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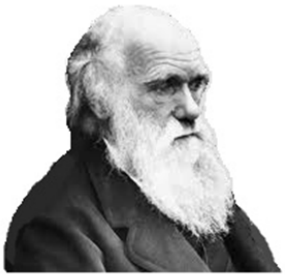

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Ethno-ornithological knowledge of indigenous people of the Amazon rainforest

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ABSTRACT

Traditional ecological knowledge is a system of knowledge that reflects the adaptation of human populations to their environment. The objective of this study was to accomplish a knowledge survey of the Arara indigenous on the birds of natural occurrence in their territory, and the understanding that these indigenous people have about the diversity of birds and their interrelationships, according to their common characteristics and ecological connections. The studies were carried out with indigenous people of the Arara ethnic group, residents of the Arara's Big Bend of Xingu Indigenous Land, in the State of Pará, Brazil, in the Amazon rainforest. As a method for collecting the data was used open and semi-structured interviews. The basis of this approach encompasses a socio-affective construction of knowledge. This method aligns with the Indigenous worldview, respects and upholds its relational significance, transcribes lived and presented cultural experiences with a rich use of metaphors, stories, and symbols, with sound and visual features and landscapes as an experience of living space, exploring the environmental, mythical and spiritual dimensions of indigenous peoples.

***Keywords*:** Indigenous, Amazon rainforest, ethnotaxonomy, ornithology, diversity of birds

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1. INTRODUCTION

Human-animal interaction can be considered an ancestral binomial, whose origin is lost in time, with the first human expressions of graphic art representing animals. Our fascination with nature is innate. Men have contemplated the beauty and fury of animals for thousands of years. They have observed how they moved, fought, fed, reproduced, and since prehistory, they wanted to catch his spirit painting them in the caves that they occupied [1].

Birds are recognized as archetypal symbols present in the imagination of various cultures throughout the history of humanity. Ethnoornithology is the study of the relationship between people and birds, combining anthropological, cognitive, and linguistic perspectives with natural scientific approaches to the description and interpretation of human knowledge and its relationships with birds, covering the most diverse cultural and ecological contexts, due to the complex relationship that human beings maintain with these animals, notably due to the fascination that birds exert with their beautiful songs and vast colors [2].

Studies in indigenous communities that have fauna as their main themes, for the most part, focus on hunting fauna, with emphasis on assessing pressure on hunting and fishing, quantifying this pressure for each species, and hunting and fishing strategies. fishing used.

In this research we sought to study the interactions of wild fauna, specifically birds, to understand the cultural importance of the relationship between indigenous people and birds, not only species that have some direct use for these traditional people, such as hunting fauna, but also the interactions that occur in this relationship. These interactions often go unnoticed, but they play a fundamental role in the transmission of traditional cultural practices.

2. MATERIALS AND METHODS

The studies were carried out with indigenous people of the Arara ethnic group, residents of the Arara's Big Bend of Xingu Indigenous Land, in the State of Pará, Brazil, in two periods respecting seasonality, that is, in the rainy period (winter), in January 2019 and in the dry period (summer), in July 2019.

The study region known as “Volta Grande do Xingu” (Xingu River’s Big Bend), is located at latitude 03°23' S to 03°38' S and longitude 51°33' W to 52°00' W, a 130 km stretch of rapids and braided channels on the Xingu River (Figure 1), which is an important tributary of the Amazon River and where the Indigenous people of the Juruna and Arara ethnic groups live [3].

As a method for collecting the data was used open and semi-structured interviews [4]. This type of interview allows greater flexibility and plasticity in the interviewee-interviewer interaction, favoring a more spontaneous dialogue and the exploration of more private and complex subjects [5].

Indigenous were interviewed, in both genres and different ages. The interviewees were chosen through the indication of the communities themselves, based on the knowledge of these people on the entities. The basis of this approach encompasses a socio-affective construction of knowledge since such knowledge is an integral part of the history and reality of the subjects.

The approach used in this study was qualitative because the data were obtained through semi-structured interviews, following free dialogues in obtaining descriptive data from the reports of the target audience [6]. The rationale for approaching this work, with the qualitative

methodology, encompasses a socio-affective construction of knowledge since such knowledge is part of the subjects' history and reality [7].

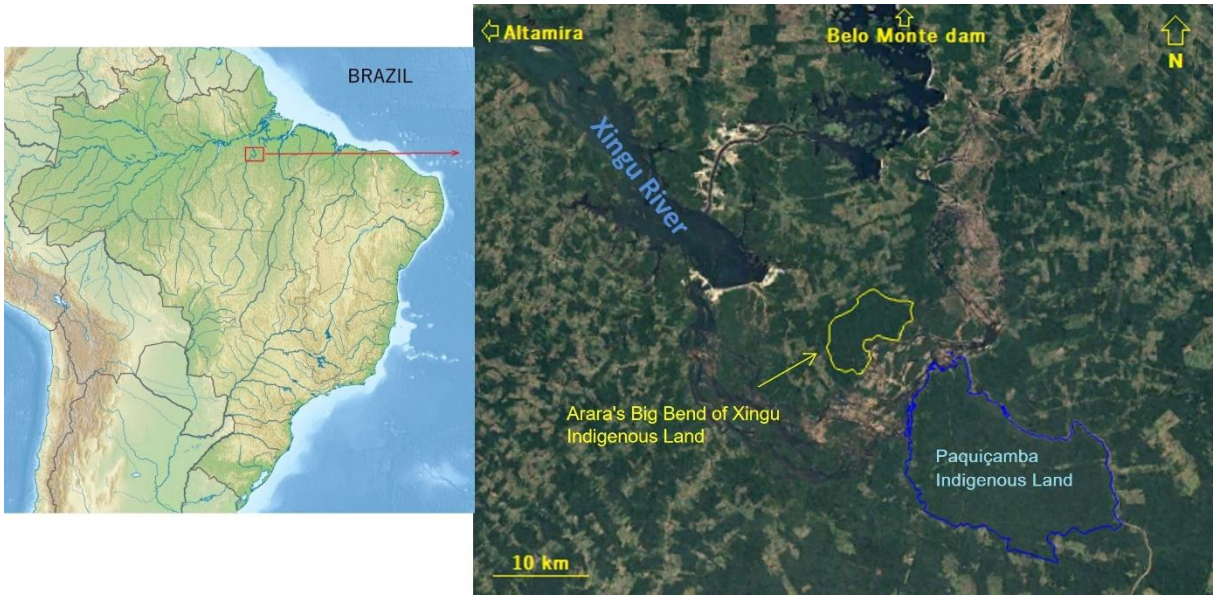

Figure 1. Localization of the studied area.

The object of the qualitative approach is the level of perceptions and feelings, in constant interaction with ecological elements, of meanings, motives, aspirations, attitudes, beliefs, and values, which are expressed through common language and in everyday life, seeking to delve deeper in the complexity of phenomena. The essential material of qualitative research is the word that is expressed in speech, revealing specific historical, socioeconomic, and cultural conditions of each group studied [8].

Indigenous participation occurred through activities such as monitoring trails and expeditions on boats to places of relevant interest to indigenous people, thematic workshops, and collective and individual interviews, with the participation of all indigenous people interested in the topics, from the three villages that make up Arara's Big Bend of Xingu Indigenous Land: Terrawangã, Guary-duan, and Itkoum.

Marcel Mauss (1872-1950), one of the founders of modern anthropology, in his Manual of Ethnography, originally written in the first half of the 20th century and published for the first time in 1967, states:

> "Ethnological science [anthropology] has as its aim the observation of societies, as its object the knowledge of social facts [ ]. The ethnographer must be concerned with being exact and complex; it must have a sense of the facts and the relationships between them, a sense of proportions and articulations" [9].

The methodological rigor proposed on a theoretical level by Mauss finds its demonstrative counterpart in the fieldwork carried out by the Polish anthropologist Bronisław

Malinowski (1884-1942), one of the first and most influential ethnographers of the 20th century, for whom:

> "No one can be seen seriously if they make their sources a mystery and talk about the past as if they knew it through divination. In ethnography, the author is, at the same time, his own chronicler and historian; its sources of information are undoubtedly quite accessible, but also extremely misleading and complex; they are not incorporated into fixed documents, but rather into the behavior and memory of human beings. In ethnography, the distance between the final presentation of research results and the raw material of information collected by the researcher through his own observations, the assertions of the natives, the kaleidoscope of tribal life is often immense" [10].

The information on bird species, obtained through interviews, was important to group the species into ethnocategories, according to the ecological and cultural connections presented by the indigenous people, such as habitat, eating habits, and social behavior, with identification of the ethnospecies in bibliographic drawings illustrated bird fauna. All photos presented in this report were realized by Fabio Rossano Dario, using a digital photo camera Canon PowerShot.

3. RESULTS AND DISCUSSION

Ecological knowledge about birdlife

The thematic workshops and participatory mapping carried out in the indigenous community, where indigenous people of different ages and genders from all villages participated, it was observed that these indigenous people are familiar with the daily life of their territory, a fact that contributes to the strengthening of knowledge. The indigenous people cited 194 species of birds, nine species including cracids (guans and curassows) and tinamids (tinamous), four species of mallards, eight species of herons and bitterns, twenty species of falcons and hawks, fifteen species of macaws, parakeets and parrots, three species of toucans and aracaris, six species of woodpeckers, 86 species of passerines (thrushes, tanagers, flycatchers, tyrants, woodcreepers, antbirds, swallows, and manakins) and another 43 species including vultures, cormorants, sandpipers, rails, kingfishers, hummingbirds, doves, owls, and nightjars.

Respondents showed broad traditional ecological knowledge about birds, including categories related to morphology, eating habits, habitats, and songs. During interviews, workshops, and walks along trails inside the forest, interviewees provided qualitative data that categorized species according to flight, feather color, type of nests, feeding habits, habitat, behavior, and vocalization.

Biodiversity and interrelationships between birds and vegetation

Knowledge of the characteristics of certain species of birds and their relationship with the environment in which they live is passed on and learned informally by the Arara people. The transfer of knowledge occurs naturally in everyday life, with children and especially teenagers present in various activities carried out by their parents, uncles, and older brothers. It was found

that many young indigenous people have such knowledge, which has been improved through observations of the environment in which they live.

It was found that few people are aware of the names of birds in the indigenous language, with *karaja* (red-and-green Macaw - *Ara chloropterus*) and *kawik* (white-eyed Parakeet - *Psittacara leucophthalmus*) being presented. Only 23% of the 194 species of birds recognized as naturally occurring in the Arara's Big Bend of Xingu Indigenous Land had their names indicated in Portuguese, often in a generalized way, such as *beija-flor* (hummingbirds), *saracura* (rails), *tucano* (toucans), *aracari* (aracaris), *pica-pau* (woodpeckers), *curica* (parrots) (Figure 2), *dorminhoco* (trogons), *rolinha* (doves), *bico-de-agulha* (jacamars), *sabiá* (thrushes), *brincador* (birds of the subfamily Tyranninae), and *seguidor-de-formigas* (birds of the Thamnophilidae family).

Figure 2. Despite the taxonomic differences between these and other species of parrots, which are domesticated and live in villages, the indigenous people generically call them *curica*, without distinction: (A) *Amazona aestiva*; (B) *Amazona farinosa*; (C) *Amazona festiva;* (D) *Pionus menstruus.*

The same common name for certain groups of bird species seems to originate from aspects related to the birds' morphological characteristics, song, and behavior, facts that corroborate studies carried out with the Xikrin indigenous people, in the State of Pará, Brazil [11], who name and classify birds through the principles of classificatory systems based on morphology, songs, habitats and mainly, the understanding of myths.

There is a negative effect on the standardization of common names, such as the loss of traditions in the local language [12]. The common names of birds in Brazil are of Portuguese or indigenous origin and are generally regional designations established through local cultures and oral traditions [13-15], such as the *acauã* (*Herpetotheres cachinnans*), *jaçanã* (*Jacana*

jacana), *juriti* (*Leptotila verreauxi*), *biguatinga* (*Anhinga anhinga*), *chincoã* (*Coccycua minuta*), *curica* (*Amazona amazonica*), *anambé* (*Cotinga cotinga*), *japu* (*Psarocolius decumanus*), *maracanã* (*Ara severus*), *cujubi* (*Aburria cujubi*), and even *arara* (species of macaws of the genus *Ara*), common names of Tupi origin [16] designated by the Arara people in the identification of bird species, with the Arara speaking a language from the Karib family [17].

18% of these bird species were found in field observations, indicated by indigenous people, through song and/or visual. The German ornithologist Helmut Sick (1910-1991) states that, for several species of birds, sound manifestations are as characteristic as their morphological aspects. According to the author, "The voice betrays a bird that cannot be seen or cannot be seen well enough, in dense vegetation, in flight, at dusk or night. It is often impossible to see more than two-thirds of the birds encountered during an incursion" [18].

This fact applies very well to the species *Lipaugus vociferans*, known by the Arara as *seringueiro*, *castanhal*, *feiticeiro*, and *capitão-da-mata*, one of the most conspicuous species in the forest of the Arara's Big Bend of Xingu Indigenous Land and recognized by all the indigenous people interviewed, for its strong vocalization. This species of bird has a behavior where individuals come together at a variable distance and sing in a group, to show off and attract the attention of females for copulation [19]. However, it is a difficult bird to see, as it occupies the forest canopy and has an unattractive color. Even so, the characteristics of this species in terms of the shape and color of the feathers were presented by some of the interviewees, which demonstrates the high degree of observation among the Arara and a deep knowledge of these indigenous people with the environment in which they live.

> "The *pomba-relógio* [*Patagioenas speciosa*] has a song that doesn't sound like it's hers, due to her size. We keep imagining that that song is coming from a big animal, but when you see it, you imagine how big its gullet is to make that sound. The *castanhal* [*Lipaugus vociferans*] also has a strong song and is difficult to see, the people here call it the *feiticeiro* [sorcerer]. It is at the top of the chestnut tree. I think his story is passed [term used to say that this bird is probably no longer from this world] because you can't see him. The *uirapuru* [*Cyphorhinus arada*] is not found here, because here in our land I have never seen it sing" (A.P. Arara, 42 years old, ♂, Arara ethnic group, Terrawangã village, Arara's Big Bend of Xingu Indigenous Land, January 24, 2019).

Some species of birds were introduced by the Arara for their characteristic song: the *jaó* (*Crypturellus undulatus*), the falcon *acauã* (*Herpetotheres cachinnans*), the *chincoã* (*Coccycua minuta*), the *pomba-da-mata* (*Patagioenas cayennensis*), the *udu* (*Momotus momota*), toucans and thrushes in a generalized way. Knowledge of the richness of birdlife among the Arara is surprising not only due to the large number of species identified but also due to the high sensitivity in observing. Taxonomic details of birds were often indicated, individualizing taxonomically very similar species, such as the tinamous *Crypturellus cinereus*, *Tinamus tao*, and *Tinamus major* (Figure 3), three species of the Tinamidae family that occur naturally in the Arara's Big Bend of Xingu Indigenous Land. Another distinction was between the macaws *Ara chloropterus*, of great occurrence in the Arara's Big Bend of Xingu Indigenous Land, and *Ara macao*, of more restricted occurrence and with yellow detail in the feathers of the middle part

of the wing (Figure 4). Other details presented were the red feathers on the shoulders of the parrot *Amazona aestiva* and the color of the feathers that distinguish the species *Coccycua minuta* and *Piaya cayana*, as well as the trogons *Trogon viridis* and *Trogon rufus*.

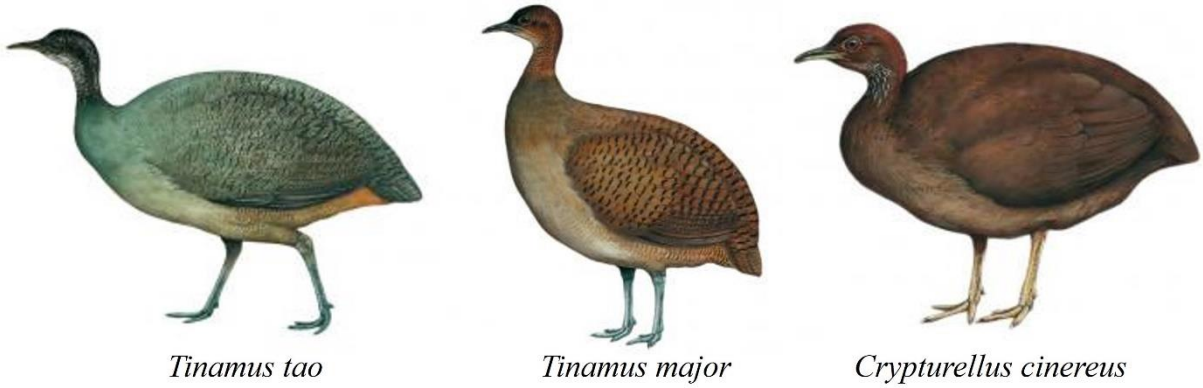

Figure 3. Taxonomic differences between three species of birds from the Tinamidae family. Fonte: Handbook of the Bird of the World

Figure 4. Photo of *Ara macao* registered in the Itkoum village. Note the yellow detail in the feathers of the middle part of the wing, which differentiates it from the species *Ara chloropterus*.

Among the species that were identified by a greater number of interviewees are those known by indigenous people for the showy color of their feathers and occasionally used in feather art, such as the macaws *Ara macao* (scarlet Macaw), *Ara chloropterus* (red-and-green Macaw) and *Anodorhynchus hyacinthinus* (hyacinth Macaw), several species of parrots and parakeets, such as *Amazona amazonica* (orange-winged Parrot), *Pionus menstruus* (blue-headed Parrot), *Aratinga jandaya* (jandaya Parakeet) and *Eupsittula aurea* (peach-fronted Parakeet), the crestless Curassow (*Pauxi tuberosa*), falcons and hawks such as *Busarellus nigricollis* (black-collared Hawk), *Herpetotheres cachinnans* (laughing Falcon) and *Harpia harpyja* (harpy Eagle), toucans and aracaris.

> "The gavião-real [*Harpia harpyja*] is a hunting bird. It catches the guariba [howler monkey] and even the veado-roxo [deer species of the genus *Mazama*]. Small game like that, like the preguiça [sloth, arboreal mammal of the genus *Bradypus*], catches everything. He also catches fish in the water. It's difficult to come here to catch chickens because there's a lot of food for them in the forest" (A.P. Arara, 42 years old, ♂, Arara ethnic group, Terrawangã village, Arara's Big Bend of Xingu Indigenous Land, January 24, 2019).

The majority of interviewees drew connections between bird species and the places where they live and their behaviors: "birds that walk along the ground": tinamous (family Tinamidae), nighthawks (family Caprimulgidae), and trumpeters (family Psophiidae); "birds that live in lagoons and on the banks of streams": herons and bitterns (family Ardeidae), rails (family Rallidae), teals, ducks, and pochards (family Anatidae), and kingfishers (family Alcedinidae); "birds that live on river beaches": limpkin (*Aramus guarauna*) and ibis (family Threskiornithidae); "birds that live in thickets": antbirds, antwrens (family Thamnophilidae), and hummingbirds; "birds that build nests in communities in trees": caciques, blackbirds, orioles, and oropendolas (family Icteridae); "birds that fly together in large flocks": parakeets, swallows and toucans; "birds that live in pairs": macaws and the burrowing owl (*Athene cunicularia*); "birds that eat insect larvae from rotten trunks": woodpeckers and woodcreepers (family Dendrocolaptidae) in a generalized way, with the majority of interviewees demonstrating an ecosystemic understanding, relating the place where certain species of birds live with the availability of food, nesting and eating habits (Figure 5).

Connections with the landscape were defined by the interviewees in the ethnocategories related to the flight of birds and the places in which they live, with the groups with the largest number of ethnospecies being "birds that live high up in the trees" (n=43), "birds that live in thickets" (n=38) and "birds that live in lagoons and on the banks of streams" (n=23), with a relationship between environments and certain species of birds, giving this information a sense of belonging of certain species to places known by the indigenous people:

> "The *arapapá* [species of heron - *Cochlearius cochlearius*] is a bird that lives just on the edge of the stream" (E.M. Arara, 24 years old, ♂, Arara ethnic group, Itkoum village, January 25, 2019); "the *rolinha* [species of dove - *Columbina minuta*] is a yard bird" (A.P. Arara, 42 years old, ♂, Arara ethnic group, Terrawangã village, Arara's Big Bend of Xingu Indigenous Land, January 25, 2019).

Figure 5. Illustrative examples of bird species from some ethnocategories defined by indigenous people: (A) birds that walk along the ground (*Podager nacunda*); (B) birds that live in lagoons and on the banks of streams (*Pilherodius pileatus*); (C) birds that live on river beaches (*Aramus guarauna*); (D) birds that live in thickets (*Thamnophilus doliatus* ♂); (E) birds that build nests in communities in trees (*Cacicus cela*); (F) birds that fly together in large flocks (*Progne tapera*); (G) birds that live in pairs (*Athene cunicularia*); (H) birds that eat insect larvae from rotten trunks (*Dryocopus lineatus* ♂).

Figure 6. Illustrative examples of bird species from some ethnocategories defined by indigenous people: (A) insect-eating birds (*Galbula ruficauda* ♀); (B) fruit-eating birds (*Thraupis sayaca*); (C) fish-eating birds (*Chloroceryle amazona* ♂); (D) seed-eating birds (*Sporophila americana* ♀); (E) worm-eating birds (*Phimosus infuscatus*); (F) birds that drink honey from flowers (*Chionomesa fimbriata*); (G) caterpillars-eating birds (*Trogon melanurus* ♂); (H) birds that eat leaves (*Opisthocomus hoazin*).

The eating habits of other bird species were also highlighted (Figure 6), such as the *acauã* Falcon (*Herpetotheres cachinnans*), for being a voracious snake eater, the gray-lined Hawk (*Buteo nitidus*), for eating chickens, the osprey (*Pandion haliaetus*), for being an agile fisherman, as well as the anhinga (*Anhinga anhinga*), a bird quite common in the Xingu river waterfalls, the tinamus *Crypturellus cinereus*, *Tinamus tao* and *Tinamus major*, for being fruit eaters, the ibis *Aramus guarauna*, *Mesembrinibis cayennensis*, and *Phimosus infuscatus*, because they are earthworm eaters, and some species of antbirds (Thamnophilidae family) because they are "ant-following birds", a scientifically correct term [20] and used by one of the interviewees, who explained that:

> "These birds do not feed on ants, but when the ants pass by all together at once, the insects jump away and the birds eat them" (E.M. Arara, 24 years old, ♂, Arara ethnic group, Itkoum village, January 25, 2019). After this explanation, the interviewee indicated the species *Formicarius colma* (rufous-capped Antthrush) in the illustrated bird guide, calling it the "king of ants".

Connections between the habitat and eating habits of various species of birds were addressed, as correlations between the place where these birds live or spend most of their time, with the availability of food, highlighting the importance of the trophic niche in the survival relationship of these species:

> "The *coroca* [*Phimosus infuscatus*] lives on the beiradão [river beach], as that is where it finds worms to eat" (A.P. Arara, 42 years old, ♂, Arara ethnic group, Terrawangã village, Arara's Big Bend of Xingu Indigenous Land, January 25, 2019).
> "The *nambé* [*Cephalopterus ornatus*] lives on the islands, where it finds the fruits it likes to eat" (F.P. Arara, 44 years old, ♂, Arara ethnic group, Terrawangã village, Arara's Big Bend of Xingu Indigenous Land, January 25, 2019).

Connections with human survival were presented by some interviewees through the birds that are hunted for food by indigenous people:

> "The *azulona*, the *jaó-preto*, the *cabeça-vermelha*, the *nambu-jaó*, the *cujubi*, and the *cococó* [species of guans and tinamous], all of these are good to eat" (J.M. Arara, 37 years old, ♂, Arara ethnic group, Terrawangã village, Arara's Big Bend of Xingu Indigenous Land, January 25, 2019).

Connections were also made between prey and predator, with indications in the photos in the illustrated bird guide and comments on some specific foods:

> "All these [species of guans and tinamous] are food for hawks" (L.C.F. Arara, 33 years old, ♂, Arara ethnic group, Terrawangã village, Arara's Big Bend of Xingu Indigenous Land, January 25, 2019).

> "This hawk there [*Busarellus nigricollis*], it eats nambu, snakes and frogs" (E.M. Arara, 24 years old, ♂, Arara ethnic group, Itkoum village, Arara's Big Bend of Xingu Indigenous Land, January 25, 2019).
> "This hawk [*Harpia harpyja*], it even eats the guariba [howler monkey]" (W.J. Curuaia, 51 years old, ♂, Arara ethnic group, Guary-duan village, Arara's Big Bend of Xingu Indigenous Land, January 25, 2019).
> "The *chincoã* [*Coccycua minuta* - the interviewee pointed to the size of the tail of this species comparing with another very similar one, *Piaya cayana*, distinguishing one from the other], it eats caterpillars. And this one too [*Trogon viridis*] it eats caterpillars" (E.M. Arara, 24 years old, ♂, Arara ethnic group, Itkoum village, Arara's Big Bend of Xingu Indigenous Land, January 25, 2019). The interviewee explained that in the Arara's Big Bend of Xingu Indigenous Land there is only this species of trogons, which he called "dorminhoco" [this is a species with a cryptic habit], with a yellow belly, and there are no species with a red belly, present in some figures in the illustrative guide to birds, which includes species with the most widespread occurrence.

In the behavioral connections we can highlight information about how these animals live, whether in couples or groups, and where they nest, like most parrots (macaws, parrots, and parakeets): "*they nest in holes made in trees*"; of trogons (*Trogon* spp): "*they sleep inside termite mounds*"; of the white-headed Marsh Tyrant (*Arundinicola leucocephala*): "*builds a nest on a tree branch on the edge of the stream*".

The species of birds were grouped into 27 ethnocategories, according to the ecological and cultural connections presented by the indigenous people, such as habitat, eating habits, social behavior, sometimes in a generic way, grouping a certain amount of species that have certain common characteristics, and many of these species are present in more than one ethnocategory, forming ethnospecies, with only those species considered to have a high degree of cultural consensus, indicated by the majority of interviewed: birds that live high up in the trees, birds that live in thickets, birds that walk along the ground, birds that live in lagoons and on the banks of streams, birds that live on river beaches, birds that live in the backyard, birds that build nests in communities in trees, birds that build nests in the hollows of the trees, fruit-eating birds, insect-eating birds, birds that eat insect larvae from rotten trunks, fish-eating birds, worm-eating birds, birds that eat other birds, seed-eating birds, birds that drink honey from flowers, birds that eat chickens, birds that eat snakes, birds that eat frogs, birds that eat tortoises, caterpillars-eating birds, birds that eat leaves, birds that fly together in large flocks, birds that live in pairs, ant-following birds, birds hunted for food, birds that are kept as pets.

4. CONCLUSION

The diversity of birds presented by Arara of natural occurrence in the indigenous territory was considered large. These indigenous people have great knowledge about the main interactions between the vegetation of the Amazon Forest and the diversity of birds that live

there. The Indigenous knowledge about the ecological interactions between animals and plants travels through generations from older to younger ones in oral transmission.

It is observed that in the culture of the Arara, birds are grouped according to their common characteristics and ecological connections. This grouping is called ethnocategories, which correspond to the ecological and cultural connections presented, such as habitat, eating habits, and social behavior, sometimes in a generic way, grouping a certain number of species that have certain common characteristics, and many of these species are present in more than one ethnocategory, forming ethnospecies.

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