

## A NEW SUBSPECIES OF SCARLET MACAW AND ITS STATUS AND CONSERVATION

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**Abstract.** Scarlet Macaws from northern Middle America (Mexico through Nicaragua) differ from those occurring from Costa Rica southward throughout the species' range in South America. This new subspecies (*Ara macao cyanoptera*) differs in having yellow wing covert feathers tipped with blue, but with no green band separating the yellow from the blue tip, and in being larger than South American birds. The new subspecies is already in danger of extinction, because of habitat loss and internal trade within its home range countries. Protection of the species in the wild can be best afforded by protecting its remaining habitat in Middle America and by reducing the internal market for pets in those countries. Many Scarlet Macaws, including more than 400 *Ara macao cyanoptera*, were imported into the developed countries between 1976 and 1986. Captive breeding of these individuals, keeping the subspecies' bloodlines separate, can contribute to conservation of the subspecies. Accepted 18 November 1994.

**Key words:** Scarlet Macaw, *Ara macao*, conservation, Central America, subspecies, geographic variation.

### INTRODUCTION

Carolus Linnaeus described and named the Scarlet Macaw (*Ara macao*) in his *Systemae Naturae* more than two hundred years ago. Although subspecific geographic variation has been recognized in many of Linnaeus's species, the Scarlet Macaw has remained monotypic until now (Forshaw 1989). This does not mean that intraspecific variation in the species has never been noticed. Indeed, for many years aviculturists have been aware of variation in plumage coloration in Scarlet Macaws and suspected that this variation is related to the geographic origins of the birds (e. g., Smith 1991).

To study geographic variation in the Scarlet Macaw, I examined 31 specimens (16 ♂, 14 ♀, one unsexed) of wild-taken birds with known collecting localities. The specimens are from across most of the range of the species and represent a fair proportion of wild-taken specimens in North American collections. From these specimens it is apparent that the plumage variation mentioned above does indeed have a geographic basis. Linnaeus's description of the species was based on a specimen from "South America", probably from Pernambuco, Brazil (Ridgway 1916). Therefore, I name:

*Ara macao cyanoptera* subsp. nov.

**Holotype.** Adult ♂, LSUMZ no. 29047, collected by J. Alan Feduccia on 7 October 1962, 11.2 km

northeast of Choluteca, Depto. Choluteca, Honduras, elevation 61 m; 923.6 g mass; testes about 4 x 2 mm; soft parts of head white, traces of fat. **Diagnosis.** Separable from *Ara macao macao* by having some or most yellow wing coverts tipped in blue with no green band separating the yellow and blue parts of the feather. In *Ara macao macao*, all yellow feathers with blue tips have a green band separating the yellow and blue.

Although this distinction seems minor, the overall appearance of the wing of *Ara macao cyanoptera* is of having a red, blue, and yellow wing, with little or no green. In contrast, individuals of nominate *Ara macao macao* have small to substantial amounts of green on the wing.

**Specimens examined.** *Ara macao cyanoptera* — Mexico: Chiapas, Santa Efigenia (one ♂, USNM 57821); Belize: Cayo District, 34.4 km SSE Cayo on east Br. of Belize River (one ♂, LSUMZ 20535); Guatemala: Depto. Izabal, Las Amates (one ♀, FMNH 19683); Honduras: Depto. Yoro, Coyoles (one ♂, CMNH 134255); Honduras: Depto. Choluteca, 11.2 km northeast of Choluteca (one ♂, LSUMZ 29047); Nicaragua: Depto. Zelaya, Banbana River, Santa Rosita and Tunkey (one ♂, ANSP 75202); Nicaragua: Depto. Zelaya, Eden (one ♀, ANSP 75201); Nicaragua: Depto. Chontales, Ocotal or Río Grande (one unsexed, AMNH 102717).

*Ara macao macao* — Nicaragua: Depto. Rivas, San Emilio-Lake Nicaragua (one ♂, FMNH

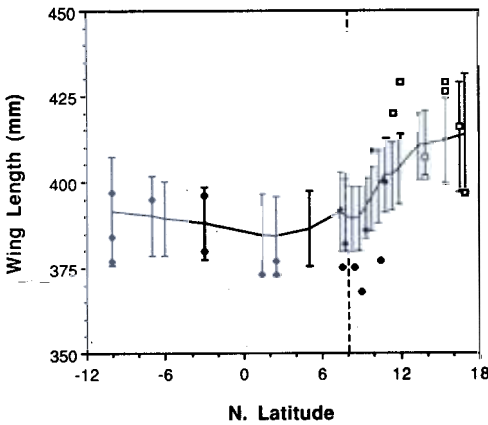


FIG. 1. Wing-length smoothed (using LOESS,  $f = 0.5$ ; Cleveland & Devlin 1988) against latitude of source of Scarlet Macaw specimens. Error bars indicate two standard errors of the estimate. Sexes and subspecies have been combined. Middle American latitudes are to the right of the dashed vertical line, South American latitudes to the left. Open boxes indicate individuals of *Ara macao cyanoptera*; closed diamonds are *A. m. macao*.

21867); Nicaragua: Depto., Río San Juan, San Juan River, Los Sabalos (one ♂, AMNH 143776); Costa Rica: Guanacaste, south slope Volcán Rincon de la Vieja, Hacienda Santa María (one ♂, USNM 361451); Costa Rica: Limón, Guapiles (one ♀, CMNH 13180); Costa Rica: Puntarenas, Pigres (one ♀, USNM 198766); Costa Rica: Puntarenas, Boruca (one ♀, AMNH 474212); Panama: Prov. Chiriquí, Bugaba (one ♀, AMNH 474211); Panama: Isla Coiba (three ♀, USNM 460655, FMNH 19627 and 19628); Colombia: Magdalena River (one ♂, AMNH 121459); Colombia: Córdoba, Pueblo Nuevo (one ♂, USNM 410648); Colombia: Meta, La Mascarena, Río Yerly (one ♂, FMNH 248516; one ♀, FMNH 248515); Colombia: Mitu, Río Vaupes (one ♀, ANSP 145084); Venezuela: Bolívar, Upper Caura River (one ♂, CMNH 32371); Peru: Depto. Loreto, lower Río Napo region, east bank of Río Yanayacu, ca. 90 km north of Iquitos (one ♂, LSUMZ 114610; one ♀, LSUMZ 114611); Peru: Depto. Ucayali, Río Curanja (one ♂, LSUMZ 31262; two ♀, LSUMZ 31261 and 34005); Brazil: Amazonas, Rio Madeira, Auara Igarapé (one ♂, AMNH 279026); Brazil: Amazonas, Arimã, Rio Purus (one ♂, CMNH 93893).

*Measurement and plumage variation.* Although individuals in the sample of *Ara macao cyanoptera* average larger than *Ara macao macao* in all four measurements in Table 1, they are significantly larger only in wing chord ( $t = 4.26$ ,  $df = 30$ ,  $P < 0.000$ ) and mandible length ( $t = 2.64$ ,  $df = 30$ ,  $P = 0.013$ ). All tests except between wing chords are non-significant when ♂ are considered alone ( $t = 2.20$ ,  $df = 15$ ,  $P = 0.045$ ) and ♀ were considered alone ( $t = 2.78$ ,  $df = 13$ ,  $P = 0.017$ ). Although ♂ usually seem to be larger than ♀ (Table 1), the differences between the two sexes are all non-significant, although wing length just missed significance ( $t = 1.98$ ,  $df = 28$ ,  $P = 0.058$ ).

Plotted against latitude, wing length declines fairly sharply within Middle America, and levels out in South America (Fig. 1). The wing length of *Ara macao cyanoptera* is noticeably greater than that of *A. m. macao*. The southern Middle American population of *A. m. macao* shows a continued decline in wing length, but from Panama southward, the wing length changes little.

Wing length variation from about 8° to 12° N. Latitude appears to form a steep cline between *Ara macao cyanoptera* and *A. m. macao* of South America. Likewise, the presence of green bands between the yellow and blue on wing coverts seems to intergrade in southern Middle America, the same area where the wing-length trend is the steepest. This suggests gene flow between *Ara macao macao* and *A. m. cyanoptera*, forming a zone of intergradation in southern Nicaragua and northern Costa Rica.

*Etymology.* I name the new subspecies *cyanoptera* because of its noticeably blue wings, showing little green.

*Geographic range.* *Ara macao cyanoptera* historically occurred below about 400 m elevation from southern Mexico in Veracruz, Oaxaca and Chiapas, through all of Belize, south through Guatemala, El Salvador, and Honduras, to central Nicaragua in the northern half of Depto. Zelaya and to Depto. Chontales. (The modern range of the subspecies will be discussed below in the section on the subspecies's status.) Specimens from southern Nicaragua in Deptos. Rivas and Río San Juan and from northern Costa Rica (including specimens at the American Museum of Natural History examined for me by

John M. Bates) show this area to be a zone of intergradation between the two forms. From Panama (including Isla Coiba) southward through Colombia and throughout the South American range of the species, specimens that I examined are all referable to the nominate race. *Ecology.* *Ara macao cyanoptera* seems to occur more commonly in the open habitats of Middle America. In Honduras and Nicaragua it does occur in tall, evergreen tropical forest, but is more common in lowland gallery forests in the pine savannas and (originally) in the mixed pine / broad-leaved woodlands of the lower mountainous areas. It also occurred in the tropical deciduous forest of the Pacific Slope of Central America. In the lowland pine savannas of the Mosquitia region of Honduras and Nicaragua, *Ara macao cyanoptera* can be encountered many kilometers from broad-leaved forests. In these areas they forage on Caribbean Pine (*Pinus caribea*) seeds, crushing the cones and dropping a shower of scales (*pers. observ.*). J. Salaverri and V. Murphy (*pers. comm.*) also report the macaw to use pine woods in the Mosquitia and eastern Depto. Olancho, Honduras, especially in the transition zone between broad-leaved forests and pine savannas.

*Nesting.* Nesting records from the wild are few for this form, but seem typical of the Scarlet Macaw and macaws in general. Huber (1932) reported a nest in northeastern Nicaragua in a tree hollow 16 m above ground. Howell (1972) also recorded a nest in northeastern Nicaragua, in a cavity in a large, broken-off pine. Lowery & Dalquest (1951) recorded a nest 10 m above ground in the hollow of a dead trunk in Veracruz, Mexico.

*Status.* Even as I describe a new form of Scarlet Macaw, I must report that it is in danger of extinction. Although once widespread in southern Mexico and northern Central America, *Ara macao cyanoptera* has been reduced to only a small number of birds in isolated populations. It has been almost completely extirpated from the Pacific slope in Mexico, Guatemala, El Salvador (from which country it was completely extinguished "some decades ago"; Thurber *et al.* 1987), Honduras, and Nicaragua (Ridgely 1982). There is a small remnant population on the Peninsula of Cosigüina, Nicaragua (*pers. observ.*). On the Caribbean slope, the macaw now occurs in Mexico only in the Selva Lacandona (Forshaw 1989), in the forest of southwest Belize (Manzanero 1991), in the southwestern Petén region of Guatemala (J. Vannini, *pers. comm.*), north-eastern Honduras (*pers. observ.*), and eastern Nicaragua (Martínez 1991).

In 1992 during 90 days of survey work for macaws and other parrots in Honduras, I visited many parts of the country. In this century, the species has been extirpated from all of Honduras except the Depto. Gracias A Dios, northeastern Depto. Olancho, and possibly southeastern Depto. Colón. The macaw apparently no longer occurs in the area from which the holotype was taken, on the Pacific slope in southern Honduras, although there is a small population at Volcán Cosigüina, Nicaragua, about 65 km southwest of the type locality (*pers. observ.*). During the 90 days of surveys, in both rainy and dry seasons, I encountered the Scarlet Macaw only 19 times for a total of 72 individuals, all in Depto. Gracias A Dios. Judging by the extent of the species' remaining range and habitat in Hon-

TABLE 1. Measurements for four characters in *Ara macao*, all in mm. The standard deviation for each is given in parentheses following the mean. Maxilla Length = straight-line length from top of base of maxilla to tip; Mandible Length = straight-line length of gonys; Longest Toe Length = length of third digit; Wing Chord = flattened wing chord length.

	N	Maxilla Length	Mandible Length	Longest Toe Length	Wing Chord
<i>A. m. macao</i>	22	67.4 (3.2)	37.7 (2.3)	61.3 (5.9)	388.7 (14.5)
♂	10	68.2 (3.7)	37.6 (2.3)	60.9 (4.9)	394.0 (14.1)
♀	12	66.9 (2.8)	37.7 (2.3)	61.6 (6.8)	384.3 (13.9)
<i>A. m. cyanoptera</i>	9	69.5 (3.0)	39.9 (1.7)	62.5 (4.6)	413.0 (14.2)
♂	6	69.8 (3.3)	39.7 (1.8)	63.3 (4.5)	409.7 (13.4)
♀	2	67.6 (0.7)	39.4 (0.8)	58.5 (4.7)	415.0 (19.8)
Unsexed		71.9	42.1	65.8	429.0

duras and estimating the amount of area I covered, I calculate there to be 1000 to 1500 Scarlet Macaws in the country.

Extrapolating from the numbers estimated for the Honduran Mosquitia, the total Middle American population of both subspecies of the Scarlet Macaw is probably about 5000 birds, including 4000 *Ara macao cyanoptera*. These birds are in several isolated populations. Although each population (for example, Selva Lacandona/Petén, or the Mosquitia) now may be large enough to avoid genetic inbreeding problems, because the populations are small and isolated, their long-term survival seems unlikely.

**Conservation.** The Scarlet Macaw is listed on Appendix I of CITES (Convention on International Trade in Endangered Species of Flora and Fauna), and therefore, international trade in the macaw (including *Ara macao cyanoptera*) is small, both legal and (apparently) illegal. However, the birds are threatened by both habitat destruction and internal trade within Middle American countries. In nearly every one of about 50 villages of any size that I visited in the Honduran Mosquitia, at least one household had a pet Scarlet Macaw (*pers. observ.*). I also encountered the macaws in captivity at many other places in Honduras, including hotel courtyards, restaurants, and many private homes, although macaws are not kept as frequently as the Yellow-naped Amazon (*Amazona auropalliata*) or some of the smaller parrots and parakeets. I never found the bird being sold in the markets, during five visits to the markets in February, March, September and October 1992. However, an informal market in the species must exist for individuals to be kept as pets far from the area where they naturally occur.

Because the macaw's numbers are so low, strong efforts should be begun immediately to preserve the species. These should include an enforced prohibition of trade, both within Middle America and for export as pets to the developed countries. Habitat preservation should also be a high priority. Continued efforts to preserve the forests in the Selva Lacandona and Petén areas will provide habitat in the remaining northern part of the subspecies's range. A substantial population remains in Honduras within the Río Plátano Biosphere Reserve. If the Tawahka Sumu reserve is formally established in the Cordillera

Entre Rios area of Depto. Olancho, Honduras, it will form a corridor between the Bosawas reserve in adjacent Nicaragua and the Río Plátano reserve, and also provide some protection for the subspecies. In addition, an effort should be made to monitor future population trends in the Scarlet Macaw throughout Middle America.

An educational program to teach the value of this beautiful and rare species should be developed for Middle America, perhaps along the lines of the educational program described by Butler (1992) for the endemic parrots of the Lesser Antilles. The Scarlet Macaw is one of the few species of birds most Central Americans recognize, although few have ever seen one in the wild. The species is also widely recognized outside the tropics and is one of those species that represents the essence of the tropics to most persons living in North America or Europe. The macaw can serve as a "flagship" species, and by encouraging its conservation, additional species and habitats can be protected as a by-product of the macaw's conservation (for example, see Munn 1994).

Other species of macaws also occur in Central America. Of these, the Great Green (or Buffon's) Macaw (*Ara ambigua*) occurs in many of the same areas as the Scarlet Macaw, although not in exactly the same habitat. Although it is not as spectacularly colored or as widely recognized as the Scarlet Macaw, the Great Green Macaw may be in even greater danger of extinction; its current range and total population are both much smaller, and it seems to tolerate human disturbance much less (*pers. observ.*).

**Captivity.** In the decade leading up to the 1986 listing of the Scarlet Macaw on CITES Appendix I, large numbers of the macaws were imported to the United States (Table 2), with peak years in 1982 and 1983, just before Bolivia ceased exportation of wildlife. The countries of origin listed on importation records may not have been the actual origin of the birds, because of transshipment. However, using these records, it is possible to estimate the number of *Ara macao macao* and *A. m. cyanoptera* that entered the country (Table 2). Macaws are long-lived, and therefore it is possible that many of these birds are still alive in the country. If the fraction surviving is one-half, there still would be more than 1700 wild-caught Scarlet Macaws in captivity in

TABLE 2. Scarlet Macaw importation to the United States for the ten years before the species was placed on CITES Appendix I in 1986 (data from unpublished report by Greta Nilsson and David Mack to TRAFFIC USA and from U. S. Fish and Wildlife Service Annual Reports to CITES for 1980–1986). Birds imported from Panama and South America are considered to be *Ara macao macao*; those from Nicaragua and Costa Rica are considered to be from the intergradation zone; those from Honduras north in Middle America are considered to be *Ara macao cyanoptera*. Birds from an unknown source or from countries outside the natural range of the Scarlet Macaw (for example, Europe) are grouped together as “unknown”.

Year	<i>Ara m. macao</i>	Intergradation zone	<i>Ara macao cyanoptera</i>	Unknown	Annual Total
1976	19	8			
1977	131		2		
1978	124		34	211	
1979	74		109	69	
1980*					
1981	37		89	2	128
1982	990		66	3	1 059
1983	1 018		61		1 080
1984	42				43
1985	98	30	52	26	206
1986	45	1	5	14	65
Total	2 578	42	418	327	3 365

\* There are no records of Scarlet Macaws imported into the U. S. in 1980.

the U. S., and of those more than 200 would be of *Ara macao cyanoptera*. Because so many of the birds entered the country in 1982 and 1983, and because macaws are usually taken from the wild as chicks, most of those birds would be only ten or 11 years old.

Scarlet Macaws can be bred with relative ease, provided the breeder makes a sufficient investment in facilities and time (Clubb *et al.* 1992). Respondents to the 1991 Psittacine Captive Breeding Survey (Johnson 1992) reported that 123 pairs of the macaws had produced 102 offspring that year. Because the Middle American population is small, an effort should be made to identify the remaining individuals from the Middle American population that still survive in the United States and Europe. With this information it would be possible to initiate a captive breeding program to maintain the Middle American bloodline (*Ara macao cyanoptera*), keeping it distinct from that of the South American line (*Ara macao macao*). Some macaw breeders already keep the two forms separate in their breeding programs (Susan L. Clubb; *pers. comm.*), but many breeders do not yet recognize the separate forms.

Along with active efforts to protect and preserve the macaws and their habitat in Middle America, keeping the gene pools separate in cap-

tivity and actively promoting captive-breeding of the birds already in the developed countries could help to preserve this distinct new form of the Scarlet Macaw, *Ara macao cyanoptera*.

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