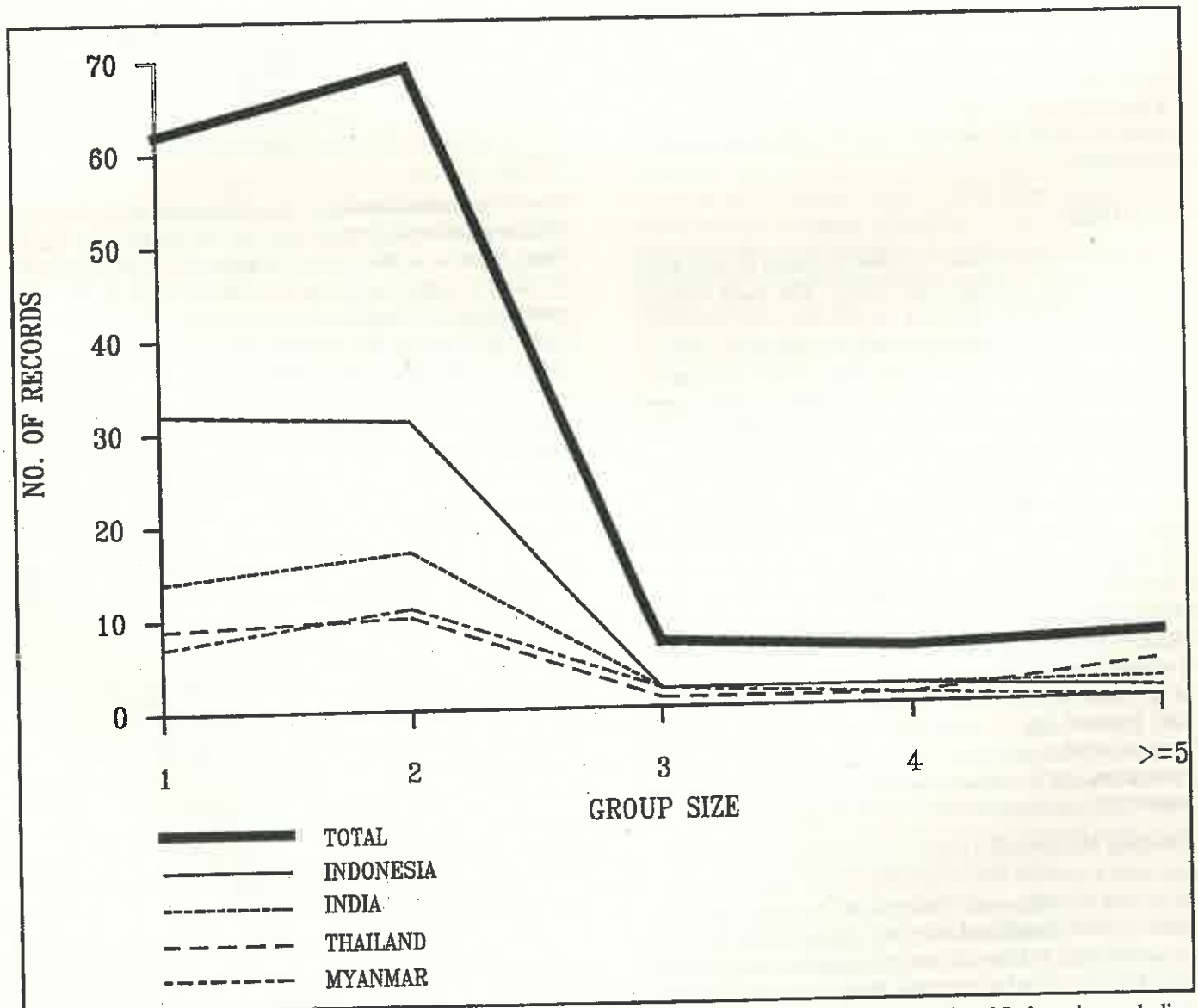

Fig. 6. Known group sizes of *C. scutulata* sightings in the literature for India, Myanmar, Thailand and Indonesia, excluding unreliable records, those of adults with ducklings and those in Sumatra by Chambers (1990). Where authors give only the maximum group size seen, these data are excluded.

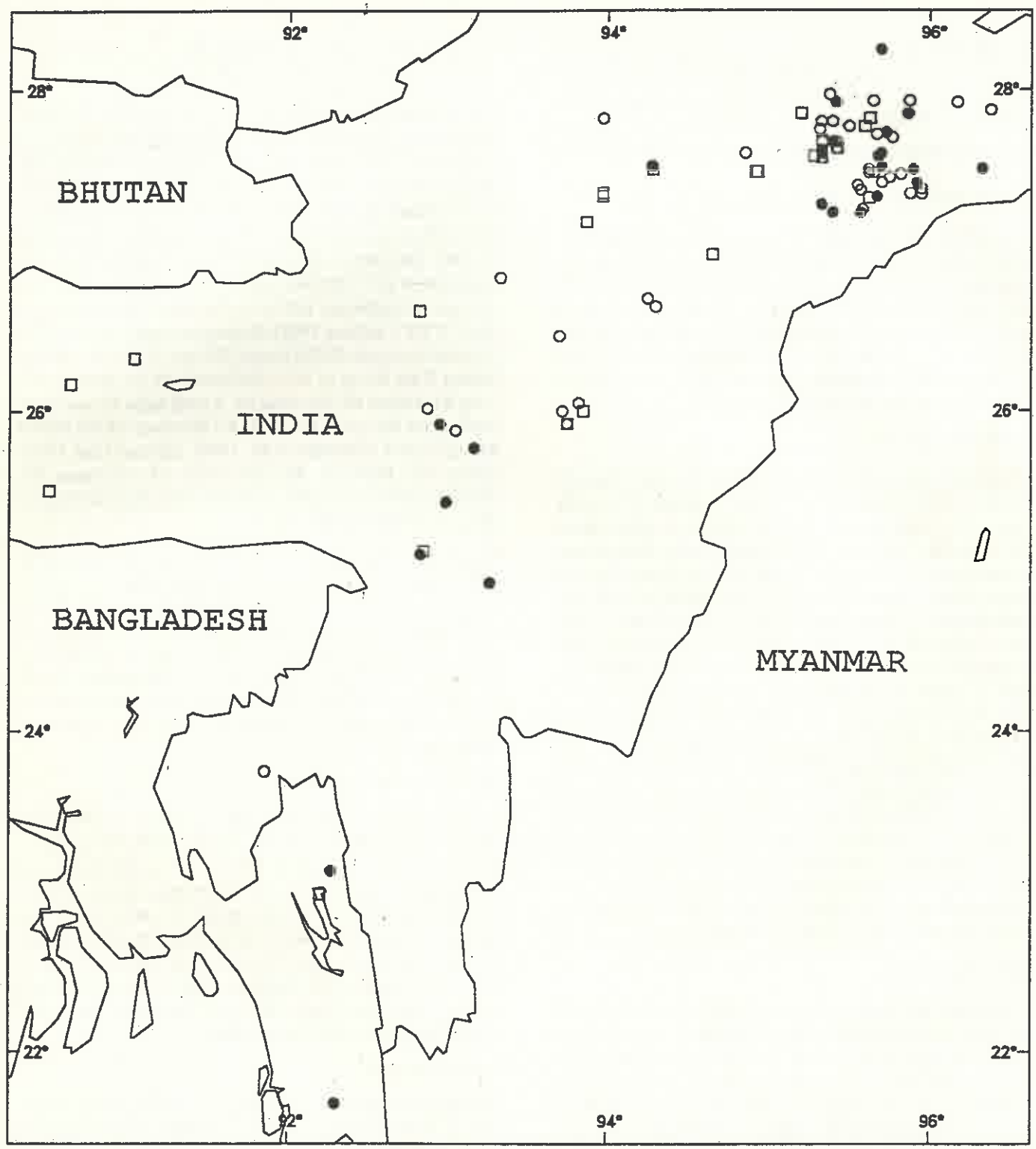

Fig. 7. Records of *C. scutulata* in India (top) and Bangladesh (bottom). Open squares indicate records pre 1940 or undated, open circles 1940-1980 and solid circles post 1980. Unreliable records are excluded, as are some reliable records that lack coordinates (e.g. in Manipur). See 4.10 and 5.10 for details of records.

eastern hills in 1925, and of a single bird and pair on a chain of bheels South-east of Imphal in 1931-1932 (Huggins 1933).

4.2.8 Madhya Pradesh

Unreliable report ("probably incorrect", Baker 1908) of one in a tank in Bilaspur District before 1900 (Young 1900). This location is 500 miles South-west of the confirmed sightings in North-east India.

4.2.9 Chota Nagpur

Possible sighting of four at Sini, Singbhum before 1897 (Baker 1897), 300 miles South-west of the confirmed sightings in North-east India.

4.2.10 West Bengal

Probable sighting of one on the Neora river, Jalpaiguri District, before 1920 (Inglis *et al.* 1920).

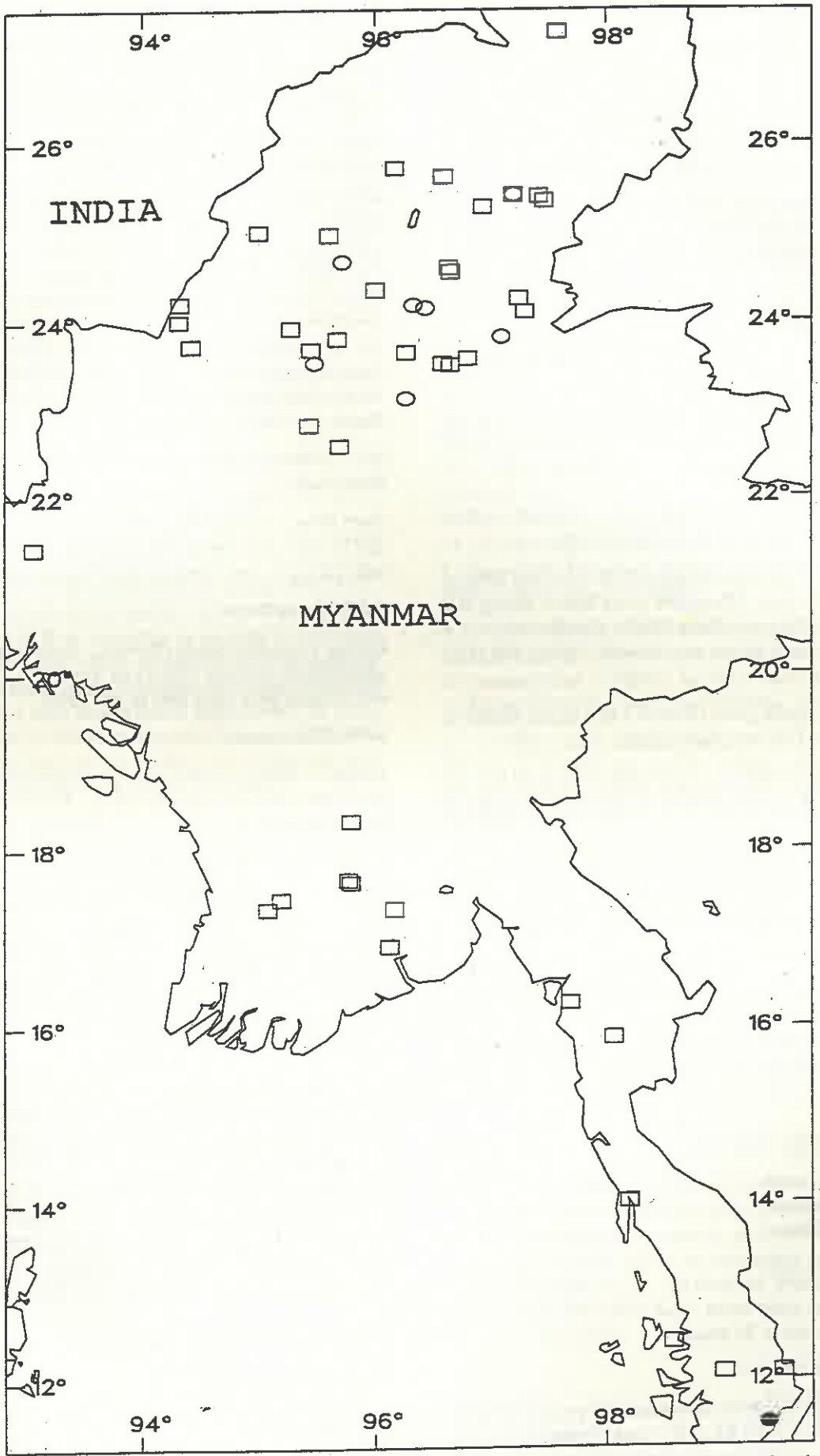

Fig. 8. Records of *C. scutulata* in Myanmar. Open squares indicate records pre 1940 or undated, open circles 1940-1980 and solid circles post 1980. Unreliable records are excluded, as are some reliable records that lack coordinates. See 6.10 for details of records.

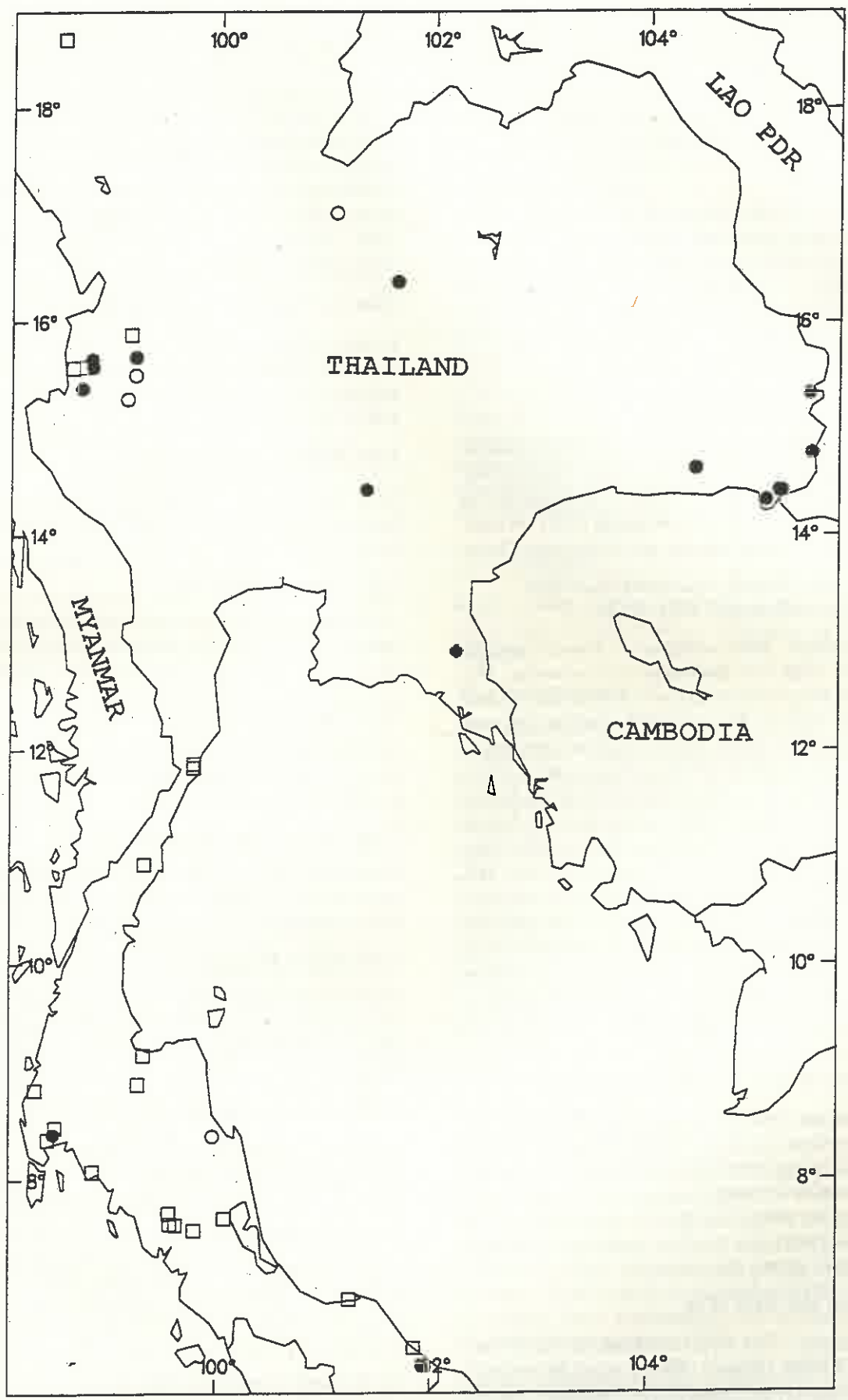

Fig. 9. Records of *C. scutulata* in Thailand. Open squares indicate records pre 1940 or undated, open circles 1940-1980 and solid circles post 1980. Some post 1980 records are based on local reports that have yet to be confirmed (see text). See 7.10 for details of records.

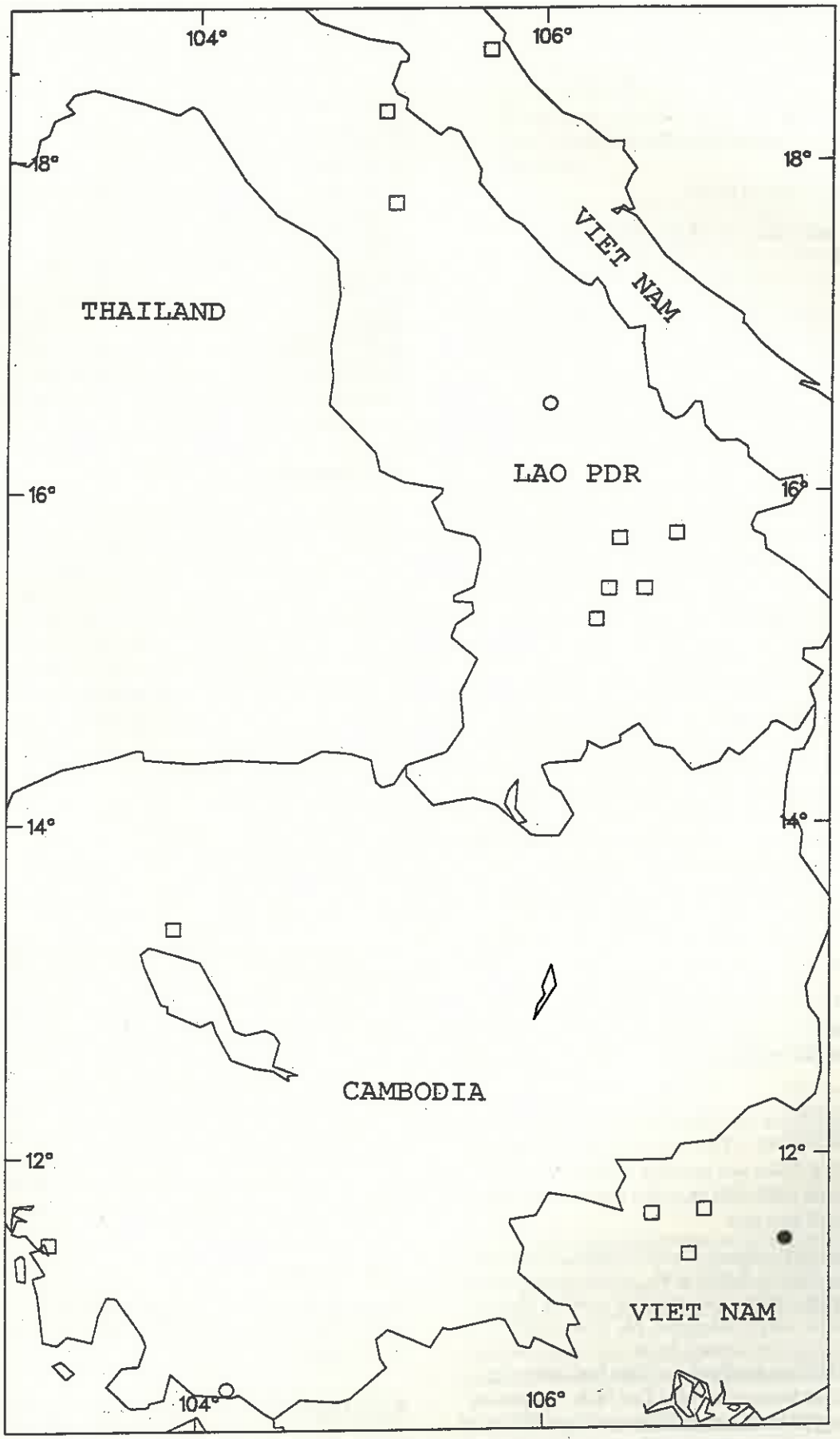

Fig. 10. Records of *C. scutulata* in Lao PDR, Viet Nam and Cambodia. Open squares indicate records pre 1940 or undated, open circles 1940-1980 and solid circles post 1980. Some Cambodian records lacking coordinates are excluded. See 8.10, 9.10 and 10.10 for details of records.

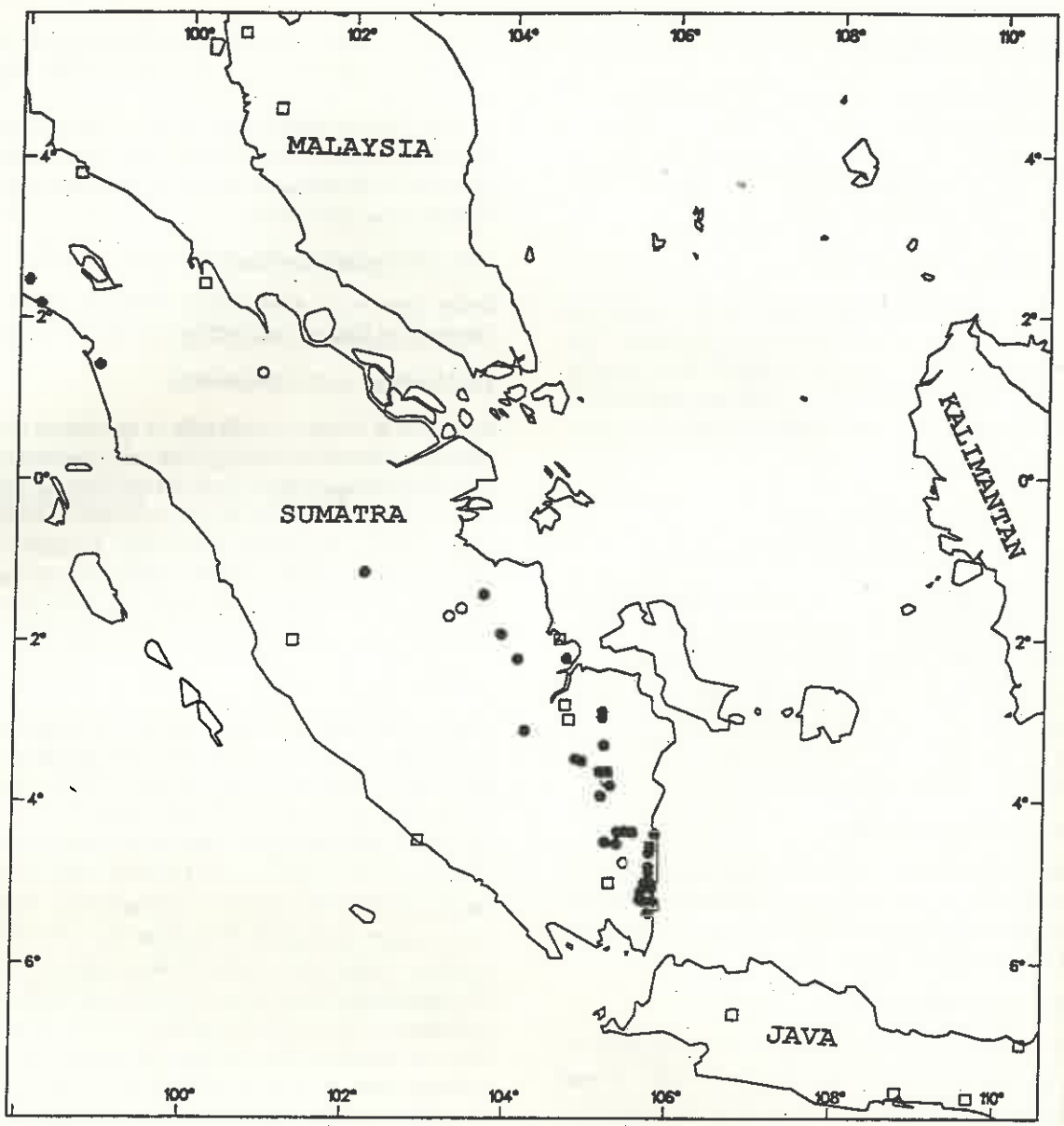

Fig. 11. Records of *C. scutulata* in Malaysia (top) and Indonesia (Sumatra left, Java right). Open squares indicate records pre 1940 or undated, open circles 1940-1980 and solid circles post 1980. Unreliable records are excluded, as are some reliable records that lack coordinates. See 11.10 and 12.10 for details of records.

On the basis of evidence from the past two decades (see below), Freshwater and Peat Swamp Forest are regarded as the major habitat of *C. scutulata* in Indonesia. According to maps of original vegetation (Mackinnon & Mackinnon 1986), swamp forest was particularly abundant in eastern Sumatra, and is likely to have been the major terrestial habitat for the birds found in Riau, Jambi, Sumatra Selatan and Lampung Provinces. There were also bands of this forest near other *C. scutulata* records along the east coast of Utara Province in North Sumatra, in Bengkulu and in the valleys of the western mountains.

Owing to its drier climate, Java had less swamp forest, and the Javan *C. scutulata* population was probably not wholly associated with this forest type. Records from Bogor, Lake Garang and Kebumen were probably from Tropical Wet Evergreen or Tropical Semi-evergreen Forest. The most recent reports came from Ujung Kulon NP, which contains only 800 ha of Freshwater Swamp Forest but 40,800 ha of Wet Evergreen Forest.

12.3.2 Wetlands

According to Hoogerwerf (1950), in southern Sumatra *scutulata* was found in freshwater marshes and swamp fore the interior, and was not present along the coast or in bra wetlands. The first detailed description of wetlands used *scutulata* is given by Holmes (1976; 1977). These sightings made in degraded habitats, and are discussed below.

12.3.3 General Terrain

The great majority of *C. scutulata* records come from low plains of less than 100 m elevation.

12.4 CURRENT DISTRIBUTION

Since 1980 all records of *C. scutulata* have come from Sum (Fig. 11) and the species is probably extinct in Java. Th confirmed record from Java was in 1907, and the last local

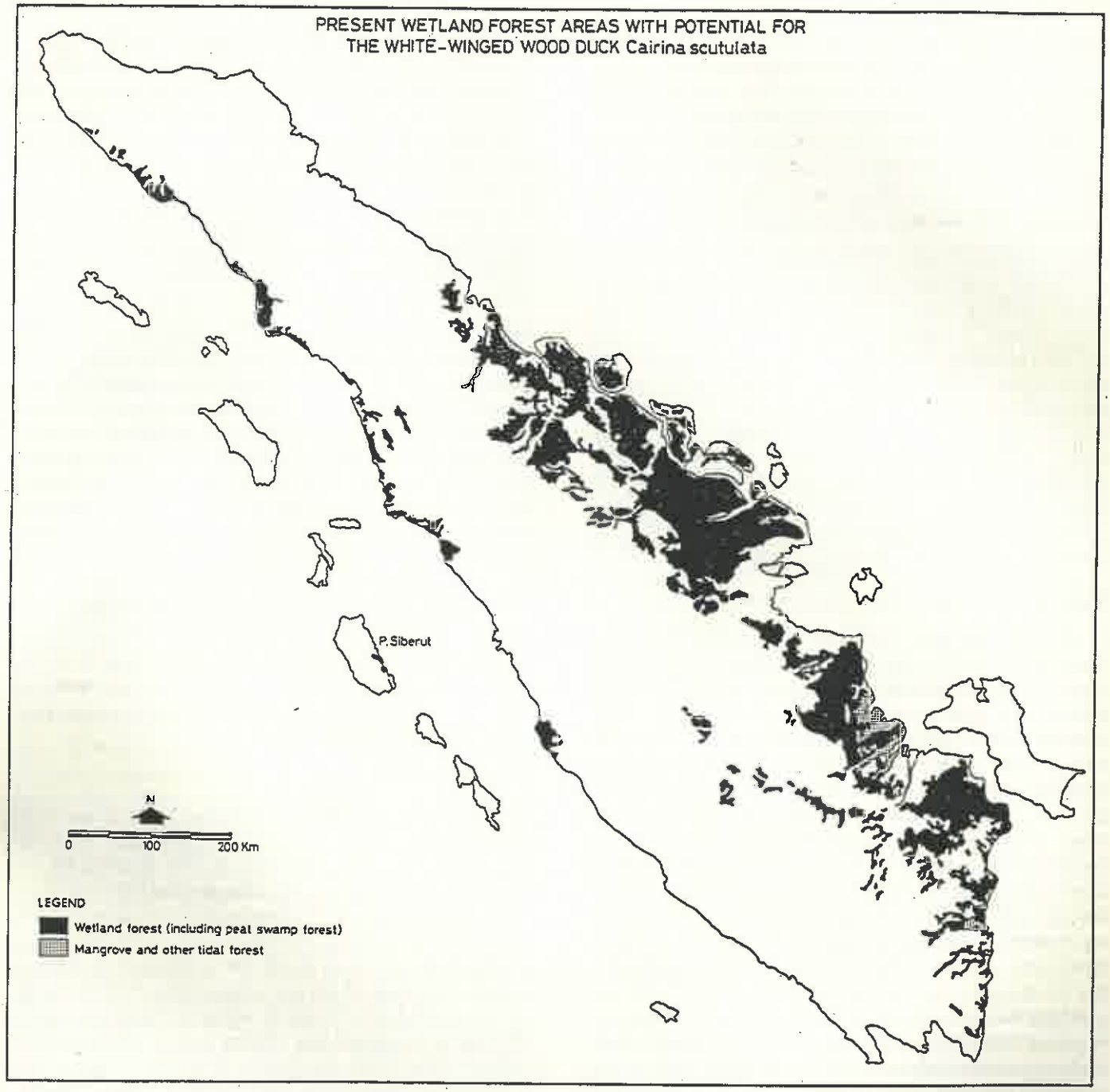

Fig. 12. Present distribution of wetland forest in Sumatra (prepared by M.J. Silvius and based largely on RePPProT 1988).

disturbance at times, and Holmes (1977) found that it was reported to breed within shouting distance of large villages. In Jambi, he found birds feeding in daylight within 70 m of three occupied huts.

All recent records of *C. scutulata* are from coastal plains at an altitude of below 100 m Lambert (1988) showed that his sightings and those of Holmes (1976, 1977) in Sumatra are all within 10 km of permanent water-logged plain, suggesting a strong dependence of the species on permanently flooded, non-acid freshwater swamps close to forest. These plains had mostly been mapped as "Klaru Land System" or "Herbaceous Hygrophytic Communities" (Laumonier 1983, 1986; Lambert 1988; RePPProT 1988). However, birds recorded at S. Tapus, Sumatra Utara Province, were in an area of very acidic coastal swamps (Holmes 1990).

12.5.2 Wetlands

As a consequence of an association with water-logged areas, almost all Lambert's and Holmes's records of birds not in flight came from coastal and inland riverine freshwater swamps ranging in size from 0.5 to several km^2. In South-east Sumatra there is a wet season from November to March, and a dry season from May to October, and these swamps are flooded seasonally, reaching a maximum depth of 1-3 m in December and January. Swamps within the permanent water-logged plain are often permanent, but other swamps dry out completely during the dry season. All swamps where *C. scutulata* was reported contain sedges and grasses that grow when indundated, and typically protrude up to 50 cm above the

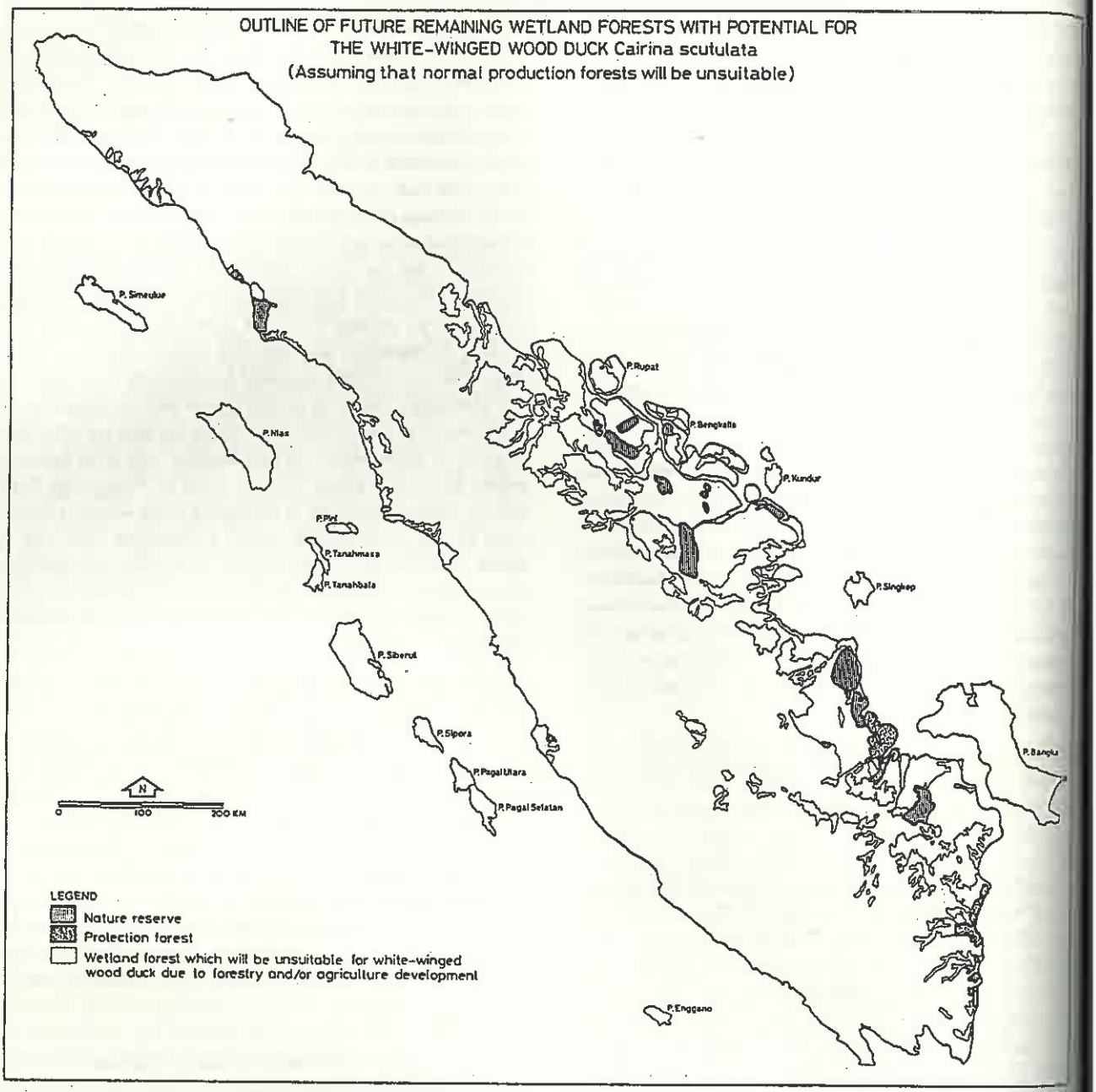

Fig. 13. Future distribution of wetland forest in Sumatra, predicted to be reality by 2015 (prepared by M.J. Silvius and based largely on RePPProT 1988).

line. In January 1977 a family of seven ducklings was caught in Lampung, where villagers used strong lamps at night to net the ducklings of the Lesser Whistling Duck *Dendrocygna javanica* and possibly also *C. scutulata*. Villagers also took the eggs of *C. scutulata* for food (Holmes 1977). Rudyanto (*in litt.* 1990) found that a hunter from near Lahat, Lampung, used nets to catch *D. javanica*, taking the occasional *C. scutulata*.

Lambert found evidence that birds are sometimes caught for trade. At Bujung Tenuk on S. Tulang Bawang, Lampung, a villager reported that a westerner had paid him for one bird and an unknown number of eggs in 1985. Kuah (*in litt.* 1991) saw four birds on sale at a Java bird market in 1991.

12.6.4 Pesticides

Ducks feeding in paddy are at risk from the variety of pesticides in use in Sumatra.

12.6.5 Way Kambas NP

From 1968 to 1974 Way Kambas NP was opened up for commercial forestry. In the next eight years there was much illegal logging by local people who settled in the reserve. In 1984 the reserve became strictly protected and the villagers were evicted. By then, almost all primary forest was gone, and about half the reserve had been overtaken by Alang-alang *Imperata cylindrica*, preventing forest regeneration. Most of the forest destroyed was dryland forest rather than swamp forest, but this habitat destruction has probably contributed to the reputed decline in abundance of *C. scutulata* in recent years. Less than 30% of the reserve area is now suitable for duck (Silvius *in litt.* 1991). Another probable cause of decline is deforestation around the reserve and drainage of surrounding swamps during the past decade. All the surrounding forest that remains is being clear felled (Chambers 1990).