Alpha taxonomy of the *Xiphorhynchus spixii* species group with the validation of *X. juruanus* Ihering, 1904

Marcos A. Raposo and Elizabeth Höfling


The species group *Xiphorhynchus spixii* occurs over a vast region from the Colombian Andes and Bolivia into north-west Brazil and south along the right bank of the rio Amazonas to Mato Grosso, Pará, Tocantins and Maranhão. Indeed, it is one of the most complex and debated species groups within the genus.

Cory & Hellmayr stated that taxa within the group *spixii* are probably conspecific, also raising the possibility that *X. pardalotus* is merely a geographic substitute, i.e. yet another subspecies distributed north of the rio Amazonas. No subsequent author has linked *X. pardalotus* to the group in question, but some have tended to treat the entire complex as conspecific. *X. ocellatus* and *X. obsoletus* were considered closely related to this complex by Raikow, who removed *X. elegans* from the group and considered it only indirectly related to *X. spixii*. Haffer and Aleixo, however, recognised two species as valid: *X. spixii* (Maranhão to the rio Tapajós) and *X. elegans* (of the Tapajós/Madeira interfluvium to Bolivia), including *X. e. juruanus* (western Amazon, from south-east Peru and Bolivia to the rio Madeira), *X. e. insignis* (Peru), *X. e. ornatus* (north-west Peru, Ecuador, south Colombia) and *X. e. buenavistae* (north-east Colombia).
**Cotinga 20**

_alpha taxonomy of the Xiphorhynchus spixii species group_

X. spixii\(^{15}\) was described on the basis of *Dendrocolaptes tenuirostris* Spix, 1824 (type lost), homonym of *Dendrocolaptes tenuirostris* Lichtenstein, 1818 (= *Lepidocolaptes fuscus*). Cory & Hellmayr\(^9\) proposed Pará as the type locality. The species’ small size is comparable to that of *X. obsoletus*\(^{14,22}\), from which it is distinguished by having more ochraceous plumage and a longer bill. It also differs from *X. ocellatus*, which it approaches in size, by its paler guttate spotting, more sharply demarcated and more amply distributed over the belly and mantle. *X. s. spixii* occurs in terra firme forest south of the rio Amazonas, from Maranhão west to the rio Tapajós. The occurrence of *X. spixii* in Ceará, mentioned by Teixeira et al.\(^{29}\), proved false and was based on the incorrect identification of an immature specimen of *X. picus* (corrected in Teixeira et al.\(^{27}\)\(^\text{25}\)). Cory & Hellmayr\(^9\) included *Xiphorhynchus fraterculus*\(^{15}\), described on the basis of a single specimen obtained in Santarém, Pará, as a junior synonym of *X. spixii*.

*X. elegans*\(^{16}\) was described on the basis of specimens from Engenho do Capitão Gama, Mato Grosso, and is characterised, according to Cory & Hellmayr\(^4\), by the large ochraceous, ovoid ocelli distributed over the entire back from the nape to the uropygium. It has rufous shoulders, and the upperwing-coverts possess an ochraceous streak along the rachis, terminating in a small spot. It also has broad fan-shaped spots on the neck and breast, a straight dark bill and yellowish lower mandible. *X. elegans* occurs in the Madeira–Tapajós interfluvin and its headwaters, where it occasionally comes into close proximity with the *X. e. insignis* and *X. s. ornatus* forms from the upper Ucayali in Peru to Colombia. Zimmer\(^{29}\) concluded that all material examined from Sarayacu and Orosa to the east consisted of typical *X. s. juruanus*, whereas forms from the upper Ucayali were substantially different and matched Hellmayr’s diagnosis in respect of bill and pileum coloration, and the mantle and ventral spots. Zimmer also suggested the possibility of intergradation with *juruanus* and, in noting the existence of morphological variation north of the rio Amazonas, concluded by describing two new taxa, *X. s. ornatus* and *X. s. similis*.

*X. elegans juruanus*\(^{12}\) was described on the basis of material from the rio Juruá, is immediately distinguished from *X. s. spixii* and *X. elegans* by its smaller size and fewer breast spots, and the near absence of dorsal spots. It lacks the narrow ochraceous streaks on the upperwing-coverts of *X. elegans*. Moreover, it has a bright white throat patch and straight dark bill very similar to that of *X. elegans* but different from *X. e. insignis*\(^{6,11}\). It occurs on the left bank of the rio Madeira, south of the rio Amazonas and north to the lower rio Ucayali in Peru. Zimmer\(^{29}\), however, concluded that material from the left bank of the lower rio Madeira (Rosarinho, Porto Velho and Manaqueri) more closely matched specimens of *X. elegans* and that the species therefore occurs on both sides of the river. There is much disagreement in the literature on this point. Most recently, Ridgely & Tudor\(^{20}\) and Haffer\(^9\) agreed that *X. spixii juruanus* occurs in all localities immediately west of the Madeira, except Rosarinho, from where morphological variants requiring further study are known\(^{29}\).

*X. elegans insignis*\(^{12}\) is based on a specimen from Samiria, Peru. At the time of its description, Hellmayr was unaware of the description of *juruanus* by Ihering\(^{15}\), and as a result the two descriptions overlapped considerably. Hellmayr\(^11\) presented his diagnosis in relation to the form described by Ihering only after the latter had sent him two specimens of *X. s. juruanus*, an adult and immature. However, given the considerable individual variation in these forms, insufficient material was available for more than initial remarks, limited to the more sharply curved and paler bill of *X. e. insignis*. In the original description, *X. e. insignis* was distinguished from *X. elegans* by its more stripe-like dorsal markings confined to the nape. In addition, its coloration was, in general, reportedly darker than *elegans*, including the ground colour of the pileum, which is dusky in *X. e. insignis*. As in *X. s. juruanus*, the median streaks on the upperwing-coverts characteristic of *X. elegans* are absent in *X. e. insignis*. Cory & Hellmayr\(^9\) added that, in comparison to *X. e. insignis*, *X. s. juruanus* has spots both smaller and more confined to the upper body. Hence, he argued, *X. e. insignis* occupied the entire eastern portion of the region in which the complex occurred, from the left bank of the Ucayali in Peru to Colombia. Zimmer\(^{29}\) concluded that all material examined from Sarayacu and Orosa to the east consisted of typical *X. s. juruanus*, whereas forms from the upper Ucayali were substantially different and matched Hellmayr’s diagnosis in respect of bill and pileum coloration, and the mantle and ventral spots. Zimmer also suggested the possibility of intergradation with *juruanus* and, in noting the existence of morphological variation north of the rio Amazonas, concluded by describing two new taxa, *X. s. ornatus* and *X. s. similis*.

*X. elegans ornatus*\(^{20}\) was described on the basis of a specimen from Puerto Indiana, near the rio Napo in Peru. It closely resembles *X. elegans* but is brighter and has larger ventral and dorsal spots. The bill is pale grey except the base of the lower mandible, whereas *X. elegans* has a dark bill. According to Zimmer\(^{29}\), both possess a similar pattern of median streaks along the rachis of the upperwing-coverts, but *X. s. ornatus* is darker cinnamon on the wings, tail and rump. It is distinguished from *X. e. insignis* by even larger ventral and dorsal spots, and by its deeper
ochraceous ventral spots. The throat is deep buff, not white as in X. e. insignis and X. s. juruanus. It occurs in northern Peru and on the left bank of the rio Amazonas from the rio Napo region to eastern Ecuador, north to eastern Colombia and east to the vicinity of São Paulo de Olivença, Brazil. Several specimens clearly identifiable as X. s. juruanus were available from the same area as the sample of X. s. ornatus taken at the latter locality. Zimmer29, expressing surprise at the presence of the two forms in the same locality and south of the Solimões, suggested that as the two were not collected on the same day they had been taken in different habitats, and plausibly even on opposite banks of the river. Todd20, in contrast, accepted that they had all been collected from one area and concluded that they were species, given that if they were subspecies they would reproduce freely and lose their diagnostic characters. He also claimed that specimens of the two had been taken on the same day, but this was subsequently emphatically refuted by Haffer9, who suggested that those of X. s. ornatus had been collected from an island in mid-river, c.500 m from the south bank of the Amazonas. Thus, they could be considered subspecies, as their potential reproductive compatibility was restored. After describing a degree of individual and geographic variation for his new subspecies, Zimmer29 realised that an even more distinct form was present further north, in Buena Vista, upstream of Villavicencio, and described it as subspecies named for its place of origin.

X. elegans buenavistae20, was initially described as X. s. similis but its name was subsequently corrected, also by Zimmer20, because Dendroplex similis14, a synonym of X. obsoletus, preoccupied the name similis. The holotype is from Buena Vista, Colombia. This form closely resembles X. elegans, but is distinguished by a paler bill, less rufous shoulders and merely obsolete streaks along the rachis of its coverts and scapulars. It differs from X. e. ornatus in its overall greyer coloration, distinctly more ochraceous and smaller dorsal and ventral spots, and whiter throat, albeit not as white as X. e. insignis, from which it also differs in the larger size and distribution of its dorsal and ventral spots. X. e. buenavistae occurs from the eastern slopes of the Colombian Andes to the Orinoco basin. Closing his description, Zimmer raised the possibility of intergradation with X. s. ornatus, but did not reach a conclusion on the subject.

Here we review the alpha taxonomy of the X. spixii species group, adopting the concept of species proposed by Nelson & Platnick10. It should be noted that the results obtained using these parameters do not differ substantially from those that would be achieved if other supposedly phylogenetic concepts were deployed (for a review of such species concepts, see de Pinna17).

Materials and methods

A total of 751 specimens was analysed, 308 of X. spixii and 443 of X. elegans (including X. e. juruanus X. e. insignis, X. e. buenavistae and X. e. ornatus). This material included the types of X. spixii ornatus (AMNH 231998; for museum acronyms see below), X. spixii similis (AMNH 122088), Dendroalis ocellata juruana (MZUSP 3535), Dendroalis elegans (syntype NHM 89520522), X. obsoletus parvimaculatus (ANSP 104157) and Dendroalis fraterculus (USNM 120928). Our work focused on plumage coloration and morphometric characters (length of wing, tail and exposed culmen).

Material analysed was from the following institutions: Museu Paraense Emílio Goeldi, Belém (MPEG), Museu Nacional/Universidade Federal do Rio de Janeiro (MNRJ), Museu de Zoologia da Universidade de São Paulo (MZUSP), Field Museum of Natural History, Chicago (FMNH), Museum of Natural History, University of Kansas, Lawrence (MNHUK), Museum of Natural Science, Louisiana State University, Baton Rouge (LSUMZ), American Museum of Natural History, New York (AMNH), National Museum of Natural History, Smithsonian Institution, Washington DC (USNM), Academy of Natural Sciences, Philadelphia (ANSP); Museum of Comparative Zoology, Harvard (MCZ), Muséum National d’Histoire Naturelle, Paris (MNHN), Natural History Museum, Tring (NHM) and Museum für Naturkunde Alexander Humboldt, Berlin (MFN).

Results

Our analysis demonstrated that three taxa, X. spixii13, X. elegans16 and X. juruanus12, should be recognised as species, confirming the conclusions of Haffer9 and Aleixo4 in relation to the independence of the first two and validating, for the first time, X. juruanus. The taxa X. s. insignis, X. s. ornatus and X. s. buenavistae should henceforth not be considered taxonomically for lack of possible diagnosis and because they were consistently found to represent geographic variants of the senior synonym X. juruanus.

The three valid species of the complex are re-described below.

Xiphophyra spixii (Lesson)
Picoplutes spixii Lesson, 1831; p. 314.
Dendroalis fraterculus Ridgway, 1888; p. 88.

Type material: Holotype missing. Pará is the type locality suggested by Cory & Hellmayr6.

Diagnosis: X. spixii is the member of the complex that is most easily distinguished due to the oval shape of the breast feathers and their distribution (Fig. 2), which give the birds a scaly appearance. It
Cotinga 20

**Table 1.** Descriptive morphometrics of males and females from the three phylogenetic species in the species group. *X. juruanus* is divided arbitrarily into sample A (specimens from Brazil, Bolivia, extreme north-east Peru) and sample B (central and northern Peru, Ecuador, Colombia).

<table>
<thead>
<tr>
<th></th>
<th>Population</th>
<th>Sex</th>
<th>Wing</th>
<th>Tail</th>
<th>Bill</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>X. spixii</em></td>
<td>Male</td>
<td>99.44 (3.89)</td>
<td>79.58 (3.51)</td>
<td>29.53 (1.35)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>94.41 (2.85)</td>
<td>75.49 (2.99)</td>
<td>28.89 (1.49)</td>
<td></td>
</tr>
<tr>
<td><em>X. elegans</em></td>
<td>Male</td>
<td>97.23 (2.80)</td>
<td>79.15 (4.10)</td>
<td>29.87 (1.50)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>91.06 (2.90)</td>
<td>71.49 (3.65)</td>
<td>29.23 (1.57)</td>
<td></td>
</tr>
<tr>
<td><em>X. juruanus A</em></td>
<td>Male</td>
<td>100.42 (4.04)</td>
<td>80.54 (3.51)</td>
<td>32.46 (1.78)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>94.19 (2.80)</td>
<td>75.30 (3.45)</td>
<td>31.49 (1.66)</td>
<td></td>
</tr>
<tr>
<td><em>X. juruanus B</em></td>
<td>Male</td>
<td>98.31 (3.42)</td>
<td>78.07 (3.67)</td>
<td>32.25 (1.77)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>93.02 (3.09)</td>
<td>72.83 (3.41)</td>
<td>30.56 (1.72)</td>
<td></td>
</tr>
</tbody>
</table>


is immediately distinguished from *X. elegans* and *X. juruanus* by its oval-shaped pectoral spots, which are fan-shaped in the latter two. The ventral spots of *X. spixii* occur on the throat and breast, becoming gradually more elongated until they become stripes on the abdomen. It also differs from *X. juruanus* by the broader distribution of dorsal spots.

**Variation:** Males larger. There is a slight tendency for specimens from near the headwaters of the rio Tapajós to have less elongated spots and less chestnut plumage. This is especially conspicuous in specimens from the upper rio Cururu (4 specimens MNRJ, not yet registered with accession numbers) and the Serra do Cachimbo (MZUSP 38348, 38345 and 38349) but no sign of intergradation with *X. elegans* was detected. In Alta Floresta, the two occur on opposite sides of the rio Teles Pires, confirming their respective diagnoses. It should also be noted that if hybridisation occurred between them, it would be characterised as secondary contact, as indicated by the molecular phylogeny proposed for the genus by Aleixo, who grouped *X. elegans* and the populations included here as *X. juruanus* within a monophyletic taxon.

**Descriptive morphometrics:** See Table 1.

**Distribution:** Occurs from Maranhão, on the banks of the rios Turiáçu and Buriticupu, west to the rio Tapajós, with its northern distribution delimited by the rio Amazonas. Distributional limits elsewhere are within the vicinity of Conceição do Araguaia to the south-east and the rio Teles Pires, rio Cururu (Pará) and the Serra do Cachimbo (Fig. 1).

**Geographic representation of the series:** Brazil. **Pará:** Acará (2), right bank of the rio Teles Pires, opposite Alta Floresta (5), Altamira (2), Alto Cururu (4), Ananindeua (4), Apêhu (1), Arumatêua (2), Aveiros (6), Baião (4), Belém (70), sites along the Belém–Brasilía highway (13), Benevides (3), Bujaru (1), Cachimbo (4), Caldeirão (1), Capanema (1), Capim (53), Carajás (9), Castanhal (1), Caxiricatuba (3), Conceição (1), Diamantina (2), Fordlândia (3), Igarapé-açu (1), Ipira (1), Itacuruba (1), Jacundá (4), Marajó (1), Mirituba (1), Mocuco (1), Ourém (6), Paragominas (3), Peixoto (1), Piuri (1), Providência (3), Rio Guamá (4), Rio Iriri (1), São Félix do Xingu (4), Tapajós (2), Taparã (1), Tapiratã (1), Tauari (1), Tucunaré (1), Tucuruí (6), Utinga (6), Vitoria (1). **Tocantins:** Couto Magalhães (2).

*Xiphorhynchus elegans* (Pelzeln)

**Dendrocinus elegans** Pelzeln, 1868; p. 45.

**Type material:** Holotype from Engenho do Capitão Gama, Mato Grosso, syntypes in Natural History Museum, Tring, and Naturhistorisches Museum, Vienna.

**Diagnosis:** Distinguished from other species by fan-shaped spots (Fig. 1) distributed over the entire undersurface to the abdomen, without becoming
stripes as in *X. spixii* and not confined to the breast as in *X. juruanus*. Also distinguished from all populations of the two latter species by ochraceous streaks along the rachis of the upperwing-coverts, ending as small spots (Fig. 3). It has a darker throat than the parapatric populations of *X. juruanus*, from which it is also distinguished by ochraceous ocelli covering almost its entire mantle (Fig. 2), whereas the latter has a striped dorsum. *X. elegans* is similar to populations of *X. juruanus* north of the rio Amazonas (previously named *X. s. ornatus* and *X. s. buenavistae*), although *X. elegans* has a less cinnamon plumage, a darker bill and smaller pectoral spots confined to the apical portion of each feather. The pectoral spots of *X. elegans* also differ in being less elongated in the proximal and median portion, thus lacking the conical shape described for some populations of *X. juruanus*.

Variation: *X. elegans* is highly homogeneous throughout its distribution, and no sexual dimorphism has been observed in coloration. Males are larger on average. Specimens from Rosarinho (AMNH 282269, 282271, 282272 and 282273), previously considered intermediate between *X. juruanus* and *X. elegans*9,29, matched the diagnosis of *X. elegans*, possessing marked lesser wing-coverts and intermediate spots. The presence of dorsal spots and ochraceous throat are additional characters of *X. elegans*.

Descriptive morphometrics: See Table 1.

Distribution: Occurs south of the rio Amazonas where it is confined to the Tapajós–Madeira interfluvium (Fig. 4), and known as far west as the banks of the rio Sepotuba (MNRJ 13346) near Cáceres (Mato Grosso). To the south-west, its distribution appears to be delimited by the rio Guaporé, except in Bolivia, where it crosses this river.

Geographic representation of the series: **Brazil. Pará:** Alta Floresta, left bank of the rio Teles Pires (6), Itaituba (1), Uruá (1), Urucurituba (1), Vila Braga (4); **Amazonas:** left bank of the rio Aripuanã (5), rio Theodore Roosevelt (2), Rosarinho (5); **Mato Grosso:** Engenho do Capitão Gama (1), Jacaré (1), right bank of the rio Aripuanã (Cachoeira Dardanelus) (5), Rio Peixoto de Azevedo (6), Salto Grande do Sepotuba (1), Teles Pires (3); **Rondônia:** Aliança (3), Alvorada do Oeste (6), Cachoeira Nazaré (29), Calama (5), Jiparanã (2), Ouro Preto do Oeste (6), Pedra Branca (10), Porto Velho (4), Principe da Beira (1), rio Anari (4), rio Jamari (1), São João do Norte (1), UHE Samuel (8); **Bolivia. Santa Cruz:** Velasco (16), Serranía de Huanchaca (9).
**Cotinga** 20

**Alpha taxonomy of the Xiphorhynchus spixii species group**

*Xiphorhynchus juruanus* (Ihering)

*Dendrornis ocellata juruana* Ihering, 1904; p. 436.

*Dendrornis insignis* Hellmayr, 1905; p. 55.

*Xiphorhynchus spixii ornatus* Zimmer, 1934; p. 7.

*Xiphorhynchus spixii similis* (= *buenaestiae*) Zimmer, 1934; p. 9.

*Xiphorhynchus obsoletus parvimaculatus* Carriker, 1934; p. 3231.

**Type material**: Holotype from the banks of the *rio Jurúa*, housed in the Museu de Zoologia da Universidade de São Paulo.

**Diagnosis**: *X. juruanus* possesses pronounced geographic variation. The Brazilian and Bolivian populations, which are geographically close to *X. elegans*, are distinguished from the latter by their smaller fan-shaped pectoral spots confined to the breast, and the dorsal spots reduced to stripes. In addition, they lack the latter's ochraceous stripes on the upperwing-coverts and have a more whitish throat. These populations of *X. juruanus* differ from *X. spixii* in the shape and distribution of spots, which are large, oval and rather diffuse in the latter. Peruvian, Ecuadorian and Colombian populations of *X. juruanus* (previously named *X. e. ornatus* and *X. e. buenaestiae*) vary considerably but are distinct from *X. spixii* by having ventral spots that are conical and fan-shaped, rather than ovoid, and by having a pale bill, whereas both *X. spixii* and *X. elegans* have a dark bill, as do the Brazilian and Bolivian populations of *X. juruanus*. They also differ from *X. elegans* in having larger spots.

**Variation**: No sexual dimorphism detected in respect of plumage coloration. The young approximate to the pattern observed in other species of *Xiphorhynchus*, in that they are more chestnut and have a smaller, darker bill. They present pronounced modifications in body spots, which may be larger in some individuals (e.g. AMNH 824056).

Our analysis confirmed that *X. juruanus* also presents considerable geographic variation in respect of characters historically used for diagnostic purposes. In the area of contact with *X. elegans*, the belly spots are similar in shape to those of the latter, but much smaller and confined to the breast. Spots become larger in populations further from the *rio Madeira*, towards Ecuador and Colombia, confirming the observations of Zimmer29. The same applies to the dorsal spots, which are larger in the western range of *X. juruanus*. Localities near the *rio Madeira* (e.g. Porto Velho) have merely incipient dorsal spots appearing as stripes. In Porto Pardo, Porto Maldonado and the *rio Manu* (all in Madre de Dios, Peru) and Nicolas Suarez (Pando, Bolivia), the dorsal and ventral spots are slightly larger, but the bill remains black (e.g. AMNH 82456 and 824057). Around Lagarto, Santa Rosa, Puerto Bermudez, the *rio Linlla Pichis*, Tingo Maria and Chuchurras, in the upper *rio Ucayali* region, a number of specimens have larger spots and paler bills (e.g. AMNH 240408 and 240411), typical of the synonym *X. e. insignis* (agreeing with Hellmayr29). In this region it is still possible to find some with black bills (AMNH 239365). North along the left bank of the *Ucayali* these characteristics are even more distant from typical *X. juruanus*, in Yarina Cocha, dpto. Loreto and thence to dpto. Amazonas (e.g. Huampami, Urakusa and La Poza), where the predominant phenotype is rather closer to the holotype of *X. s. ornatus*. The latter predominates east in the region of the *rio Napo* and north in Ecuadorian localities such as Archidona, Limoncocha and Santa Cecilia (*Napo*). Colombian populations closely resemble *X. elegans* except for their larger, more cinnamon-coloured pectoral spots, less ovoid dorsal spots and paler bill in most specimens.

It should be stressed that this transition does not occur on the banks of the *rio Amazonas*, where populations continue to present the typical phenotype of *X. juruanus* as far as the lower *Ucayali*, on the opposite bank of the mouth of the *rio Napo*, and at Iquitos. In this area, specimens from the right bank of the *rio Amazonas* correspond to the morphotype *X. s. juruanus* (e.g. specimens from Orosa, AMNH 232006, 232002, 232005 and 232008) while specimens from the left bank correspond to former *X. s. ornatus* (e.g. one from the *rio Mazan*; AMNH 407167), giving the impression of an abrupt transition.

The same variation is observed in size. Populations of *X. juruanus* from north-west Peru, Ecuador and Colombia are conspicuously closer in morphometrics to *X. elegans* than Brazilian and Bolivian populations of *X. juruanus*. This pattern of variation matches what Brown & Wilson4 term ‘character displacement’.

**Descriptive morphometrics**: Table 1 summarises mensural data for *X. juruanus*. Specimens were arbitrarily divided into sample A, comprising those from Brazil, Bolivia and extreme north-east Peru (previously named *X. s. juruanus*), and sample B, comprising the rest (previously named *X. e. insignis*, *X. e. ornatus* and *X. e. buenaestiae*). The purpose of this was to test whether populations geographically more distant from *X. elegans* were closer to the latter in morphometrics. Indeed, it was generally observed that mensural data from sample B were closer to *X. elegans* than those of sample A, particularly the wing and tail measurements of males. With regard to tail measurements, sample A specimens of *X.
juruanus were significantly larger than *X. elegans* (p<0.05), whereas sample B specimens were not.

**Distribution:** *X. juruanus* occurs from the left banks of the Madeira and Guaporé west, as far as La Poza, Huampani and Nazareth, dpto. Amazonas (Peru). South, it occurs along the eastern slopes of the Andes to Nicolas Suarez, dpto. Pando (Bolivia), and Astillero, Porto Pardo and Porto Maldonado in the region of the río Manu, dpto. Madre de Dios (Peru). North, it also occurs on the left bank of the río Solimões, occupying the region of the río Napo in the vicinity of Iquitos, and extending into Ecuador in dpto. Napo (e.g. Archidona, Limoncocha, the río Manu and Santa Cecilia) and Colombia in dpts. Putumayo, Caquetá, Cauca and Meta (in Villavicencio and Buena Vista).

**Geographic representation of the series:** **Bolivia.**
Pando: Nicolas Suarez (14). Brazil. Amazonas: Boca Lago Tefé (1), Estirao do Equador (8), Igarapé Grande (8), João Pessoa (8), río Caiatuinharin (1), río Jurua (1), Santa Cruz (5), Santo Isidoro (3), Tefé (1), Vila Bela Imperatriz (1); Acre: Cruzeiro do Sul (9), Iquiri (1), río Branco (2), Vila Taunaturgo (Seringal Oriental on the río Jurua) (1); Rondônia: Porto Velho, left bank of the río Madeira (1).

**Colombia. Cundinmarca:** Bogotá (8); Meta: Buena Vista (1), Montanhas Macareanas (1), río Duita (7), Villavicencio (5); Caucá: Moscopan (2); Caquetá: Morelia (2), Puerto Venecia (2); Putumayo: Guascaaycu (1); Sucre: río Linilla Pichis (1).

**Ecuador. Napo:** Archidona (1), Concepcion (5), Limoncocha (15), río Manu (1), Pacayaca (1), río Payamino (1), Santa Cecilia (8), San José Nuevo (1); Pastaza: Aucaaycu (2). **Peru. Amazonas:** Huampani (4), La Poza (3), Nazareth (2), Urakusa (3); Huánuco: Águas Calientes (1), Calientillo (1), Chuchurras (1), El Indio (1), Tingo Maria (1); Madre de Dios: Altamira (1), Napo (1), Puerto Maldonado (4), Puerto Pardo (4), río Tambopata (3); San Martin: El Tingo (1), Saposoaa (3); Loreto: Balta (4), Chayautas (1), Estacion Ecologica Pitheia (2), Iquitoa (28), Oroza (5), Pebas (1), Quebrada Vanilla (25), Yurimaguas (1); Pasco: Puerto Bermudez (2), Navati Mission (1); **Puno:** Astillero (3), Huacamayo (3), Puerto Vessup (8), río Pachitea Nebil (1), río Ucayali (6), Santa Rosa (6) Yarina Cocha (1); **Ucayali:** Lagarto (10), Pucallpa (12). **Imprecise localities:** río Mazan (1), ‘Ecuador’ (1), ‘Colombia’ (5), Madre Dios (1).

**Discussion**

**Taxonomic definitions:** As they are clearly diagnosable and allopatric, *X. juruanus* and *X. elegans* cannot be considered conspecific as proposed by Ridgely & Tudor20, Haffer2 and Aleixo1. From the material we examined it can be inferred that there is only one area of possible contact between *X. elegans* and *X. spixii*; this lies in the vicinity of the Serra do Cachimbo, Pará, on the border with Mato Grosso. Nevertheless, all of the specimens of *X. spixii* from this area (e.g. four uncatalogued specimens in MNRJ and three in MZUSP, 38345, 38348 and 38340) and those of *elegans* (e.g. MPEG 33617, 33618, 33619, 33620, 33621, 33622) are perfectly diagnosable.

Records relating to specimens that supposedly match the diagnosis of the synonym, *X. j. ornatus*, for the right bank of the río Amazonas in São Paulo de Olivença are most probably the result of imprecise labelling, as hinted by Zimmer29 *contra* Todd20. A similar case may also have occurred with specimens collected around Orosa (AMNH 232006, 232002, 232005 and 232008), which present pronounced variation in dorsal and ventral spots. It must be stressed that the Olalla brothers employed several local hunters to collect birds28, thus some ‘mislabelling’ is perhaps to be expected, and may be true for those specimens from São Paulo de Olivença.

If, however, the material was taken from the right bank of río Amazonas, Orosa must represent a transition site from typical *X. juruanus* to the more spotted form, distributed further east and north. It should be noted that the site is close to the mouth of the río Ucayali and that strongly spotted forms predominate on the opposite bank of the latter river.

That the transition is abrupt around the mouth of the río Ucayali and that populations may be isolated in this area does not justify validation of *X. e. insignis* (which would have priority over Zimmer’s *X. s. buenavistae* and *X. s. ornatus*), as the transition in the southern distribution is gradual and characteristic of primary contact, which was corroborated by the molecular analysis of Aleixo3.

**Group phylogeny:** Bledsoe et al.19 and Raikow29 concluded that the species group is not monophyletic and excluded *X. elegans* from it. However, their findings (which used the same character matrix) have not been employed here because of major inconsistencies. In separating *X. elegans* from the *X. spixii* group, both studies used (see Raikow19) specimens of *X. elegans* (LSUMZ 83715 and FM 330388) and a single *X. spixii* (LSUMZ 114412). FM 330388 was taken from the río Jiparaná, Rondônia, and thus pertains to true *X. elegans*, whereas LSUMZ 83715 is from the province of Napo (Ecuador, 00°24’S 73°37’W), where *X. juruanus* occurs (labelled *X. elegans* *ornatus* in LSUMZ collection). Additionally, the specimen of *X. spixii* used in the previous studies is from Quebrada Vanilla, at the mouth of río Napo (Peru), and is therefore another specimen of *X. juruanus* (identified as *X. spixii juruanus* in the collection). As mentioned earlier, *X. spixii* occurs only in Brazil, from the right bank of río Tapajós west. The large
phylogenetic distance attributed to two specimens of the same species (LSUMZ 114412, 83715) therefore represents the potential negative effects of poor sampling combined with inconsistent terminals (polyporphic species) within a phylogenetic analysis.

We consider that biogeographic patterns (parapatry), coloration and morphometrics to be highly indicative of the complex being monophyletic, thus agreeing with the phylogeny proposed by Aleixo. The 'character displacement' described for X. juruanus / X. elegans is also typical of closely related populations. At the same time, X. juruanus and X. elegans both have fan-shaped breast spots of a shape that is unique in the family (see diagnoses) and derived from that found in X. spixii, which in turn occurs in many related species, such as X. obsoletus, X. ocellatus and Lepidocolaptes fuscus (=X. fuscus; see García-Moreno & Silva and Aleixo). This, combined with the difficulty of diagnosing some populations of X. juruanus as distinct from X. elegans, indicates that they form a sister group derived from the same ancestral stock as X. spixii.

Considering that the cladogenesis of the group occurred dichotomously and that rivers have contributed decisively to the formation or maintenance of currently extant groups, our findings point to an area cladogram broadly congruent with that presented by Bates et al. for the oscines (see their Fig. 3a). The group comprising the areas referred to as Belém, Pará 1 and Pará 2 would be a sister group of the one comprising Rondônia, Inambari and Napo. The latter, in turn, would be divided into Rondônia and Inambari–Napo subgroups. However, this cladogram is not consistent with the hypothesis that Bates et al. propose as the most parsimonious for the 'total passerine data set' (see Bates' Fig. 3b).

Acknowledgements
We are grateful to Fundação de Amparo à Pesquisa de São Paulo (FAPESP) for financial support of MAR's doctoral research (Proc. 97/05079-0), and to the Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq), Brazil, for the research grant extended to EH. The invaluable assistance of the following collection managers and curators is also gratefully acknowledged: Hélio F. A. Camargo (MZUSP); Dante Martins Teixeira and Jorge Bruno Nacinovic (MNRJ), who also reviewed the English text; Fernando Novaes and David Oren (MPEG); Paul Sweet, Joel Cracraft, George Barowclough and Mary LeCroy (AMNH); John Bates and David Willard (FMNH); Mark Adams (NHM); Eric Pasquet (MNHN); Sylke Frahnert (MFN); James Dean, Chris Milensky and Richard Zusi (USNM); Nathan Rice and Leo Joseph (ANSP); Doug Siegal-Causey (MCZ); Van Renssen (LSUMZ); Richard Prum and Kristof Zyskowski (MNHUK). The American Museum of Natural History provided financial assistance for a visit by MAR in 1993. Michael Patten and Curtis Marantz generously revised the first version of this manuscript. Alexandre Aleixo (LSUMZ) graciously devoted his time to discussing the taxonomy of this group. The project would also have been impossible without the support of Renato Gaban Lima, Luís Fábio Silveira, Andrés Calonge Mendés, Fernando Horta and Ricardo Panniri, who contributed comments or other valuable input, including vocalisation recordings.

References
Cotinga 20

Alpha taxonomy of the Xiphorhynchus spixii species group


Marcos A. Raposo
Setor de Ornitolgia, Departamento de Vertebrados, Museu Nacional/UFRJ, Quinta da Boa Vista s/n, Rio de Janeiro, RJ, 0940-040, Brasil. E-mail: raposo@mn.ufrj.br.

Elizabeth Höfling
Departamento Zoologia, Instituto de Biociências, Universidade de São Paulo, Rua do Matão, Trav. 14, 101, Edif. Zoologia, 05508-900, São Paulo, SP, Brasil. E-mail: ehofling@usp.br.