

The North American population of this large, low-density woodpecker is very probably extinct, and the most recent evidence suggests that there is almost as little hope for the Cuban form, which was last reported in 1987 or 1988 with glimpses in 1991, despite much intensive searching in the Sierra de Moa, the area to which it finally retreated in the course of this century; destruction of its virgin forest habitat, of which each pair evidently needed very large amounts, is chiefly to blame for the loss of the species.

DISTRIBUTION The Ivory-billed Woodpecker formerly occurred throughout the south-east U.S.A. (nominate *principalis*) and Cuba (race *bairdii*; see Remarks 1), but is now virtually or actually extinct in both countries, although evidence for its survival in Cuba is far more recent; for this reason, the following account principally treats the Cuban form, the North American race being judged probably extinct and not to be covered in detail here.

U.S.A. Ivory-bills once ranged through the south-east of the country from south-east North Carolina, southern Kentucky, Illinois, Missouri, Arkansas and Oklahoma to the coast of the Gulf of Mexico and the Florida peninsula, with populations disappearing (as a result of forest destruction, but compounded by commercial collecting, which eliminated certain populations) from the northern and western extremities of its range before 1885, from most of Missouri, Arkansas, Mississippi and Alabama between 1885 and 1900, and from most of Florida, eastern Texas and Louisiana by 1930 (King 1978-1979). The last known population disappeared by 1948 with the clearance of the 311 km² Singer (Sewing Machine Company) Tract in Louisiana for soybean cultivation, since when there have only been random observations in scattered localities ranging from Texas to Florida (King 1978-1979); some of these records are assembled in Dennis (1979) and Aldrich (1980). Ten years ago Short (1982) considered the chances of a population surviving in the U.S.A. “virtually nil”, and the U.S. Fish and Wildlife Service is now moving to de-list it from the Endangered Species Act as extinct in the country (Shull 1985, L. L. Short *in litt.* 1992). Despite this, “an ongoing survey (to be completed by 1992) holds out hope that Ivory-billed Woodpeckers may yet be found in Louisiana’s Atchafalaya Basin or along South Carolina’s Santee River, Georgia’s Altamaha River, Mississippi’s Hyazoo or Pascagoula rivers, or Florida’s Suwannee, Withlacoochee, or Ochloconee rivers” (Ehrlich *et al.* 1992). What is apparent from below is that no reintroduction into the U.S.A., speculated as an option if the Cuban population were to be found sufficiently numerous (Ehrlich *et al.* 1992), will take place (see Remarks 2).

Cuba The species was formerly distributed throughout the island (Barbour 1943, Bond 1956b, Alayón and Garrido 1991), although the evidence below indicates that basically it was only ever known to investigators from the western and eastern sectors of the island, and Shull’s (1985) assertion that it occurred on the Isle of Pines appears unfounded. During the first half of the twentieth century its range became restricted to the mountains in the (north-)east of the island (e.g. Sierra de Moa, Sierra del Cristal, Sierra de Nipe) and subsequently to the Sierra de Moa. In the following account, records are given roughly from west to east, with coordinates, unless otherwise indicated, taken from OG (1963a), and in most cases records consist of single birds or pairs observed:

Pinar del Río mountains north of San Diego de los Baños (22°39’N 83°22’W), late nineteenth century (see Barbour 1943); Pan de Guajabón (22°48’N 83°22’W), undated (Gundlach 1871-1875); Soroa (= Villa Soroa, a few kilometres north-west of Candelaria, 22°45’N 82°58’W), April 1982 (Garrido 1985), although this is a most doubtful record (TAP, G. Alayón García *in litt.* 1992);

Matanzas río Hanábana (22°33’N 80°58’W), late nineteenth century (see Barbour 1943); Ensenada Cochinos, undated (Gundlach 1871-1875); Calimete (22°32’N 80°54’W) and Banagüises (22°46’N 80°51’W), both late in the nineteenth century (see Barbour 1943);

Holguín Cauto el Embarcadero (presumably on the río Cauto, c.12 km south of Urbano Noris, 20°36’N 76°08’W), undated (Gundlach 1871-1875); highlands of Mayarí (i.e. Sierra de Nipe, 20°28’N 75°49’W), where a nesting pair was collected around 1900 and the species was observed around 1920 (Barbour 1943);

Holguín/Guantánamo (Sierra de Moa area) Sierra de Moa, where a group of six birds was reported in 1941 (see Dennis 1948); “mountains of Oriente province” (presumably Sierra de Moa), March 1988 (Jackson 1991; see Remarks); Cupeyal del Norte Reserve (c.20°29’N 75°02’W: read from ICGC 1978), between 1941 and 1943 (Alayón and Garrido 1991); c.8 km north-west of Cupeyal (20°35’N

75°11'W), February 1968 (Bond 1968, Garrido and García Montaña 1975, Garrido 1985); Monte Cristo (untraced but near Cupeyal), November 1973 (King 1978-1979); Vega Grande (5 km south of Cupeyal), undated (Bond 1968, Garrido and García Montaña 1975, Garrido 1985); La Municipión (c.7 km north-east of El Manguito, 20°21'N 75°08'W), December 1984 (Alayón and Garrido 1991); Ojito de Agua area (c.20°28'N 74°59'W: read from ICGC 1978), July 1956 (Lamb 1957); headwaters of Yarey river, Ojito de Agua), March and April 1986 and March 1987 (Short and Horne 1986, Alayón and Garrido 1991; see Population); Cayo Chiquito (within the Bandolero area, which is c.10 km south-west of Moa and south of río Cabañas, 20°39'N 74°55'W), where a pair was reported nesting in 1941 (see Lamb 1957); Bandolero area, where a nesting pair and a subadult were observed in April 1948 (Dennis 1948; also Lamb 1957) and another pair was observed in 1956 (Lamb 1957); “near Moa”, 1954, with four pairs in 1956 (see Lamb 1957); headwaters of the río Calentura (c.20°32'N 74°59'W: read from ICGC 1978), July 1956 (Lamb 1957); Nuevo Mundo (c.15 km south of Moa), 1978 (see Garrido 1985); headwaters of the río Jaguaní (c.20°28'N 74°56'W: read from ICGC 1978), 1965 (Lamb 1957); between ríos Moa and Punta Gorda (20°37'N 74°51'W), where two pairs were present between March and June 1956 (Lamb 1957); La Melba (c.20°26'N 74°49'W: read from ICGC 1978), 1970 (Alayón and Garrido 1991); Jaguaní Forest Reserve (c.20°24'N 74°43'W: read from ICGC 1978), 1973 (see Alayón and Garrido 1991); Macanibar (untraced but south of Taco Bay, 20°31'N 74°40'W), between May and June 1985 (Alayón and Garrido 1991);

Guantánamo San Luis de la Cabeza, untraced (Barbour 1923); Yateras (a municipality at 20°12'N 75°09'W), May 1972 (see King 1978-1979); mountains of Yateras, undated (Gundlach 1871-1875); Monte Verde (20°19'N 75°00'W), September 1861 and April 1907 (specimens in USNM).

POPULATION The Cuban Ivory-billed Woodpecker has suffered a steady decline, first indicated by Gundlach (1871-1875), who noted the species's increasing rarity from one year to the next. By the second half of the nineteenth century it was already considered very rare and difficult to observe, having disappeared from several localities where it was once reported, although birds were still present in the mountains of Pinar del Río, in the lowlands of Ensenada Cochinos, Matanzas, and in Yateras, Guantánamo (Gundlach 1871-1875, 1876). Barbour (1943) considered the species to be “virtually extinct” and Garrido and García Montaña (1975) referred to it as “extremely rare” and almost extinct. In the Sierra del Cristal, the last sighting occurred in 1920 (Dennis 1948), searches and enquiries in the area in 1956 obtaining no positive results (Lamb 1957, 1958).

In the Sierra de Moa (the last known refuge for the species), Dennis (1948) heard of a group of six birds in 1941 and himself observed three – including an incubating pair – in April 1948. The species was again recorded in the area in 1954 (one pair) and in 1956 (six pairs), between the watersheds of the río Moa to the west and the río Punta Gorda to the east, along the north coast of north-east Holguín, and in the extreme headwaters of the Calentura and Jaguaní; furthermore, excellent evidence of former nesting (16 nest-holes) was found in 1956 within the Bandolero area south of Moa (Lamb 1957). In the early 1970s the surviving population was estimated at probably fewer than six pairs and certainly no more than eight pairs (King 1978-1979). By around 1980, perhaps based on the foregoing, the population was guessed at “perhaps... a dozen birds” (Short 1982). The last reported observations of the species occurred in the Sierra de Moa in March and April 1986 and April 1987 (Alayón and Garrido 1991) and in March 1988 (see Distribution, Remarks). Thorough searches in 1990 and 1991 in this general area proved unsuccessful (Alayón and Garrido 1991; M. Lammertink *in litt.* 1991); however, fresh barking activity and 2-3 second long glimpses in the Sierra de Moa in April 1991 could well have been by or of the species (J. W. McNeely *in litt.* 1991, McNeely 1992).

The Ivory-billed Woodpecker is now near extinction, and the most recent expedition in March 1992 failed to find it, although fresh signs of foraging (presumably by this species) in the headwaters of the río Jaguaní (“El Toldo”) fostered the view that probably one or two birds still existed between río Piloto and Ojito de Agua, and perhaps in other unstudied areas, such as east of La Melba (McNeely 1992, G. Alayón García *in litt.* 1992). Basically, however, the forests in the Sierra de Moa are too degraded, and the last possible refuge in the area is a narrow corridor between the Cupeyal Reserve and Ojito de Agua and the upper reaches of the río Jaguaní (M. Lammertink *in litt.* 1991, 1992). Even if some birds survive, there seems to be no real chance that the species can be saved; the precise date of its extinction, whether passed or impending, is unlikely ever to be determined.

ECOLOGY The Cuban Ivory-billed Woodpecker inhabited forested areas in both lowlands and

mountains; however, extensive deforestation in the former restricted the species to the mountains where the best-preserved forests of pines *Pinus cubensis* were present (Bond 1956b, Lamb 1957). In the north-eastern sierras of Holguín and Guantánamo and in the Sierra de los Organos, Pinar del Río, the species inhabited the pine forests, but its former occurrence in the lowlands, e.g. in Matanzas, indicates that it once also locally inhabited dense tropical hardwood forest (Lamb 1957, 1958). Dead trees, especially pines, are of great importance in providing both food and nesting cavities (see below). In the Sierra de Moa, Ivory-bills have been reported in pine, mixed pine with hardwood, and hardwood forests (Lamb 1957, King 1978-1979, Alayón and Garrido 1991). It must be assumed that the Cuban populations existed at similar low densities to those in the U.S.A. (see Remarks 4), itself a biological factor that rendered the species notably extinction-prone.

Cuban Ivory-bills feed mainly on the wood-boring larvae of insects, notably: beetles of the families Cerambycidae, Buprestidae, Scolytidae, Elateridae and Eucmenidae, taken from under the bark of old or rotting trees (Dennis 1948, Lamb 1957, Alayón and Garrido 1991, Jackson 1991); but seasonally the species's diet includes a considerable percentage of seeds and fruits (Alayón and Garrido 1991), this also being true of the former North American population (see, e.g., Cottam and Knappen 1939). By 1956, the Ivory-bills appeared to have adapted to the changing habitat of lumbered areas, where old pines were still standing and food seemed fairly plentiful due to the many fires occurring in the pine forests and the subsequent infestation of the dead trees by beetle larvae (Lamb 1957). Data on food and feeding in the North American population are in Tanner (1942) and Short (1982).

The nesting season extends from March to June, most breeding activity being detected in April; nest-excavation mainly occurs in old and dying pines (Dennis 1948, Lamb 1957, Short and Horne 1986, Alayón and Garrido 1991) but palms appear also to have been utilized (see García undated). Data on breeding in the North American population are in Tanner (1942) and Short (1982).

THREATS Habitat destruction appears to have been the main cause for the Ivory-billed Woodpecker's decline in Cuba (Gundlach 1876, Alayón and Garrido 1991). The species's former haunts have been transformed by clearance for lumber, sugar plantations and charcoal-burning, the most serious depletion of the forests occurring during the first half of the twentieth century (Dennis 1948, Lamb 1957). In the Sierra de Moa, most of the forests inhabited by Ivory-bills were owned by the Bethlehem Cuba Iron Mines Company, but despite its declared sympathy for the plight of the species (Lamb 1957) forests were cleared rapidly right up to the time the company left the area (L. L. Short *in litt.* 1992). Fires also accompanied lumber activities in the Sierra de Moa in 1948 (Dennis 1948). The last untouched pinewoods in the Sierra de Moa were perhaps those reported as being logged in 1956, the work due to be completed by 1960 (Lamb 1957). Human persecution has also threatened the Ivory-bills: according to Dennis (1948) and Alayón and Garrido (1991), specimens were nailed to the huts of local people to counter witchcraft ("maleficios"), or birds were shot for no other reason than enjoying their beauty in the hand or for adornment (Gundlach 1871-1875, 1876, García undated). In March 1992, McNeely (1992) found unauthorized chromium prospecting only 6 km east of Ojito de Agua (one of the last areas from which the species was reported), and although immediate intervention stopped further activity, the disturbance already caused was presumably irreparable, since the main camp was only a few hundred metres from the previous year's roost or nest cavity.

MEASURES TAKEN Forest reservations have been established within the species's last known range, namely Cupeyal and Jaguaní Natural Reserves. After 1986 the Cuban government closed an area with a radius of 10 km around Ojito de Agua to logging activities (Short and Horne 1986, Alayón and Garrido 1991). Between 1985 and 1992 no less than 17 expeditions to the last known areas were made in order to assess the status of the species (Alayón and Garrido 1991, M. Lammertink *in litt.* 1991, J. W. McNeely verbally 1992).

MEASURES PROPOSED Lamb (1957) suggested the protection of the Bandolero area which in 1956 contained excellent evidence of the species's former nesting (see Population), although it had already been lumbered; the presence of lateritic soil (i.e. not arable) meant that prospective farmers would not suffer; and the suggested area (see the map in Lamb 1957, 1958) supported a good growth of pine which in time would be able to support the Ivory-billed Woodpecker again. Amongst the proposals presented by Short and Horne (1986) after visiting the Ivory-billed Woodpecker area at Ojito de Agua are: a special guard to

monitor the birds; exclusion of all but scientists and wildlife management personnel from the area; limited girdling to kill pines along the trails and thereby provide more feeding trees; further searches to locate other possible birds. The 1992 Ivory-billed Woodpecker expedition team (four Cubans, one Chilean and one North American) favoured the last territory being visited as much as possible (contrary to previous recommendations) because (“even with official protection”) the area cannot be defended against mining, logging and foraging unless concerned individuals are present (McNeely 1992). The río Yarey valley needs fuller investigation; and satellite images of the region (Jaguaní basin, above La Melba) are needed in order to clarify the status of the remaining forests (McNeely 1992).

REMARKS (1) The differences between the two forms appear minute (see Short 1982). (2) The remark in Ehrlich *et al.* (1992) about reintroduction is best attributed to an understandable despair, as it bears no scrutiny in the face of political and, more emphatically, biological reality. In the latter regard, it is worth noting that Short (1982) considered that competitive interaction with Pileated Woodpeckers *Dryocopus pileatus* played a part in the Ivory-bill's demise once the latter's primary habitat began to disappear in the U.S.A., and he was “pessimistic about chances for establishing a viable Ivorybill population in the presence of Pileated Woodpeckers”, hence believing “Cuba, where no *Dryocopus* is found, the main hope for preservation of the Ivorybill”. (3) This sighting was not accepted by G. Alayón and O. H. Garrido, who consider the last certain record to have been in late 1987 (L. L. Short *in litt.* 1992). However, birds were glimpsed in April 1991 (McNeely 1992; see Population). (4) The densities at which the Ivory-bill (the second largest of Neotropical woodpeckers after Imperial *Campephilus imperialis*: see relevant account), lived in North America were judged by Tanner (1942), but these seem to have been misinterpreted in various texts: thus Aldrich (1980) referred to suitable habitat being capable of holding one pair per 6-8 km², Shull (1985) indicated one pair per 6-17 km², and Ehrlich *et al.* (1992) suggested that one pair needed “up to 2,000 acres” (= 8 km²), although in fact Tanner (1942) considered the species's *maximum* abundance to have been one pair per six and a quarter square miles (= 16 km², as given in King 1978-1979), and most of his other data indicated a far lower density even than this.