



Aguaruna Knowledge of Bird Foraging Ecology: A comparison with scientific data

Kevin Jernigan and Nico Dauphiné

Research

Abstract

We present a detailed look at local ecological knowledge (LEK) of the Aguaruna-Jívaro on plants foraged by frugivorous tropical birds. When asked how a particular plant is useful to people, Aguaruna men often mentioned whether the plant in question was eaten by birds or other animals. The Aguaruna use their knowledge about what plants particular birds eat to help them locate species when hunting. We focus on indigenous knowledge of the diet of five mainly frugivorous bird families that are of local economic importance: Cracidae (guans, chachalacas and curassows), Pipridae (manakins), Psittacidae (parrots), Ramphastidae (toucans) and Steatornithidae (Oilbird). Fieldwork took place in communities along tributaries of the upper Marañón river in the Peruvian Amazon from 2003 to 2005. Results indicate a high correspondence between western science and Aguaruna LEK. This research contributes to the larger goal of promoting dialog between indigenous and scientific systems of knowledge in the context of future conservation efforts.

Introduction

Indigenous people sometimes harbor knowledge that supersedes scientific knowledge, such as the case of the Bedouin in Syria who demonstrated that a bird species thought extinct by scientists did in fact still persist in the wild (Serra 2003). During the last decade researchers in several fields have shown increasing interest in local ecological knowledge (LEK) that indigenous and other groups of people have of plant-animal interactions, animal behavior and plant communities (Fleck & Harder 2000, Gilmore 2005, Nabhan 2000, Posey 1979, Posey 1981, Shepard *et al.* 2001). To date, however, there has been little research on indigenous knowledge specifically about ecological relationships between birds and plants. Gilchrist *et al.* (2005) present a compelling case for scrutinizing LEK with the purpose of applying it to wildlife management de-

terminations, while Gilchrist & Mallory (2007) note that “tangible examples of [LEK’s] application to wildlife management are rare.”

We present a detailed look at LEK of members of a native Amazonian group, the Aguaruna-Jívaro, regarding plants foraged by frugivorous tropical birds. We then compare their LEK with relevant scientific knowledge to assess the level of correspondence between these two bodies of knowledge. We will focus here on this question as it applies to five mainly frugivorous families of birds: Cracidae (guans, chachalacas and curassows), Ramphastidae (toucans), Psittacidae (parrots), Steatornithidae (Oilbird) and Pipridae (manakins). These families are important to the Aguaruna, either in terms of their usefulness or their prominence in folklore. For each of these five families, we discuss Aguaruna folk classification of the species found in the area, as well as the information provided by our informants on food plants composing the diet of each bird family. We then provide a more detailed account of Aguaruna LEK about bird diet as compared with available scientific data for one focal species per family.

Correspondence

Kevin Jernigan, Ethnobotany Program, Kuskokwim Campus, University of Alaska, Bethel, AK 99559. U.S.A.
awatidiam@yahoo.com

Nico Dauphiné, Warnell School of Forestry and Natural Resources, University of Georgia, Athens, Georgia 30602. U.S.A.

Ethnobotany Research & Applications 6:093-106 (2008)

Other than some limited ornithological (e.g., Berlin *et al.* 1981, Boster *et al.* 1986) and botanical research (e.g., Berlin 1970, Lewis *et al.* 1999), little scientific exploration has taken place in the region of northern Peru occupied by the Aguaruna. Diet, ecology and basic natural history of many bird species in the region remain poorly known (del Hoyo *et al.* 1994, Parker *et al.* 1996). The Aguaruna as a group have demonstrated extensive familiarity with the bird species found in their environment (Berlin & Berlin 1983, Berlin *et al.* 1981, Boster *et al.* 1986). A high degree of correspondence has been shown between Aguaruna folk taxonomy and scientific classification for both birds (Berlin *et al.* 1981, Boster *et al.* 1986) and plants (Berlin 1970, 1992).

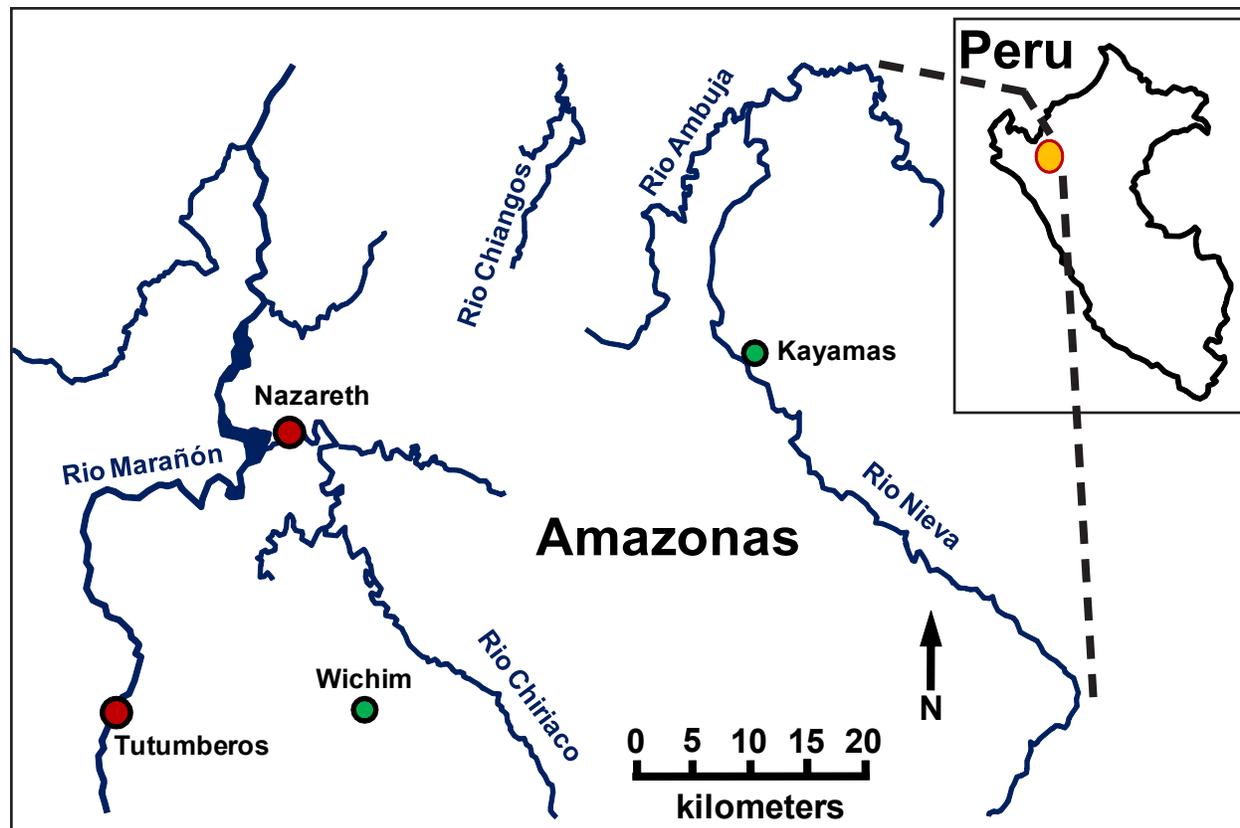
Methods

We conducted research between 2003 and 2005 in several indigenous Aguaruna-Jívaro communities along Upper Marañón and Nieva rivers in the northern Peruvian Amazon (Figure 1). We carried out structured interviews about birds and plants with 10 Aguaruna informants: four in the community of Kayamas and six in the community of Wichim. We asked the informants to make a list of birds they could name (hereafter freelist), and then asked them which of those birds were **kumpaji** (companions) to es-

tablish which birds they considered to be related. We then asked the informants to describe the diet for each bird on their freelist. When an informant mentioned that a particular species foraged on fruits, we requested that he give specific plant names. We also obtained some basic data on preferred foraging stratum and habitat for each species by asking informants whether the bird was 'ground dwelling' or 'canopy dwelling,' and whether the bird was **pakajíya** (lowland) or **mujajíya** (montane).

We used data from our field observation of birds to establish correspondence between the folk genera mentioned and species as designated by scientific taxonomy. We also drew on data from the investigations of Berlin *et al.* (1981) and Boster *et al.* (1986) on the Cenepa River, and those of Guallart (1969) at various sites. In most cases, data from these three sources are in agreement, but we have noted some differences that may reflect regional or temporal variation in naming. We made botanical collections in the vicinity of our research sites to determine most of the plant names mentioned by informants when describing bird diet. Voucher specimens of these collections were deposited at the herbarium of the Universidad Nacional Mayor de San Marcos (UNMSM) in Lima. We also supplemented our taxonomic data with data collected by Berlin (1970) and Guallart (1997).

Figure 1. Map of the study area in the northern Peruvian Amazon.



We chose five bird species for the comparison of LEK of bird diet with corresponding scientific data: the Wattled Guan *Aburria aburri*, the Channel-billed Toucan *Ramphastos vitellinus*, the Blue-headed Parrot *Pionus menstruus*, the Oilbird *Steatornis caripensis* and the Golden-headed Manakin *Pipra erythrocephala*. For these species, we compared plants named as food for the birds by Aguaruna informants to available corresponding scientific data. We compare the data sets mostly at the broad level of plant families because some of the scientific studies were conducted in locations such as Trinidad or the Brazilian Atlantic forest that were far from our own study site, and so not all of the same species or even genera can be expected to occur in such widely separated locations. In addition, a few Aguaruna plant terms that informants mentioned are very broad and correspond more or less to an entire botanical family. For example, the term **tinchi** corresponds to the family Lauraceae and the term **chinchák** corresponds to the family Melastomataceae.

Results and Discussion

We recorded a total of 249 Aguaruna bird folk genera, of which 127 are considered partially or fully frugivorous, and observed 126 species corresponding to reported folk genera in the field. Some Aguaruna bird folk genera correspond fairly well to scientific genera; for example, the Aguaruna genus **pinínch** is equivalent to the scientific genus *Pteroglossus* (araçaris). Some folk genera correspond to a single species; for example, **achayáp** is the Golden-headed Manakin *P. erythrocephala*. Other folk genera may correspond to entire avian families; the word **jémpe**, for instance, is a general term for hummingbirds. Our complete list of Aguaruna bird names show that about 90% of folk genera are monotypic while the remaining 10% have two or more folk species.

The Aguaruna give linguistic recognition to only a few intermediate level taxa (Berlin 1992) within the life form **píshak**. For example, the Aguaruna term **yámpits** refers to doves (family Columbidae) and **pínchu** to hawks (order Falconiformes). However, informants readily recognize the relatedness of many avian families and say that the members are **kumpají** (companions) or **patají** – ‘family’ (Jernigan 2006). For example, informants said that **wága** (*Tinamus major*), **sékuch** (*Tinamus osgoodi*) and **wagkúsh** (*Crypturellus* sp.), which all correspond to birds in the family Tinamidae, are companions. The Aguaruna language does not have a single general word equivalent to the English word ‘tinamou’ but has words for various kinds of tinamou. The Aguaruna make a distinction between **nugkaya píshak** (ground dwelling birds) and **yakiya píshak** (canopy dwelling birds).

Cracidae: Curassows, Guans and Chachalacas

The family Cracidae includes the largely arboreal chachalacas, guans and piping guans and the terrestrial curassows (Brooks 2006). The Aguaruna give linguistic recognition to more than half a dozen folk genera of birds in the Cracidae. These include: the guans **aúnts** (*Penelope jacquacu*), **kúyu** (*Aburria cumanensis*), **pítsa** (*Chamaepetes goudotii*) and **uwáchau** (*A. aburri*); and the curassows **báshu** (*Mitu* sp.), **piwi** (*Crax globulosa*) and **ayáchui** (*Nothocrax urumutum*). The genus **báshu** includes the folk species **múun báshu**, which corresponds to the Razor-billed Curassow *Mitu tuberosa*. Berlin & O’Neill (n.d.) identify **wakáts** as *Ortalis guttata* while Guallart (1969) lists it as *Penelope montagnii*. Some Aguaruna believe that all of the birds in this family are related as companions, but there are many who separate the curassows from the other cracids. The Aguaruna highly value cracids as gamebirds. Brown (1984) names the cracid species **báshu** (*Mitu* sp.), **kúyu** (*Aburria cumanensis*), **aúnts** (*P. jacquacu*) and **wakáts** (*P. montagnii*) as particularly favored game species of the Aguaruna in the Alto Mayo region. In our study area, informants reported that some cracid species, particularly **múun báshu** (Razor-billed Curassow) and **piwi** (Wattled Curassow) are no longer present; thus these may have been recently extirpated from the areas where we worked.

Cracids are predominantly frugivorous (Clements & Shany 2001, Hilty & Brown 1986, Ridgely & Greenfield 2001). Members of this family feed mainly on fruits, seeds and tender shoots but they also eat arthropods, mollusks and tree frogs. Curassows tend to forage on fruits fallen on the ground or from low branches although the Wattled Curassow is more arboreal than others in this group; guans and chachalacas tend to feed mostly in the middle and upper canopy (del Hoyo 1994). The Aguaruna consider birds of this family to consume mainly fruits and seeds. One informant said that **ayáchui** (*N. urumutum*) and **aúnts** (*P. jacquacu*) also eat **námpich**, a general term for worms. Aguaruna informants stated that curassows are typically ground dwelling birds while guans and chachalacas are generally placed as canopy dwelling birds. There was a slight disagreement on this point for certain species however; one informant said that **pítsa** (*C. goudotii*) and **aúnts** (*P. jacquacu*) are ground dwelling. Aguaruna informants most commonly listed fruits of many trees, especially species in the following families, as food sources for cracids: Araliaceae (genus *Schefflera*), Burseraceae (genus *Dacryodes*), Lauraceae, Melastomataceae, Meliaceae, Moraceae, Myristicaceae and Rubiaceae (genus *Isertia*).

The Wattled Guan (*A. aburri*) has a range extending from northern Colombia to southern Peru, inhabiting primary and late secondary montane forest. Its conservation status is near threatened due to habitat loss and hunting pressure (IUCN 2006). In Peru, it is normally found at elevation between 1000–1900 m above sea level (a.s.l.),

but it has also been observed at 500 m (del Hoyo 1994). Wichim and Kayamas are located at 400 m and 290 m a.s.l. respectively, but both communities are located near mountains at elevation greater than 1000 m a.s.l. It is likely that the Aguaruna in our study region do not generally observe the Wattled Guan except on hunting trips to nearby higher elevation areas.

Ríos *et al.* (2005) recently published data on the principal plant species comprising the diet of the Wattled Guan, based on a study conducted in the Columbian Andes at 1800–2100 m a.s.l. In Table 1, we compare plants mentioned in Ríos *et al.* (2005) with Aguaruna LEK as provided by our Aguaruna informants. Four out of ten (40%) of the plant families that Aguaruna informants mentioned also appear in Ríos *et al.* (2005). Table 1 shows our Aguaruna data and the ornithological data collected by Ríos *et al.* (2005). Data from Ríos *et al.* (2005) appears under the

heading 'Ornithological Data'. The section labeled 'Aguaruna Data' contains plant names that informants commonly named as food for the species in question, along with botanical determinations of those names. The table is organized so that plant families in each data set match up for easy comparison.

Psittacidae: Parrots

The family Psittacidae includes parrots, parakeets and macaws. The Aguaruna recognize more than a dozen folk genera within this family. These include the macaws **wácha** (*Ara severus*), **takúm** (*Ara ararauna*), **yúsa** (*Ara macao*) and **shaámak**, which our informants identified as *Orthopsittaca manilata* and Guallart (1969) lists as *Ara militaris*. The Aguaruna recognize the parrots **tuwísh** (*P. menstruus*), **chawáit** (*Pionus chalcopterus*), **kawáu** (*Amazona sp.*), **uwájmas** (*Amazona ochrocephala*) and

Table 1. Diet data for **Uwáchau** (Wattled Guan *Aburria aburri*).

ORNITHOLOGICAL DATA ¹ (SCIENTIFIC NAME)	AGUARUNA DATA	
	SCIENTIFIC NAME	AGUARUNA NAME
Araliaceae		
<i>Dendropanax macrophyllum</i> Cuatrec.	<i>Schefflera</i> sp. ²	séntuch
Burseraceae		
—	<i>Dacryodes</i> sp.	újuts
Fabaceae		
—	<i>Inga</i> sp.	sámpi
Lauraceae		
<i>Ocotea oblonga</i> (Meisn.) Mez	<i>Ocotea floribunda</i> (Sw.) Mez <i>Ocotea cf. wachenheimii</i> Benoist ²	batút
<i>Aniba muca</i> (Ruiz & Pav.) Mez	<i>Licaria</i> sp. <i>Ocotea costulata</i> (Nees) Mez	káikua
—	<i>Ocotea argyrophylla</i> Ducke <i>Ocotea longifolia</i> Kunth	tuntúu tínchi
Melastomataceae		
—	<i>Bellucia cf. pentamera</i> Naudin	sáu chinchák
—	<i>Miconia poeppigii</i> Triana ²	yujúya
Moraceae		
—	<i>Ficus</i> sp.	yapít
Myristicaceae		
—	<i>Virola</i> sp.	takáikit tsémpu
Myrsinaceae		
<i>Geissanthus francoae</i> Pipoly	—	—
Olacaceae		
—	<i>Minquartia guianensis</i> Aubl.	páini

ORNITHOLOGICAL DATA ¹ (SCIENTIFIC NAME)	AGUARUNA DATA	
	SCIENTIFIC NAME	AGUARUNA NAME
Rubiaceae		
<i>Guettarda crispiflora</i> Vahl	<i>Coussarea brevicaulis</i> K. Krause	supínim
Symplocaceae		
<i>Symplocos quindiuensis</i> Brand	—	—
Urticaceae		
—	<i>Coussapoa</i> sp. ²	kasúa
<i>Cecropia telealba</i> Cuatrec.	<i>Pseudolmedia laevis</i> (Ruiz & Pav.) J.F. Macbr. ²	chími

¹Ríos *et al.* 2005

²from ethnobotanical collections of Berlin *et al.* n.d.

tigkú (*Amazona amazonica*); the parakeets **pajái** (*Aratinga mitrata*), **chípi** (*Aratinga leucophthalma*) and **mantseét** (*Pyrrhura picta*) and the parrotlets **kíjug** (*Brotogeris jugularis*) and **shiwíg** (*Forpus xanthopterygius*). Our informants identified **nuinú** as *Touit strictoptera*, while Berlin & O'Neill (n.d.) reported *Brotogeris cyanoptera* for that name. Some informants consider all members of the family Psittacidae to be related as **kumpají**, while others divide them up into two groups. One informant put the macaws (**wácha**, **takúm**, **yúsa** and **shaámak**) into a sepa-

rate group; another informant divided the parrots into two groups based on tail length, with the macaws and other long tailed parrots in one group, and short tailed parrots, such as those in the genera *Pionus*, *Brotogeris* and *Forpus*, in the other group. The Aguaruna may consume birds in this family and occasionally keep them as pets (Figure 2). Members of the family Psittacidae eat mostly tree fruits and seeds, often foraging high in the canopy. Some species have very strong beaks capable of cracking hard shells (Sick 1993). Aguaruna informants named many

tree species whose fruits or flowers are foraged by Psittacids. Informants said that the macaws mainly eat the fruit of the Fabaceae (genus *Inga*), Euphorbiaceae (genera *Aparisthium*, *Hevea*, *Hura*); and Lecythidaceae (genus *Eschweilera*) For the parrots, parakeets and parrotlets, informants most commonly mentioned the fruit of the Burseraceae (genus *Dacryodes*), Fabaceae (genus *Inga*), Lauraceae and Moraceae (genus *Pseudolmedia*). Informants also said that many macaws and other parrots consume the fruit and flowers of *Erythrina* sp. (Fabaceae).

Tuwish (the Blue-headed Parrot) ranges from Costa Rica in the north to Bolivia in the south and Brazil in the east. The species is common in lowland humid forest and gallery forest up to an elevation of 1400 m a.s.l. Collar (1997) has compiled diet data from a variety of sources for the Blue-headed Parrot. The data is presented only to the level of genus (Table 2). Six out of the nine (67%) families mentioned by Aguaruna informants appeared in Collar (1997), who mentions eight additional families not named by Aguaruna informants.

Steatornithidae: Oilbird

The family Steatornithidae has a single member, the Oilbird (*S. caripensis*), which is known to the Aguaruna as **táyu**. A few informants



Figure 2. A Takúm (Blue-and-gold Macaw *Ara ararauna*) in the care of the Reátegui family, Santa María de Nieva.

Table 2. Diet data for **Tuwish** (Blue-headed Parrot *Pionus menstruus*)

ORNITHOLOGICAL DATA ¹ (SCIENTIFIC NAME)	AGUARUNA DATA	
	SCIENTIFIC NAME	AGUARUNA NAME
Anacardiaceae		
<i>Anacardium</i> sp. <i>Mangifera</i> sp.	_____	_____
Apocynaceae		
_____	<i>Tabernaemontana undulata</i> Vahl	íwakip
Arecaceae		
<i>Euterpe</i> sp.	<i>Oenocarpus mapora</i> H. Karst. ²	shimpi
Burseraceae		
<i>Tetragastris</i> sp.	<i>Dacryodes nitens</i> Cuatrec.	tsáju kunchái
Clusiaceae		
<i>Caraipa</i> sp. <i>Clusia</i> sp.	_____	_____
Euphorbiaceae		
<i>Hevea</i> sp. <i>Hura</i> sp.	<i>Aparisthium cordatum</i> Baill.	dátash
Fabaceae		
<i>Albizia</i> sp.	<i>Inga</i> sp.	sámpi
<i>Dialium</i> sp.	<i>Inga marginata</i> Willd.	sejempách
<i>Erythrina</i> sp.	<i>Erythrina</i> sp.	shikiú
<i>Inga</i> sp.	<i>Pithecellobium basijugum</i> Ducke	mujayá samíknum
_____	<i>Inga edulis</i> Mart.	wámpa
Goupiaceae		
<i>Goupia</i> sp.	_____	_____
Lauraceae		
<i>Ocotea</i> sp.	various species in Lauraceae	tínchi
Marcgraviaceae		
<i>Norantea</i> sp.	_____	_____
Melastomataceae		
_____	<i>Miconia poeppigii</i> Triana ³	yujúya
Monimiaceae		
_____	<i>Siparuna</i> sp.	mejégkach
Moraceae		
<i>Ficus</i> sp. <i>Brosimum</i> sp. <i>Pseudolmedia</i> sp.	<i>Pseudolmedia laevis</i> ³	chimi
Myrtaceae		
<i>Psidium</i> sp.	_____	_____
Sapotaceae		
<i>Micropholis</i> sp.	_____	_____
Urticaceae		
<i>Pourouma</i> sp.	_____	_____

ORNITHOLOGICAL DATA ¹ (SCIENTIFIC NAME)	AGUARUNA DATA	
	SCIENTIFIC NAME	AGUARUNA NAME
Verbenaceae		
<i>Tectona</i> sp.	_____	_____

¹ del Hoyo *et al.* 2002

² from ethnobotanical collections of Guallart 1997

³ from ethnobotanical collections of Berlin *et al.* n.d.

mentioned two folk species, **úchi** (small) **táyu** and **múun** (large) **táyu**. This distinction in the folk taxonomy does not appear to correspond to any recognized scientific taxonomic difference, and it is not clear how these folk species are thought to be different, other than size. The Oilbird is an economically important species for the Aguaruna. They make expeditions to caves where the birds live and harvest nestlings, which have a high percentage of body fat. Although not considered to be globally threatened, the Oilbird has been suffering dramatic population declines throughout its range with colonies near human settlements most vulnerable to extirpation (Roca 1994). In at least one Oilbird colony in our study area, most or all Oilbird nestlings present every year are reported to be harvested by local residents to the point that the continued survival of the colony appears to be in jeopardy (Dauphiné *et al.* in press).

Oilbirds range from Costa Rica to Bolivia in the south and northern Brazil and Guyana in the east. During the day, Oilbirds roost in caves and grottos, typically in mountainous areas, up to an elevation of 3400 m a.s.l. (Thomas 1999). Oilbirds forage at night in the surrounding forest and are exclusively frugivorous. They eat only the pericarp of fruits, regurgitating the seeds. They have highly developed olfactory capacities (del Hoyo *et al.* 1994), and tend to favor aromatic fruit, particularly those of the families Arecaceae, Burseraceae and Lauraceae (Bosque *et al.* 1995, Snow 1979, Snow 1962a). In the above-mentioned studies, investigators determined the diet of the Oilbird by identifying the regurgitated seeds found in or near caves where the species roosts. It seems likely that the Aguaruna also learn about the Oilbird's diet in a similar way. On one occasion, when we traveled to Oilbird caves near the study sites, our Aguaruna guides identified the seeds present below the opening of the cave. Aguaruna informants in the present study listed fruits from the families Arecaceae, Burseraceae and Lauraceae as the primary food sources for the Oilbird.

In Table 3, we compare diet information from Aguaruna informants to diet data collected by Snow (1979) in Ecuador in the eastern Andean foothills at 550 m a.s.l. in an area near our own study sites. All families mentioned by the Aguaruna are also reported in Snow's data. Snow also lists two other families, that the Aguaruna did not mention, Annonaceae and Polygonaceae, but these families

account for only 4% and 2% respectively of the randomly collected samples of seeds.

Ramphastidae: Toucans

Toucans are distinctive birds known for their spectacular bills. Aguaruna folk genera for this family include the toucanets **ikáuk** (*Aulacorhynchus* sp.) and **kajúntsam** (*Selelidera reinwardtii*); the araçari **pinínch** (*Pteroglossus* sp.); and the toucans **kéjua** (*R. vitellinus*), **piígsha** (*Ramphastos cucvieri*) and **sháatak**, which our informants identify as *Ramphastos ambiguus* and Guallart (1969) reports as *Andigena hypoglauca*. The word **tsukagká** is a more general term to refer to species in the genus *Ramphastos*. The Aguaruna regard all birds in this group to be related as **kumpají**. The Ramphastidae may be consumed and are especially valued for their bright feathers, which are used to decorate the **tawás**, a crown worn by men.

Toucans and araçaris are mainly frugivorous birds that forage in the canopy, and play an important role in seed dispersal; they are also known to supplement their diet with arthropods and the eggs and nestlings of other birds. The Aguaruna consider the members of this family to feed primarily on fruit; informants did not list any animal food sources for species in this family. All toucans were considered as canopy dwelling. Aguaruna informants listed many tree species as food sources for toucans; the most commonly mentioned families were Annonaceae, Araliaceae (genus *Schefflera*), Arecaceae (genus *Jessenia*), Burseraceae (genus *Dacryodes*), Flacourtiaceae (genus *Carpotroche*), Lauraceae, Melastomataceae, Meliaceae (genus *Guarea*), Moraceae (genus *Pseudolmedia*), Myristicaceae, Rubiaceae (genus *Isertia*) and Sapindaceae (genus *Allophylus*).

The Channel-billed Toucan (*R. vitellinus*) ranges from Colombia and Venezuela in the north to Bolivia in the south, and Brazil in the east. The species is common in lowland and gallery forest and is found up to 1700 m a.s.l. Galletti *et al.* (2000) published diet data for the Channel-billed Toucan based on observations in lowland Brazilian Atlantic forest while Holbrook (n.d.) has reported diet data for this species in humid lowland forest in eastern Ecuador. Ten of the twelve (83%) of botanical families that Aguaruna informants mentioned for this species also appear in one or both of the above-mentioned studies (Table 4).

Table 3. Diet data for **Táyu** (Oilbird *Steatornis caripensis*)

ORNITHOLOGICAL DATA ¹ (SCIENTIFIC NAME)	AGUARUNA DATA	
	SCIENTIFIC NAME	AGUARUNA NAME
Arecaceae		
<i>Jessenia bataua</i> (Mart.) Burret	unidentified species ²	kugkúk
<i>Euterpe</i> sp.	<i>Euterpe precatoria</i> Mart. ²	sáke
—	<i>Oenocarpus mapora</i> ³	shímpi
Burseraceae		
<i>Dacryodes</i> sp.	<i>Dacryodes kukachkana</i> L.O. Williams	múun kunchái
—	<i>Dacryodes peruviana</i> (Loes.) H.J. Lam	númi kunchái
—	<i>Dacryodes nitens</i>	tsáju kunchái
—	<i>Dacryodes</i> sp.	újuts
Lauraceae		
<i>Aniba</i> sp. and other unidentified species	<i>Nectandra cuneatocordata</i> Mez	mantagá
—	<i>Ocotea argyrophylla</i> <i>Ocotea longifolia</i>	tuntúu tínchi
Annonaceae		
an unidentified species	—	—
Polygonaceae		
<i>Coccoloba</i> sp.	—	—

¹ Snow 1979² from ethnobotanical collections of Berlin *et al.* n.d.³ from ethnobotanical collections of Guallart 1997**Pipridae: Manakins**

The Aguaruna appear to have a covert category that corresponds fairly well to the family Pipridae (manakins). Informants typically group together the following birds as companions: **achayáp** (*P. erythrocephala*), **chiájmach** (*Pipra filicauda*), **shitagkuí** (*Pipra coronata*), **pinchinam** (*Machaeropterus regulus*) and **apú wishám** (*Chloropipo holochlora*). Informants typically distinguished females of these species at close range, but at a distance tended to apply the name **wishám** to the females of several manakin species. Informants disagreed as to whether **tashíjim** (*Manacus manacus*) should be placed with the others. Some informants included birds from other families in this group, particularly **jínincham** (*Mionectes oleagineus*). The Ochre-bellied Flycatcher (*M. oleagineus*) shares some important characteristics with manakins including a diet high in fruits and berries, and lekking behaviour; it is often associated with manakin feeding flocks, so it can be considered quite literally a 'companion' of the manakins (Westcott & Smith 1994). The Aguaruna report that birds in this group forage mainly on Melastomataceae but also on Flacourtiaceae (genus *Carpotroche*), Myristicaceae and Rubiaceae (genus *Psychotria*). Some infor-

mants also mentioned that birds in this group can eat insects.

The Golden-headed Manakin (*P. erythrocephala*) is found from Panama and Trinidad, in the north, to northern Peru in the south, and Brazil and the Guianas in the East. It is common in lowland primary and secondary forest and eats mainly berries and insects. Snow (1962b) made 445 records of 43 plants foraged on by the Golden-headed Manakin in Trinidad over the course of several years. In Table 5, we compare the plants most often mentioned by Aguaruna informants to Snow's extensive data on this species. In the interest of brevity, we have only listed Snow's data to the level of genus. Considering the wide geographical separation between his study location and our own, one would not expect to find the same plant species present in both locations. Four out of five (80%) of the botanical families mentioned by Aguaruna informants also appear in Snow (1962b) (Table 5). Snow mentions 14 additional families that Aguaruna informants did not name. It is worth noting that 63% of Snow's records were from the family Melastomataceae, far greater than any of the other families he mentioned, while Aguaruna informants also reported plants in the Melastomataceae much more commonly than plants in other families.

Jernigan & Dauphiné - Aguaruna Knowledge of Bird Foraging Ecology: A 101 comparison with scientific data

Table 4. Diet data for **Kéjua** (Channel-billed Toucan *Ramphastos vitellinus*)

ORNITHOLOGICAL DATA (SCIENTIFIC NAME)	AGUARUNA DATA	
	SCIENTIFIC NAME	AGUARUNA NAME
Annonaceae		
<i>Rollinia pittieri</i> Saff. ¹	<i>Pseudoxandra</i> sp.	yaisá kumpaji
Araliaceae		
<i>Dendropanax</i> sp. ² <i>Schefflera morototoni</i> (Aubl.) Maguire, Steyerl. & Frodin ¹	<i>Schefflera</i> sp. ³	séntuch
Arecaceae		
<i>Euterpe edulis</i> Mart. ²	unidentified species ³	kugkúk
Burseraceae		
<i>Protium widgrenii</i> Engl. ²	<i>Dacryodes kukachkana</i>	múun kunchái
—	<i>Dacryodes</i> sp.	újuts
Caricaceae		
—	<i>Carica</i> sp.	shiwánúk
Euphorbiaceae		
<i>Hyeronima alchorneoides</i> Allemão ² <i>Margaritaria nobilis</i> L.f. ²	—	—
Lauraceae		
undetermined species ²	<i>Ocotea floribunda</i> <i>Ocotea wachenheimii</i> ³	batút
undetermined species ¹	<i>Licaria</i> sp. <i>Ocotea costulata</i>	káikua
<i>Ocotea</i> sp. ¹	<i>Nectandra cuneatocordata</i>	mantagá
<i>Ocotea</i> sp. ²	various Lauraceae	tínchi
<i>Rhodostemonodaphne</i> sp. ¹	cf. <i>Nectandra schomburgkii</i> Meisn.	wampúsnum
Melastomataceae		
—	<i>Miconia bulbalina</i> Naudin <i>Miconia serrulata</i> (DC.) Naudin	chijáwe
—	<i>Miconia poeppigii</i> ³	yujúya
Meliaceae		
<i>Trichilia</i> sp. ¹	<i>Guarea</i> sp.	cedrón
—	<i>Guarea macrophylla</i> subsp. <i>macrophylla</i> Vahl	ishpíg
—	<i>Guarea pubescens</i> subsp. <i>pubescens</i> (Rich.) A. Juss. ³	kúwai
Moraceae		
<i>Ficus</i> sp. ¹	<i>Ficus</i> sp.	yapít
Myristicaceae		
<i>Viola gardneri</i> (A. DC.) Warb. ²	<i>Iryanthera tricornis</i> Ducke <i>Viola pavonis</i> (A. DC.) A.C. Sm.	ejésh
<i>Viola oleifera</i> (Schott) A.C. Sm. ²	<i>Viola</i> sp.	takáikit tsémpu
<i>Viola flexuosa</i> A.C. Sm. ¹ <i>V. elongata</i> ¹	<i>Iryanthera juruensis</i> Warb. <i>Viola elongata</i> (Benth.) Warb.	úntuch tsémpu

ORNITHOLOGICAL DATA (SCIENTIFIC NAME)	AGUARUNA DATA	
	SCIENTIFIC NAME	AGUARUNA NAME
Myrtaceae		
undetermined species ²	——	——
Phytolaccaceae		
<i>Phytolacca dioica</i> L. ²	——	——
Rubiaceae		
<i>Psychotria mapourioides</i> DC. ²	<i>Isertia laevis</i> (Triana) B.M. Boom	tságnum
Sapindaceae		
<i>Matayba elaeagnoides</i> Radlk. ²	<i>Allophylus divaricatus</i> Radlk. <i>Allophylus floribundus</i> (Poepp.) Radlk. ³	jimájima
Sapotaceae		
<i>Chrysophyllum flexuosum</i> Mart. ²	——	——
Urticaceae		
<i>Cecropia</i> sp. ¹	——	chími
<i>Cecropia</i> sp. ²	——	yapít
Verbenaceae		
<i>Citharexylum myrianthum</i> Cham. ²	——	——

¹ Holbrook n.d.

² Galetti *et al.* 2000

³ from ethnobotanical collections of Berlin *et al.* n.d.

Conclusion

At the level of plant families, Aguaruna knowledge exhibits a high level of correspondence to evidence from ornithological studies, particularly those studies conducted in locations closest to our own study site in terms of both distance and ecological similarity. Snow's (1979) study of Oilbird ecology was the most similar to our study area in terms of geographical distance and elevation. There is a high level of agreement between data sets at the level of plant family. The three plant families mentioned by Aguaruna informants, Arecaceae, Burseraceae and Lauraceae also accounted for 96% of the seeds that Snow recorded in a random sample. There was also a reasonably high agreement for the Channel-billed Toucan. For this species, we compared Aguaruna knowledge with two ornithological studies, one of which was conducted in the lowland Ecuadorian Amazon (Holbrook n.d.), and the other in the Brazilian Atlantic forest (Galetti *et al.* 2000). For this species, 83% of the plant families mentioned by Aguaruna informants also appeared in one or both of the above-mentioned studies. In the case of the Golden-headed Manakin, 80% of the plant families that Aguaruna informants mentioned also appear in Snow's (1962b) study of this species in Trinidad. Both the Aguaruna and Snow indicate the primary importance of fruits of the Melastomataceae for the Golden-headed Manakin. However, Snow lists many plant families that the Aguaruna did not mention. The fact that Snow's study was a highly detailed one involving 445 ob-

servations over several years might account for this difference. The geographical separation between Trinidad and the Peruvian Amazon may also be a factor. Sixty-seven percent of plant families that the Aguaruna mention for the Blue-headed Parrot also appear in Collar (1997).

The least agreement between Aguaruna knowledge and scientific evidence was found in the case of the Wattled Guan. Only 40% of plant families mentioned by the Aguaruna were reported by Ríos *et al.* (2005). Ríos *et al.* conducted their study at an elevation of 1800-2100 m a.s.l. which is significantly higher than our study sites at 290 m and 400 m a.s.l. respectively, and they only listed a few of the most common food sources they observed. In this case, limited agreement between data sets may be due to the geographical and elevation differences in the sites of each study.

We present LEK research of this kind in order to contribute to the larger goal of promoting dialogue between indigenous and scientific systems of knowledge. Some social scientists (e.g., Agrawal 2002, Nadasdy 2003) have been critical of efforts to combine scientific and indigenous knowledge in conservation and development projects, arguing that efforts of this kind often mainly benefit parties other than the indigenous peoples in question. Murray (2000) points out resistance to the use of indigenous knowledge on the part of biologists, in part because indigenous LEK and scientific knowledge do not always map on to each

**Jernigan & Dauphiné - Aguaruna Knowledge of Bird Foraging Ecology: A 103
comparison with scientific data**

Table 5. Diet Data for **Achayáp** (Golden-headed Manakin *Pipra erythrocephala*)

ORNITHOLOGICAL DATA ¹ (SCIENTIFIC NAME)	AGUARUNA DATA	
	SCIENTIFIC NAME	AGUARUNA NAME
Aquifoliaceae		
<i>Ilex</i> sp.	_____	_____
Araliaceae		
<i>Schefflera</i> sp.	_____	_____
Asteraceae		
<i>Wulffia</i> sp.	_____	_____
Burseraceae		
<i>Protium</i> sp.	_____	_____
Dilleniaceae		
<i>Davilla</i> sp. <i>Doliocarpus</i> sp. <i>Pinzona</i> sp.	_____	_____
Elaeocarpaceae		
<i>Sloanea</i> sp.	_____	_____
Euphorbiaceae		
<i>Alchornea</i> sp. <i>Hieronyma</i> sp. <i>Maprounea</i> sp. <i>Sapium</i> sp.	<i>Alchornea glandulosa</i> Poepp. <i>Conceveiba rhytidocarpa</i> Müll. Arg. ²	kántsa
Flacourtiaceae		
<i>Laetia</i> sp.	<i>Casearia arborea</i> (Rich.) Urb. ²	umpákainim
Lauraceae		
<i>Ocotea</i> sp. <i>Phoebe</i> sp.	_____	_____
Melastomataceae		
<i>Henriettea</i> sp.	<i>Miconia</i> sp.	antumú chinchák
<i>Miconia</i> sp.	<i>Miconia bulbalina</i> <i>Miconia serrulata</i>	chijáwe
_____	various species in Melastomataceae	chinchák
_____	<i>Miconia affinis</i> DC. <i>Miconia</i> sp.	kapantú chinchák
_____	<i>Bellucia</i> cf. <i>pentamera</i> Naudin	sáu chinchák
_____	<i>Miconia ternatifolia</i> Triana	tseék
_____	<i>Miconia poeppigii</i> ²	yujúya
Moraceae		
<i>Ficus</i> sp.	_____	_____
Myristicaceae		
_____	<i>Virola</i> sp.	takáikit tsémpu
Myrtaceae		
<i>Myrcia</i> sp.	_____	_____
Nyctaginaceae		
<i>Pisonia</i> sp.	_____	_____

ORNITHOLOGICAL DATA ¹ (SCIENTIFIC NAME)	AGUARUNA DATA	
	SCIENTIFIC NAME	AGUARUNA NAME
Rubiaceae		
<i>Cephaelis</i> sp. <i>Iserfia</i> sp. <i>Malanea</i> sp. <i>Palicourea</i> sp. <i>Psychotria</i> sp.	<i>Psychotria</i> sp.	mujayá shuípiu
Phytolaccaceae		
<i>Phytolacca</i> sp.	_____	_____
Solanaceae		
<i>Cestrum</i> sp.	_____	_____
Urticaceae		
<i>Trema</i> sp.	_____	_____
Verbenaceae		
<i>Aegiphila</i> sp.	_____	_____

¹ Snow 1962

² from ethnobotanical collections of Berlin *et al.* n.d.

other neatly, particularly where questions of value are concerned. Other authors have argued that practical benefits can emerge from this kind of collaboration. Posey & Camargo (2002:133), for example, have maintained that: "It is precisely this type of integrated knowledge, based upon intricacies of indigenous science, that offers many new ideas for those persons and institutions interested in long-term, ecologically and socially sound plans for development and conservation in the humid tropics." The upper Marañón region is considered a high priority area for both bird and plant conservation, based on species diversity and endemism, and yet it remains little-known by scientists (Rodríguez & Young 2000). We believe that Aguaruna LEK can help advance science in this region where little scientific study has taken place.

Acknowledgements

Funding for this project was made possible through grants from the National Science Foundation, the Critically Endangered Neotropical Species Fund at Conservation International, the IDEAS program at the University of Georgia, the Georgia Ornithological Society, the Tinker and Wenner-Gren Foundations. We thank the Comunidades Nativas de Wawas–Anexo Wichim and Kayamas for inviting and hosting fieldwork and the Instituto Nacional de Recursos Naturales (INRENA) for granting permission to conduct research. For field and logistical support, we are grateful to Martha and Oscar Tsamajain Shiwig, Roberto Jeremías Wampush, Enrique Tsamajain Chumpi, Agustín and Segundo Tsamajain Yagkuag, Anika Mahoney, Juan Díaz Alvan, José Alvarez Alonso, José Lirio, and Daniel M. Brooks. KJ extends special appreciation to Brent Ber-

lin, Elois Ann Berlin, Steve Kowaleski, Glenn Shepard, the Universidad Nacional Mayor de San Marcos, Kelsey Hannon, Kintamai Agkuash Anag, Emiliano Nugkum, Jorge Shinkip and Martin, Nestor, and Gregorio Réategui. ND wishes to express heartfelt gratitude to Oscar Beingolea, Miguel and Wilfredo Aguilar Torres, Flor Idiáquez Acevedo, Flor and Jaso Angulo, and Yolanda Rojas for their generous hospitality during her extended stays in Peru, to Robert J. Cooper for his help and guidance, and to the Warnell School of Forestry and Natural Resources at the University of Georgia for financial support.

Literature Cited

- Agrawal, A. 2002. Indigenous knowledges and the politics of classification. *International Social Science Journal* 54(173):287-297.
- Berlin, B. 1970. *A Preliminary Ethnobotanical Survey of the Aguaruna Region of the Upper Marañón River Valley, Amazonas, Peru*. Report to the Wenner-Gren Foundation for Anthropological Research, Washington, D.C.
- Berlin, B. 1992. *Ethnobiological Classification: Principles of Categorization of Plants and Animals in Traditional Societies*. Princeton University Press, Oxford.
- Berlin, B. & E.A. Berlin. 1983. Adaptation and Ethnobiological Classification: Theoretical implications of animal resources and diet of the Aguaruna and Huambisa. Pp 301-325 in *Adaptive Responses of Native Amazonians (Studies in Anthropology)*. Edited by Hames, R.B. & Vickers W.T. Academic Press, New York.

Jernigan & Dauphiné - Aguaruna Knowledge of Bird Foraging Ecology: A comparison with scientific data 105

- Berlin, B., J.S. Boster & J.P. O'Neil. 1981. The perceptual bases of ethnobiological classification: Evidence from Aguaruna Jívaro ornithology. *Journal of Ethnobiology* 1:95-108.
- Berlin, B. & J.P. O'Neill. n.d. *Field notes, Cordillera del Condor, Peru*. Unpublished.
- Berlin, B., C.M. Crandall & W.H. Lewis. n.d. *Taxonomic Checklist of Plants Collected in the Department of Amazonas, Peru, 1972-1980*. Unpublished.
- Bosque C., R. Ramirez & D. Rodriguez. 1995. The diet of the oilbird in Venezuela. *Ornitología Neotropical* 6:67-80.
- Boster, J., B. Berlin & J.P. O'Neil. 1986. The correspondence of Jivaroan to scientific ornithology. *American Anthropologist* 88:569-583.
- Brooks, D.M. 2006. Conserving Cracids: The most threatened family of birds in the Americas. *Miscellaneous Publications of the Houston Museum of Natural Science* 6.
- Brown, M.F. 1984. *Una Paz Incierta: Historia y cultura de las Comunidades Aguarunas Frente al Impacto de la Carretera Marginal*. Centro Amazónico de Antropología y Aplicación Práctica, Lima, Peru.
- Clements, J.F. & N. Shany. 2001. *A Field Guide to the Birds of Peru*. Ibis Publishing Company, Temecula, CA.
- Collar, N. 1997. Family Psittacidae (Parrots). Pp 280-477 in *Handbook of the Birds of the World. Vol. 4: Sandgrouse to Cuckoos*. Edited by J. del Hoyo, A. Elliot & J. Sargatal. Lynx Edicions, Barcelona.
- Dauphiné, N., A. Tsamajain Yagkuag & R.J. Cooper. In press. Bird conservation in Aguaruna-Jívaro communities in the Cordillera de Colán, Peru. *Ornitología Neotropical* 19.
- del Hoyo, J. 1994. Family Cracidae (Chachalacas, Guans and Curassows). Pp 310-363 in *Handbook of the Birds of the World. Vol. 2: New World Vultures to Guineafowl*. Edited by J. del Hoyo, A. Elliot & J. Sargatal. Lynx Edicions, Barcelona.
- Fleck, D.W. & J.D. Harder. 2000. Matsés Indian rainforest habitat classification and mammalian diversity in Amazonian Peru. *Journal of Ethnobiology* 20:1-36.
- Galetti, M., R. Laps & M.A. Pizo. 2000. Frugivory by toucans (Ramphastidae) at two altitudes in the Atlantic Forest of Brazil. *Biotropica* 32:842-850.
- Gilchrist, G., M. Mallory & F. Merkel. 2005. Can local ecological knowledge contribute to wildlife management? Case studies of migratory birds. *Ecology and Society* 10(1):20. www.ecologyandsociety.org/vol10/iss1/art20.
- Gilchrist, G., & M.L. Mallory. 2007. Comparing expert-based science with local ecological knowledge: What are we afraid of? *Ecology and Society* 12(1):r1. www.ecologyandsociety.org/vol12/iss1/resp1.
- Gilmore, M. 2005. *Majuna rain forest habitat classification in the Peruvian Amazon*. Paper presented at the 46th Annual Meeting of the Society for Economic Botany, Ft. Worth, Texas.
- Guallart, J.M. 1969. Nomenclatura Jíbara-Aguaruna de especies de aves en el Alto Marañón. *Mesa Redonda de Ciencias Prehistóricas y Antropologas* 1:150-160.
- Guallart, J.M. 1997. *La Tierra de los Cinco Ríos*. Instituto Riva-Agüero, Lima, Perú.
- Hilty, S. & W. Brown. 1986. *A Guide to the Birds of Colombia*. Princeton University Press, Princeton, NJ.
- Holbrook, K.M. n.d. *Seed Dispersal by Toucans in Amazonia, Ecuador*. Unpublished Field Report.
- IUCN. 2006. *2006 IUCN RedList of Threatened Species*. www.iucnredlist.org
- Jernigan, K. 2006. *An Ethnobiological Exploration of Sensory and Ecological Aspects of Tree Identification among the Aguaruna Jívaro*. Ph.D. Dissertation. University of Georgia, Athens, Georgia.
- Lewis, W.H., G. Lamas, A. Vaisberg, D.G. Corley & C. Sarasara. 1999. Peruvian medicinal plant sources of new pharmaceuticals. *Pharmaceutical Biology* 37(Supp 1):69-83.
- Murray, D. 2000. *Tempered Optimism: Recognizing the Barriers to the Use of Traditional Ecological Knowledge in Arctic Canada*. Master's Thesis. Carleton University, Canada.
- Nabhan, G.P. 2000. Interspecific relationships affecting endangered species recognized by O'odham and Comcaac cultures. 10:1288-1295.
- Nadasdy, P. 2003. *Hunters and Bureaucrats: Power, Knowledge, and Aboriginal-state Relations in the South-west Yukon*. UBC Press, Vancouver, British Columbia.
- Parker, T.A. III., D.F. Stotz & J.F. Fitzpatrick. 1996. Ecological and distributional databases. Pp 113-436 in *Neotropical Birds: Ecology and Conservation*. Edited by D.F. Stotz, J.W. Fitzpatrick, T.A. Parker, III, & D.K. Moskovits. University of Chicago Press, Chicago, IL.

- Posey, D. 1979. *Ethnoentomology of the Gorotire Kayapó of Central Brazil*. Ph.D. Dissertation. University of Georgia, Athens, Georgia.
- Posey, D. 1981. Wasps, warriors and fearless men: Ethnoentomology of the Kayapó Indians of Central Brazil. *Journal of Ethnobiology* 1:165-174.
- Posey, D. & J.M.F. Camargo. 2002. Additional notes on the classification and knowledge of stingless bees (Meliponinae, Apidae, Hymenoptera) by Kayapó Indians of Gorotire, Pará, Brazil. Pp 112-133 in *Kayapo Ethnoecology and Culture*. Edited by K. Plenderleith. Routledge, New York, NY.
- Ridgely, R.S. & P.J. Greenfield. 2001. *The Birds of Ecuador Field Guide*. Cornell University Press, Ithaca, NY.
- Ríos, M.M., G.A. Londoño & M.C. Muñoz. 2005. Density and ecology of the Wattled Guan (*Aburria aburri*) in an Andean forest. *Bulletin of the Cracid Specialist Group* 21: 33-37.
- Roca, R.L. 1994. *Oilbirds of Venezuela: Ecology and Conservation*. Nuttall Ornithological Club Publication No. 24, Cambridge, Massachusetts.
- Rodriguez, L.O. & K.R. Young. 2000. Biological diversity of Peru: Determining priority areas for conservation. *Ambio* 29:329-337.
- Serra, G. 2003. The discovery of Northern Bald Ibises in Syria. *World Birdwatch* 25(1):10-13.
- Shepard, G.H., D.W. Yu, M. Lizarralde & M. Italiano. 2001. Rain forest habitat classification among the Matsigenka of the Peruvian Amazon. *Journal of Ethnobiology* 21:1-38.
- Sick, H. 1993. *Birds in Brazil: A Natural History*. Princeton University Press, Princeton, NJ.
- Snow, B.K. 1979. The Oilbirds of Los Tayos. *Wilson Bulletin* 91:457-461.
- Snow, D.W. 1962a. The natural history of the Oilbird (*Steatornis caripensis*) in Trinidad, W.I. Part 2: Population, breeding ecology, and food. *Zoologica* 47:199-221.
- Snow D.W. 1962b. A field study of the Golden-headed Manakin, *Pipra erythrocephala*, in Trinidad, W.I. *Zoologica* 47:183-198.
- Thomas, B.T. 1999. Family Steatornithidae (Oilbird). Pp 244-251 in *Handbook of the Birds of the World. Vol. 5: Barn-owls to Hummingbirds*. Edited by J. del Hoyo, J., A. Elliot & J. Sargatal. Lynx Edicions, Barcelona.
- Westcott, D.A. & J.N.M. Smith. 1994. Behavior and social organization during the breeding season in *Mionectes oleagineus*, a lekking flycatcher. *The Condor* 96:672-683.