Threatened Birds of Asia:
The BirdLife International Red Data Book

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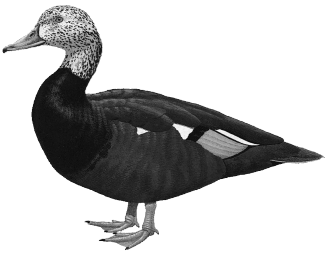
WHITE-WINGED DUCK
Cairina scutulata



Critical □ —
Endangered ■ A1c,d; A2c,d; C1; C2a
Vulnerable □ D1

This forest duck qualifies as Endangered because it has a very small, rapidly declining, severely fragmented population as a result of deforestation, wetland drainage and exploitation.

DISTRIBUTION The White-winged Duck (see Remarks 1) was historically distributed widely from north-east India, through Bangladesh, Myanmar, Thailand, Laos, Vietnam, Cambodia and Malaysia, to the Indonesian islands of Sumatra and Java (see Remarks 2). It now survives in relatively few scattered sites, having disappeared from many portions of its previous range.

■ ***INDIA*** The species was "formerly widespread" in north-eastern India (Green 1992a), particularly in districts and states bordering the Brahmaputra river and its major tributaries (see Choudhury 1996d,e). It has been recorded from Arunachal Pradesh, Assam (mainly in the east and patchily elsewhere), Meghalaya, Nagaland and Manipur (no recent records from the latter two states), with its distribution currently centred on the eastern lowlands of Assam (see map of current sites in Choudhury 2000c) and Arunachal Pradesh. It has also been inconclusively reported from Madhya Pradesh, Bihar, West Bengal and Tripura. In the following account, several older, generalised localities have been omitted when they have been superseded by more specific information; moreover, there may be many overlaps undetectable as a consequence of use of slightly different formulations of names, including spellings. Records are as follows:

■ *Arunachal Pradesh* **Mehao Wildlife Sanctuary**, small numbers reported along the lower Dri river, 1989 (Scott 1989), a maximum population of 10–16 (but possibly much fewer) estimated for the whole reserve, 1990 (Green 1992a), with two seen near Bijari, March 1993, and two in January 1994 (Choudhury 1995a, 1996e); **Dibang Reserve Forest**, one in 1989, and two near Khelbari, 1990 (Choudhury 1996e); **D'Ering Memorial Wildlife Sanctuary**, April and/or May 1986–1988 (Green 1992a), a population of 10 estimated, 1990 (Pandya 1990), or four (Green 1992a), and still present, 1996 (Barman 1996); near **Anpun**, south-west of Bijari, two, 1991 (Choudhury 1996e); **Tezu**, Lohit district, one pair, January 1947 (Ali and Ripley 1948, 1968–1998); between Anpun and **Paglam**, Tinali, two, November–December 1992 (Choudhury 1996e); **Brahmakund**, Lohit district, one pair, January 1947 (Ali and Ripley 1948, 1968–1998); Tirap river, near **Namsai**, one, c.1956 (Mukherjee 1961), and a "good number" of birds reported at Namsai Reserve Forest, 1975 (Green 1992a); **Noa Dihing river** (Noadehing, Noadihing), 1967 (Savage and Mackenzie 1967); **Namdapha National Park**, flock of seven in February 1988 (Singh 1989), probably along the Noa Dihing at the lowest elevations of the park (Scott 1989), one in flight upstream at Vijayanagar Station, March 1988 (Ripley *et al.* 1991), and two at Rani jheel, November 1990 (Green 1992a), leading to estimates of 7–10 in the park (Green 1992a), with more recent records from the "M-Pen Nala" area, 1993 (Yahya 1994), two elsewhere, January 1993 (Choudhury 1996b), two, April 1997 (J.-C. Kovacs *in litt.* 1998), five, December 1997 (A. Choudhury *et al.* 1999), and two at Embeong, December 1997 (A. Choudhury *et al.* 1999); Subansiri Frontier Division (Subansiri district), reported in 1975 (Green 1992a), and seen at least twice on the **Subansiri river**, Arunachal Pradesh–Assam border, 1986–1987 (Green 1992a); **Kharsang**, Changlang district, one each in early 1980s and 1990s (Choudhury 1996e); Namsangmukh Reserve Forest, Tirap district, at Dirak or Namsang beel, two, 1991, two, April–June 1993, and near **Namsangmukh** village, five, January–February

1993 (Choudhury 1996e); **Pakhui Wildlife Sanctuary**, two, January 1991, April 1992 (Choudhury 1995a); **Namtok**, near Assam–Arunachal Pradesh border, Changlang district, 3–4, 1993 (Choudhury 1996); **Zedua Basti**, Tirap district, 4–5, 1993 (Choudhury 1996e);

■ *Assam* **Singpho**, one caught at night, January 1961 (Mukherjee 1961); **Kundil Kalia Reserve Forest**, two estimated, 1976 (Pirie and Choudhury 1976); **Sadiya Station Reserve Forest**, two estimated in 1976 (Pirie and Choudhury 1976), one seen, 1978 (Green 1992a); **Kukurmara Reserve Forest**, two estimated, 1976 (Pirie and Choudhury 1976), reportedly heard in 1981 (Green 1992a); **Sadiya**, one, undated (Baker 1908), many records, 1900–1905 (two specimens in BNHS, Baker 1908), found on most forested wetlands, with the largest flock containing 11 individuals, undated (Parsons 1939); **Lohit river**, two, February 1992 (Choudhury 1996e); 1 km from **Poba river mouth**, north bank of Brahmaputra, c.1940 (Mukherjee 1961), and Kobochopri/Poba river, 1967 (Savage and Mackenzie 1967), presumably in or near Kobo-Pobo Wildlife Sanctuary; **Dollah**, near Saikhowa, May 1877 (female in BMNH, Hume 1888); **Dhulajan**, four, May 1991 (Green 1992a); **Hahkhati Reserve Forest**, 1988 (Choudhury 1996e); **Kumsong Reserve Forest**, two, November 1974 (Chanda 1975), an estimate of two, 1976 (Pirie and Choudhury 1976), a recent sighting reported c.1986 (Green 1992a), four eggs in 1991 (Choudhury 1996e), and at Nao Nadi, two, c.1974 (Chanda 1975); Mesaki Reserve Forest and Mekati Reserve Forest, two estimated in 1976 (Pirie and Choudhury 1976), two reportedly killed for food at the former in 1978 (Green 1992a), and 4–5 in the **Mesaki** area, 1980–1981 (Choudhury 1996e); **Burhi beel**, four ducklings captured, 1974 (Chanda 1975) and three in 1981–1982 (Choudhury 1996e); **Dibru-Saikhowa National Park** (see Remarks 3), Tinsukia and Dibrugarh districts, extensively, 1940s–1990s (Gee 1958, Mukherjee 1961, Pirie and Choudhury 1976, Green 1992a), with numerous subsites including (maximum number recorded in brackets afterwards, all stemming from the 1990s) Amguri (3), Baghjan (1), Bhokboki (–), Borbhanga Beel (2), Dighali Beel (4), Dighaltarang (2), Garo Nala (11), Hatighuli (2), Houlmari Hula (6), Kaitia (5), Kochuoni Pathar (nest), Kolomi (including Kolomi Tiniali, Kolomi Nala, Kolomi Beel and Kolomi Camp) (5), Lower Salbeel (4), Mora Dolki (2 plus nest), Mukchung Bam (2), Nahoronijan (1), Pani-Kauri Pathar (2), Raidang Beel (2), Salbeel (3), Schoolgora (2) and Western Torali (2) (Choudhury 1996e, supplemented by Green 1992a, Yahya 1994, Choudhury 1995b), plus Rungagora, March 1901 (female in MCZ), February 1902 (female in BNHS, Stevens 1914–1915), February 1904 (male in YPM), Gurrung Jan (Garamjan), a flock of five, and Paropara Jan, 1901–1911 (Stevens 1914–1915), Laikajan river, reportedly "common", c.1930 (Mukherjee 1961), Guijan, two pairs, 1969–1970 (Mackenzie 1975); **Dangori Reserve Forest**, one duckling, 1989, Hanhchara area, two, c.July 1992 (Choudhury 1993b), Dubajan, one duckling, around July–August 1992, one, November 1992, Sessajan area, two, December 1992 (Choudhury 1993b), Lohali area, three, November–December 1992 (Choudhury 1993b), 14 then seven, November 1995 (Choudhury 1996e), western portion, one, December 1992 (Choudhury 1993b), west of Kakopathar Division Block Office, two, November 1995 (Choudhury 1996e), and nearby Dangori Tea Estate, two, November 1992 (Choudhury 1993b); **Koliapani beel**, three, 1993 (Yahya 1994); **Dum Duma Reserve Forest**, March 1902 (female in AMNH), six young taken for captive breeding in 1969 (Mackenzie 1970), up to 10 seen at once in 1970 (Scott and Mackenzie 1970) and extensively in recent years, with numerous subsites including (maximum number recorded in brackets afterwards, all stemming from the 1990s) Kachijan or Kasijan (in Ghulajan or Ghotojan area) (4), Litong (17), Nam-Hulung (nesting), Romai-Gabharu (6), Sookerating Nulla (3, nesting), Tejigaon (12, nesting) and Ubhata (8) (Choudhury 1996e supplemented by Green 1992a, Yahya 1994, Talukdar and Bhattacharjee 1995b), and also nearby in the adjacent proposed Mohong Reserve Forest, several, 1970 (Scott and Mackenzie 1970); **Jamjing**, Jiadabl and Buri Suti area, 1956 (Scott and Mackenzie 1970); **Phillobari** area, including Phillobari Reserve Forest and tea estate (adjacent to Dum Duma Reserve Forest), up to six, 1958–1989 (Gee 1958, Mackenzie 1970, Scott and Mackenzie 1970, Green 1992a), a population of two estimated

in the Reserve Forest (Green 1992e); **Sotingjan** (Sotinganj), near Kolakhowa, six ducklings, summer, 1992 (Choudhury 1996a), up to 10 seen, 1970 (Scott and Mackenzie 1970), two pairs, 1975 (Mackenzie 1975), up to four pairs, 1976 (Pirie and Choudhury 1976), seven, April 1985, flocks of eight and nine, 1985 (Mackenzie 1985), five, May 1991 (Green 1992a); **Bordubi tea estate**, adjacent to Dum Duma Reserve Forest, five roosting above captive birds in aviary, March 1986, and an unspecified number of birds doing the same in 1987, also 3–4 regularly near the aviary c.1990 (Green 1992a); **Dibru river**, probably within or adjacent to present-day Dibru-Saikhowa National Park, two between 1900–1903 (Baker 1903), common, with largest flock seen containing seven individuals, 1897–1908 (Baker 1908), and near Nazirating, boundary of Kakojan Reserve Forest and Upper Dihing (East Block) Reserve Forest, two, 1986–1987, two, 1990–1991 (Choudhury 1996e); **Duarmora Reserve Forest** (Dauramara, Duarmara), 13–14 fledglings, 1968–1971 (Choudhury 1996e), with records from the "Duarmara" area, two, August 1968 (Mackenzie 1969), a population estimate of 14 in late 1969, with eight, mid-January 1970, and two pairs, May 1970 (Mackenzie and Kear 1976), one family group of 12, 1975 (Mackenzie 1975), two males and a female, September 1975 (Mackenzie 1975), two, 1976 (Pirie and Choudhury 1976), seen in 1981 (Green 1992a), and four at Kathalguri Pathar, October 1988 (Green 1992a); **Tinkopani Reserve Forest**, two, 1990–1991, two, 1992, two, 1993, two and 4–5 ducklings, June 1993, two, August–September 1993, two, May and June 1994 (Choudhury 1996e), including the Namchik river, 1992 (Choudhury 1996e); **Derpai** (Dirpai), 1901–1911 (Stevens 1914–1915); **Dibrugarh**, not uncommon resident in adjacent "heavy forest jungles", around 1900 (specimens in AMNH, BMNH), sometimes flying over the town, undated (Oates 1898–1899, Baker 1908), fairly common in the district (Hume and Marshall 1879–1881, Stevens 1914–1915); **Kakojan Reserve Forest**, about four reported, 1976 (Pirie and Choudhury 1976), recent reports (Choudhury 2000c); **Burhi Dihing river** (Buridihing river), reportedly "common", c.1930 (Mukherjee 1961), and in Burhi Dihing Reserve Forest, two estimated, 1976 (Pirie and Choudhury 1976), and a female and duckling reported in 1980 (Green 1992a); **Pengari Reserve Forest** (Pengeri), four young birds taken from forest near Pengari Tea Estate for captive breeding in September 1969 (Mackenzie 1970), also three pairs, 1970 (Mackenzie 1975); **Namphai Reserve Forest**, one at Namchick stream, February–March 1961 (Mukherjee 1961), and a pair in 1975 (Mackenzie 1975), with two elsewhere in 1976 (Pirie and Choudhury 1976), another two around 1990 (Choudhury 1996e), also at nearby Namchick Reserve Forest, Changlang district, two in October 1990 (Green 1992a); **Simoluguri Chuk**, October 1993 (Choudhury 1996e); **Upper Dihing (East Block) Reserve Forest**, since at least 1969 into 1990s (Mackenzie 1975, Pirie and Choudhury 1976, Choudhury 1996e), with subsites including (maximum number recorded in brackets afterwards) the "Bogapani side" (8, 1969–1970), and (all stemming from the 1990s) Dilpi (8, breeding), towards Khatangpani (5, breeding), Pengeri Gate (4) and Rig 650 (3) (Choudhury 1996e), plus Enthem (2), 1971 (Choudhury 1996e); **Deohal**, Tinsukia district, August 1901 (male in AMNH); **Upper Dihing (West Block) Reserve Forest**, since at least 1975 into 1990s (Pirie and Choudhury 1976, Choudhury 1996e; also Mackenzie 1975), with subsites including (maximum number recorded in brackets afterwards, all stemming from the 1990s) Balijan (2, breeding), Bandormora Ghuli (–), Borjan (presumably also Jorajan) (in Choraipung or Choraipani) (8, breeding), Burkhi-Dihing river (presumably the Burhi Dihing) near Kurka (–), Dekhiajan (–), Digboi Nadi (2, breeding), Dighal Chot (–), Erali Hola (–), Janglu Nadi (10–12 pairs), Kaladubi (2), Kheto Nadi (3–4), Khatangpani Nullah (2), Kopohuagaon (–), Mothla Nogabari (2), at and near Nagajan (7–8, breeding), Pawoi Nadi (8, breeding), Tel Nala (–) and Tipling Nadi (–) (Choudhury 1996e, 1997), with records just outside at Dhobi Nala (–) and Pawoimukh (–) (Choudhury 1996e); **Kotha Reserve Forest**, two, 1990–1991 (Choudhury 1996e); **Bajaloni**, two, 1992–1993 (Choudhury 1996e); **Digboi**, Borjan (Borajan)–Digboi road, seen twice, 1943–1947 (Mukherjee 1961), Digboi town, occasional reports around 1958 (Gee 1958), the Sookerating–Digboi area, a few birds killed in 1966–1968 (Savage and Mackenzie 1967, Mackenzie 1969), 12 (ducklings) near Digboi

in 1992–1993, one, March 1993, two, December 1993, two, February 1994 (Choudhury 1996e), and at Digboi Oil Fields, 1996 (D. Allen verbally 1999); Tirap river, Tinsukia district, 1950s (Green 1992a), and in **Tirap Reserve Forest**, two, 1976 (Pirie and Choudhury 1976); **Bogapani** (close to Upper Dihing Reserve Forest), one male at the tea waste destruction pond, December 1968 (Mackenzie 1969), three young, September–December 1969 (Mackenzie 1970), 2–3, c.1990 (Green 1992a); **Namdung** (Namdang) **Reserve Forest**, Dibrugarh district, two, 1991 (Choudhury 1996e); Diju (Dejoo), four, August 1908 (Stevens 1914–1915), and **Joyhing**, Diju river (Dejoo), January 1909 (Stevens 1914–1915); **Margherita**, December 1902 (male in SMF), January 1904 (male in MCZ); **Dirak Reserve Forest** (Dirok), a pair, 1975 (Mackenzie 1975), one adult and five eggs, 1985 (Choudhury 1996e); at Tipam river (apparently near Tipam bridge), two reported, 1967–1968 (Choudhury 1996e), and elsewhere in **Joypur Reserve Forest**, Dibrugarh district, reported in winter 1985 (two pairs) and October 1990, with several wild-caught birds reportedly sold for food at nearby Naharkatiya (Naharkatia), 1990 (Green 1992a), c.19 estimated (Choudhury 1996e); **Laluk**, April 1911 (Stevens 1914–1915); Behali Reserve Forest, one or two pairs, 1958 (Gee 1958), this area now inside **Nameri National Park**, where recorded in 1990s at numerous subsites including (maximum number recorded in brackets afterwards, all stemming from the 1990s) Arasuti (7), Balipung Nala (4), Kaliajuli (1), Karisuti (3), Khari river (9), Kharimukh (4), Kharinadi (3), Kurua beel (1), Magurmari beel (10), Morisuti camp (5) and Upper Dikorai (12) (Das 1995), the total population thought to be around 30 individuals (Choudhury 2000c); **Ranga Reserve Forest**, a few pairs, 1958 (Gee 1958); **Duklingia tea estate** near Mariani, Jorhat district, three shot, 1950s (Green 1992a); **Majuli beel**, Moriani range, Jorhat district, a pair, 1953 (Mukherjee 1961); **Darrang**, "rare", undated (Baker 1908); **Tezpur**, one nearby, undated (Godwin-Austen 1874, Hume and Marshall 1879–1881); Nambar forest (Nambor Reserve Forest, including Nambor Wildlife Sanctuary), an area that covers parts of **Golaghat** and Karbi Anglong district, "found in some numbers", undated (Baker 1922–1930), c.20, 1992–1994 (Choudhury 2000c); **Kaliani river**, Mikir hills, a pair, c.1958 (Gee 1958); **Barpeta district**, two, 1886 (Baker 1908); **Bokajan**, Manipur road, Dhansiri river, 1944–1945 (Mukherjee 1961), 1964 (Green 1992a), 1967 (Savage and Mackenzie 1967); **Diyungmukh**, North Cachar Hills district, breeding, April 1885 (egg in BMNH), undated (Baker 1908; although see Remarks 4); near **Lumding**, a pair on the border of Cachar and Nagaon (Nowgong) districts (the Kopili river), undated (Baker 1908), at Dhulahar, 1967 (Savage and Mackenzie 1967), two at Doboka Reserve Forest, 1979–1980, two reportedly captured at Lanka wetlands, 1982, and one flushed in October 1988 (Green 1992a); Dihangi, lower **Haflong**, one, late September 1983 and reported by villagers to be present in the area in 1990 (Green 1992a); Hollongapar Reserve Forest (not mapped; now Gibbon Wildlife Sanctuary), Jorhat district, recent records (Choudhury 2000c); Kampung beel (untraced), a pair, c.1961 (Mukherjee 1961), this site probably being in Dhemaji district (A. Choudhury *in litt*. 2000); Tikeri (untraced), 1–2 pairs, 1956–1957 (Mukherjee 1961); Sonai-Rupai Wildlife Sanctuary (not mapped), and Balipara Reserve Forest, Sonitpur district, c.10 estimated, and in the same district at Charduar, Naduar and Behali Reserve Forest, 1990s (Choudhury 2000c);

■ ***Meghalaya*** interior of **Garo hills**, one, undated (Godwin-Austen 1874, Hume and Oates 1889–1890); Balpakram National Park (not mapped), 1990s (Choudhury 1996c); Siju Wildlife Sanctuary (not mapped), 1990s (Choudhury 1996c);

■ ***Nagaland*** Naga hills, probably around **Dikhu river** (Bhiku river; see Distribution: India under White-bellied Heron *Ardea insignis*), two, c.1920 (*J. Bombay. Nat. Hist. Soc.* 27: 411); **Dimapur** (Dinapur), Dhansiri river (Dunsiri river), breeding, c.1872 (Godwin-Austen 1874, Hume 1888), February 1900 (two specimens in BMNH), several sightings of pairs, February, July and August 1945 (Hutchinson 1946);

■ ***Manipur*** Changhi (Chungki), here presumed to be **Chingai**, January 1920 (two specimens in BNHS, Abdulali 1968–1996); **Laishan Lokchao**, tributary of Iril river below Laishan, group of three, July 1913 (Higgins 1913b, 1933–1934).

Omitting inconclusive reports from known sites, records here considered unconfirmed include: 1–2 reported at a chain of wetlands south-east of Imphal, Manipur, July 1931 and June 1932 (Higgins 1933–1934); four reported at Sini, Singbhum, Bihar state, undated (Baker 1908); a bird reported to be this species at Neora river, Jalpaiguri district, West Bengal, undated (Inglis *et al.* 1920); one probably seen in the eastern hills of Manipur, July 1925 (Higgins 1933–1934); a reported of being "common" on the Jonai river (Murkog-Selek), c.1930 (Mukherjee 1961); a report from unspecified hilly areas of Tripura, 1940–1947 (Mitra 1957); and over 200 birds (!) in inundated ricefields at Gandhigram, Arunachal Pradesh, March 1991 (Ripley *et al.* 1991); a report from Siang district, Kameng district, with a "good number" at Koriapani Reserve Forest, 1975, and at Injan, Miao subdivision, September 1982, all in Arunachal Pradesh (Green 1992a); a report of one shot at an unspecified locality in Bilaspur district, undated (Young 1900), thought "probably incorrect" (Baker 1908) and "unreliable" (Green 1992a); a report by villagers at Hansara, Sibsagar district, and at North Cachar and Barail Reserve Forests, 1990 (Green 1992a); and two pairs reported at Jiri Reserve Forest, January 1990 (Green 1992a).

■ ***BANGLADESH*** The species is known with certainty only from the Chittagong Hill Tracts of the far south-east. It is also listed as possibly occurring in the north-eastern and north-central regions of the country (Rashid 1967), and there were unconfirmed records in the nineteenth century from the Brahmaputra not far upstream of Dhaka (Dacca) (Hume and Marshall 1879–1881, Baker 1908; see Remarks 5), and Mymensingh district in the 1960s (Mountfort and Poore 1968, Savage and Abdulali in Isakov 1970). If the species ever occurred in these regions it is unlikely to do so today (P. M. Thompson *in litt*. 1998). Rangkheong and Sangu-Mantamuhuri Valley Reserve Forests (further south in the Chittagong Hill Tracts) possibly hold the species but these have yet to be surveyed (Khan 1986b), although two birds were reported from between Lama and Alikadam (at Sangu-Mantamuhuri) in October 1988 (Green 1992a). Records are from: Mainimukh, Chittagong Hill Tracts, 1956–1958, disappearing from this area after inundation of Kaptai (Karnafuli) reservoir (Mountfort and Poore 1968, Husain 1977), but surviving nearby in the **Kasalang Reserved Forest** (Kassalong Reserve), mainly at Pablakhali Wildlife Sanctuary, with records including "one or two pairs", c.1970, 9–10 pairs, 1976 (Husain 1977), c.15 pairs, 1978 (Husain 1989), an estimated 40 present, c.1980 (Khan 1982), but with present status largely unknown (Thompson and Johnson 1996), although the area is reported to have been surveyed more than once in 1998–1999 (P. M. Thompson *in litt*. 1999) with only one sighting reported—two birds just south of Marisya, on Kassalong Khal near the Pablakhali Wildlife Sanctuary, June 1999 (N. J. Ash *in litt*. 1999).

■ ***MYANMAR*** The White-winged Duck was once distributed widely in Myanmar (Peacock 1933), being previously found in nine of the 14 regions into which it is now divided (Green 1992a). Records are from: near **Putao**, on the Mali Hka river, c.400 m, 1932–1936 (Stanford and Ticehurst 1938–1939), and reported from the same area, pre–1977 (Green 1992a); **Jade mines**, Myitkyina district, regularly, 1932–1936 (Stanford and Ticehurst 1938–1939), and elsewhere in the region at Nauya yan (untraced), January 1901 (specimen in BMNH) and at an unspecified locality, Myitkyina district, 1908 (*J. Bombay. Nat. Hist. Soc.* 18 [1908]: 706); **Nanyaseik** (or Naryazeik), Myitkyina district, December 1900 (specimen in BMNH); **Tamanthi Wildlife Sanctuary**, 28 adults, 17 ducklings, July–October 1995 (Saw Han 1996, *Oriental Bird Club Bull*. 24 [1996]: 13–20), including Mayinle lake, near Kaunghein village, 21, monsoon of 1996, one captured prior to 1996 (U Thein Aung *per* Khin Ma Ma Thwin *in litt*. 1997, U Thein Aung verbally 2000); **Pidaung Sanctuary**, seen on the Manaw saltlick, September 1929, "often seen and heard" in December 1933 and seen "on several occasions" in April 1936 (Smith 1942), common in 1932–1936, including April 1936 (Stanford and Ticehurst 1938–1939), also recorded at Namse Reserve (within the sanctuary) in 1939 (U Tun Yin 1960), a female with six ducklings seen in June 1959 at Changnam Water Hole (Milton and Estes

1963, Milton *et al.* 1964), and believed to be still breeding in the area in the 1970s as there were reports of breeding in Kachin state in 1970 and some reported sightings at or near this site in 1974 (U Tun Yin 1977); **Tamanthi**, Upper Chindwin, Sagaing state, December 1903 (female in BMNH); **Mogaung chaung**, common, 1932–1936 (Stanford and Ticehurst 1938–1939), and reported from the same area, pre–1977 (Green 1992a); **Mansi**, and the Uyu side of Mansi, reported pre–1935 (Green 1992a), also apparently breeding at Mansi tract, Bhamo district, 1970 (U Tun Yin 1977); **Kunphe** and nearby Thayetta, Kaukkwe chaung, Sagaing state, Katha district, one at each site, May 1929, with at least three regularly at Mongnaka Sakan at the same time (Smith 1942); **Kalat** (as "Kalata"), Upper Chindwin, December 1903 (female in BMNH); **Kabaw valley**, Sagaing state, Upper Chindwin, pre–1933 (Higgins 1933–1934; also Stanford and Ticehurst 1938–1939); **Bhamo**, two, February 1900 (Evans 1901), and several specimens from around 1909 (presumably including that taken at Sinkan [Sinkin], Bhamo, March 1908 [female in AMNH]) (Harington 1909), and also reported in the Sikaw area, Bhamo district, 1970 (Vincent 1966–1971); **Tamu**, Sagaing state, Upper Chindwin, 1905 (female in BMNH); **Yinke Reserved Forest**, a pair, December 1974 (U Tun Yin 1977); "often seen" along the Mu river, Sagaing, with one shot at **Auk Singwe**, undated (Smith 1942); **Kawlin**, Katha district, one shot, December 1903 (specimen in BNHS, Green 1992a); **Kindat**, Sagaing state, Upper Chindwin, 1908 (Hopwood 1908), with breeding on the Yu river, April 1911 (one egg in BMNH); **Nyaungbinhla** *in* ("*in*" is a small marsh), Katha district, two, December 1931 (Smith 1942); near **Sagagon**, at the mouth of Wai Chaung, a tributary of the Irrawaddy (Ayeyarwady), Katha district, two, December 1974 (with a total of six reported from Katha Township Group) (U Tun Yin 1977); **Hintha**, Sagaing state, Katha district, one, January 1927 (Smith 1942); **Singan**, Shweli river, Shan state (Mongmit state), a pair in February 1927 (Smith 1942); Shweli river, Shan state, four birds at a small marsh, 1916, and a pair between **Mabein** and Kota, on the same river, January 1927 (Smith 1942); **Webaung**, near Shwe-U-Daung Sanctuary, Shan state, one in April 1974 (U Tun Yin 1977); **Upper Chindwin Township Group**, Sagaing state, one, 1895, two pairs, 1920s, and considered "common" (Stanford and Ticehurst 1931, 1938–1939); along the **Mu river**, Sagaing state, Katha and Shwebo districts, before 1942 (Smith 1942); **Shwebo**, 1911 (*J. Bombay. Nat. Hist. Soc.* 20 [1911]: 1184), and 3–4 reportedly shot, pre–1977 (Green 1992a); Kauti, near **Mandalay**, December 1904 (four specimens in BMNH); **Paletwa Township Group**, 1912 (Hopwood 1912b); **Tharrawaddy district**, Pegu (Bago), pre–1914 (specimen in AMNH, Stanford and Ticehurst 1931), but no records over three years in the area during the 1940s (Smythies 1986); **Shwelaung Kodugwe Reserved Forest** (Shwe-Laung-Kodugwe Reserve), Bago state, 1920s (U Tun Yin 1960, Green 1992); **Paunggyi valley**, Insein district, one pair, December 1925 (Stanford and Ticehurst 1931, 1935a), with a pair (perhaps the same) reported in Yangon State, before 1935 (Green 1992a); between **Haungtharaw river** and Ataran river, Kyaikkami district (Amherst district), Mon state, three shot, November 1908 (Macdonald 1909); mouth of **Pyinma chaung**, "Bassein district", four, February 1929 (Smith 1942); **Pakabo Reserve**, Ataran valley, one, April 1923 (Smith 1942); **Tavoy** (Dawe), Tenasserim (Taninthayi), one shot before 1860 (Gould 1859); **Mergui** (Myeik), Tenasserim, 1850, a pair (Blyth 1850); **Thagyet**, Tenasserim, March 1914 (specimen in BNHS, Green 1992a); shot between December 1913 and April 1914 at unspecified localities in Tenasserim, and more recently trapped in this region (specifically around 11°30′N 99°22′E, and thus probably on the **Ngawun chaung**), two around 1983 and two around 1990 (Green 1992).

A report from the Mohingyi Wildlife Sanctuary in Myanmar of a population of 1,000 White-winged Ducks in 1971, declining to 100 in the next few years (Kear and Williams 1978), is clearly in error as there is no suitable habitat for the species in the region (Salter 1983). The species was reported from the Upper Meea Chaung, Katha district, and Yetho (Karen area in Tharrawaddy), Pegu state, pre–1935 (Green 1992a). There have been no published confirmed reports from Kyatthin Wildlife Sanctuary (Chatthin Wildlife Sanctuary

or, previously, Fuel Reserved Forest), where breeding was reported in 1941 (U Tun Yin 1954); the species was reportedly still present in 1955 (U Tun Yin 1960), and Scott (1989) thought that it "may still occur", but it was not seen on two visits in the early 1980s (Salter 1983). It was reported from Maha Nanda Lake, Shwebo district, pre-1977 (Green 1992a). There were possible sightings at Yenwe chaung, Pegu yoma, in November 1981, and at Hlawga lake (Reservoir), Yangon state, division, in late 1982 (Green 1992a).

■ ***THAILAND*** Although the species was thought to occur "sparsely in peninsular, south-western and central" regions (Gyldenstolpe 1920), the White-winged Duck has disappeared from most of its former range. Parr *et al*. (1993a) identified three main areas along with two other sites at which, if still present, it is very close to extinction. Its current range focuses on (1) the eastern border complex of parks and sanctuaries along the Phanom Dongrak range, (2) the western border complex (Thung Yai Naresaun, Umphang and possibly Huai Kha Khaeng and other adjacent protected areas), and (3) Phu Khieo–Nam Nao National Parks in the north-east. It is almost certainly now absent from Khao Ang Ru Nai, the last remaining area of lowland forest in south-east Thailand (Parr *et al*. 1993a). It should be noted that records listed by Parr *et al*. (1993a) are the result of intensive village surveys rather than actual field records. While the accuracy of these reports is thought to be high, the potential errors inherent in this method are considerable (see Remarks 6 and Distribution: Cambodia) and some records might therefore be the result of misidentifications or misunderstandings. Records are from: **Doi Inthanon National Park**, 5–6 at c.1,500 m (Deignan 1945), but no longer present (P. D. Round *in litt*. 1998); Buknon, "eastern Siam", here taken to be **Nong Buk**, March 1936 (specimen in IRSNB); **Phu Lom Lo**, Kok Sathon, Dan Sai district (inside present day Phu Hin Rong Kla Wildlife Sanctuary), one collected, February 1955 (*Bangkok Bird Club Bull.* 7, 9 [1990]: 12), although no recent records, suggesting that the species is extinct at this locality; Huai Satod, near **Phu Phan National Park**, a nest with 6–7 ducklings reported in a *Dipterocarpus* tree-hole, July or August, c.1979 (Parr *et al*. 1993a); **Phu Kradung National Park**, Nam Nao district, Loei province, 3–4 reported on the Mae Nam Phong, c.1987 (Parr *et al*. 1993a); **Nam Nao National Park**, Petchaburi province, at Huai Phrom Laeng, up to four, 1981–1991, Huai Nam Phrom, a pair with two young, c.1985, Huai Samborn, one, May 1991, Huai Nam Dur, 10, December 1991, Huai Hur, local reports, 1991–1992, and Tina reservoir, two, May 1992 (Parr *et al*. 1993a); **Phu Khieo Wildlife Sanctuary**, Chaiyaphum province, reported in the south-east, February 1984 (Mackenzie 1985), one found dead in 1986 (Round 1988a), nine pairs estimated within 610 km^2 of plateau country, with records from 17 discrete sites, 1987–1993, including Bung Mek (pair), Bung Mon (6, regular and nesting), Bung Waeng–Bung Paen at Nong Pla Duc and Nong Dao (5), Huai Bang Lai (4), Huai Ching (3), Huai Pu–Huai Mae Sot (2–3), Huai Mae Sot Noi (1) and Lam Saphung (10) (Parr *et al*. 1993a); **Umphang Wildlife Sanctuary**, Tak province, where a pair were reportedly seen in the dry season at Nong Daeng, around 1976 (Parr *et al.* 1993a), an unconfirmed report in around 1988 (Collar and Andrew 1988), and more recently sighted at Bung Faet (Bung Fad), 3–4, around 1983, 1–2, June–July 1992, one, March 1993 (Parr *et al.* 1993a); **Mae Wong National Park**, Nakhon Sawan province, at least one shot, 1912 (Barton 1914), probably in the level lowlands which lie outside, and to the east, of the present-day national park, whence no recent records have emerged (Parr *et al*. 1993a, P. D. Round *in litt*. 1998); **Huai Kha Khaeng Wildlife Sanctuary**, Uthai Thani province, recorded around 1970, two at the Huai Mae Dee–Huai Kha Khaeng confluence, 1976 (Nakhasatien and Stewart-Cox 1990), and one in 1990 (Green 1992a), elsewhere an unconfirmed report in 1987 (Jepson 1987), and one near Bor Nam Rorn (at the northern fringes of the sanctuary) in February 1987 (Green 1992a); **Thung Yai Naresuan Wildlife Sanctuary**, Kanchanaburi/Tak provinces, an estimated five pairs, mostly seen around the Mae Kasart, 1987, and on the plateau between Huai Mae Chan and Huai Mae Klong, February 1988 (Green 1992a), then often near Bung Lakatu, including a pair, April 1988 (P. D. Round

and U. Treesucon *in litt*. 1990), six, November 1989 (*Oriental Bird Club Bull.* 11 [1990]: 40–48), three, April 1993 (Parr *et al*. 1993a), and occasionally present along the Mae Kasart, up to four seen in early 1987 (Jepson 1987, Parr *et al*. 1993a), reported by sanctuary staff, March 1988 (P. D. Round *in litt*. 1998); **Sanambin Non-Hunting Area**, just north of Prakhon Chai, Buriram province, 2–4, April 1986 (Scott 1989); **Huai Sala Wildlife Sanctuary**, Sisaket province, reported present by local people and sanctuary workers, estimated population 10 pairs, occurring at Huai Jong Gore, Huai Ta Chu, Huai Chan, Huai Chawae (east), Huai Satung Ta Mok, Huai Satung Sala, Chong Khao Kad, Huai Sawai, Huai Sangam, Huai Sa, Chawae (Huai Sala reservoir), Oo Bang Koe reservoir, Huai Tik Chu and Nong Lahan (Parr *et al*. 1993a); **Phu Jong Na Yoi National Park**, Ubon Ratchathani province, reported at three locations before May 1991 (Green 1992a), and then reported by villagers or remains seen at various subsites including (with highest totals in brackets) Huai Durn Ha (1), Huai Sam Pet (1), Huai Don Noi (2), Lam Dom Noi (5), Huai Geng Sawang (2), Huai Khun Lat ("a pair seen every year"), Huai Nong Plaek (2), Huai Phu (1), Huai Ngae Muang (1), Huai Phu Jan Daeng (1), Huai Lok (2), Huai Pun Taek (1–2), Nong Bek (2), Huai Bok Beua (4), Huai Mak (2), Huai Phung ("many birds" reported), Huai Bon (1), Huai Chan La (1), Chan La Reservoir and Huai Hu Chang (3), Huai Thap Thi (–), Huai Geng Sawang (2) (Parr *et al*. 1993a), although no sign of the species was detected in a survey in 1999 (Ling *et al*. 1999); **Khao Phanom Dongrak Wildlife Sanctuary**, Sisaket province, recent reports from Huai Tha, Huai Sangkot, Nong Yai and Huai Khayung (Parr *et al*. 1993a); **Nam Yun district**, Ubon Ratchathani province, six eggs apparently taken from wild, 1984 (Kamolnorranath 1991) and at Tambon Dome Pradit, 7–10 at Nong Sim swamp, November–December 1985 (Green 1992a); **Khao Phra Viharn**, Sisaket and Ubon Ratchathani provinces (area under consideration for gazetting as a national park), reported present by local people, estimated total population two pairs ranging between Huai Som, Huai Kanun, Ta Goi reservoir, Nong Tim and Nong Yai (Parr *et al*. 1993a); **Yot Dom Wildlife Sanctuary**, Ubon Ratchathani province, an estimated 10–20 (Round 1988a, Scott 1989, Green 1992a), perhaps as many as 30 in Lam Dom Yai area, 1984–1986 (Kamolnorranath 1991), Parr *et al*. (1993a) estimating a population of five pairs in the 203 km^2 sanctuary area including at Lam Dom Yai (where three were captured in 1984 and 1985 on a pond amongst ricefields: Scott 1989), Nong Wung Wern, Ban Nong Korn, Huai Din Dam, Huai Hai, Hua Chan Daeng, Huai Wang Yai, Huai Asamor and Huai Bon (Parr *et al*. 1993a); upper course of the **Hue Sai**, Prachuap Khiri Khan, a pair, 1914–1915 (Gyldenstolpe 1916), and "a little further north" at Hat Sanuk creek, Prachuap Khiri Khan, two pairs, January 1915 (Gyldenstolpe 1916); **Huey Sak**, February 1917 (female in BMNH); Ban Krun, **Sawi district**, Chumphon, July 1996 (*Bird Conserv. Soc Thai. Bull.* 13[10]: 12, *Oriental Bird Club Bull.* 25 [1997]: 61–69); **Ban Kok Klap**, Surat Thani province (Bandon), one male shot, June 1913, and fairly common throughout the area at this time (Robinson 1915a); **Ban Talat Nua** (Tankopah/Kopah), pre–1880 (Hume and Marshall 1879–1881); **Phangnga**, Phangnga province, pre–1880 (Hume and Marshall 1879–1881), with a bird reported (unconfirmed) flying past Ao Phang-nga National Park headquarters, March 1991 (Green 1992a); Kussoom, "just south of Tenasserim" (and taken to be **Takua Thung**: Green 1992a), undated (Hume 1879–1880); **Tung Song**, May 1916 (male in AMNH); **Nong Kok**, Krabi, four males collected, January 1918 (Robinson and Kloss 1918); Nong Tao, near **Kapang**, Trang province, a pair, January 1935, although specimen label data transcribed as "9.1.38" (Meyer de Schauensee 1946, male and female in ANSP); **Khao Nor Chuchi**, Krabi and Trang provinces, now extinct, but reliably reported by villagers to have been present until early 1970s (P. D. Round *in litt*. 1998); **Ban Lamphu La** (Lam-ra), Trang, January 1910 (specimens in BMNH, ZRCNUS); **Ban Khuan Khan** (Ko-Khan, Ko-Khau Kong), Trang, January 1910 (specimens in BMNH, ZRCNUS); **Khao Kachong** (Chong), Trang province, December 1869 (specimen in BMNH), "fairly common", December 1909–January 1910 (Robinson 1909a, Robinson and Kloss 1910–1911, specimen in ZRCNUS); **Patalung** (Patelung), one female collected, April 1899 (Bonhote

1901); **Chalerm Prakiat Wildlife Sanctuary** (=Phru To Daeng or "Pa Phru"), Narathiwat province, probably a rare resident (see Remarks 7), three seen and single (juvenile) bird shot at Khlong Nam Baeng, December 1986, also reported November 1990 (Green 1992a), with other reports (maxima in brackets) between 1988 and 1992 from Mae Nam Bangnara (1) and Ban Gor Sit (2) (Parr *et al*. 1993a); Nakhon Si Thammarat province (not mapped), one, June of an unspecified year (Medway and Wells 1976, also Green 1992a).

Unconfirmed records include: Kaeng Krachan National Park, Phetchaburi and Prachuap Khiri Khan province, 2–3 reported, around 1984–1985 and May, around 1988 (Parr *et al*. 1993a); Khao Yai National Park, one reported flying over the headquarters, January 1989 (Green 1992a).

■ ***LAOS*** The species occurs in several areas in the centre and south of the country. Records are from: **Nape**, Bolikhamxai, one, c.700 m, January or February 1928 (Delacour 1929); **Nakai-Nam Theun NBCA**, Khammouane, near Nakai, 500 m, January 1932 (female in AMNH, Dickinson 1970a), evidently widespread, if localised, on Nakai Plateau rivers such as Nam Xot, Nam Mon, Nam Theun and Nam On, 500–520 m, mid–1990s (Evans *et al*. 1997, Thewlis *et al.* 1998); 20 km north of **Muang Phin**, Savannakhet, three, 1944 or 1945 (David-Beaulieu 1949–1950); **Sekong**, a few, around 1930, probably below 100 m (Delacour and Jabouille 1931, Green 1992b); **Salavan**, July 1926 (female in MNHN, Engelbach 1927b), several shot, around 1928 (Delacour and Jabouille 1931, David-Beaulieu 1949–1950); **Bolaven plateau**, Attapu, January or February 1932 (female in AMNH, Dickinson 1970b), regularly on the plateau or at its base (Engelbach 1932), including at Tha Teng, where four were shot at c.800 m, December 1931 (Engelbach 1932, male and female in FMNH); **Dong Hua Sao NBCA**, Champasak, several reports, February 1996 (Thewlis *et al.* 1998, Evans *et al*. 2000); the Xe Pian in **Bolaven South-West proposed NBCA**, three groups (of two, three and four), 300–320 m, April 1995 (Thewlis *et al.* 1998); **Xe Pian NBCA**, one, 250 m, December 1993, three, May 1995, pair with three young, probably December 1994 (Thewlis *et al.* 1998), and in the south, April 1998 (D. A. Showler verbally 2001); **Dong Khanthung proposed NBCA**, widely reported in May and August 1996 with one, 110 m, mid-August 1996 (Barzen 1997, Thewlis *et al.* 1998, Evans *et al*. 2000), two pairs, March 1998 (Baird and Phylaivanh 1998), several sightings, March and July 1998, including a brood of eight (Round 1998a).

An unconfirmed record is: Dong Ampham NBCA, at Nam Kamah, reported by locals, 1997 (Davidson *et al.* 1997).

■ ***CAMBODIA*** Recent records and reports of the species are clustered around Tonle Sap lake, although there is a dearth of survey data for other areas (J. W. Duckworth *in litt.* 1999). In addition, records on the Thai side of the border in the Phanom Dongrak range suggest that the species might also occur in adjacent Cambodia (although see under Population). There is also a recent record from the Vietnam–Cambodia border (see Dak Dam stream record under Vietnam). Further 1990s reports of singles, small groups and nests in the Tonle Sap flooded forest, Battambang and Kompong Thom, were given by Parr *et al.* (1996) and Goes *et al*. (1998b). These are treated as provisional in this account because of subsequent contradictory interviews with local people, the lack of sightings during recent surveys, and the potential confusion with Spot-billed Duck *Anas poecilorhyncha*, a population of which resides in the Tonle Sap forests year-round (F. Goes *in litt*. 2000). Other reports without accurate locational data are Siem Reap province between 1947 and 1961 (Thomas 1961) and Ratanakiri, undated (Thomas 1964), although it was not recorded at the latter site during a recent survey (Timmins and Soriyun 1998). Confirmed records are from: **unnamed locality** (at 13°19′N 103°44′E), in Tonle Sap flooded forest, Siem Reap, one, August 1999 (F. Goes *in litt*. 1999); **Boeng Chhma**, linked to Tonle Sap lake, 60 km west of Kompong Thom, reported to breed, 1996 (Parr *et al.* 1996), with six seen in January 1996 (Edwards 1996, 1999); near Trapeang Kok (70 km inland), **Cardomom mountains**, Koh Kong, a pair flying up a valley at

sunset and returning the following dawn, April 1944 (Engelbach 1948, 1952); northern Chhep district (not mapped), two on the O'Kapok, a tributary of the Tonle Lepon, February 2001 (P. Davidson *in litt*. 2001).

■ ***VIETNAM*** Records are from: near **Vinh**, Nghe An, around 1926 (Delacour *et al.* 1928, Delacour and Jabouille 1931); **Ke Go Nature Reserve**, Ha Tinh, over Ke Go lake, May 1993 (*Oriental Bird Club Bull*. 18 [1993]: 67–70); **Dak Dam stream**, Dak Mil district, Dac Lac, two, May 1998 (Brickle *et al.* 1998; this stream forms the border between Vietnam and Cambodia and thus this record is relevant to both countries); **Phu Rieng**, Binh Phuoc, one or two, around 1928 (Delacour and Jabouille 1931); **Hon Quan**, Binh Phuoc, 1929–1931, apparently scarcer than at Phu Rieng (David-Beaulieu 1932); **Cat Tien National Park**, one at Bau Sau (Crocodile) Lake, January 1990 (Robson *et al.* 1991), two reported in the north-east, early

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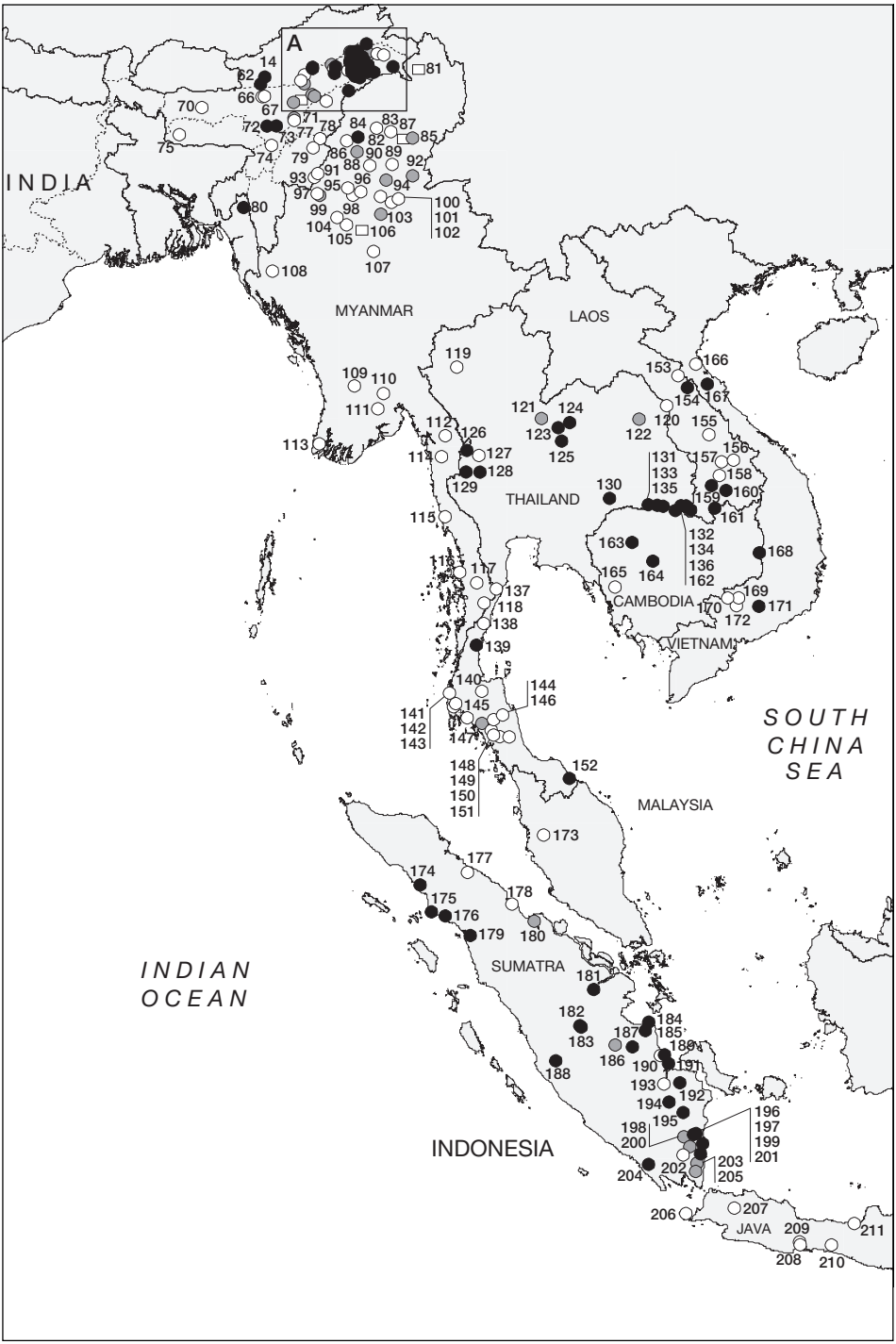
The distribution of White-winged Duck *Cairina scutulata* (map opposite): (1) Mehao Wildlife Sanctuary; (2) Dibang Reserve Forest; (3) D'Ering Memorial Wildlife Sanctuary; (4) Anpun; (5) Tezu; (6) Paglam; (7) Brahmakund; (8) Namsai; (9) Noa Dihing river; (10) Namdapha National Park; (11) Subansiri river; (12) Kharsang; (13) Namsangmukh; (14) Pakhui Wildlife Sanctuary; (15) Namtok; (16) Zedua Basti; (17) Singpho; (18) Kundil Kalia Reserve Forest; (19) Sadiya Station Reserve Forest; (20) Kukurmara Reserve Forest; (21) Sadiya; (22) Lohit river; (23) Poba river mouth; (24) Dollah; (25) Dhulajan; (26) Hahkhati Reserve Forest; (27) Kumsong Reserve Forest; (28) Mesaki; (29) Burhi beel; (30) Dibru-Saikhowa National Park; (31) Dangori Reserve Forest; (32) Koliapani beel; (33) Dum Duma Reserve Forest; (34) Jamjing; (35) Phillobari; (36) Sotingjan; (37) Bordubi tea estate; (38) Dibru river; (39) Duarmora Reserve Forest; (40) Tinkopani Reserve Forest; (41) Derpai; (42) Dibrugarh; (43) Kakojan Reserve Forest; (44) Burhi Dihing river; (45) Pengari Reserve Forest; (46) Namphai Reserve Forest; (47) Simoluguri Chuk; (48) Upper Dihing (East Block) Reserve Forest; (49) Deohal; (50) Upper Dihing (West Block) Reserve Forest; (51) Kotha Reserve Forest; (52) Bajaloni; (53) Digboi; (54) Tirap Reserve Forest; (55) Bogapani; (56) Namdung Reserve Forest; (57) Joyhing; (58) Margherita; (59) Dirak Reserve Forest; (60) Joypur Reserve Forest; (61) Laluk; (62) Nameri National Park; (63) Ranga Reserve Forest; (64) Duklingia tea estate; (65) Majuli beel; (66) Darrang; (67) Tezpur; (68) Golaghat; (69) Kaliani river; (70) Barpeta district; (71) Bokajan; (72) Diyungmukh; (73) Lumding; (74) Haflong; (75) Garo hills; (76) Dikhu river; (77) Dimapur; (78) Chingai; (79) Laishan Lokchao; (80) Kasalang Reserved Forest; (81) Putao; (82) Jade mines; (83) Nanyaseik; (84) Tamanthi Wildlife Sanctuary; (85) Pidaung Sanctuary; (86) Tamanthi; (87) Mogaung chaung; (88) Mansi; (89) Kunphe; (90) Kalat; (91) Kabaw valley; (92) Bhamo; (93) Tamu; (94) Yinke Reserved Forest; (95) Auk Singwe; (96) Kawlin; (97) Kindat; (98) Nyaungbinhla; (99) Sagagon; (100) Hintha; (101) Singan; (102) Mabein; (103) Webaung; (104) Upper Chidwin Township Group; (105) Mu river; (106) Shwebo; (107) Mandalay; (108) Paletwa Township Group; (109) Tharrawaddy district; (110) Shwelaung Kodugwe Reserved Forest; (111) Paunggyi valley; (112) Haungtharaw river; (113) Pyinma chaung; (114) Pakabo Reserve; (115) Tavoy; (116) Mergui; (117) Thagyet; (118) Ngawun chaung; (119) Doi Inthanon National Park; (120) Nong Buk; (121) Phu Lom Lo; (122) Phu Phan National Park; (123) Phu Kradung National Park; (124) Nam Nao National Park; (125) Phu Khieo Wildlife Sanctuary; (126) Umphang Wildlife Sanctuary; (127) Mae Wong National Park; (128) Huai Kha Khaeng Wildlife Sanctuary; (129) Thung Yai Naresuan Wildlife Sanctuary; (130) Sanambin Non-Hunting Area; (131) Huai Sala Wildlife Sanctuary; (132) Phu Jong Na Yoi National Park; (133) Khao Phanom Dongrak Wildlife Sanctuary; (134) Nam Yun district; (135) Khao Phra Viharn; (136) Yot Dom Wildlife Sanctuary; (137) Hue Sai; (138) Huey Sak; (139) Sawi district; (140) Ban Kok Klap; (141) Ban Talat Nua; (142) Phangnga; (143) Takua Thung; (144) Tung Song; (145) Nong Kok; (146) Kapang; (147) Khao Nor Chuchi; (148) Ban Lamphu La; (149) Ban Khuan Khan; (150) Khao Kachong; (151) Patalung; (152) Chalerm Prakiat Wildlife Sanctuary; (153) Nape; (154) Nakai-Nam Theun NBCA; (155) Muang Phin; (156) Sekong; (157) Salavan; (158) Bolaven plateau; (159) Dong Hua Sao NBCA; (160) Bolaven South-West proposed NBCA; (161) Xe Pian NBCA; (162) Dong Khanthung proposed NBCA; (163) unnamed locality; (164) Boeng Chhma; (165) Cardomom mountains; (166) Vinh; (167) Ke Go Nature Reserve; (168) Dak Dam stream; (169) Phu Rieng; (170) Hon Quan; (171) Cat Tien National Park; (172) An Binh; (173) Ipoh; (174) Suaq Balimbiang; (175) Runding; (176) Sungai Tapus; (177) Deli Serdang; (178) Labuhanbilik; (179) Lumut; (180) Sungai Rokan; (181) Kerumutan Nature Reserve; (182) Sungai Gelumpangkecil; (183) Gelumpang; (184) Sungai Berbak; (185) Air Hitam Dalam; (186) Muarabulian; (187) Kumpeh; (188) Kerinci; (189) Sungai Sembilang; (190) Sungai Benawang; (191) Sungai Bungin; (192) Padang Sugihan Wildlife Reserve; (193) Talangbetutu; (194) Kayuagung; (195) Mesuji; (196) Teladas; (197) Gunung Tapa; (198) Menggala; (199) Cabang; (200) Rawa Susuk; (201) Way Kambas National Park; (202) Gunung Sugi; (203) Jepara lake; (204) Bukit Barisan Selatan National Park; (205) Sungai Ketibung; (206) Ujung Kulon National Park; (207) Bogor; (208) Desa Langgen; (209) Kali Pucang; (210) Kebumen; (211) Garang lake.

○ Historical (pre-1950) ◍ Fairly recent (1950–1979) ● Recent (1980–present) □ Undated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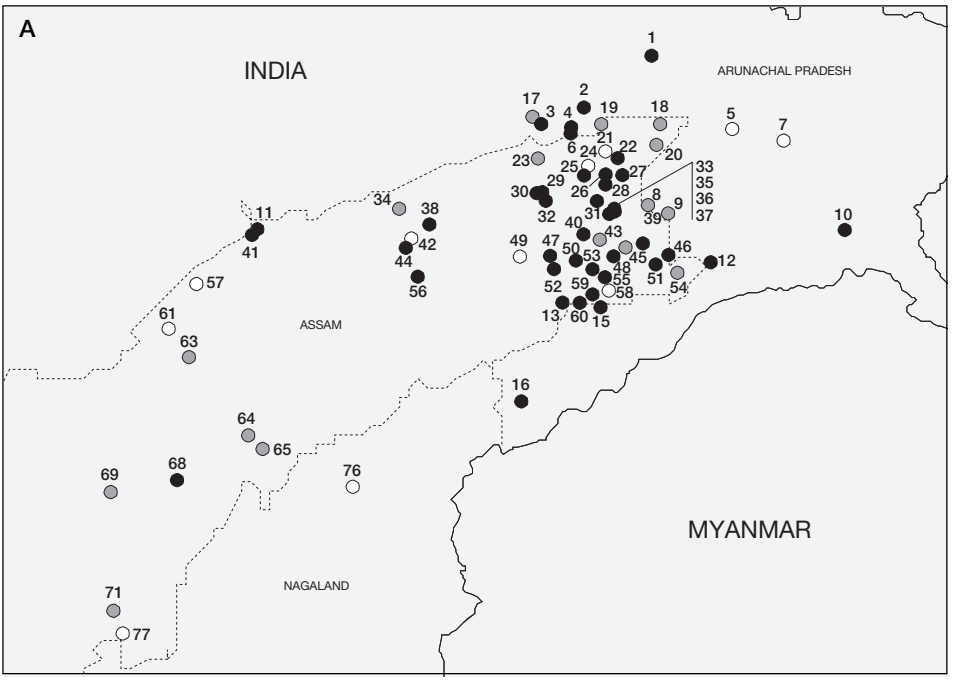
JAVA

1991 (Robson *et al.* 1993b). **An Binh**, Binh Phuoc, one or two, March 1927, c.1928 (female in MNHN, Delacour *et al.* 1928, Delacour and Jabouille 1931).

Unconfirmed records include those at Tram Chim National Park, Dong Thap, January–March 1992 and February–April 1993 (Anon. 1993c). These are presumably erroneous given the habitat, and in a recent review White-winged Duck was dropped from the site list for the park (S. T. Buckton verbally 2000).

■ ***MALAYSIA*** There is only one specimen record and a handful of unspecified/unconfirmed reports (see also Wells 1999). Unconfirmed records include the suggestion that "it may occasionally reach Kedah, as the Malays there speak of it" (Gibson-Hill 1949b), verbal reports of sightings in the 1930s and 1940s at Taman Negara (cited in Green 1992a), and a report from Kota Tinggi Falls, Johor, August 1981 (Green 1992a). Inclusion of this species as a Malaysian bird in ornithological literature is based on the Perak record (Yong 1997b), as



The distribution of White-winged Duck *Cairina scutulata* (map A): (1) Mehao Wildlife Sanctuary; (2) Dibang Reserve Forest; (3) D'Ering Memorial Wildlife Sanctuary; (4) Anpun; (5) Tezu; (6) Paglam; (7) Brahmakund; (8) Namsai; (9) Noa Dihing river; (10) Namdapha National Park; (11) Subansiri river; (12) Kharsang; (13) Namsangmukh; (15) Namtok; (16) Zedua Basti; (17) Singpho; (18) Kundil Kalia Reserve Forest; (19) Sadiya Station Reserve Forest; (20) Kukurmara Reserve Forest; (21) Sadiya; (22) Lohit river; (23) Poba river mouth; (24) Dollah; (25) Dhulajan; (26) Hahkhati Reserve Forest; (27) Kumsong Reserve Forest; (28) Mesaki; (29) Burhi beel; (30) Dibru-Saikhowa National Park; (31) Dangori Reserve Forest; (32) Koliapani beel; (33) Dum Duma Reserve Forest; (34) Jamjing; (35) Phillobari; (36) Sotingjan; (37) Bordubi tea estate; (38) Dibru river; (39) Duarmora Reserve Forest; (40) Tinkopani Reserve Forest; (41) Derpai; (42) Dibrugarh; (43) Kakojan Reserve Forest; (44) Burhi Dihing river; (45) Pengari Reserve Forest; (46) Namphai Reserve Forest; (47) Simoluguri Chuk; (48) Upper Dihing (East Block) Reserve Forest; (49) Deohal; (50) Upper Dihing (West Block) Reserve Forest; (51) Kotha Reserve Forest; (52) Bajaloni; (53) Digboi; (54) Tirap Reserve Forest; (55) Bogapani; (56) Namdung Reserve Forest; (57) Joyhing; (58) Margherita (59) Dirak Reserve Forest; (60) Joypur Reserve Forest; (61) Laluk; (63) Ranga Reserve Forest; (64) Duklingia tea estate; (65) Majuli beel; (68) Golaghat; (69) Kaliani river; (71) Bokajan;(76) Dikhu river; (77) Dimapur.

○ Historical (pre-1950) ◎ Fairly recent (1950–1979) ● Recent (1980–present) □ Undated

follows: near **Ipoh**, Perak, undated (Robinson 1909a, also Robinson and Chasen 1936, Madoc 1950–1951), the specimen possibly lost or stored in the Perak Museum, Taiping (Yong 1997b).

■ ***INDONESIA*** The species has been recorded from seven of Sumatra's eight provinces (Green and Crosby 1992). Summarising the evidence, Holmes (1996) judged that Kluet and the Singkil region of Aceh, the west coast of North Sumatra province, Kerumutan in Riau and the Jambi swamps may now be the most important sites remaining for this species in Sumatra. Records are from:

Sumatra ■ *Aceh* **Suaq Balimbiang**, Kluet extension of Gunung Leuser National Park, 1992–1993 (Holmes 1996); **Running** in the Singkil region, September 1991 (Green and Crosby 1992, van Balen 1992a); Paris lake, locally reported, 1999 (Wibowo *et al*. 2000); ■ *North Sumatra* **Sungai Tapus**, by wholly reliable report, 1990 (Holmes 1990), and again locally reported from Lae Tapus, at ricefields near Lae Monong/Sei Rokot-rokot villages (Wibowo *et al*. 2000); **Deli Serdang**, 1880s (Hagen 1890), September 1917 (specimen in ZMA); south of **Labuhanbilik** at Telok Pandji on Sungai Batun, August 1937 (Green and Crosby 1992); near **Lumut** at the Rianiate transmigration settlement, August 1990 (Holmes 1990), near Sihiong village, two, July–August 1999 (Wibowo *et al*. 2000); ■ *Riau* on the **Sungai Rokan** or a tributary, 40 km west of Duri, March 1979 (Green and Crosby 1992); **Kerumutan Nature Reserve** south to the Rengat river, late 1992 (Burn and Brickle 1992, Holmes 1996); ■ *Jambi* **Sungai Gelumpangkecil**, July and August 1991 (Green and Crosby 1992); **Gelumpang**, Bukit Tigapuluh, July–August 1991 (Danielsen and Heegaard 1995a); **Sungai Berbak** near Kampung Sekumbang, April 1989 (Silvius and de Iongh 1989), with Berbak National Park now determined as a key site for the species (Callaghan *et al*. 1998) and records at Desa Sei Rambut and Air Hitam Dalam, 11–21 adults and 15 ducklings, October 1998 (Sibuea 1996, Sibuea *et al*. 1997, Putra and Lubis 1999); **Air Hitam Dalam**, late 1992 (Burn and Brickle 1992, Holmes 1996) and at least 12 there in June 1995 (Holmes 1996); **Muarabulian** on the Batang Hari river, January 1976, with local reports of occasional sightings at a site 20 km away (Holmes 1976); **Kumpeh** region, late 1992 (Burn and Brickle 1992, Holmes 1996); ■ *West Sumatra* "**Kerinci**" (i.e. presumably in the adjacent fault valley that runs irregularly up the West Sumatran mountains), undated (Robinson and Chasen 1936), with birds seen in swamp forest at Sindang Silaut (south of Tapan) in the wet season only, December 1996 to January 1997 (Holden 1997); Kotto Djama (untraced but this evidently the "Kitta Dhawa" mentioned under Large Green-pigeon *Treron capellei*; believed by Rudyanto to be in West Sumatra), April 1896 (two specimens in MCML); ■ *Bengkulu* somewhere in "South Benkulen" (Bengkulu), in the 1930s (Hoogerwerf 1950a)—possibly in the area now occupied by the northern fifth of Bukit Barisan National Park (see below); ■ *South Sumatra* **Sungai Sembilang** in mangroves by accepted local report in 1980s (Verheugt *et al.* 1993); **Sungai Benawang** ("near Beniawang"), undated (Vorderman 1892a); **Sungai Bungin**, March/April 1986 (Silvius 1986); **Padang Sugihan Wildlife Reserve**, March–May 1985 (Nash and Nash 1985), and reported in 1988 (Lambert 1988), although the reserve has now been overrun by settlers (Rudyanto verbally 2000); **Talangbetutu**, 1918 (Green and Crosby 1992); **Kayuagung**, 5–8 individuals thought to survive in this area, February 1988 (Lambert 1988); **Mesuji**, Palembang, 1930s (Hoogerwerf 1950a), and around Pematang Penggang on the Mesuji river, 1980s (Lambert 1988); ■ *Lampung* **Teladas**, two were seen crossing the Sungai Tulang Bawang 500 m from the sea, February 1988 (Lambert 1988); **Gunung Tapa**, on Sungai Tulang Bawang, visiting nearby ricefields until at least January 1988, up to four birds reported to visit swamps between Bakung and Gedonghadji, and two seen crossing the river c.10 km upstream of Gunung Tapa, February 1988 (Lambert 1988); near **Menggala**, 1976–1977 (Holmes 1977b), but although still reported there by local people in 1993–1994 concerted searches were fruitless (Holmes and Noor 1995); **Cabang**, at the confluence of Sungai Seputih and Sungai Pegadungan, near Way Kambas, with several birds reported in the area, either flying over or

at nearby swamps, 1981–1985 (Lambert 1988); **Rawa Susuk**, 1976–1977 (Holmes 1977b); **Way Kambas National Park**, 1976–1977 (Holmes 1977b) and subsequently at many sites including open areas adjoining the Way Kanan stream and forest pools near the entrance road (Lambert 1988, Chambers 1990, Parrott and Andrew 1996); **Gunung Sugi**, under 150 m, October/November 1901 (Green and Crosby 1992; specimen in ANSP); **Jepara lake**, June 1976 (Holmes 1976, 1977b); **Bukit Barisan Selatan National Park**, a pair in the mid–1990s (M. F. Kinnaird and T. G. O'Brien *per* F. Verbelen *in litt*. 1999), and in riverine forest on the Sleman river, August 1998 (F. Verbelen *in litt*. 1999); **Sungai Ketibung**, a tributary of the lower Sekampung, 1976–1977 (Holmes 1977b);

Java ■ ***West Java*** **Ujung Kulon National Park**, four passing birds in September 1932 (Hoogerwerf 1969–1971); **Bogor**, 1839–1844 (Green and Crosby 1992); **Desa Langgen**, Rawa Lakbok, December 1907 (Green and Crosby 1992); **Kali Pucang**, February (clutch of eggs) (Hoogerwerf 1950a); ■ ***Central Java*** **Kebumen**, a clutch of eggs found in February, year not specified (Hoogerwerf 1950a); **Garang lake**, 1839–1844 (Green and Crosby 1992).

On Siberut, off Sumatra, local reports were repeatedly obtained in 1976, but confirmation was not possible (Kear 1979 in Green and Crosby 1992).

POPULATION In 1992 the known wild population (absolute minimum) was only 210, although few surveys had then been conducted (Parr *et al*. 1993a), and this figure rose to an estimated 336 soon afterwards (Green 1993a). After further survey work in India, Indochina and Indonesia the most recent global population minimum is 450, comprising 130 in South-East Asia, 170 in India and Myanmar, and 150 on Sumatra (Rose and Scott 1997). The minimum global population may now be 400, with the "true" figure probably in the region of "a few thousand, undergoing a continuing decline" (Evans *et al*. 1997). Although recent surveys (Das 1995, Choudhury 1996e) imply that some localities may hold more birds than previously registered (with 300–350 birds now estimated in India), the species unquestionably appears to be declining in all portions of its range. Callaghan *et al*. (1998) referred to the subspecies *leucoptera* (i.e. the non-Indonesian population; see Remarks 1) as numbering 1,000–5,000.

There has been a considerable amount of extrapolation of densities using observed and estimated numbers against known areas of protected and other discrete areas, but such exercises are fraught with difficulty, and in any case, as noted by Parr *et al*. (1993a), comparison between sites is inappropriate as ecological factors such as habitat quality, disturbance levels and nest-site availability are poorly understood in relation to the breeding biology of the species. One extrapolation worth repeating is that which assumes that if population densities of the species vary from one adult bird per 50 ha to one per 500 ha, the original population of the species may have been in the order of 50,000–500,000 (Green 1992a, 1993a,b).

India The species was once fairly common and widespread in forests of the north-east but it has now declined severely in both its distribution and density. In the 1870s it was "common" in Tinsukia and Dhemaji districts (Hume and Marshall 1879–1881, Baker 1908) and it was considered to be the fourth commonest duck species (after Teal *Anas crecca*, Mallard *A. platyryhnchos* and Gadwall *A. strepera*) at forest beels throughout the Sadiya Frontier Tracts in the 1930s, with at least a pair in almost every waterlogged area (Parsons 1939). Baker (1908) mentioned that it was found "in some numbers throughout the Namba Forest, south of the Brahmapootra, and the foothills and forest to the north of the same", adding that in "eastern Assam it becomes comparatively common". In 1900 the species was sufficiently plentiful in the Tinsukia district that it was sometimes seen flying over Dibrugarh town, and 30–40 were trapped in the area and kept in captivity by Baker (1908). In the Himalayan foothills of that region, it was "sought almost with a certainty of success" and hunters could procure up to five birds a day, having seen "possibly twice as many again"

(Baker 1908). However, even by the 1920s it was considered rare, and Wright and Dewar (1925) stated that it "seems to be nearing extinction".

In Tinsukia district, Assam, numbers have declined dramatically since Baker's (1908) day, leaving an estimated 44 in 1976 (Pirie and Choudhury 1976). Gee (1958) found the species to be much rarer than in the previous 20 years, although it occurred on all the streams of current Dibru-Saikhowa National Park. In 1960, an estimated population of 30 was given for Dibru Reserve Forest (part of present-day Dibru-Saikhowa National Park) (Mackenzie 1975), while in 1990 the total for the whole park was thought to be in the region of 20 (Green 1992a). A population estimate of 60 was made for the Dibrugarh/Dum Duma/Digboi area in 1975 (Mackenzie 1975). Along the Burhi Dihing river the duck was common in 1930 (Mukherjee 1961), yet by 1976 only two birds were thought to be present in the Burhi Dihing Reserve Forest (Pirie and Choudhury 1976). A recent survey of Manipur concluded that, although the species probably once occurred there, it has now probably disappeared (Choudhury 1992a). The species has possibly also disappeared from Meghalaya and Nagaland, and from Barpeta, Sanitpur, Golaghat, Jorhat and the Cachar district of Assam (Green 1992a). However, although its known wild population in India was put at 65 (including 45 in Tinsukia district) in 1991, and estimates of 500 in Assam were considered "groundless" (Green 1992), recent surveys have been slightly more optimistic (Yahya 1994, Das 1995, Choudhury 1996e). Choudhury (1996e) estimated a population of 290 in Tinsukia district, plus 59 in Arunachal Pradesh. In Nameri National Park, Assam, Das (1995) estimated that 23–29 were present. These populations, along with others in the north-eastern states, suggest that the total Indian population may be over 400. Tinsukia district is its stronghold and populations are apparently stable in Nameri National Park and Namdapha National Park (A. Choudhury *in litt*. 1998, Choudhury 2000c). Choudhury (2000c) places the Indian population at 300–350, of which c.200 would be in the Tinsukia-Dibrugarh area, but still declining.

Bangladesh The species is rare and localised in the country (Ali and Ripley 1968–1998, Khan 1982), persisting in small numbers in the Chittagong Hill Tracts despite the assertion of Mountfort (1969) that it "has now vanished". An undated letter from T. C. Jerdon to A. O. Hume (probably from before 1864 and mentioned by Hume and Marshall 1879–1881) contained the information that he had "seen several flocks of *Casarca leucoptera* [=*Cairina scutulata*] in the lower parts of the Brahmapootra, where it joins the Ganges" ("this area includes that around Goalundo, part of the 100 km section in the reports from 1947": P. M. Thompson *in litt*. 1998; see Remarks 5). However, Hume and Marshall (1879–1881) pointed out that "dozens of people" later surveyed this area without success and they and Baker (1908) treated this record as unconfirmed (perhaps in mistake for Comb Ducks *Sarkidiornis melanotos*). More recently, fieldwork indicated that the species was "once fairly common" in the Chittagong Hill Tracts, with around 30 estimated at the Pablakhali area of Kassalong Reserve in 1978 (Husain and Haque 1981, Husain 1985). Even in this small area, it is thought to have declined dramatically after 1960 (Khan 1986b) and to be under continuing unsustainable pressure (Sarker and Sarker 1983). Claims that its population increased owing to the construction of the Kaptai (Karnafuli) reservoir (Karpowicz 1985) are entirely untenable (Khan 1986b). Until recently, estimates from the area were unavailable owing to political instability (Husain 1989, Khan 1986b), but the fact that the species still occurs there was confirmed in 1999 (N. J. Ash *in litt*. 1999). It has not been conclusively identified elsewhere in Bangladesh.

Myanmar The species was apparently "by no means uncommon" in northern Myanmar in the 1930 and 1940s, when it was "one of the most characteristic birds of the Shweli river" (Smith 1942), but less common further south (Hume and Davison 1878, Smythies 1986). However, it was also a "characteristic bird" of the streams in forests of Bassein district, with birds being "frequently flushed" there (Smith 1942). At Bhamo around 1900, it was described as "rare" and locals did not recognise a shot bird (Evans 1901). At the start of the twentieth century, it was "sparingly distributed" in Kindat district (Hopwood 1908) and "occasionally

met with" in north Arakan (Hopwood 1912b). Although Blyth (1875) described it as common in various areas of Myanmar, J. Davison saw very few on his travels, exploring the valleys of Sittang, Salween (Thalwin), Ataran, Gyn, Haung-Thaw, Tavoy and Tenasserim without encountering it, leading to the judgement that "if it does occur in Tenasserim, it can only be as an extremely rare straggler" (Hume and Davison 1878). Stanford and Ticehurst (1931) expected that it did not occur in Prome district, but were informed that before the war (i.e. presumably pre–1914) it was "not uncommon in Tharrawaddy". It is reported to be still "common" in the Hukaung valley of Kachin and Sagaing provinces (U Thein Aung verbally 2000).

Thailand Early in the twentieth century the species was "very abundant" in Trang province, and generally "common" in peninsular Thailand (Robinson and Kloss 1910–1911, Robinson and Chasen 1936). In Surat Thani province (Bandon) in 1913 it was "fairly common" in the "upcountry" ricefields "and almost down to the coast", either in pairs or in larger numbers (Robinson 1915a). South of Trang, in "Pattani province", it was less common (Gibson-Hill 1949b). It was always scarce in northern Thailand (Deignan 1945) but seems to have completely disappeared from that part of the country and declined dramatically elsewhere. Although Green (1992a) estimated the Thai population at 27, increased fieldwork in the 1990s revealed this to be overcautious, and Parr *et al.* (1993a) concluded that around 106 remained in 1992. Of these, at least 64 were located in the Phanom Dongrak range (Parr *et al*. 1993a; see Remarks 6). The estimated 34 in the tract of forest extending from Phu Jong Na Yoi National Park in the east through Yot Dom Wildlife Sanctuary to the eastern margin of Khao Phra Viharn (Parr *et al*. 1993a) may be the largest population anywhere in the bird's range. A population of 10 pairs is estimated for Phu Jong Na Yoi National Park, and 30 birds are judged to occur in the Khao Phanom Dongrak and Huai Sala Wildlife Sanctuaries (Parr *et al*. 1993a). In Yot Dom Wildlife Sanctuary, the population has been estimated at 10–20 (Round 1988a, Scott 1989, Green 1992a), or perhaps as many as 30 (Kamolnorranath 1991), although Parr *et al*. (1993a) thought it was more likely that five pairs inhabited the 203 km^2 sanctuary area. The total population in the contiguous Phu Khieo–Nam Nao area may be around 24 (Parr *et al*. 1993a). While it is possible that further populations of White-winged Ducks remain in Thailand, they are judged likely to be "highly scattered, very small and so of little conservation significance" (Parr *et al*. 1993a). Populations in several of these areas (principally Phu Jong Na Yoi and Yot Dom) may be sustained by the presence of large areas of habitat in Dong Khanthung proposed protected area in adjacent Laos (Round 1998).

Laos Past reports certainly indicate that the species was widespread and locally common in Indochina early in the twentieth century. Delacour *et al.* (1928) considered it "probably abundant" in suitable habitat. Recent records and reports from hunters suggest a total population of 10–20 adult birds around the Bolaven South-West Proposed NCBA, including some birds occurring as high as 800 m (Thewlis *et al.* 1998). The species has evidently declined greatly, having been recorded widely from central and southern Laos (Engelbach 1927a,b, 1932, Delacour 1929, David-Beaulieu 1949–1950, Dickinson 1970a). In particular, it was said to be not uncommon around Salavan (previously Saravane) (Engelbach 1927b), although at Savannakhet the only sightings during two years in the region were those at Muang Phin and it was reportedly rare even then (David-Beaulieu 1949–1950). Populations remain in three parts of the country: the Nakai Plateau; the Xe Pian NBCA, Bolaven South-West Proposed NBCA and Dong Hua Soa NBCA; and finally Dong Kanthung Proposed NBCA (Thewlis *et al.* 1998). The latter site adjoins the Sayphou Damlek mountains of Thailand, where the world's largest known White-winged Duck populations were then thought to occur (Parr *et al.* 1994b), presumably forming a single population. Villagers near Phu Jong Na Yoi National Park, Thailand, reported that the species was common in adjacent Laos (Parr *et al*. 1993a), presumably referring to the Dong Khanthung area (J. W. Duckworth *in litt.* 1999). The Nakai Plateau population is estimated at 9–24 adults (Evans *et al.* 1997). The area probably supports 6–12 groups, each perhaps representing a single or pair occupying a

potential breeding territory (Thewlis *et al.* 1998). As of 1996, there were at least 15 adults in southern Laos, and possibly as many as 50 if local reports are accurate (Evans *et al.* 1997).

Cambodia Although Thomas (1964) thought the species apparently "not uncommon near the coast", Engelbach's (1948) Cardomom Mountain record is apparently the only one in the coastal provinces (C. M. Poole *in litt*. 1999). Villagers were apparently familiar with the species over a large area at Tonle Sap and nests were shown to fieldworkers, leading to the report that it was "quite common"; taking into account the availability of suitable habitat, the surviving population was thought to number perhaps "several hundred pairs" and as such to be the most significant remaining in the world (Parr *et al.* 1996); but see below. The populations around Boeng Chhma and Prek Toal were thought possibly to be fairly large, but remained unquantified as a result of the reclusive nature of the species (Edwards 1996, Goes *et al*. 1998b). However, because the veracity of earlier reports (including nest records) has been questioned (see under Distribution), these optimistic views "have to be seriously tempered" (F. Goes *in litt*. 2000). After a considerable amount of survey work there are only two confirmed sight records and no audial records from the Tonle Sap region, and the likelihood emerges that the local White-winged Duck population is extremely small (F. Goes *in litt*. 2000). It is quite likely that populations also survive in northern Cambodia and the Cardamom range, but again these are likely to be small (R. J. Timmins *in litt.* 2001).

Although reliable reports from Yot Dom, Huai Sala and Khao Phanom Dongrak Wildlife Sanctuaries, Thailand, might imply that the species could be common in adjacent parts of Cambodia (Parr *et al*. 1993a), this may not be the case given that the habitat is different on the Cambodian side, with steeper slopes and no slow-flowing streams suitable for the duck; indeed, there were no records during a 1999 survey of the Dongrak range in Cambodia (F. Goes *in litt*. 2000).

Vietnam It was thought fairly common and frequently observed at Phu Rieng, although uncommon at Hon Quan (David-Beaulieu 1932). It is recently only known from three sites, two of which are protected. However, return visits to Ke Go Nature Reserve have failed to produce further sightings of the species (e.g. Treesucon 1994). The overall population is undoubtedly small (Green 1992a,b, Nguyen Cu *in litt.* 1997), although significant areas of potentially suitable habitat on the Cambodian border and in Lam Dong province have not been surveyed (A. W. Tordoff verbally 2000).

Peninsular Malaysia While early accounts suggest that the species was common in southern Thailand, it appeared to be "very rare" in adjacent Malaysia (Robinson and Chasen 1936). The unconfirmed 1981 sighting in Johor is the only report of the species from the country since 1950. As the location of this sighting and of the confirmed record are now largely devoid of suitable habitat, and no further reports have been made from the often-visited Taman Negara, the species is probably extinct in the country (Green 1992a, Yong 1997b).

Indonesia In the 1930s and 1940s the species was judged not rare in southern Sumatra (Hoogerwerf 1950a). In the 1970s it was speculated that, despite the paucity of records, the species might be "still tolerably common" there, where appropriate habitat was thought to be widespread and hunting pressure and human density low (Holmes 1976). Guessed densities of one pair per 100 ha in Assam (Mackenzie and Kear 1976) have been matched in Sumatra by a suggestion of four pairs per 500 ha, dropping to one pair per 500 ha in densely populated areas (Holmes 1977b). In Way Kambas, between August 1988 and July 1989, birds were seen on 104 out of 300 days of observation, and the population was estimated to be at least 30 (Chambers 1990). Drilling (2000) suspected that this estimate might have been "a little optimistic" after counting 13–15 separate individuals in the majority of the park. The inability of researchers to relocate the species in the Menggala region in 1993–1994, when 15 years before it had been relatively easy to observe, suggested that a real crash had occurred (Holmes and Noor 1995). Meanwhile, however, it is possible that the 100 km^2 of alluvial and swamp forest and adjacent ricefields in the Kluet portion of Gunung Leuser National Park

"may hold a significant population" (Holmes 1996). Moreover, an estimated 4,500 km^2 of wetlands exist down the west coast of Sumatra, and some are probably suitable for the species (Holmes 1996), so population estimates must await surveys. It has recently been suggested that the total number of birds on Sumatra was over 1,000 until the early 1990s, when dramatic habitat losses must have caused a major decline (Callaghan *et al.* 1998). Green and Crosby (1992), in not accepting the Ujung Kulon record from 1932, found that the species had not been confirmed from Java since 1907 and that therefore it is almost certainly extirpated there.

ECOLOGY ***Habitat*** The White-winged Duck mainly inhabits forested wetlands, previously even in small forest patches, such as pools, swamps, sluggish streams and channels or nearby lakes and flooded agricultural fields (Oates 1898–1899, Baker 1908, Green 1992a). The commonest generalisations are that it frequents very secluded and overgrown jungle pools in evergreen forest, often with gaunt dead trees standing about, and in shallow wetlands (*beels*) amidst dense cane-brakes and tall elephant grass jungle (Ali and Ripley 1968–1998, Smythies 1986; see Remarks 8). It is almost always associated with either primary or secondary forest, having been recorded in tropical wet evergreen forest, tropical semi-evergreen forest, montane wet temperate forest and tropical moist deciduous forest (Green 1992a). There is no evidence to suggest that it occurs in deciduous forest types (Green 1993a, Evans *et al.* 1997); in areas dominated by deciduous formations it appears to depend on narrow bands of gallery evergreen forest flanking watercourses (Nakhasathien and Stewart-Cox 1990).

In the north of its range it has been recorded from a variety of stagnant and slow-moving wetlands including rivers (Smith 1942), forest streams (Hopwood 1908, Smith 1942), swamps/jheels (Evans 1901), marshes, "*ins*" (extensive open wetlands edged with grasses and shrubs), flooded forest, puddles (Smith 1942), small pools, waterholes, saltlicks (Smith 1942, Milton and Estes 1963) and flooded paddyfields (Stanford and Ticehurst 1938–1939, U Thein Aung *per* Khin Ma Ma Thwin *in litt.* 1998). Parsons (1939) found it to be common in swamps created where forest had been flooded (as a result of earthquakes or by streams changing course) and in forest pools overgrown by "cane brake", elephant grass and dead trees. In Thailand, Parr *et al.* (1993a) linked the extraordinary concentration of birds in the last forest remnants along the Phanom Dongrak range with the gently sloping topography, in which slow-flowing rivers are traversed at intervals by natural weirs formed by stratified sandstone rock. However, the presence of rocky weirs at various current sites is probably a cause of reduced boat access, and therefore of reduced hunting pressure, rather than a correlate of any significant ecological factor (J. W. Duckworth *in litt.* 1999).

In Vietnam birds occupies "well-wooded localities, with marshy streams and ponds surrounded by trees, on which they spend much of their time" (Delacour *et al.* 1928). Sightings at Cat Tien National Park derive from seasonally flooded freshwater swamp forest—possibly the only remaining fragment of lowland swamp forest in Vietnam (Green 1992b)—which occupies about 500 ha in the centre of the park (Green 1993a), and mainly comprises *Hydrocarpus anthelmintica* and *Ficus benjamina* (Thai Van Trung 1988). In Laos, most records on the Nakai plateau were of birds on or by the bank of major rivers (Thewlis *et al.* 1998), and they were observed on pools or open marshes of densely forested regions in southern Laos (Engelbach 1932).

In Indonesia, the species inhabits remote marshes in forest, often along streams or in marshy hollows along narrow forest tracks (Hagen 1890). Most records derive from freshwater swamp and peatswamp forest (Green 1993a), but some Javan records may have been from evergreen forest and Sumatran birds have been observed in mangroves (Lambert 1988, Holmes 1990), suggesting that Hoogerwerf's (1950a) assertion that it is never found along the coast or in brackish water was mistaken. Although on mainland Asia the swamps used are largely inland, freshwater and non-acidic (Parsons 1939), acidic coastal swamps are used in northern

Sumatra (Holmes 1990). Most recent Indonesian records are within 10 km of permanent waterlogged plain, suggesting a degree of dependence on the permanent freshwater swamps that occur in these areas (Lambert 1988).

Roosting areas The two most commonly used habitats in Thailand are slow-flowing streams or rivers and forested swamps (Parr *et al*. 1994a). One suggestion is that they might prefer straight stretches of river so that they can take off and land easily, and thus minimise predation (Parr *et al*. 1994a). Chambers (1990) also noted that the species may favour areas with clear approach and escape routes. However, they can rise almost vertically from small forest pools on occasion (Parr *et al*. 1994a) and it is perhaps more likely that they select sites with good visibility (J. W. Duckworth *in litt*. 1999). At Bung Mon, ducklings were located in dense *Saccharum* grassland (Parr *et al*. 1994a). At Bung Lakatu, two birds flew in during the late afternoon and, after alighting on the water briefly, flew to roost overnight in tall forest trees; they left the roost before first light (P. D. Round *in litt.* 1998). In Indonesia birds roost on large branches fairly high up in trees, the sites being traditional (Hoogerwerf 1950a). At evening ("regularly at six o'clock") birds were seen flying over the canopy calling loudly on their way to their roosting sites (Hagen 1890). In Myanmar, they were observed to spend the day on "small pieces" of water, often up small streams in remote parts of the forest, coming out to the river at dusk to remain there all night and return to the jungle soon after dawn (Smythies 1986). They have been observed spending the night on lakes associated with paddyfields and returning to the forest in the morning (U Thein Aung verbally 1997).

Use of man-made and degraded habitats The species is likely to have made increasing use of artificial wetlands such as ricefields, regular visits to which were reported as early as 1910 (Robinson and Kloss 1910–1911; also Mukherjee 1961). Most grassy swamps in south-east Sumatra from which many recent records derive are probably man-made as a result of logging and burning of swamp forest in seasonally inundated areas (Lambert 1988). Indeed, many records now come from remnant patches of woodland in open swamp or from adjacent dense old secondary dryland forest, although sometimes (probably only if suitable tall trees are present) birds use fairly open woodland with little shade (Holmes 1977b). This is particularly true in south-east Sumatra, where most sites have only small patches of forest amongst grasslands and agricultural areas (Lambert 1988). A possible reason for the apparent greater tolerance of habitat degradation on Sumatra is the *rengas* trees (family Anonaceae), whose sap causes blistering to humans; these are therefore left standing when most other large trees have been felled, providing suitable nest sites for White-winged Ducks when there might otherwise be none available (Lambert 1988). Even inside forest the influence of man is evident: forest ponds in Way Kambas National Park are favoured by the species, and many of these are created where logging tracks have dammed small streams (Chambers 1990) (note the parallel here with the observation above that the species would turn up where earth tremors and streams changing course created new pools).

Elevation It occurs at a variety of altitudes. Indeed, as habitat loss has been so serious at lower altitudes, the species now appears to be restricted to uplands in some parts of its range (Green 1992a). While most Indian records derive from lowland areas below 200 m, it has been recorded from gentle foothills at 200–500 m and there are many records from up to 1,400 m, especially plateaus containing sluggish sections of perennial rivers (Higgins 1913, Ripley *et al*. 1991, Choudhury 1995a). All known sites in Vietnam apparently lie below 200 m (Green 1992a), although Brickle *et al.* (1998) recorded it at 200–300 m. A specimen from the Bolaven Plateau, Laos, was taken at 750 m (Dickinson 1970b). Altitude does not appear to be a limiting factor in itself, but the terrain needs to be relatively level with shallow, slow-moving or stagnant waterbodies, and the lowlands appear to provide optimum habitat (J. W. K. Parr *in litt*. 1996). In Thailand the species, "having been extirpated from wetlands in the plains, 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" (Scott 1989).

Use of open water The assertion that it never occurs on large, open lakes or rapidly flowing rivers or streams (Baker 1908, Khan 1986b, Green 1993a), and the implication that it exclusively uses small waterbodies lined with good tree cover (Choudhury 1996e,g, 1997a), are reasonable generalisations but not entirely accurate. It only infrequently uses large waterbodies, but is occasionally observed in swamps such as Kolomi and Dighali beels and open rivers such as the Sian (Green 1992a), and it has been recorded on Lake Lakatu (300 ha) and Bung Fad (130 ha) in Thailand, both of which are reportedly greater than 10 m deep and above 700 m in altitude (Parr *et al.* 1994a,b); individuals are more frequently encountered on large waterbodies in the dry season, presumably when smaller forest pools and watercourses have dried up (Mackenzie and Kear 1976, Parr *et al.* 1994a,b).

Sociality The White-winged Duck is usually encountered singly or in pairs (Hagen 1890, Robinson 1909a, Gee 1958, Mackenzie and Kear 1976, Husain and Haque 1981, Green 1993b, Parr *et al.* 1994a, Choudhury 1996e,g, 1997a). However, single adult males attended by two adult females have been reported (Choudhury 1996e,g, 1997a). Groups of 6–8 have been observed in South-East Asia by Parr *et al.* (1994a) and Evans *et al.* (1997). These are perhaps family parties, although in some cases they appeared to be loose aggregations of pairs at waterholes in the dry season (Evans *et al.* 1997). The largest groups recorded include 11 (Parsons 1939), 12 and 14 (Choudhury 1996e,g, 1997a). The group of 14 in Assam included one family party (male, female and four offspring) with seven other birds, all of which roosted together but went separate ways in daylight (Choudhury 2000c). Although Hagen (1890) stated that in Indonesia birds are usually solitary and less often in pairs, most recent reports suggest that the species most commonly occurs in pairs or trios in the country (Chambers 1990, Burn and Brickle 1992, Drilling 2000). Hoogerwerf (1950a) reported seeing pairs in Indonesia in December–February, and mentions that they occasionally they occur (or occurred) in loose foraging groups of tens together. Reports of groups larger than this are presumed to be erroneous.

Daily activity patterns The daily activity patterns of the species appear to vary with levels of disturbance, hunting pressure, food availability etc. (Green 1993b). It generally has peaks of activity at dawn and dusk and is then most frequently observed (Chambers 1990, Green 1992a, 1993b). However, analysis of local reports in Thailand did not reveal clear patterns of daily activity (Parr *et al.* 1993a), and the species remains active over the day (Green 1993b), notably in less disturbed areas (Choudhury 1996e,g, 1997a). At Bung Lakatu, it was heard and seen throughout moonlit nights in April 1993 (Parr *et al.* 1994a), and indeed most nocturnal records occur at full moon, the birds apparently resting on dark nights (Green 1993b, Parr *et al.* 1993a). In India (Mukherjee 1961, Ripley 1982), Myanmar (Stanford and Ticehurst 1938–1939), Thailand (Scott 1989), Laos and Vietnam (Delacour and Jabouille 1931) birds have been reported feeding in agricultural fields or marshes at night after leaving their forest roosts at dusk. Captive birds in India were reported to feed at dawn and dusk, preferring walking to flying as the means of foraging approach: a female that was kept domesticated half a mile from a pool "invariably walked there and back every evening, returning to the house for the hot hours of the day and for the night" (Baker 1908). At Chong, in peninsular Thailand, birds used to feed in partially flooded ricefields in the early morning and late evening, after which they reportedly flew to roost in patches of forest on small, steep hills nearby (Robinson and Kloss 1910–1911). This information suggests that the species has become more strictly nocturnal in recent times, perhaps in response to disturbance and hunting pressure at feeding sites. In some areas, diurnal feeding is thought to be more intensive in the morning than in the afternoon. Field studies in Bangladesh showed that around 34 minutes in the hour were spent feeding in the morning compared with 21 minutes in the hour each evening (Husain and Haque 1981). On the Nam Mon and Nam Xot rivers of the Nakai Plateau, Laos, individuals were generally seen "loafing" through the day and foraging was only observed at night (J. W. Duckworth *in litt.* 1999). In Bangladesh,

birds have been reported feeding throughout the day, and flighting back to a roosting site for the night (Husain and Haque 1981). Several observers have reported them resting through the middle of the day on water, logs, driftwood, low branches or under overhanging vegetation, almost always in the shade (Mitra 1957, Gee 1958, Mackenzie and Kear 1976, Husain and Haque 1981). During the night, birds have been recorded roosting singly or in small groups of up to 12 (Choudhury 1996e,g, 1997a), on broad branches in high trees, sometimes at the same site for several months in succession (Hoogerwerf 1950a, P. D. Round *in litt*. 1998). Strong tendencies to communal roosting are indicated by birds spending the night in trees above captive individuals in aviaries in India (Green 1992a), presumably attracted by their calls.

Moult The annual moult takes place in September or early October in India, and during this time individuals are rendered flightless for around a fortnight (Baker 1908). Locals reported that individuals move to impenetrable forest swamps for the moult, only emerging when they are once more able to fly (Baker 1908).

Food The species has been noted feeding in wet grass areas and shallow pools (Hoogerwerf 1950a), shallow, stagnant or slow-flowing streams, ponds, swamps or ricefields (Green 1993a). Its diet includes seeds, vegetation, fish and other animal matter (Ali and Ripley 1968–1998). In Bangladesh, it has been observed foraging mainly on aquatic snails (*Vibira* sp.), but also on vegetation (specifically *Hydrila*), fish (c.15 species), spiders and insects (Husain and Haque 1981); and it is clear that birds will exploit local abundances of particular foods, whether animal or vegetable. In Way Kambas National Park, Sumatra, for example, Drilling (2000) recorded concentrations of the species foraging on grass and sedge seeds in December, but moving to forest pools in the dry season where they appeared to consume small fish and invertebrates. Thus stomachs have revealed predominant or exclusive use of vegetable matter, e.g. "pyramidal seeds of an aquatic plant" (Hutchinson 1946), "principally vegetable matter with a few small pieces of pebble" (Hume 1888, Oates 1898–1899), algae, grasses, small tubers of rushes and "teki tubers", a type of grass (Hoogerwerf 1950a); one Thai bird was even seen to eat what appeared to be a wild fig *Ficus* floating in the water (Parr *et al*. 1993a, 1994a). On the other hand, specimens examined by Robinson and Kloss (1910–1911) had been feeding on "very large snails, apparently a species of *Ampullaria*, with which their crops were crammed" as well as a few freshwater mussels; the gullet of one bird killed by Stevens (1914–1915) in upper Assam was full of shells, presumably of molluscs; and Chambers (1990) found birds to eat animal matter, including grasshoppers, tadpoles, dragonflies and small fish. In deeper water, Chambers (1990) noted individuals changing direction rapidly and jabbing their bill under the water, as if chasing live prey just under the surface, while in shallow water they waded around with beak immersed and thrusting their head forward, again as if chasing prey.

Feeding at night on Sumatra is undertaken out in the grasses in the open swamp, also in weedy stubble of swamp rice; birds fly out, as in Assam, when the light has virtually gone (a distance of 4 km has been recorded), and usually, unless they are undisturbed and remain into the day, they return just before dawn (Holmes 1977b). Night feeding at Nam Nao, Thailand, seemed to involve prolonged surface dabbling (Parr *et al*. 1993a, 1994a).

Diet and feeding habits of the species were studied in captivity by Baker (1908), who found it to be omnivorous, eating rice and other grains, but apparently preferring live (never dead) animal food (fish, worms, grasshoppers, frogs and snails); individuals were quite adept at capturing live fish by skimming along the surface of water with their head and neck immersed, and when necessary diving under water, but they could not be induced to eat any water-weeds, refusing any "green food" unless very hungry.

Breeding *Season* Breeding generally seems synchronised with seasonal rainfall such that laying occurs in the late dry season and hatching occurs in the early wet season, which, in the north of the species's range, begins in May (Green 1993b). In India, breeding activity starts in February/March and lasts until the end of July (Mackenzie 1975, Husain 1977, Choudhury

1996e), a pattern reflected by local captive birds (Mackenzie and Kear 1976) and by wild birds in Bangladesh (Husain 1977, Husain and Haque 1981 *contra* Sarker 1987a). A female with six ducklings near Myitkyina was observed in June (Milton and Estes 1963), suggesting a similar regime in Myanmar. In Thailand local reports suggest that the species begins nesting in April, and ducklings, usually attended by the female, have been observed or reported in June at the onset of the wet season, the young staying with parent birds until November or December and dispersing when dry weather reduces the extent of available wetland habitat (Parr *et al.* 1994a,b); however, a brood was still in the nest at Khao Phanom Dongrak until August (Parr *et al.* 1993a) or possibly December (Parr *et al.* 1994b). In Laos, breeding appears to be spread over the year and less closely aligned with the wet season: incubation was suspected in March (Nam Mon, Nakai Nam Theun NBCA), there are several "imprecise reports" of adults accompanying chicks in the wet season, May–August (Evans *et al.* 1997), a brood of eight ducklings was collected by locals at Dong Khanthung on 15 July, and three downy young were seen with two adults in December (Xe Pian NBCA) (Round 1998). In Indonesia, the occurrence of birds in pairs in the period December–February (see Population) suggests breeding at that time, and indeed nesting appears to coincide with the period of flooding (Hoogerwerf 1950a); nests with fresh eggs have been found twice in December (Hoogerwerf 1950a). One nest (possibly not genuine) contained eight eggs in mid-January (Holmes 1977b), and villagers reported birds with ducklings (in one case seven) in January, one guide indicating that breeding was geared to the peak in the flood cycle; it was, however, generally assumed that the season must last from December to April (Holmes 1977b). Drilling (2000) saw two matings in December at Way Kambas National Park, and remarked that ducklings were present there from early April to late September, so the "breeding season seems very protracted". Eggs from Java are dated February (see Distribution).

Nest site and structure The White-winged Duck usually nests in tree holes, forks and hollows (Green 1992a, Parr *et al.* 1994a,b). The tree species used vary with availability (Green 1993a,b) and nest cavities have been recorded 3–12 m from the ground (Baker 1908, 1922–1950, Hoogerwerf 1950a, Talukdar and Bhattacharjee 1995b). Four of the six nests found by Choudhury (1996e) were in tree cavities, while the others were on the ground, one of the latter underneath a fallen tree-trunk at the water's edge.

In India (see Remarks 9) the species has been recorded nesting in *Albizzia*, *Bischofia javanica*, *Dipterocarpus macrocarpus*, *Ficus*, *Mesua ferrea*, *Pterospermum acerifolium*, *Salix tetrasperma* and *Terminalia myriocarpa* (Choudhury 1995b, 1996e, Talukdar and Bhattacharjee 1995a,b). A nest found by Baker (1908, 1922–1930) was on the banks of a stream in dense forest and placed in a deep cavity caused by decay, 6 m above the ground in the fork of a thick tree where three limbs branched from the main trunk; this nest was a mass of grass, other rubbish and a lining of feathers and down. More recently, a nest was found placed in a 14–15 cm deep cavity found at the broken end of a tall seasonally inundated *Salix tetrasperma* (often the largest trees occurring in the area) in a forest under flood (Choudhury 1993a). The species seems to favour similar bowl-shaped cavities formed on top of broken tree-trunks (Choudhury 1996). On the ground, a nest was placed beneath a large fallen log on the bank of a stream and another was placed amidst dense *Arundo donax* reeds (Choudhury 1996e). The eggs in these ground nests were placed on flattened short grass (Choudhury 1996e).

In Bangladesh, the species has been recorded nesting in civit *Swintonia floribunda*, a tropical wet evergreen forest species and often the tallest tree species in the area, and in barta *Artocarpus lakoocha*, a tropical semi-evergreen forest species (Husain and Haque 1981, Green 1993b), also *A. chaplasha* and uriam *Mangifera longipes* (Khan 1983a). Nests at Pablakhali were most often placed in holes in civit: two examples were 12 m up in a 37 m tree and 23 m up in a 38 m tree; another was located only 4 m up in a barta (Husain and Haque 1981). The duck may select the tallest trees surrounded by deep forest for nesting, with the hole usually being above the upper canopy to facilitate access; nest holes are generally around a metre deep

with entrance holes c.30 cm wide, and nests have been found to contain small amounts of vegetation, e.g. straw, leaves, roots of water hyacinth *Eichhornia crassipes* and grasses (Husain and Haque 1981).

In Thailand, Parr *et al*. (1993a) received reports of six nests: three were in dipterocarp trees (two in *Dipterocarpus*, one in *Anisoptera*) and one in a *Lagerstroemia* 10–30 m above the ground; one report was of a nest in a tree hollow, 1 m above the water level, while another was on the ground. Parr *et al.* (1996) reported two nests in Cambodia: one in July 1995 in a tall (15 m high) broadleaved tree (local name "dan ta oo"), another in August 1995 in a *Barringtonia acutangula*. Return visits to the first nest resulted in reidentification of the nest tree to *Coccoceras anisopodum*, and suggestions that the hosts were not White-winged Ducks (F. Goes *in litt*. 2000). These two breeding records in Cambodia, as well as most observations of the species, are now treated as provisional.

On Sumatra the species apparently favours *rengas* trees (family Anonaceae; mainly genera *Melanorrhoea* and *Gluta*) for nesting (Holmes 1977b, Lambert 1988). There, Hoogerwerf (1950a) described two nests, one 3 m up in a broken *renga* stump, surrounded by new shoots from the bole, the other in a round hole between three large branches of a *bungur* tree. Local people reported nests as situated 6–8 m up, in a cavity between heavy branches, sometimes in a large tree hollow (Hoogerwerf 1950a).

Clutch and brood size Clutch and brood sizes in India range from one to 15 (Choudhury 1996a). Of the two 1995 nests described in Cambodia by Parr *et al.* (1996), one contained 16 eggs and the other c.20 eggs (although these records are now treated as provisional). Broods recorded in Thailand were much smaller, containing an average of five young (range 3–7, n=7 broods) (Parr 1994a,b, Parr *et al*. 1993a). Eight broods of ducklings in Bangladesh had a mean pre-fledging brood size of 3.9 (Husain and Haque 1981). In captivity, however, clutch size is known to vary from six to 13 eggs (mode of ten), the incubation period lasts around 33 days and chicks take about 14 weeks to fledge (Mackenzie and Kear 1976). In Indonesia, nests consisting of clutches of six and nine eggs were described by Hoogerwerf (1950a), while local people reported nests often containing over 10 eggs (Hoogerwerf 1950). The observation of more than two birds with ducklings (Choudhury 1996a) might indicate either post-fledging brood-merging in the species, multiple clutches laid in single nest cavities (which seems possible given the large brood sizes recorded) or that helpers assist the breeding pair. Indeed broods at Way Kambas were watched being accompanied by helpers and even individually by different females at different times (Drilling 2000).

Behaviour The female incubates overnight, while the male roosts nearby and approaches at dawn to escort he to foraging grounds for the first few hours of the day; he then accompanies her back to the nest and returns to his roost until late afternoon, when he again visits and accompanies her on a foraging trip, the birds returning to their original positions for the night towards dusk (Husain and Haque 1981). When the male returns to the nest with the female (i.e. late morning and dusk) he perches in the nest tree for a while or flies about nearby until she is settled, a behaviour which helps in the detection of nests (Husain and Haque 1981, Parr *et al.* 1996). The constant attendance of the male has been interpreted as mate-guarding behaviour during the fertile period (Owen and Black 1990), but he continues accompanying her after all the eggs are laid. Although ducklings have occasionally been observed with both parents (Green 1992a, 1993b), they are more usually accompanied by a single parent, presumably the female (Parr *et al*. 1993a).

Migration The species is presumably resident, although short movements in response to dry weather and water conditions are frequently recorded: the drying of small upland watercourses tends to result in an increase of records from larger watercourses in the nearby lowlands (Parr *et al*. 1994a,b, A. Choudhury *in litt*. 1998). Birds are also sometimes forced to forsake the relative security of forested regions at the driest time of year in order to visit suitable wetlands (Parr *et al*. 1993a, 1994a,b). Hoogerwerf (1969–1971) apparently regarded

the species as a visitor to Java from Sumatra, but this was evidently not the case in the nineteenth century (Green and Crosby 1992).

THREATS ***Habitat loss and modification*** *Forest* Deforestation in South-East Asia has accelerated in recent decades owing to a rapid increase in economic development and local human population (Collins *et al.* 1991). Lowland forests have incurred the heaviest losses during this period as these are the most rapidly converted to agriculture and other uses, an unfortunate overlap with optimum habitat for White-winged Duck (Green 1993a). Over the species's entire range, deforestation is continuing at about 15,000 km^2 per annum, equivalent to about 1.5% of the remaining forest cover in the region (Collins *et al.* 1991). All known populations outside protected areas, and many inside, are at risk through habitat destruction in the next 25 years if no preventative action is taken (Green 1992a). Ongoing deforestation, although illegal, is commonplace in many of the protected areas where the species occurs (Khan 1986b, Round 1989; for Sundaic Indonesia see equivalent section under Crestless Fireback *Lophura erythrophthalma* and Hook-billed Bulbul *Setornis criniger*).

Holmes (1990) suggested that, in Sumatra, the first phase of forest clearance may actually have benefited the species by creating extra feeding habitat where swamp forest was cleared. Similarly, initial deforestation in the continental lowlands may conceivably have benefited the birds when ricefields were still surrounded by vast areas of suitable habitat (Green 1993a). Indeed, the species was "fairly common on ricefields" in Thailand in 1913 (Robinson 1915a). On the other hand, as the largest forest trees are usually the first to be felled and often the ones favoured by nesting White-winged Ducks (see above), continuing deforestation must reduce nest-site availability: the civit is both the favoured nesting tree and the main target of commercial logging in the Chittagong Hill Tracts (Husain and Haque 1981). Recently selectively logged areas may thus be unable to support the species. As development pressure has intensified, rotation cycles in both commercial forestry and in shifting agriculture have been shortened (Collins *et al.* 1991), reducing the opportunity for forest to regenerate to a mature stage (Green 1993a).

Moreover, fragmentation of forests into smaller, more isolated tracts, which may not be large enough to support a demographically or genetically viable population of the species, increases the likelihood of local extinctions, with little chance of recolonisation (Green 1993a, Ounsted *et al.* 1994). For example, habitat at Way Kambas is now so isolated that its well known population of White-winged Ducks is unlikely to be viable, especially as the forest will be a very high fire risk during the next ENSO event (D. A. Holmes *in litt.* 1999). Indeed it is possible that there is no population large enough to ensure survival into the long term, although areas of open country are not barriers to dispersal between forest areas, since the species is known to travel at least 6 km across open, populated terrain to reach foraging habitat after dark (Chambers 1990). As the species favours lowland riverine areas, it suffers particularly severely because of the high rate at which these river systems are disturbed, the low overall area of suitable habitat in given protected areas, and the fact that rivers are often used to define protected area boundaries (a less appropriate approach than using ridge-tops, at least for aquatic species). A fuller discussion of threats specific to riverine species appears under Masked Finfoot *Heliopais personata*. *India* Destruction of forest is the main cause of the decline in this species (Green 1993a). The major limiting factor in Assam and Arunachal Pradesh is the clearance and occupation of suitable habitat for human settlements and tea plantations (most of Tinsukia district) (Choudhury 1996e). Indeed, long ago Stevens (1914–1915) observed that deforestation for tea plantations had opened up large tracts of forest. Forests on the upper Brahmaputra, notably on the north bank, were badly damaged by an earthquake in 1950, which raised the riverbed by 7 m and flooded the forest extensively (Mackenzie and Kear 1976, Green 1992a). Deforestation accelerated after 1950 with an increase in human population (including refugees), modernised forestry and agricultural

practices (Mukherjee 1961, Choudhury1996, 2000c). Lowland forest, once continuous in the central and western Brahmaputra valley, is now severely fragmented; suitable but much disturbed habitat occurs only in protected areas or reserve forests which still face pressures of deforestation, mismanagement, hunting and pollution (see Green 1992a, Choudhury 1996e). Forest everywhere is being destroyed for fuelwood, agriculture, *jhum* (shifting) cultivation and selective logging by government and other agencies, all abetted by the construction of new roads (Choudhury 1996e, A. Choudhury *in litt*. 1998); there is encroachment by cane-cutters, hunters and grazing cattle, many clear-felled areas have been replaced by plantations of *Bombax malabaricum* and *Dipterocarpus macrocarpus*, and the introduced *Makenia* vine appears to have spread into many secondary forest areas of Assam, preventing forest regeneration (Mackenzie and Kear 1976, Green 1992a). By 1982–1983 forest cover in Assam was only 22% (Green 1992a), and by that time in Tinsukia district vast areas of forest important to the species (e.g. Dum Duma Reserve Forest, Dauramara Reserve Forest, Upper Dihing East and West Block Reserve Forests) had been either selectively logged or clear-felled over their entire area (Mackenzie 1985; see Remarks 10). Even though commercial timber collection has ceased in Dibru-Saikhowa National Park, Assam, the inhabitants of two enclave villages (Laika and Dadhia) and peripheral villages are engaged in forest encroachment, timber smuggling (sometimes under the employment of merchants from Dibrugarh), and fuelwood collection, activities which pose a "real danger" to the remaining habitat (Choudhury 1995b, Kazmierczak and Allen 1997). The reserve's forests are also threatened by unusually large annual floods, presumably owing to greater run-off from the denuded Brahmaputra watershed (Choudhury 1995b). Forest cover in north-east India in general is decreasing at an alarming rate in north-east India, with at least 1,000 km^2 cleared annually (Choudhury 1996h). Forest around Namdapha National Park is disappearing rapidly because of cattle-grazing and wood-cutting, while certain areas inside it have been cleared by Chakma refugees who collect wood and poach wildlife (Samant *et al*. 1995). Until recently, management practice in reserve forests involved the removal of old and dead wood that could have provided nesting sites for the species, and the drainage and planting of marshes and swamps (Green 1992a). Almost all eight reserve forests with populations of the species in Dum Duma division have been earmarked for felling (Talukdar 1994) although this has not yet been undertaken (SS). If these plans are carried out, the future of the species, in one of its last strongholds, is bleak. *Bangladesh* The main cause of decline is deforestation (Khan 1986b). Selective logging of larger trees for furniture, plywood and matchsticks has reduced the number of nesting sites (Khan 1986b). Military control of the hill tracts could not control the problem, and it is reportedly accelerating since the peace agreement was signed (P. M. Thompson *in litt.* 1999). *Myanmar* Deforestation for agriculture and by forestry activities is likely to have extirpated the species from large areas of the country. Collins *et al.* (1991) estimated remaining forest cover at 47.4%, including 8.3% of degraded forest and 37.7% lowland forest (below 900 m) (Green 1992a). Annual deforestation rates were estimated at 2% (Collins *et al*. 1991) or 2,200 km^2 (Green 1992a). The process is assumed to have accelerated since Thailand's logging ban in 1989, which caused Thai timber merchants to scale up their operations in Myanmar (Green 1992a; also *BBC Wildlife* October 1989: 691). Goldmining and collection of forest products may also pose a threat to the species (Khin Ma Ma Thwin *in litt*. 1997). The inefficacy of the country's protected area system in the current climate of political instability is cause for considerable concern, as those sites that once held populations of the species are now largely off-limits and subject to uncontrolled habitat loss and hunting (Green 1992a). *Thailand* Habitat destruction has been the major factor in the past decline of the species (Green 1992a). In the peninsula, where it was once locally common, less than 4.7% of original forest cover below 200 m remained by the mid–1980s (Round 1988a), with far less now. Gyldenstolpe (1916) found it in creeks of the peninsula, "the banks of which were densely covered with evergreen jungle". Such habitat is now almost impossible to find in the region's lowlands

(Round 1988a). In addition, while the species was abundant in Trang province, Round (1988a) stated that "the swamps of Trang have disappeared almost without trace", and the White-winged Duck has vanished with them. The bird's present range includes some large tracts of forest that are nominally protected as wildlife sanctuaries or national parks, so this may no longer be the primary threat (although waterbodies in Phu Khieo and some other protected areas have been mooted for proposed irrigation reservoirs: Parr *et al.* 1993). Most protected areas supporting the species continue to suffer illegal deforestation and burning of habitat (Green 1992a). Small-scale illegal logging has been noted in Phu Jong Na Yoi National Park and in the adjacent Yot Dom Wildlife Sanctuary (Parr *et al.* 1993a), and without official intervention this will continue unhindered. *Cambodia* Although large areas of suitable habitat remain in the Tonle Sap basin, the felling of large trees is constantly reducing the availability of nest sites (Sun Hean *in litt.* 1997). *Vietnam* Widespread deforestation has had a severe impact: huge areas of suitable habitat have been lost in recent decades, including 20,000 km^2 of forest destroyed through warfare (Green 1992a,b). An account of forest loss in the country appears under Crested Argus *Rheinardia ocellata* and information specific to Ke Go appears under Vietnamese Pheasant *Lophura hatinhensis*. A shortage of feeding areas in the dry season around sites such as Cat Tien National Park possibly limits populations (Green 1992a,b), and illegal logging has also been recorded in this protected area (Robson *et al.* 1990). Rates of loss of the riverine forests inhabited by this species are particularly high, because river valleys are often the most accessible areas for settlers (A. W. Tordoff verbally 2000). *Indonesia* The extraordinary rarity and patchy distribution of this duck indicate that there is some major constraint on its numbers, and the apparent crash in its population near Menggala, Sumatra, was taken as a sign that "the bird's apparent adaptability to habitat degradation and human population pressures in Sumatra was an incorrect assumption" (Holmes and Noor 1995). At Jepara lake in southernmost Sumatra in 1976 the habitat was plentiful but disappearing rapidly in the face of rapid human immigration from Java (Holmes 1976). Logging is rampant in lowland Sumatra; the previously pristine Suaq swamp forest within Gunung Leuser National Park, for example, was being rapidly cleared in 2000 (J. Wall *in litt*. 2000), doubtless with disastrous results for the vitally important populations of both orangutan *Pongo pygmaeus* and White-winged Duck. In 1997 forest fires appear to have destroyed or severely damaged large areas of prime habitat for the species on Sumatra, probably resulting in a major loss of population (Sibuea 1998, Callaghan *et al*. 1998); Berbak Wildlife Reserve is known to have been affected (Legg and Laumonier 1999). B. Hughes (*in litt*. 2000) stated that between February and October 1997 over 2,700 separate fires were reported in Sumatra, covering 360 km^2. Many were in the White-winged Duck's peatswamp habitat, including the two most important sites: Way Kambas and Berbak National Parks. A Wetlands International-Indonesia expedition in April–May 1998 found that over 80 km^2 of suitable habitat had been destroyed in Way Kambas and 1 km^2 at Berbak, with a possible decline in White-winged Duck numbers reported. The area around Lae Tapus and the Rianate Transmigration Settlement, Sumatra, had been modified between 1990 and 1999 from peatswamp forests to palm plantations rice fields and other land uses (Wibowo *et al*. 2000). In addition, five out of the nine sites outside protected areas that were found to support the species in Sumatra by Lambert (1988) were destroyed by logging or fire a few years later (Ounsted *et al*. 1994). For a fuller account of deforestation and the effects of forest fires on swamp forest in Indonesia, see Threats under Hook-billed Bulbul. On Java only 3% of non-montane forest remains (Green 1992a) and the duck is thus unlikely to persist.

Wetland drainage Swamps, marshes and other wetlands have been extensively drained throughout the species's range, primarily for agricultural use. Drainage of wetlands inside forests as well as in fringe areas is common in India (A. Choudhury *in litt*. 1998). The installation of several flood barrages and drainage operations to minimise flood damage at

Pa Phru Wildlife Sanctuary in southern Thailand has probably had a negative impact on the species (Parr *et al.* 1993a). Bolaven South-West Proposed NBCA, which holds one of the last populations of White-winged Duck in Laos, faces the imminent threat of commercial peat extraction from pools in and around the site: the consequences for the species are likely to be serious (J. W. Duckworth *in litt.* 1999). Drainage of suitable swamps has been widespread in Sumatra, and is continuing (Holmes 1977b, 1990). This is likely to be the most serious threat as it reduces crucial areas of dry-season foraging habitat (Green 1993a). The loss of the species from Java is partly attributable to swamp drainage (e.g. reclamation of Desa Langgen began in 1924: Green and Crosby 1992).

Hydropower development In Bangladesh's Kassalong Reserve, 906 km^2 of the 960 km^2 reserve is now largely submerged following the creation of the Kaptai reservoir, leaving only small patches of evergreen forest on the higher ground like "oases in a desert", and greatly reducing the amount of habitat suitable for the species (Husain 1977, Khan 1986b). Hydropower development is a major threat in Indochina, especially Laos where up to 29 dams were proposed for construction on Mekong tributaries by the year 2010 (Thewlis *et al.* 1998); even if (as is likely) the actual number completed by that time is small (J. W. Duckworth *in litt*. 1999), these projects will have catastrophic impacts on fluvial ecosystems and populations of White-winged Duck (Thewlis *et al.* 1998). The Nakai Plateau population will possibly disappear if the Nam Theun 2 hydropower project goes ahead (Timmins and Evans 1996), and even if it is abandoned (as currently seems to be the case) the effects of salvage-logging in the proposed inundation zone have already been severe (Thewlis *et al.* 1998). Further, the Xe Namnoy–Xe Pian Hydropower Project will affect waterflow in this river system, with serious implications for the wetlands of the area (Thewlis *et al.* 1998), flooding some areas of suitable duck habitat and affecting downstream flow (Evans *et al.* 1997). An extended discussion on the likely impact of these developments on White-winged Duck populations in Laos is given by Evans *et al.* (1997). In Vietnam, there are advanced plans to construct two dams on the Dong Nai river upstream of Cat Tien National Park, a currently unsurveyed area that is expected to support this species (A. W. Tordoff verbally 2000).

Protected area management problems The level of protection offered by park or sanctuary designation is minimal throughout the White-winged Duck's range (Parr *et al*. 1993a, J. W. Duckworth *in litt*. 1999). Deliberate burning of forest by local people during the dry season is widespread, affecting large areas in Thailand, Laos and elsewhere, causing a gradual conversion of dense evergreen forests into drier, deciduous and less suitable forests (Round 1988a, J. W. Duckworth *in litt*. 1999). Burning is concentrated at the end of the dry season, during the suspected breeding season (Green 1993a). Until recently, reserve forests were managed in ways believed harmful to the species (removal of old or dead trees, drainage of wet areas: see above). Staff and equipment levels in areas such as Dibru-Saikhowa National Park are insufficient: with few roads and no radios, the 640 km^2 park cannot be covered by its 21 forest guards and 10 foresters, and illegal human pressures continue (Choudhury 1995b). In Bangladesh the protection and management of parks and reserves is hampered by "lack of funds, lack of technical, managerial and planning expertise and lack of adequate scientific data", plus failure of law enforcement and the effects of institutional bottlenecks, with (to date insufficient) international assistance (Rashid and Khan 1987, Rahman 1995); unrest in the Kassalong Reserve area has made it difficult to survey and protect (Khan 1986b, Husain 1989). In similar vein, forested upper reaches of waterways and the adjacent watershed in the Yot Dom Wildlife Sanctuary area, Thailand, were long "a major stronghold of the Khmer Rouge" (Scott 1989), and the problem with landmines and bandits remains there and at Huai Palai Sua (C. M. Poole *in litt*. 1999, J. W. K. Parr *in litt*. 1999). The proposed reserve at Dong Khanthung in Laos is under threat from immigrant-driven agricultural development, habitat loss and hunting such that "urgent intervention is needed to prevent the further erosion of biodiversity" (Round 1998).

Persecution and hunting The fragmentation of forests causes a rise in hunting pressure because White-winged Ducks are more easily encountered, at least initially (Green 1993a). Even though most hunting and egg collection must go unreported, the evidence suggests that it is intense in many areas (Holmes 1977b, Choudhury 1993a, 2000a, Parr *et al.* 1996). This species is a conspicuous and tempting target for hunters, and is believed to be especially sought after because of the quantity and quality of its meat (Timmins and Evans 1996; see Remarks 11). The fact that its populations are concentrated in predictable wetland areas during the dry season, when the agricultural calendar affords plenty of free time for hunting, is presumably a compounding factor in its plight (Evans *et al.* 1997). Collection of eggs from nests is a problem as the nests are sometimes quite easy to find: all c.36 eggs at two Cambodian nests (provisionally identified as this species) found in 1995 were collected by locals for food (Parr *et al.* 1996). Fledged birds or ducklings have been recorded being caught by various methods: in fishing nets, with baited fishing line, tracked with dogs, shot or taken using a variety of traps and nets (Husain and Haque 1981, Lambert 1988). Snaring in fish-nets appears often to be accidental, but with fishing pressure high throughout Asia it must be a common problem (as suggested by Husain 1977, Parr *et al.* 1994a). *India* Hunting of this (and other waterfowl) species (with guns, bows and arrows, nets and traditional snares), and the collection of its eggs and nestlings, has intensified with the increase in human population in north-east India (Mukherjee 1961, Bhattacharjee and Saikia 1993, Choudhury 1996e). It is easy to catch by setting numerous nooses at specific places along the water's edge where it habitually enters or leaves forest pools (Baker 1908). Incubating birds are also frequently trapped at the nest (Choudhury 1993a). Individuals have been recorded caught with lassoes or beaten with sticks (Choudhury 1996e), presumably when they are flightless during the annual moult; they run the gauntlet of firearms, slingshots, fishtraps and nooses (Choudhury 1995b, 1996e), and in the districts of Lohit, Changlang and Tirap almost every household possesses firearms, usually self-made muzzle-loaders (Choudhury 1996e). In Tinsukia district, in 1969, at least 26 were taken for food (Green 1993a). The collection of ducklings, which are easy to catch while flightless, is another serious threat: 177 were known or reported to have been collected between 1968 and 1995 in north-east India (Choudhury 1996e), accounting for 71% of the total live birds reportedly destroyed. Given that most taking of birds will go unreported, this indicates the scale of the problem faced by breeding White-winged Ducks in the country. Ducklings collected from nests survive well under captive conditions in villages, and may be sold in markets (Choudhury 1996e). Local people who harvest eggs are unaware of the legal or conservation status of the species (Choudhury 1993a). *Bangladesh* Uncontrolled hunting and trapping has caused the species to become excessively rare and shy (Husain 1977, Sarker and Sarker 1983), and legislation remains ineffective (Sarker 1986a). In Pablakhali Wildlife Sanctuary, 74% of 31 ducklings in eight broods in 1977 and 1978 were taken by local hunters, and two adults were taken by fishermen; local people apparently search creeks and ponds in forest areas specifically to catch ducklings after the breeding season (Husain and Haque 1981, Khan 1986b). Birds are occasionally ensnared in fishing nets (Husain and Haque 1981, Khan 1986b). *Myanmar* Hunting is likely to be a threat, particularly in northern and eastern areas where firearms are widely available owing to security problems, and indiscriminate hunting is frequent, including inside protected areas such as the Kyatthin Wildlife Sanctuary (Scott 1989) and Tamanthi Wildlife Sanctuary (Rabinowitz *et al.* 1995, Saw Han 1996). *Laos* Intense hunting is a major threat for a variety of cultural and economic reasons, particularly close to towns and villages (Timmins and Evans 1994, Evans *et al.* 1997, Thewlis *et al.* 1998). The facts that there is substantial suitable habitat in various areas, but that the species is now very difficult to find in it, can best be explained by intense hunting pressure (Evans *et al.* 1997, Thewlis *et al.* 1998). *Thailand* Hunting is a major problem in protected areas in Thailand (Round 1988a, Green 1992a; see equivalent section under Rufous-necked Hornbill *Aceros nipalenisis*), particularly in ones such as Thung Yai Naresaun Wildlife Sanctuary, which

contain populations of hill tribespeople (Parr *et al.* 1993a). Hunting is also severe in the species's main stronghold along the Phanom Dongrak range where it is frequently shot or captured when encountered: Parr *et al.* (1993a) received reports of nine young and four adults caught, and three others found dead, all but one of these incidents occurring inside protected areas. Hunting parties are regularly intercepted during fieldwork in Yot Dom Wildlife Sanctuary and Phu Jong Na Yoi National Park, two important areas for the species (Parr *et al*. 1993a, Ling *et al*. 1999). Shot or trapped White-winged Ducks have been recorded on several occasions and indeed "all the *C. scutulata* sites in Thailand are routinely visited by poachers who shoot or trap birds and mammals for food" (Green 1992a). *Vietnam* Illegal hunting has been recorded in Cat Tien National Park (Robson *et al.* 1990), but is now fairly well controlled (G. Polet *in litt*. 2000). *Indonesia* There was no evidence of direct hunting pressure in Sumatra in the 1970s, but eggs might sometimes be taken for food or ducklings trapped (Holmes 1977b). The loss of the species from Java is partly attributable to hunting pressure (Green and Crosby 1992).

Inbreeding It has been suggested that Sumatran birds may be inbred (a phenomenon perhaps promoted by the perenniality of the swamps, which is a disincentive to dispersal), which might explain (a) their high incidence of albinism and (b) their greater tolerance of disturbance and habitat modification (Holmes 1977b)—although of course it is arguable that (b) is a benefit rather than a threat. The view that either domestication or inbreeding is responsible for albinism in Indonesian birds has, however, been opposed—domestication because the bird occupies areas remote from man and is rare in captivity (Hoogerwerf 1950a, Green *et al*. in Kear in prep.), inbreeding because the population on Sumatra was, into this century, simply too large (M. J. S. Mackenzie *in litt.* 1985; see Mackenzie 1990). It is perhaps more likely that racial differences underlie variable albinism in the Sumatran population (A. J. Green *in litt*. 2001; see Remarks

Trade and captivity There is evidence that trade in the species is occasionally a problem in some areas (Green 1993a, A. Choudhury 1998c). "Quite large numbers" of live White-winged Ducks were imported into Thailand from Cambodia in the last decade (Anon. 1998). One private owner possessed 10 in 1998 (P. D. Round *in litt*. 1998), suggesting that trade is a substantial threat given the low populations of the species. Ducklings and young are taken from the nest or captured and kept in captivity as domestic waterfowl (Parr *et al*. 1994a). Four birds were obtained as pets from Myanmar by a Thai policeman in the 1980s (Green 1992a). In Sumatra a villager was paid by a westerner for a bird and eggs in 1985 (Lambert 1988), while four birds were on sale at a Javan market in 1991 (Green 1992a).

Disturbance Whilst the species is a shy forest bird generally sensitive to disturbance, it has been recorded in ricefields close to villages during the day (Holmes 1977b). Sites for the species suffer from regular encroachment by people living in or around the site and extracting logs or other forest products, hunting, grazing cattle, fishing etc. (Green 1993a). Whilst logging and hunting have a direct impact on the species, other activities may cause harm through disturbance, preventing the birds from feeding or breeding effectively. *India* The Indian villages found within most of the larger reserve forests, often within prime habitat of the species, are growing in size (Choudhury 1996e). The high incidence of fishing in small jungle pools, and other disturbance by local people (logging, grazing and turtle-hunting), reduce the availability of foraging areas in India, and increase the likelihood of incidental chick collection (Choudhury 1996e). Favoured haunts of the species are quickly becoming unsuitable due to human encroachment and consequent disturbance (Choudhury 1993b). *Bangladesh* For one commentator, the greatest single negative factor for all the country's wildlife resources, after direct persecution, is habitat disturbance (Rahman 1995). In the Kassalong Reserve area, heavy pressure by fishermen both day and night leaves little space for the ducks to roost or feed (Husain 1977). A policy of leasing land (at 2.5 ha per family) to settlers around Pablakhali has caused a great influx of people into the area and it is not known whether the duck

survives there (Khan 1986b). *Thailand* In the Sanambin Non-Hunting Area there is "constant, incidental disturbance of the waterbirds from fishermen" (Scott 1989), a problem that faces most wetlands in the country. Slow-flowing watercourses favoured by the species also tend to be those most frequently used by boats, thus inevitably increasing disturbance (J. W. Duckworth *in litt*. 1999). Disturbance by visitors, including birdwatchers, to the few known nesting localities might also prove to be a threat (P. D. Round *in litt*. 1998). *Laos* Wetlands are intensively used for fishing, agriculture (most of the Mekong floodplain has been converted to rice paddy), livestock grazing and grass harvesting (Thewlis *et al.* 1998). As the species breeds in the late dry season in many areas (Parr *et al*. 1993a) it is limited by habitat at this time of year and consequently must suffer heavy disturbance by people (Round 1998). The middle sections of the Houay Phaak in Dong Khanthung were being used both by a pair of White-winged Ducks and by 10–20 fishermen daily during the dry season in 1998 (Round 1998). *Vietnam* Up to 50 fishermen used to visit wetland sites daily inside Cat Tien National Park (Green 1992b, Nguyen Cu *in litt.* 1997), although the situation may now have improved (A. W. Tordoff verbally 2000). *Indonesia* The species's reduced use of a set of forest pools in Way Kambas National Park coincided with the construction of road access along their periphery (Green 1993a).

Pollution and pesticides Persistent pesticides have been used in large quantities in South-East Asian ricefields in recent decades (Green 1993a). The species must have encountered these during its foraging forays to this habitat, and seems likely to have suffered as a consequence (Round 1988a, Green 1993a). In Assam, India, the species occurs in forested areas adjacent to tea plantations where wetlands are polluted with limed tea waste (Green 1993a). The White-winged Duck has been seen using tea-waste destruction ponds, especially during drought periods; a bird netted on such a pond died three days later with aspergillosis, possibly caused by the tea waste (Green 1993a). Oil-drilling (e.g. East and West blocks of Upper Dihing Reserve Forest and Digboi area) and open-cast mining occur in Assam and other forested areas in the species's range and may cause significant pollution (Green 1993a). Amongst the threats to the species Choudhury (2000c) listed "severe water pollution caused by seepages from oil rigs, refuse ponds near rigs, effluents of Digboi Oil Refinery, and the use of dangerous non-biodegradable pesticides such as Thiodan and Dieldrin in the tea gardens". Furthermore, toxic effluent from timber mills may have harmful effects on many river systems (Green 1993a). Fishermen use pesticide cocktails to kill fish in Dibru-Saikhowa National Park, Assam, and in the waters flowing into Way Kambas National Park, Sumatra (Chambers 1990, Choudhury 1995b) and presumably in countless other regions of the species's range. In Thailand DDT and dieldrin, two infamous persistent toxic chemicals, were found in water samples collected from two protected areas (Thung Yai Naresaun and Yot Dom) supporting White-winged Duck (Nakhasathien and Stewart-Cox 1990, Green 1992a). Enormous quantities of organochlorines such as these are imported into South-East Asia, a factor that has presumably played some part in the dramatic declines of large waterbirds (Green 1992a).

Natural predation Gee (1958) provided two records of the species being attacked in flight by raptors. In Bangladesh, an adult was killed by an otter, although it may already have been snagged in a fishing net (Husain and Haque 1981). It is unlikely that natural predators are a factor in the decline of this species, although disturbance and discarded fishing equipment may increase their vulnerability to predation.

MEASURES TAKEN Comments on captive breeding are made under Remarks 12.

Legislation and education The species is listed under Appendix I of CITES and is legally protected from hunting and collection in seven countries: Bangladesh, India, Myanmar, Thailand, Indonesia, Cambodia and Laos (Green 1993a, Evans *et al*. 1997, C. M. Poole *in litt*. 1999). However, there has been little effort to enforce this protection or to educate hunters

about the law; indeed in countries such as Myanmar the protection applies to all ducks in a blanket and unenforceable law rather than as a specific measure for the White-winged Duck (Green 1992a, 1993a). Nevertheless, the government of Laos is having notable success in controlling gun ownership, a measure that in Vietnam has apparently benefited populations of large waterbirds (J. W. Duckworth *in litt.* 1999). There have been "major" education efforts targeted at raising awareness of the conservation status and requirements of this species in India, Thailand and Indonesia (A. J. Green *in litt*. 2000). It is also the subject of a WCS poster campaign in much of Laos and appears on awareness material (posters and books) produced by the Wildlife Protection Office as part of an ongoing campaign to reduce hunting of waterbirds in Cambodia (C. M. Poole *in litt.* 1999).

Protected areas In 1993, 21 protected areas were thought to support populations of the species (Green 1993a). *India* It has occurred recently in Dibru-Saikhowa National Park (c.640 km^2), Garampani Wildlife Sanctuary (6 km^2), Gibbon Wildlife Sanctuary (21 km^2), Nambor Wildlife Sanctuary (37 km^2), Nameri National Park (200 km^2) and Sonai-Rupai Wildlife Sanctuary (220 km^2) (all in Assam), Namdapha National Park (2,162 km^2), D'Ering Memorial (190 km^2), Mehao (281.5 km^2) and Pakhuli (862 km^2) Wildlife Sanctuaries (all in Arunachal Pradesh) and Balpakram National Park (339 km^2) and Siju Wildlife Sanctuary (Meghalaya). Dibru-Saikhowa National Park in Assam is the only protected area established because of its importance to White-winged Duck (Mukherjee 1961). Nameri National Park is apparently protected by regular patrols and 11 anti-poaching camps (Das 1995). The Indian Oil Corporation and Oil India have initiated moves to declare the Digboi oilfields as a protected area (*Oriental Bird Club Bull*. 27 [1998]: 16–20). There are plans to implement measures to prevent further encroachment of the forest and to undertake some reforestation with native species, as well as to promote more awareness among local people (*Oriental Bird Club Bull*. 27 [1998]: 16–20). The Forest Department and WWF-India are cooperating in the project (*Oriental Bird Club Bull*. 27 [1998]: 16–20). *Bangladesh* Pablakhali Wildlife Sanctuary, a 420 km^2 portion of the Kassalong Valley Reserve, appears to hold the country's only known population (if it survives), but there is no enforcement (Husain and Haque 1981). *Myanmar* Tamanthi Wildlife Sanctuary (2,151 km^2) was established for the protection of this species and also large mammals (Rabinowitz *et al*. 1995, Khin Ma Ma Thwin *in litt*. 1997). It probably still bred at Pidaung Wildlife Sanctuary (705 km^2) in the 1970s (U Tun Yin 1977) but there has been no more recent information. *Thailand* The species currently occurs in Umphang Wildlife Sanctuary (2,515 km^2), Thung Yai Naresaun Wildlife Sanctuary (3,647 km^2), Phu Khieo Wildlife Sanctuary (1,560 km^2), Phu Jong Na Yoi National Park (686 km^2), Yot Dom Wildlife Sanctuary (203 km^2), Khao Phanom Dongrak Wildlife Sanctuary (316 km^2), Huai Sala Wildlife Sanctuary (380 km^2), Phu Kradung National Park (348 km^2) and Pa Phru Wildlife Sanctuary (201 km^2). It also possibly still occurs in Nam Nao National Park (966 km^2), Phu Pan National Park (665 km^2), Huai Kha Khaeng Wildlife Sanctuary (2,780 km^2) and Kaeng Krachan National Park (2,915 km^2). The Lam Dong Yai area receives protection under the Yot Dom Wildlife Sanctuary and Phu Jong Na Yoi National Park (Scott 1989). In 1992, superintendents of these two sites organised a ceremony wherein around 300 villagers' guns were handed over to the provincial authorities (Parr *et al.* 1994a). *Laos* The species occurs in several protected areas, notably Nakai Nam Theun NBCA, although the population at this site might disappear if the proposed "Nam Theun 2" hydropower project is completed (Timmins and Evans 1996, Tobias 1997, Tobias *et al*. 1998). Other areas where it is known or likely to occur are Xe Pian and Dong Hua Sao NBCAs and Dong Khantung and Bolaven South-West Proposed NBCAs; part of Muang Phin may be within what is now Phou Xang He NBCA (Evans *et al.* 1997; see Remarks 4 under Masked Finfoot *Heliopais personata*). *Cambodia* Prek Toal and Boeng Chhma/Moat Khla are included in the Tonle Sap Biosphere Reserve as core areas (Parr *et al.* 1996, C. M. Poole *in litt*. 1999). A discussion of suitable measures in the Tonle Sap area is given in the account for Greater Adjutant *Leptoptilos*

dubius. *Vietnam* riverine forest is seriously under-represented in the protected areas network of Vietnam (Wege *et al.* 1999). The species is only known from two protected areas, Cat Tien National Park (73,878 ha) and Ke Go Nature Reserve (24,801 ha). At Cat Tien, the national park only protects one bank of the Dong Nai river, which has allowed the clearance of the other bank for agriculture, and therefore this area probably cannot sustain a population of the species (A. W. Tordoff verbally 2000). There is only a single record from Ke Go despite extensive surveys, and as the area of suitable habitat is small it is unlikely that the reserve is important for the species (A. W. Tordoff verbally 2000). *Indonesia* On Sumatra in the 1970s it was hoped that "sufficient areas of swamp will always be too difficult and too remote for reclamation", but this was thought unlikely, so that the only real chance for the species lay in the establishment and effective protection of major reserves such as Way Kambas (now a national park), which covered 800 km^2 in the 1970s (Holmes 1977b). A population is known from Kerumutan Nature Reserve (Holmes 1996). Berbak National Park is important for the species (Callaghan *et al*. 1998). Gunung Leuser National Park contains 100 km^2 of apparently suitable habitat (Holmes 1996), but see Threats.

MEASURES PROPOSED Recommendations for securing the future of the White-winged Duck and its habitat tend to focus on protected areas, but some measures apply equally well to tracts of habitat outside such areas. It is not always possible to separate these out, but the wider actions are here dealt with first; this does not imply judgement on the degree of their importance. Further lengthy discussion of conservation proposals is provided for the whole range by Green (1992a) and (for Sumatra) by Lambert (1988) and (for Thailand) by Parr *et al*. (1993a).

Control of exploitation One of the most important measures with regard to the survival of this species is the minimisation of hunting pressure. A total ban (and its clear advertisement: see Awareness, below) is needed on the hunting and trading of the species throughout its range; appropriate penalties for transgressors should be developed. Strict legislation and enforcement controlling gun ownership is perhaps more achievable and effective in some areas (e.g. Laos) than designating protected areas (J. W. Duckworth *in litt*. 1999). In Myanmar, the blanket ban on duck hunting should be replaced with direct legislation controlling persecution of this species and then enforced at the earliest opportunity (Green 1992a). In Thailand the species should be upgraded to Reserved Animal Status, a step that would undoubtedly enhance its survival prospects (Parr *et al*. 1993a). A continuation of government policy and action in southern Laos and Vietnam, along with its implementation when possible in northern Cambodia, should be deemed an urgent priority. (Parr *et al.* 1994a). Non-hunting programmes involving gun handovers (as at the Yot Dom Wildlife Sanctuary and Phu Jong Na Yoi National Park in Thailand: see Measures Taken) should be encouraged around all protected areas in the range of the species.

Habitat management As far as possible, forested wetlands in and near key sites should be maintained in a natural state; as the species prefers dense cover at the fringes of pools and fallen logs for perching, all suitable streams and pools should not be "tidied" in any way (Choudbury 1996e). Commercial felling of trees (including the removal of old and dead ones possibly important as nest sites in known localities for the species) should not be permitted (Choudhury 1996e, A. Choudhury *in litt*. 1998). In Sumatra, logging of *rengas* trees should be made illegal and they should be excluded from any legal concessions (Lambert 1988).

Control of pollution Immediate steps should be taken to curb pesticide and oil pollution in India (A. Choudhury *in litt*. 1998). Use of dangerous non-biodegradable pesticides like thiodan should be banned in the region (Choudhury 1996e). Both Oil India and the tea plantations should take immediate steps to eliminate pollution and treat contaminated waterbodies (especially the ponds near oilrigs); the treatment plant at Digboi Refinery should be expanded and modified to cope with current pollution levels, and the severe pollution of

nearby Tel Nala, which results from the inadequacies of this treatment plant, should be addressed (Choudhury 1996e).

Mitigation of hydropower developments On the Nakai Plateau, Laos, proposals to translocate individual White-winged Ducks in the event of inundation subsequent to construction of the Nam Theun 2 dam should be opposed, partly because there is nowhere else in the country with sufficiently low hunting pressure to justify using as a releasing site (J. W. Duckworth *in litt*. 1999). Effort should be targeted instead towards providing potentially suitable flooded forest habitat on the reservoir's northern shore (Tobias 1997). Wherever possible, future hydropower developments should be sited so as to avoid interference with White-winged Duck populations (Evans *et al.* 1997). Efforts to locate the species should be included in the terms of reference for environmental assessments of hydropower projects in the region (Evans *et al.* 1997).

Awareness In India a campaign is needed to raise awareness among local people, involving government and academic institutions and NGOs (Talukdar and Bhattacharjee 1995b). The legal status and severe plight of the species needs to be advertised widely in forest villages, especially for tea-garden labourers, graziers and those encroaching on protected areas (A. Choudhury *in litt*. 1998). It has been suggested the species be declared the "state bird of Assam" in an effort to encourage local participation in its conservation (Talukdar and Bhattercharjee 1995a,b). Rural education programmes have been proposed in Bangladesh to help conserve waterbirds by reducing habitat alteration and hunting (Forest Department 1974). Further awareness campaigns were designed and proposed by Sarker (1989). A UNDP project was planned for early 2000 to conduct workshops on environmental issues with local people (P. M. Thompson *in litt*. 1999). In Thailand improved awareness combined with better enforcement of existing wildlife protection legislation is warranted; an intensive public awareness campaign should be mounted around the parks and sanctuaries along the Phanom Dongrak range to counteract the high level of human disturbance, using the species as a "flagship" for forest ecosystems (Parr *et al*. 1994a,b). Likewise in Laos the species should be included in further education materials aimed at raising local awareness of conservation issues (Evans *et al.* 1997, Duckworth *et al*. 1999).

Institutional strengthening The wildlife and sanctuaries division of the Myanmar Forest Department (Lwin 1995), and the Departments of Forestry in Thailand (Parr *et al*. 1993a), Laos (Berkmüller *et al*. 1995) and Cambodia (Parr *et al.* 1996) require strengthening through improved institutional framework, training of managerial staff and technical skills (see Remarks 3 under Crested Argus *Rheinardia ocellata*). There is a widely perceived need to provide better infrastructural resources (e.g. wireless sets for better communication systems) to existing protected areas throughout the species's range.

Research Long-term field research is required to clarify all aspects of its biology (Green 1993b). 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 permit clearer management prescriptions. Further surveys of suitable habitat are urgently required (Eames *et al*. 1992, Evans *et al.* 1997), in particular to ascertain numbers remaining in protected areas (Green 1992b). *India* A detailed survey should be carried out in Nagaland, Manipur, Mizoram and Tripura (A. Choudhury *in litt*. 1998), whilst surveys already completed in Assam and adjacent areas of Arunachal Pradesh (Choudhury 1996e) and in Nameri National Park (Das 1995) need to be followed up with regular monitoring (A. Choudhury *in litt*. 1998). *Bangladesh* At Pablakhali Reserve a "small scientific unit" was long ago proposed for the continuous monitoring of White-winged Duck populations and ecology in the area (Khan 1986b). *Myanmar* Much of the species's former range is now difficult of access because of political instability, a factor that greatly obstructs the collection of useful information about this duck and any conservation action. The first priority for survey work according to Green (1992a) is the forests of Taninthayi, adjacent to Thailand, and the wetter portions of the Pegu (Bago) Yomas; the second priority is Kyatthin

Wildlife Sanctuary, Yin Ke Reserve Forest, Paunglin Reserve Forest and Hlaing Yoma Reserve Forest. Areas such as Upper Chindwin (especially the Kabaw valley), Mansi Tract and the region of Bhamo Township Group should be investigated when conditions allow (Green 1992a). *Thailand* Bung Mon in Phu Khieo Wildlife Sanctuary has high potential for research into the species (Parr *et al*. 1994b). The population in the Lam Dom Noi basin, within Phu Jong Na Yoi National Park, is ripe for survey: this would enable a more accurate estimate of numbers in the Khao Phanom Dongrak range (Parr *et al*. 1993a). The mine-free (eastern) portion of Phu Jong Na Yoi provides an opportunity to research this population and to target conservation in the region (Parr *et al*. 1994b). Tap Lan National Park, which appears to contain potentially suitable habitat, should be surveyed (Parr *et al*. 1993a). *Laos* Areas requiring urgent survey are listed in Evans *et al.* (1997); populations of White-winged Duck might remain in the south-eastern portion of Khammouane province and the Xe Kong basin in Attapu and Xe Kong provinces (Thewlis *et al.* 1998). *Cambodia* The Tonle Sap basin requires intensive research to quantify the population of this species in the area, particularly around Boeng Chhma and Prek Toal, perhaps in the wet season when individuals are apparently less wary (Parr *et al*. 1996, Goes *et al*. 1998b). *Vietnam* Areas of potentially suitable habitat on the Cambodian border and in Lam Dong province should be surveyed (A. W. Tordoff verbally 2000). *Indonesia* A survey of Sumatra has been called for to assess the species's habitat requirements, population levels and appropriate conservation measures; a check on reports of the species from Siberut, off Sumatra, and from Ujong Kulon, in West Java, is also needed, as well as a survey of the fringes of peatswamps on Sumatra's eastern coastal plain as far as 2°N; even the extensive swamps of southern Borneo were considered possible (Holmes 1977b, 1990; also Green and Crosby 1992; see Remarks 2). Following the fires of 1997, plans were announced to survey the species in its three reserve strongholds, Way Kambas, Berbak and Kerumutan (Rengat) (Callaghan *et al*. 1998). The first two of these surveys have already been completed (B. Hughes *in litt*. 2000), but further work is needed to clarify the effects of the Sumatran fires on populations of White-winged Duck.

Protected areas The long-term survival of the White-winged Duck depends on the continuation or creation of appropriate conditions within existing or proposed reserves. *India* The Upper Dihing Reserve Forest should be redesignated as a 267 km^2 national park (Upper Dihing National Park) encompassing the adjacent Joypur and Dirak Reserve Forests (Choudhury 1996e, 2000c). This site has a long history of protection, contains the largest known population of the species (over 100 individuals), is the largest continuous forest block in the Brahmaputra valley, and is rich in associated wildlife (Choudhury 1996e). The following protected areas should be established: Dum Duma-Dangori Wildlife Sanctuary (38 km^2; Dum Duma and Dangori Reserve Forests), Kumsong Wildlife Sanctuary (15 km^2; part of Kumsong Reserve Forest), Namphai Wildlife Sanctuary (17 km^2; Namphai Reserve Forest, contiguous with Tinkopani and Namphuk Reserve Forests of Assam and Arunachal Pradesh respectively), Digboi Wildlife Sanctuary (35 km^2; part of Upper Dihing [East Block] Reserve Forest near Digboi oilfields), Kobo-Pobo Wildlife Sanctuary (196 km^2; a composite of Pobo and Kobo Reserve Forests, in the latter of which the species might occur), Dibang River National Park (202 km^2; part of Dibang Reserve Forest, part of Kereim Reserve Forest, proposed Sirkee Reserve Forest and Hollongapar Reserve Forest, the latter already designated as Gibbon Wildlife Sanctuary in 1997: Choudhury 2000c), Namchik Wildlife Sanctuary (45 km^2; a composite of Namphuk, Namphai and Tinkopani Reserve Forests) and Namsang or Dirak beel Sanctuary (2 km^2; an ox-bow lake near the confluence of Dirak and Burhi Dihing rivers) (Choudhury 1996e, 2000c). The Indian Oil Corporation (Assam Oil Division) at Digboi should protect the forest within the oilfield area as a nature reserve, or else the proposed Digboi wildlife sanctuary (35 km^2) should be established (Choudhury 2000c). The proposed Dhaleshwari Wildlife Sanctuary should be established if possible (Choudhury 1983, 2000c). Dibru-Saikhowa National Park requires development of ecotourism, designation of

a disturbance-free 190 km^2 core area, translocation of enclave villagers "on a priority basis", increased patrolling by (at least 100) guards using radios, and an awareness campaign in fringe villages (Choudhury 1995b). Dum Duma Reserve Forest needs much the same treatment, including clearly demarcated boundaries (Talukdar 1994, Talukdar and Bhattacharjee 1995a,b), ideally as the Dum Duma-Dangori Wildlife sanctuary (see above). Wherever possible, protected-area boundaries should be extended to incorporate adjacent lowland forest areas of potential value to the species, e.g. forests beside Dibru-Saikhowa and Namdapha National Parks in India (Choudhury 1996b). No fresh oil-drilling should be allowed inside the Upper Dihing Reserve Forests, and proposed drilling in Joypur Reserve Forest should be shelved; no refuse dumping within protected areas and reserve forests should be permitted (Choudhury 1996e). Many reserved forests and protected areas in north-east India adjoin tea estates, and protective measures in these areas would assist the conservation of the species by providing extra habitat, food and refuge (further details of proposals are in Remarks 13). Choudhury (2000c) advocated protection of the Palak dil area in Mizoram, but it is not known whether the species has been conclusively recorded in the area. *Bangladesh* A suite of measures at the Pablakhali Reserve will be needed if a population of the duck is found to persist there. Although some measures were given by Khan (1986b), including a moratorium on forestry operations, banning of gillnets in the reserve and a cessation of human settlement, these may well be out of date and a review of the current situation is required. As security problems are abating, the area should be visited and the status of White-winged Duck re-assessed. *Myanmar* A system of wetland reserves needs to be incorporated into the national framework of protected areas (Lwin 1995); clearly any remaining populations of this duck should be a major consideration in any extension of the existing system. At the earliest opportunity, protected areas such as Pidaung Wildlife Sanctuary, Shwe-U-Daung Wildlife Sanctuary and Tamanthi Wildlife Sanctuary should be surveyed to assess their current importance for the species, and granted appropriate protection (Green 1992a). *Thailand* Parr *et al.* (1993a, 1994b) suggested the incorporation of three sites into the protected-areas network: (1) Khao Phra Viharn, the forested corridor linking the Phu Jong Na Yoi National Park/Yot Dom Wildlife Sanctuary complex with the Khao Phanom Dongrak and Huai Sala Wildlife Sanctuaries complex, which support what are thought to be two of the largest populations of White-winged Duck in the world; (2) the Huai Nam Phrom basin, located between Phu Khieo Wildlife Sanctuary and Nam Nao National Park (the area should be incorporated into one of these protected areas); and (3) areas of degraded peatswamp forest not gazetted to wildlife sanctuary status at Pa Phru Wildlife Sanctuary. Better coordination of activities, particularly patrolling of protected areas, between officials of Yot Dom Wildlife Sanctuary and Phu Jong Na Yoi National Park would help reduce the threat of poaching and tree-cutting (Parr *et al*. 1993a). Improved protection and restriction of human access to known sites for this species is required (P. D. Round *in litt*. 1998). Substations should be built at strategic sites within Phu Jong Na Yoi National Park to control encroachment into the eastern portion, where high levels of human disturbance currently occur (Parr *et al*. 1993a, 1994b). At Lam Dom Noi basin, within Phu Jong Na Yoi National Park, at least one hide should be constructed and shrubs planted along the causeway to act as natural screening to minimise disturbance; Bung Mon, in Phu Khieo Wildlife Sanctuary, an important site for the species, should be managed to reduce the increasing impact of visitors (Parr *et al*. 1993a). Wherever possible, protected-area boundaries should be extended to incorporate adjacent lowland forest areas of potential value to the species, e.g. at Phu Khieo Wildlife Sanctuary. *Laos* Dong Khanthung proposed NBCA and Xe Pian NBCA are considered the two most significant areas for bird conservation in the country because of the populations of highly threatened waterbirds they contain, and as such deserve immediate action directed towards long-term protection (Thewlis *et al.* 1998). Both areas should receive full legal protection alongside development of effective management strategies and local education programmes geared at reducing wetland disturbance and exploitation of waterbirds. Duckworth *et al*. (1999)

urged a high level of international donor support for these sites in view of their conservation significance. Bolaven South-West proposed NBCA should also be granted full protection immediately, owing to its importance for the species (Duckworth *et al.* 1999). Indeed one of the most promising areas for conserving a viable population of the species is in the Xe Pian NBCA, Dong Hua Sao NBCA, Bolaven South-West proposed NBCA and Xe Khampo complex (R. J. Timmins *in litt*. 2001), and appropriate management and protection for the species should be targeted here. Management recommendations for Dong Khanthung include established boundaries as an NBCA, a moratorium on immigration, and control of hunting, wildlife trade, infrastructural and agricultural development (Round 1998b). There is an urgent requirement to hire and train staff in Lao protected areas and CPAWM (Berkmüller *et al.* 1995) and to establish cooperative management agreements with local communities that ensure the long-term survival of habitats and threatened species (Thewlis *et al.* 1998). All logging concessions granted in protected areas containing the species should be revoked. *Cambodia* Conservation issues in the Tonle Sap area are reviewed in the equivalent section under Greater Adjutant. *Vietnam* Surveys are currently planned for the riverine forests along the Dong Nai river, to the north-east of Cat Tien National Park, with a view to extending the park (A. W. Tordoff verbally 2000). Proposals for a 161 km^2 extension to Yok Don National Park might benefit the species (Wege *et al*. 1999). *Indonesia* The best opportunities for the long-term protection of the species lie with Berbak (Jambi), Kerumutan (Riau), Kluet and Singkil (Aceh) and perhaps the Tapanuli Selatan wetlands (N Sumatra) (D. A. Holmes *in litt.* 1999). A 650 km^2 nature reserve has indeed been proposed for Singkil Barat peatswamp forests (van Balen 1992a), while Sungai Tulang Bawang, Cabang/Sungai Seputih, Kayu Agung and Rengat also merit full protection as major sites for the species (Green 1992a).

REMARKS (1) This distinctive species is commonly treated as monotypic. However, the possibility that the continental population (Java being the type locality) might be appropriately accommodated under the name *leucoptera* (Hume and Marshall 1879–1881) has periodically been favoured (Hoogerwerf 1950a, Callaghan *et al*. 1998, Green *et al*. in Kear in prep.), chiefly owing to the greater but inconstant amount of white in the plumage of Indonesian birds—some Sumatran males are almost entirely white with black flight feathers (Drilling 2000)—but also weight, posture, voice and even habitat and diet (Green *et al*. in Kear in prep.; see Mackenzie and Kear [1976], who mistakenly implied that *leucoptera* was established for southern, i.e. Sumatran birds). This is clearly a subject which bears further investigation.

(2) The absence of the species from Borneo appears to be real, and might be attributable to "a comparatively recent immigration into the known areas of its Sundanese range" (Holmes 1977b).

(3) Older records from "Dangari river, Digiltarung", Tinsukia district—between 1901 and 1911 (Stevens 1914–1915), a few, 1967 (Savage and Mackenzie 1967), a pair, 1976 (Pirie and Choudhury 1976)—presumably come from the present-day Dibru-Saikhowa National Park, given that "Dighaltarung" is named as a site within it. The site also includes earlier records from Dibru Reserve Forest, Saikhowa Reserve Forest, Rungagora, Gurrung Jan, Paropara Jan, Laikhajan river, Digoli and Kolomi beels, Dangri river and Guijan (Green 1992a).

(4) The observer who described the birds at the Diyung river to Baker (1894–1901) "noticed most distinctly that the drake had a large comb", from which the inaccurate conclusion was drawn that there was "little doubt that the Wood-Duck grows a comb during the breeding season". The possibility remains, therefore, that the birds reported in North Cachar were, in fact, Comb Ducks and that the eggs in Baker's collection were wrongly identified. However, the base of the male White-winged Duck's bill does become slightly swollen in the breeding season (Green *et al*. in Kear in prep.).

(5) A record of 30 in two groups on the Padma river, between Chandpur and Goalundo, in February 1947 (Alexander 1948) seems so out of character that it is best treated as

provisional. The river in the area specified is up to 10 km wide with large islands, no trees and lots of people, which adds to the improbability of the record (P. M. Thompson *in litt*. 1998). There is also an old but unconfirmed report from the area (see Population: Bangladesh), but all these records are "likely to be misidentifications" (Green 1992a).

(6) The records and population estimates in Parr *et al*. (1993a) should be treated with slight caution because of the heavy reliance placed on retrospective reports by local people (see Distribution: Cambodia for an example of potential problems). Nonetheless, his overall conclusions are clear and well substantiated, and the importance of the Phanom Dongrak park/sanctuary cluster is proven. It is clear that, in contrast to villagers outside other protected areas, villagers around Phanom Dongrak knew and could recognise *Cairina*, so that confusion with other wildfowl (*e.g. Dendrocygna*) could be ruled out.

(7) D. R. Wells (*in litt.* 1998) has commented that White-winged Duck avoids the interior of "black-water swamps", and is absent from this habitat in Peninsular Malaysia. On this basis, it seems likely that feeding areas may lie around the periphery of Phru To Daeng, with (perhaps) birds using the primary peatswamp forest in which to roost only.

(8) In north-east India, among other plants, the trees found in the species's habitat comprised *Alstonia scholaris*, *Artocarpus chaplasa*, *A. lakoocha*, *Dellenia indica*, *Ficus*, *Pterospermum acerifolium* and *Terminalia myriocarpa*, with *Dipterocarpus macrocarpus* and *Mesua ferrea* dominant (Talukdar and Bhattacharjee 1995b). A detailed description of the habitat in the Pablakhali reserve, Bangladesh, is in Khan (1986b).

(9) One old report is intriguing: Wood (1934) described a bare tree near Dimapur, Nagaland, in which "there were six nests of the Wood-duck", adding "those eggs would be worth a lot of money now", suggesting that he was not referring to Whistling-ducks. Abdulali (1968–1996) was of the opinion that this indeed referred to *C. scutulata*, and, moreover, other records of the species derive from the site. However, the potential for confusion with the Lesser Whistling-duck *Dendrocycna javanica* requires that this account be treated as provisional.

(10) Dum Duma and East and West Dihing can only have been selectively logged, since apparently important if small populations of the duck persisted in them into the 1990s (see Distribution).

(11) Hutchinson (1945) is helpful on this matter, explaining that one he had shot "proved to be good eating though a trifle coarse", adding that "it would have been improved considerably by sage and onion stuffing".

(12) The Wildfowl and Wetlands Trust (WWT) first took an interest in the species in 1968, when concerns over its rapid decline in India and elsewhere led to the establishment of a successful captive breeding programme (Mackenzie and Kear 1976), later divided between WWT, Jersey Wildlife Preservation Trust and various centres in India, Thailand, Hong Kong and elsewhere (Green 1992a). The maintenance of a captive population of White-winged Ducks must be considered a potential element in its conservation and an important precaution, but captive breeding programmes are much lower in priority than conservation of wild populations, and it is thought undesirable to direct resources into this action unless absolutely necessary (Parr *et al*. 1994b, Tobias 1997, A. Choudhury *in litt*. 1998). The known captive population totalled c.280 birds in 1993 and was spread between several countries (Green 1993a), although these are derived almost entirely from Assamese stock (Mackenzie and Kear 1976). There were 187 birds in captivity in North America in 1999 (B. Hughes *in litt*. 2000). There have been problems of disease and inbreeding in this population (Tomlinson *et al*. 1991, Cromie *et al*. 1992). The captive breeding programme started by the Assam Valley Wildlife Society since 1975 at Bordubi and Namdang Tea Estates has not been successful owing to a poor survival rate of ducklings (decline from 40% in 1986 to 14.1% in 1992), with the surviving broods being affected by avian tuberculosis and later mycotoxicosis (Choudhury 1996e). Since the aim of captive breeding is the re-introduction of a species to the wild, it is

apparent that the danger of disease transmission from current captive stock to wild birds is serious, so it is important that no moves are made to begin using this stock for release programmes without an exhaustive review of the criteria to be satisfied by modern re-introduction programmes.

(13) The species often frequents wetlands, drains and ponds inside these estates, especially in winter when many forest pools are desiccated and the remaining wetlands increasingly disturbed by fishermen and woodcutters. In some of the larger estates contiguous with reserves holding the duck, small areas could be set aside as mini-sanctuaries. Reservoirs could be created or existing wooded pools fenced off to prevent disturbance by people or cattle, and these might be important seasonal refuges for the species. The estates for consideration of these measures (with adjoining protected areas in parenthesis) are Bagopani (near Upper Dihing [East] Reserve Forest), Phillobari (near Dum Duma Reserve Forest), Powai (near Upper Dihing [West] Reserve Forest), Dangori (near Dangori Reserve Forest), and Namdang or Dirak (near Dirak Reserve Forest).