ETHNO-ORNITHOLOGY OF THE MUSHERE PEOPLE OF PLATEAU STATE, NIGERIA: A COMPARISON OF THE TRADITIONAL BIRD KNOWLEDGE AND PERCEPTIONS OF ADULT URBAN/RURAL DWELLERS

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Abstract
Ethno-ornithology is the scientific study of the cultural relationships of people with birds, while Traditional Ecological Knowledge (TEK) refers to the knowledge that local/indigenous people have of their environment, usually borne out of a relationship that often spans protracted periods. The study sought to find out the TEK of urban/village dwelling Mushere adults, compare the various aspects of their TEK, to determine the effect of urbanization/rural life on respondents' TEK. Variables tested included age, occupation, education, childhood environment and years spent in the city, sources of TEK acquisition, and method of TEK transmission. Methods used included mixed methods approach, including the use of semi-structured questionnaires and free-listing exercises. Generalized Linear Mixed Model (GLMM) was used in data analysis. The results revealed that bird knowledge of urban respondents was significantly more than that of village respondents ($p< 0.05$), men held more knowledge in both village and urban groups ($p< 0.05$), and other occupational categories held more knowledge than farmers ($p < 0.05$). Mode of transmission was mainly through oral means, while knowledge acquisition was mainly oblique. Method of transmission was mainly vertical. Finally, culturally salient bird species were similar for both villagers/urban respondents. Urbanization did not seem to affect Mushere urban-dweller's TEK; the modes of acquisition and transmission were similar to theoretical predictions and changes in socio-cultural and economic settings might be key factors affecting TEK and perception of birds by the Mushere

KEYWORDS: *Ethno-Ornithology, TEK, Cultural Transmission, Perception. Mushere*

INTRODUCTION
Ethno-ornithology is a relatively recent and growing discipline. It is the scientific study of the relationships between people and birds, a relationship often spanning

protracted periods. As a discipline, it has evolved over the past two decades bringing together nature conservation and local or traditional knowledge systems in ecological management (Berkes *et al* 2003; Albuquerque *et al* 2009). A people's bird-related cultural beliefs and traditions, may contribute to the survival or decline of different bird species, consequently affecting their conservation (Muiruri and Maundu 2010). Therefore, an understanding of these cultural relationships, such as the cultural processes of knowledge transfer and acquisition, cultural beliefs and practices, the underlying cultural and spiritual significance of such traditions is important for effective engagement with people of diverse cultures in conservation.

Cavalli-Sforza et al (1982) defined Cultural Transmission as '…*the process of acquisition of behaviours, attitudes, or techniques, through imprinting, conditioning, imitation, active teaching and learning or a combination of these*'. It is a complex process, usually driven by socio-cultural, biological and physical factors (Boyd and Richerson1985; Kelly 1995; Smith 2000). Fundamentally (especially in small-scale societies), individuals learn from socializing and actively engaging with their cultures and environments (Henrich and Boyd 2008; Matthew and Perreault 2015). Cultural transmission theory, developed from the fields of cultural and social anthropology (Cavolli-Sforza and Feldman 1973, 1981, 1982), and deriving its origins from the biological transmission of traits, is the conceptual framework for understanding cultural patterns of the transmission. It states that knowledge is usually unevenly distributed and differentiated by gender, age, education, including political and religious views (Ayantunde *et al* 2008; Bates 2009; Zent, 2009; Reyes-Garcia *et al* 2010; Botero *et al* 2014).

Warren & Pulliam (1981) defined culture as '*a population of learned behavioural traits or customs which are transmitted between individuals through social learning*'. In this paper, we define knowledge as '...Facts, feelings, awareness, consciousness or familiarity gained by experience or learning' (The Collins English Dictionary 1986).

Cultural transmission occurs through three main routes;

1. Vertical transmission which is the inter-generational transmission of attributes from parents to offspring
2. Horizontal transmission- which involves intra-generational transmission between peers and lastly,
3. Oblique transmission method: involves inter-generational transmission between individuals who may or may not be related, for example

grandparents or schoolteachers (Carvolli-Sforza and Feldeman 1981; Acerbi and Parisi 2006).

These transmission types have relative importance depending on the societal type (Matthew and Perreault 2015). For example, horizontal transmission has been associated more with economically advanced societies, while vertical transmission is predominant in small-scale traditional societies (Hewlett and Cavalli-Sforza 1986; Acerbi and Parisi 2006). The predominant mode of knowledge transmission in small-scale societies is usually through oral means and practice, such as apprenticeship, and observation (Odden and Rochat 2004; Lancy 2010). The cultural transmission framework emphasizes the importance of familial influence on especially, vertical cultural transmission (Guglielmino *et al* 1995; Rogoff, 2016). Several authors have reported a loss of TEK by local people (e.g., Godoy *et al* 2005; Lozada *et al* 2006; Turner and Turner 2008; Gomez-Baggethun and Reyes-Garcia 2013; Reyes-Garcia *et al* 2014). This loss is as a result of drivers such as urbanization/modernization, formal learning, language loss and change in environment of learning. In addition, most local/indigenous communities are beginning to regard such knowledge as having little or no practical use.

Understanding how a group of people perceive their local environment, and the meanings and importance they attach to the different biodiversity therein is an important first step in conservation (Salmon 2000; Marten 2001; Kesby 2003; Vining *et al* 2008; Pam *et al*, 2018 b). Based on this, it was important to understand the traditional bird knowledge and the local perception of birds among the Mushere people. Thus, the specific objectives of this study are to investigate: (1) the level of TEK of birds among the urban/rural Mushere adults. (2) What local views and perceptions the Mushere hold about birds and their TEK (3) How, when and who this knowledge was acquired from?

MATERIALS AND METHODS

Study Area

Mushere is in Bokkos local government area of Plateau state, North-central Nigeria. It is located at 9º 9’ 0’’ N, 9º 3’ 0’’ E (Fig. 1), across a total land area of 870.25 km², with an estimated adult population of 37,000 residing mostly in fourteen Mushere villages. A more detailed description can be found in our previous paper (Pam, *et al.* 2018a). The Dulu Forest is part of a small remaining forest in Mushere land said to belong to the Kaddim communities comprising of

Naula, Njemut and Kaddim-kasa (made up of Njemut and Kaddim-Bisa). It covers an area of approximately 40-50 square kilometres and is to the southern-eastern fringe of Mushere land, which harbours vegetation that may have been mainly lowland rainforest type, but presently is predominantly woodland guinea savannah interspersed with gallery or riparian forest and rocky outcrops. This forest is a source of commercial timber for the surrounding communities and beyond as such it has become heavily degraded. The most pressing challenge the forest faces is logging, as most farmlands are situated at the edges of the forest. Hunting activities may also be affecting the forest biodiversity negatively although the extent of the effect of each activity on the forest is a subject for further research.

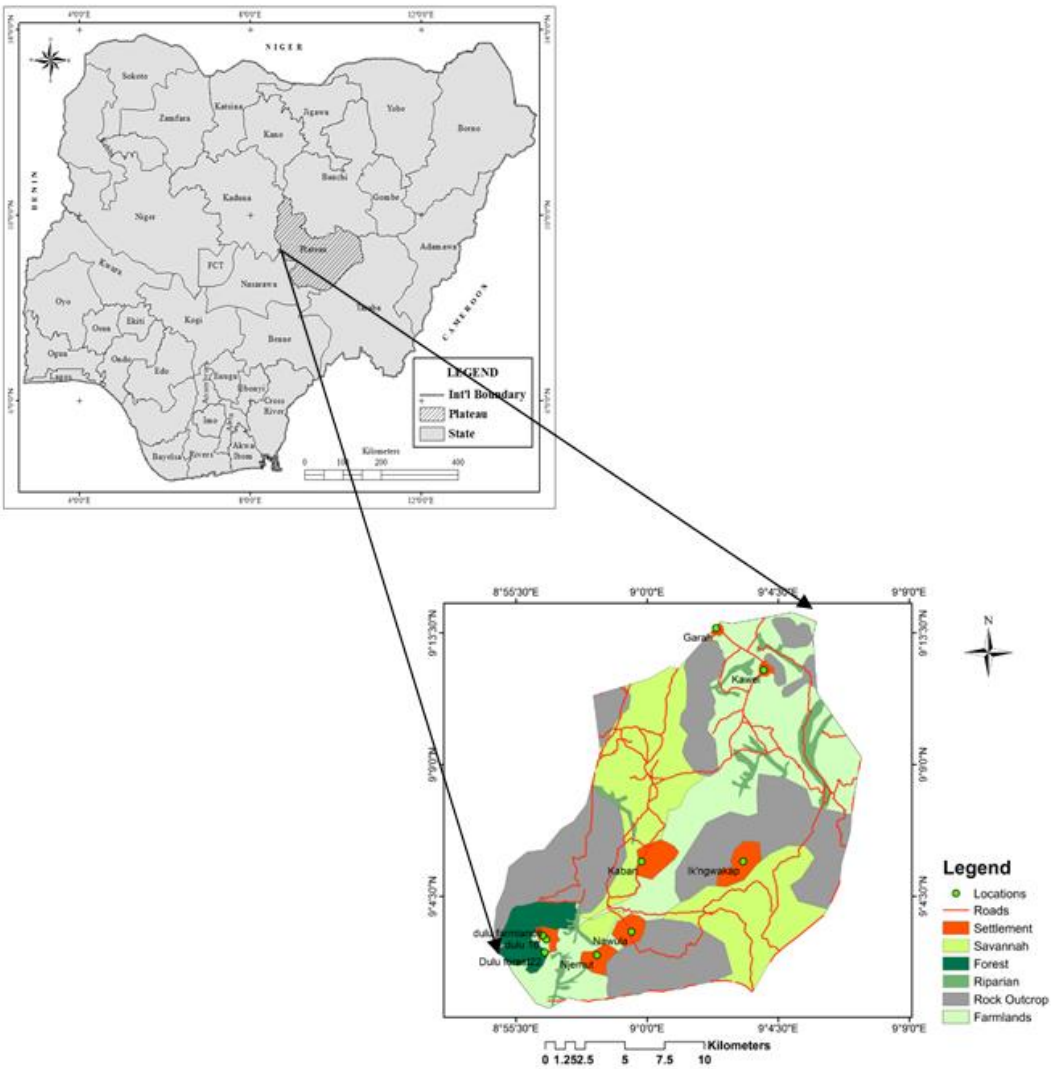

Figure 1: Map of Nigeria, Highlighting the Study Area and Study Sites © Pam, G. 2018

Sampling Village Communities

Three non-forested villages (Garah, Kawel and Ik'ngwakap) and three forested ones (Kaban, Nawula and Njemut) were selected based on the absence of a nearby forest and their relative distance to the Dulu forest to test the hypothesis that bird knowledge was independent of the presence of a forest. We hypothesized that, villagers closest to forest should hold more knowledge of birds due to the relative frequency of encounters with nature. We also expected that older respondents would hold more knowledge of birds due to experience, in

terms of naming ability (measured by the length of an individual's list) and the depth of information about birds. In addition, farmers were expected be more knowledgeable about birds than other occupational categories due to their closeness to nature. Furthermore, the less formal education an individual had, we expected that they would hold more TEK of birds compared to the more formally educated respondents.

Respondents were selected using purposive sampling technique (Black 2000; Saunders 2012; Tongco 2000). A limitation of the method was that we could not control for equal numbers of respondents based on the test variables (i.e. gender, age, occupation, education and village). The strength of the method however was in the ability focus on individuals who knowledgeable on the domain of interest within the limited time and resources available (Tongco 2007; Araujo *et al* 2012; Albuquerque *et al* 2014) Two-hundred and twenty-eight village adult respondents were surveyed in total, while respondents' educational status was classified into literate (primary, secondary or tertiary) and non-literate (no formal education) categories, age categorization was based on the social categorization of individuals i.e., 18-29 years, young adults; 30-49, mid adults 50 years old and above as older adults. There were two categories for occupation; Farmers and 'other' types for village respondents, while for urban respondents, there were civil servants and 'other' category. Furthermore, One hundred and twenty-one respondents were surveyed from non-forested villages, while 107 were from forested villages. In this study we used the length of each respondent's free list as an index for the individual's bird knowledge.

Sampling Urban-dwelling Respondents

We visited potential urban participants on two separate days (men and women separately), taking advantage of their monthly tribal gatherings, in the state capital city of Jos, Nigeria. The process involved an introduction session facilitated by our local assistant, followed by an explanation of the research objectives and data collection methods. Participants were allowed approximately 60 minutes, to round up their meeting, to reflect and decide on whether to participate in the exercise or decline. Variables measured included gender, education, age, occupation, while variables measuring the effect of urbanization included; years spent in the city, and childhood environment.

Sampling of Male/Female Respondents

Twenty-five men were present at the meeting; twenty-two were willing to participate, while three declined. A further four filled their forms from home.

Each respondent carried out the task independently, and the exercise lasted for 15-20 minutes per respondent.

On the other hand, thirty women attended the meeting; five declined participation because they were not of Mushere descents, their association was by marriage. Ten women fill their forms from home, and only five forms were eventually completed and returned, therefore the final sample size for women was ten.

Data Collection Tools

Semi-structured interviews, open-ended questionnaires and Freelisting questionnaires were used in collecting demographic information of respondents. Respondents were asked to share their knowledge, views and perceptions of various aspects of their TEK of birds, and the methods and modes of TEK acquisition. Time spent with each respondent was between 35-45 minutes for none-literate respondents who needed assistance with interpretation, and 20 minutes for literate respondents. We were careful not to ask leading questions in the questionnaire.

Data Analysis

Data was mainly analysed using descriptive statistics. In analysing the results of the perceptions of respondents to the valuing and usefulness of TEK, responses were first coded and subsequently analysed using Thematic Approach (TA), (Braun and Clarke 2006; Bernard 2000). A Generalized Linear Mixed Model (GLMM) was used in analysing the data to find out the relationships of the various variables on respondent's knowledge (age, sex, education, occupation, environment type i.e., urban/rural). Knowledge was measured by an individual's list length (Quinlan 2005). To compare results of each group (Village/Urban) and determine significance in differences in knowledge, an appropriate non-parametric test (Mann-Whitney U test) was used.

Using the software Anthropac® (Borgatti 1999), I found out the relative salience of each item (i.e. species/group mentioned) in the list, (first=1). The salience index (Smith's S), is calculated as $S = ((\sum(L - Rj_+1))/L)/N$

Where S = average rank of an item across all lists in the sample weighed by the lengths of the lists in which the item occurs, L = length of item j in the list, N=the number of lists in the sample (Smith & Borgatti 1998). The highest salient of an item=1.

RESULTS

Level of Villagers' Bird Knowledge, Effects of Age, Gender, Occupation, and Environment on TEK.

One hundred and twelve (49.1%) male respondents and 116 (50.9%) female respondents were sampled in total. One hundred and fifty-nine (70%) of these were farmers while the remaining 69 (30%) were civil servants and businesspersons. Furthermore, 86 (37%) respondents were in the age category 18-29 years, 102 (44.7%) belonged to the age 30-49, while 50 years olds-above were 40 (17.5%). One hundred and ninety-two (84.2%) were literate, while 36 (15.8%) reported having no literacy.

Bird Knowledge of respondents, measured by an individual's list length revealed that overall, respondents could recall a mean number of 9±3.3 SD birds (men =10 ±3.1 SD; women=8 ±3.1 SD).

All of the variables tested (occupation, age, gender, and environment type i.e., forested/non-forested) were statistically significant in driving the traditional knowledge of birds of village respondents except educational level. In addition, the youngest age group were more knowledgeable than the other older age categories. Men were more knowledgeable than women, while respondents from non-forested environments had longer lists than those from forested environments. Finally, farmers were more knowledgeable than all the other occupational categories (Table 1).

Table 1: Generalized Linear Mixed Model (GLMM) Results of Respondents' Knowledge in Relation to Proximity of Village to Forest, Gender, Age, Occupation and Education

Parameter	B	Std. Error	95% Wald Confidence Interval		
			Wald Chi-Square	df	Sig.
(Intercept)	10.018	.7202	193.483	1	.000
[villa=non-forested]	1.716	.4125	17.299	1	.000
[villa=forested]	0[a]	.	.	.	.
[age=18-29]	-1.638	.5958	7.555	1	.006
[age=30-49]	-.781	.5693	1.881	1	.170
[age=50-above]	0[a]	.	.	.	.
[occupation=farmers]	-1.529	.4486	11.614	1	.001
[occupation=others]	0[a]	.	.	.	.
[education=non]	-.613	.5873	1.091	1	.296
[education=educate]	0[a]	.	.	.	.
[gender=men]	1.034	.4345	5.663	1	.017
[gender=women]	0[a]	.	.	.	.
(Scale)	7.964[b]	.7459			

a. Set to zero because this parameter is redundant.
b. Maximum likelihood estimate.

Culturally Salient Birds, Valuing of Birds, Methods of TEK Transmission and Modes of Acquisition

Estrildides were the most culturally salient group having the highest frequency and salience (S) of 85.7% and 0.59 respectively, from the pooled data for villagers and urban dwellers. This was followed by the two-raptor species Shikra (*Accipiter badius*) and Common Kestrel *Falco tinnunculus* (67.9%; S=0.42). The difference in frequency of mention for urban/rural respondents was not statistically significant (Mann-Whitney U = 84.00, SE= 27.64, $p > 0.05$). Figure 4 shows the frequency (%) of mention of culturally salient birds for both urban and village respondents.

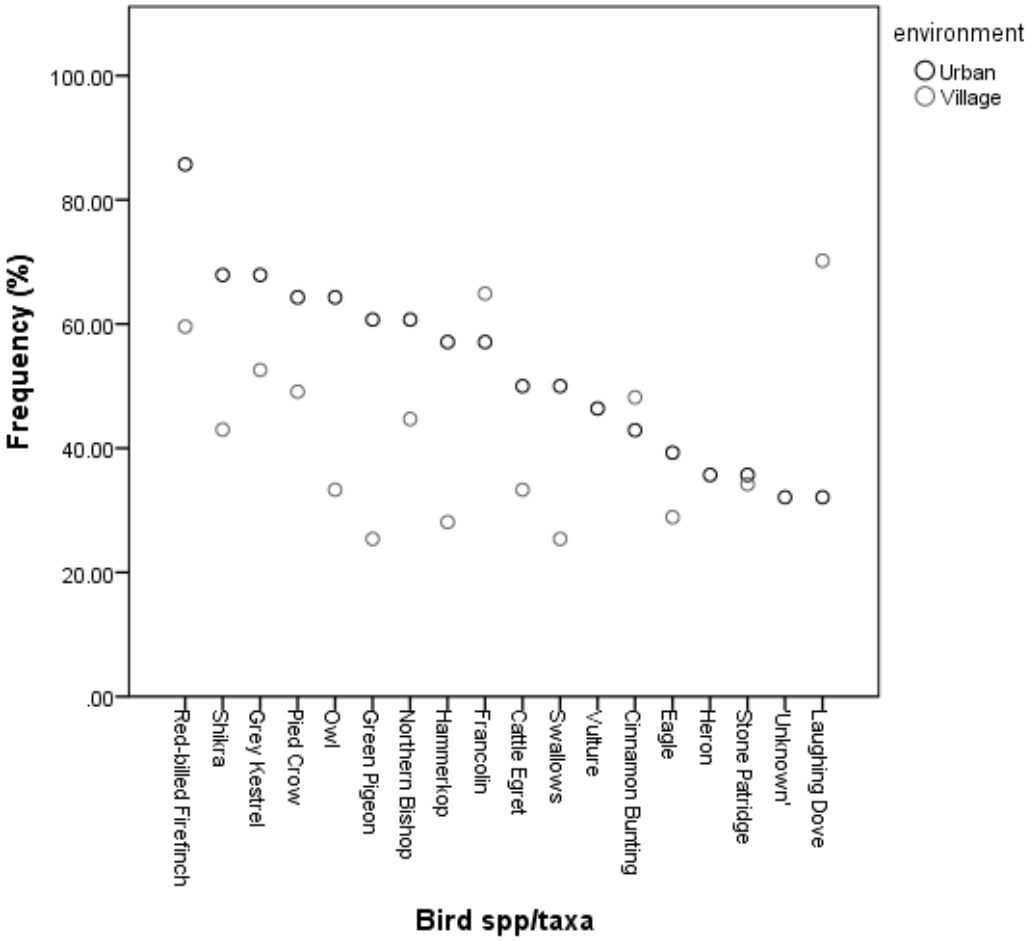

Figure 1: Graph Showing the Frequency of Mention of the Culturally Salient Species/Taxa between Urban and Rural Respondents

When respondents were asked about their perceptions of the value of birds, 141 (62%; 65 men, 76 women) thought birds were not important, while 87 (38% 47 men, 40 women) thought birds were important, these responses were not statistically different for men and women (Mann-Whitney U=6010.00, S. E=418.94, $p > 0.05$).

One hundred and thirty-four (59 %; 62 men, 72 women) respondents perceived birds to be valuable because of their cultural utility (crop pests, food, indicators or give information about phenomena), while 46 (20%; 23 men, 23 women) perceived birds negatively based on reason such as birds are just animals, only

good for eating, animals are not important. Twenty-three (10%; 14 men, 9 women) respondents valued birds because of their aesthetic values (beautiful, lovely songs), 6 (3%; 2 men, 4 women) gave religious reasons for valuing birds (e.g., birds are God's creation) and finally, 19 respondents (8%; 11 men, 8 women) could not state any reasons positive or negative for their perceptions on the values of birds. On the whole, these responses did not differ statistically between men and women (Mann-Whitney U=6117.50, S.E = 441.77, $p > 0.05$).

Methods of TEK Transmission: One hundred and forty-eight respondents (65%; 63 men, 85 women) reported learning through vertical transmission (one or both parents), while 37 respondents (16%; 20 men, 17 women) learnt through oblique transmission (one or both grandparents). Only two percent (n=6) of respondents reported learning through horizontal transmission (older sibling or friends). These responses differed significantly between genders (Mann-Whitney U=5238.55, S. E= 422.93, $p < 0.05$).

Modes of TEK Acquisition: One hundred and five respondents (46 %; 60 men, 45 women) reported being taught through oral means such as through storytelling, while 74 respondents (33 %; 20 men, 54 women) reported learning through oral tradition/observation. Eleven respondents (5 %; 4 men, 7 women) learnt through personal observation, a further 10 (4 %) learnt through observation/practice, six respondents (3 %; 3 men, 3 women) learnt through oral tradition/practice, while three people (1 %; 3 men) reported learning through practice such as while hunting or looking after animals. These responses were not statistically different for men and women (Mann-Whitney U= 7002.50, S.E = 463.73, $p > 0.05$).

Perceptions on TEK: Perceptions on TEK

Fifty-three respondents (23%, 29 men, 24 women) perceived that a change in socio-economic standard was responsible for a decrease in the interest in birds and their TEK, whereas forty-three individuals (19 %; 24 men, 19 women) indicated that a lack of interest in nature was responsible for the decline. Sixty-two others (27%; 26 men, 36 women) responded that a lack of cultural transmission of knowledge by older members was responsible for TEK loss, while a further twenty-two people (10%; 11 men, 11 women) indicated that formal education was responsible for the decline in TEK of birds. Twenty-five respondents (11 %; 9 men, 16 women) perceived that the loss of language and culture were responsible for the decline, while 23 (10%; 13 men, 10 women) did not have any reasons for their perceptions.

Urban: Data Distribution

Twenty-eight adult respondents were surveyed, 18 (64%) were men, while 10 (36 %) were women. Eight (28%) belonged to the age group 18-29 years, 17 (61 %) were between the ages 30-49 years, while three (11 %) belonged to the age group 50 years old and above.

Sixteen (57 %) were civil servants, while twelve (43 %) made up the 'other' category (farmer, businesspersons). In the education category, 27 (96 %) were literate only one respondent was non-literate. Seven respondents (25 %) had spent between 1-10 years in the city, 15 (54 %) spent between 11-20 years, and six (21 %) had spent above 20 years in the city. Likewise, 19 (68 %) of respondents grew up in a Mushere village, while nine respondents (32%) reported growing up in a non-Mushere environment.

Effects of Gender, Age, Occupation, Education on TEK

None of the variables (education, age, occupation) and variables measuring the effect of urbanization (years spent in the city), and childhood environment were statistically significant factors determining a respondent's TEK. Only gender showed significant difference, with men having a higher TEK than women.

Table 2: Generalized Linear Model Showing the Relationship between Independent Variables (age, gender, occupation, education and urbanization) to Bird Knowledge of Urban Respondents

Parameter	B	Std. Error	95% Wald Confidence Interval		Hypothesis Test
			Wald-Chi-Square	df	Sig.
(Intercept)	10.000	5.9717	2.804	1	.094
[age=18-29]	-2.125	6.2493	.116	1	.734
[age=30-49]	-5.245	6.1249	.733	1	.392
[age=50-above]	0[a]	.	.	.	.
[Gender=men]	5.453	2.8430	3.678	1	.050
[Gender=women]	0[a]	.	.	.	.
[occupation=civ/ser]	-4.507	2.7783	2.631	1	.105
[occupation=others]	0[a]	.	.	.	.
[childhood environ=Mushere]	3.890	3.5327	1.212	1	.271
[childhood environ=other]	0[a]	.	.	.	.
[years city=1-10]	-3.105	4.0229	.596	1	.440
[years city=11-20]	1.850	3.2422	.326	1	.568
[years city=>20]	0[a]	.	.	.	.
[education=educate]	4.081	8.0276	.259	1	.611
[education=none]	0[a]	.	.	.	.
(Scale)	35.661[b]	9.5308			

a. Set to zero because this parameter is redundant.
b. Maximum likelihood estimate.

However, when the data was pooled for village and urban respondents, results showed that the variables environment (urban/village), gender, and occupation were statistically significant factors (Table 3). Bird knowledge of village respondents was significantly higher than that of urban respondents ($\chi 2=4.758$, df=1, $p<0.05$); men held more knowledge than omen ($\chi 2=11.297$, df=1, $p<0.05$); and farmers held more knowledge than other occupational types ($\chi 2=5.243$, df=1, $p<0.05$). However, the unequal data sizes of villagers versus the urban respondents (Village=228, Urban=28) might account for these differences. Table 3 below provides a summary of the findings.

Table 3: GLMM Result of Pooled Data for Village vs. Urban Respondents' Knowledge by Age, Gender, Occupation and Education

Parameter	B	Std. Error	95% Wald Confidence Interval		Hypothesis Test
			Wald-Chi Square	df	Sig.
(Intercept)	10.220	2.2459	20.707	1	.000
[environ=vil]	-2.456	1.1259	4.758	1	.029
[environ=urban]	0[a]	.	.	.	.
[age=18-29]	-1.490	1.4603	1.041	1	.308
[age=30-49]	.107	1.4379	.006	1	.941
[age=50-above]	0[a]	.	.	.	.
[gender=men]	3.230	.9611	11.297	1	.001
[gender=women]	0[a]	.	.	.	.
[educat=educated]	1.285	2.0982	.375	1	.540
[educat=none]	0[a]	.	.	.	.
[occupat=farmer]	2.114	.9234	5.243	1	.022
[occupat=others]	0[a]	.	.	.	.
(Scale)	25.379[b]	3.0553			

a. Set to zero because this parameter is redundant.
b. Maximum likelihood estimate.

Sources of TEK Acquisition/Transmission Methods

The predominantly reported source of TEK acquisition was through oblique (Grandparents; 11(39 %)), and vertical transmissions (Parents 8(28.6%), Fig. 2).

When the data from village and urban respondents data was compared, the predominant source of TEK acquisition was through vertical means (parents), followed by oblique (grandparents). The difference in acquisition sources was statistically significant between urban and rural respondents (χ^2= 56.73, df = 5, p < 0.001), with urban respondents mentioning oblique transmission more, while rural respondents mentioned vertical transmission more (figure 2.).

Methods of TEK Transmission

Fourteen (50%), reported learning through oral transmission (Figure 3). When comparing methods of transmission of the rural versus urban respondents, 46 % (village=105, urban=13) reported oral method of transmission while 5 % (village=11, urban = 2) reported learning through direct observation. These reported methods of TEK transmission between the rural and urban respondents was statistically different (χ^2 = 16.48, df = 6, p < 0.05).

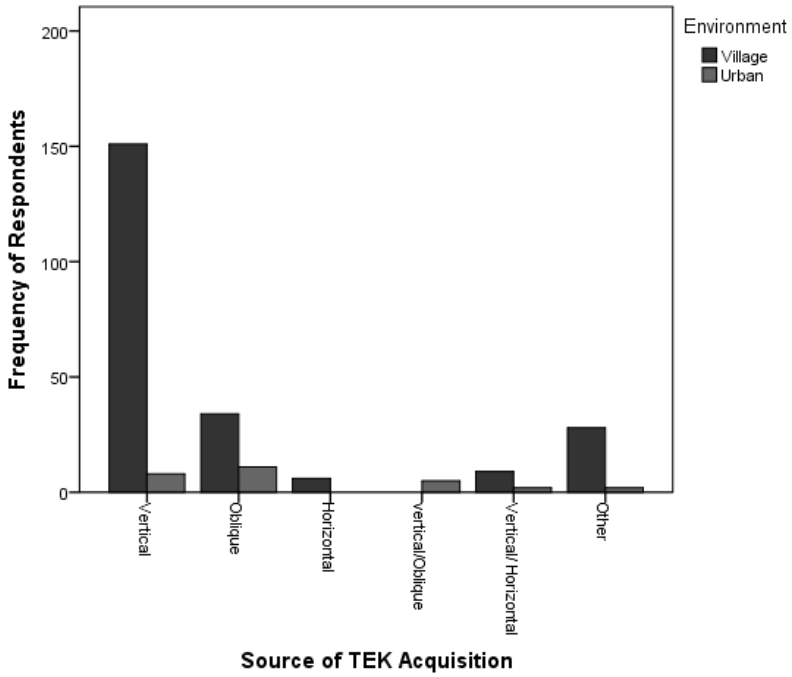

Figure 2: Sources of TEK Acquisition of Village and Urban respondents

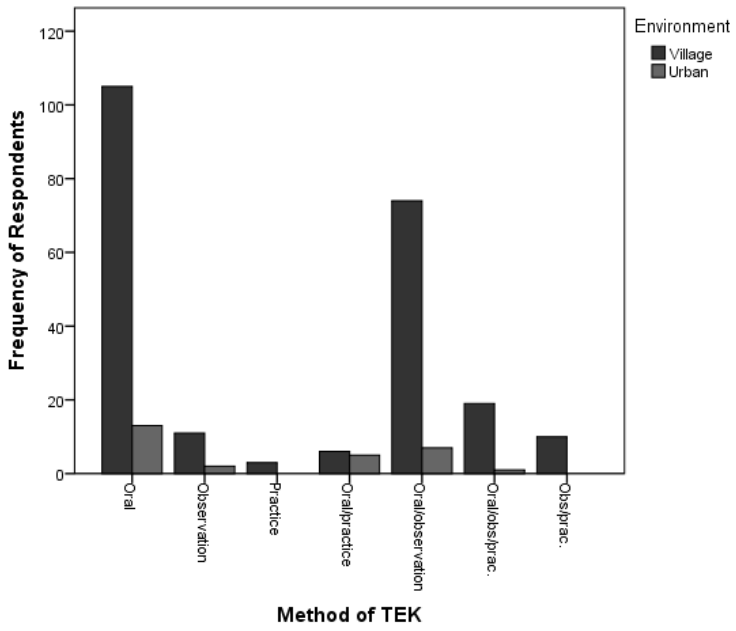

Figure 3: Methods of TEK Transmission of Village and Urban Respondents

DISCUSSION

Occupation, Gender, Age, and Environment

The outstanding finding in this work was the lack of difference in the TEK of village/urban respondents, as the patterns/perceptions did not differ significantly. This implies that the low bird knowledge observed among the urban-dwelling Mushere is not mainly caused by urbanization.

In most communities and cultures, gender roles differ between men and women, with men and boys performing the roles of farming and hunting etc., while women and girls care for the home and perform other domestic chores such as planting gardens (Bonta, 2003). These differential gender roles expose men and women to quite various parts of nature (e.g. Moller *et al.* 2004; Sinclair *et al.* 2010) and to different challenges, so that the two genders hold different sets of environmental knowledge (Berlin *et al.* 1981; Turner *et al.* 2000; Bonta 2003; Hoffman 2003; Voeks 2007; Reyes-Garcia *et al.* 2010). The Mushere situation was no different. Men exhibited more traditional knowledge of folk names than women did, suggesting that women might be less interested in birds than men might. Alternatively, it might suggest that due to the difference in roles, men tend to be exposed to birds and knowledgeable about them than women are because of the gender differential roles that do not give women the same opportunities as men to become ardent birdwatchers (Berlin *et al*, 1981). Another reason might be the effect of patriarchy on women, relegating them to the background. This has the tendency of eroding their confidence and interest levels in the environment, thereby making it hard for them to share their experiences or even dare to ask questions about their observations of the natural world, as learning in local contexts seemed to learner-initiated due to curiosity or interest (Zent, 2009). It could also be a combination of these factors. Women held more in-depth knowledge of the ecological interactions of birds relative to men, as also observed elsewhere by Bonta (2003).

Before discussing the results on age, it is important to mention that both the young and older respondents were mostly unsure of their real age, even for those who seemed to have been born in the last two decade. The ages presented here therefore were mostly approximations. Theoretically, older individuals are expected to hold more ethnobiological knowledge than younger generations, because it is assumed that knowledge accumulates as individuals get older (Berlin, 1992). As expected, older respondents (50 years and above) held more TEK than the younger respondents did. Although most researchers have found

this to be a common pattern, termed the 'wisdom of the elders' (Koster *et al* 2016), it has been argued that there could be other aspects to the relationship between knowledge and age other than the linear mostly reported patterns. Some researchers suggest that an individual's strength and agility in subsistence acquisition might also be a factor (e.g. Somnasang and Moreno-Black, 2000; Ladio and Lozada, 2004; Reyes-Garcia *et al*, 2005;). In the case of the study population, older respondents may have been more knowledgeable because of accumulated experience about a different type of nature than that experienced by the present younger respondents, and a combination of a change in priorities and interests between the generations.

Respondents living in the non-forested villages were more knowledgeable than those living close to the Dulu forest were, causing us to accept the alternative hypothesis that those living farther away from forest would hold more TEK. We propose two arguments in explaining this result. First, the respondents living in the non-forested villages did not show any ill feelings towards the research, as they did not perceive any threats to their natural resource, unlike respondents living close to the forest, who were at some point, suspicious of the true intent for this research, mainly because their main livelihoods depended on extraction of timber resources.

Secondly, most of the respondents from the forested villages were not as literate as those from the non-forested communities were, and since people's literacy usually affect how individuals comprehend and relate with issues, this might have affected their engagement with the research. Both assumptions would however need further verification, through research.

Methods of TEK Acquisition and Transmission

Oral transmission of knowledge and vertical, oblique transmissions were the predominant methods/modes of TEK acquisition and transmission reported in this study. These methods corresponded with the theoretical methods and modes of cultural acquisition and transmission of knowledge reported in literature (e.g., Cavalli-Sforza *et al*, 1982; Lozada and Ladio, 2006), especially for subsistent communities.

TEK is usually handed down to younger generations by cultural transmission mainly through oral methods (Ng'weno 2010), observation of older adults, or through practice by working with elders i.e., experiential (Berkes 1999; Moller *et al* 2004; Sinclair *et al* 2010; Tidemann *et al* 2010). We however observed that it

was difficult for respondents to say how transmission occurred, and our local assistants had to try to break down what we meant so they could better comprehend. Most responses centred around individuals following their parents to the farm or forest(practical), or parents pointing out birds to an individual (observation), or very rarely, someone would say 'I learnt by picking an interest in birds myself'. Zent (2009) also reported these kinds of observations, in his work among local Indian communities in the Venezuelan Amazon, the Joti people. In his study area, most respondents learned through oral transmission, observation and practice, and like the Mushere, were unable to explain how learning occurred, and the very thought of the question puzzled them. They only said how they took the children along with them on their camping or hunting activities (Zent 2009). He explained this to suggest that the local learning process occurs in an unconscious non-deliberate manner, with almost all respondents reporting having learned about birds at an early age (see Lozada *et al*, 2006).

Village respondents mostly mentioned parents, (especially fathers by men, mothers mostly by females) as the main sources for TEK acquisition, while urban respondents mostly reported learning from grandparents. This finding corresponds with similar findings elsewhere (Ohmagari and Berkes 1997; Hickey 2006; Mazzocchi 2006; Zent 2009; Berkes 2012). For wild plant knowledge, it has been reported elsewhere (Hewlett and Cavalier-Sforza 1986) that female family members are usually the main transmitters of such local knowledge since their roles as gatherers of family vegetables and plants makes them more knowledgeable about plants. Lozada *et al*, (2006), Quinlan *et al*, (2016), and Little and Lancy (2016) have cautioned on being careful in accepting such self-reported sources of learning, as individuals are prone to mentioning parents when asked how they learn; that seem to be the logical and most convenient answer, especially when, as noted above, learning occurs unconsciously.

The implication for the reported **form** of transmission (vertical), and **mode** of transmission (oral) as observed by Cavalli-Sforza *et al*, (1982) and Hewlett and Cavalli-Sforza (1986), is that due to the conservative nature of vertical transmission, it hinders innovation in the population where it is the predominant method. Oral tradition on the other hand, is vulnerable to decay and transformation mainly due to globalization (Lozada & Ladio, 2006).

Perceptions about TEK of Birds.

Although the Mushere did not exhibit vast TEK of birds, they reported various perceptions on the valuing of their TEK. The predominant view and perception

was that TEK was being lost. Drivers of TEK loss reported, corresponded to those reported for local communities elsewhere (e.g., Anderson 1996; Turner *et al* 2000; Hickey 2006; Zent 2009; Gomez-Baggethun and Reyes-Garcia 2013; Reyes-Garcia *et al* 2013). These included a lack of interest in nature, lack of cultural transmission from older adults to the younger generation, socio-economic changes such as change from local to global market economy, acculturation and formal education and influence of modern religions. These factors work either in isolation or as a complex to erode TEK in cultures and societies.

McCarter and Gavin (2011) and Reyes-Garcia *et al* (2005) also noted that drivers of TEK loss work interactively and as a complex, and they vary in space and between TEK domains (Godoy *et al* 2005- market economies and TEK loss, Reyes-Garcia *et al* 2005; Quinlan and Quinlan 2007 - Educational attainment and TEK Loss). However, measuring the effect of each factor on Mushere people's TEK, and how they interact to cause TEK loss was beyond the scope of this work, but will be an interesting aspect for research in the future.

In conclusion, we think that when TEK is present among a people, it can be a potential powerful resource in engaging local people and communities in conservation through the appreciation and valuing of such knowledge. In addition, adults will take with them such information, knowledge and values about nature obtained in childhood into adulthood. Where it is not instilled at the early stages, it might be harder to obtain much later in adulthood.

It is however important to be aware of the culturally important/relevant floral/faunal groups in aiming to utilize TEK in conservation, because trying to work with a people in a domain perceived to be culturally less relevant could be counter-productive, as there might seem to be an indifference or a lack of knowledge in that area. It is wiser to begin from an area of cultural interest, and work from there.

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REFERENCES

Acerbi, A., & Parisi, D. (2006). Cultural Transmission Between and Within Generations. Journal of Artificial Societies and Social Simulation, 9: 9 [Online] http://jasss.soc.surrey.ac.uk.

Anderson , E. N. (1996). *Ecologies Of The Heart: Emotion, Belief And The Environment* (Vol. 1, Pp 15-27). New York: Oxford University Press.

Albuquerque, U. P., Sousa Araújo, T. A., Ramos, M. A., do Nascimento, V. T., de Lucena, R. F. P., Monteiro, J. M., de Lima Araújo, E. (2009). How Ethnobotany Can Aid Biodiversity Conservation: Reflections On Investigations In The Semi-Arid Region Of NE Brazil. *Biodiversity And Conservation, 18*: *127-150*.

Albuquerque, U. P., Cunha L.V.F., Lucena R.F.P and Neto, E.M.F (2014). Selection Of Research Participants. In Albuquerque, U. P., Cunha L.V.F., Lucena R.F.P And Alves R. R. N (Eds.), *Methods And Techniques In Ethnobiology And Ethnoecology*(1st Ed.).(Pp 1-13) New York: Springer.

Araújo, T. A. S., Almeida, A. L. S., Melo, J. G., Medeiros, M. F. T. Ramos, M. A., Silva, R. R. V., Almeida C. F. C. B. R. and Albuquerque, U. P. (2012). A New Technique For Testing Distribution of Knowledge And To Estimate Sampling Sufficiency In Ethnobiology Studies. *Journal of Ethnobiology and Ethnomedicine, 8:1* https://doi.org/10.1186/1746-4269-8-11.

Ayantunde, A.A, Briejer, M., Hiernaux, P., Udo, H.J.M., & Tabo, R. (2008). Botanical Knowledge And Its Differentiation By Age, Gender, And Ethnicity In Southwestern Niger. *Human Ecology* [Online] DOI: 10.1007/s10745-008-9200-7 accessed 6/7/17.

Bates, P. (2009). Learning and Inuit Knowledge in Nunavut, Canada (Pp 128), UNESCO: Paris.

Berlin, B., O'Neill, J. P. (1981). The Pervasiveness Of Onomatopoeia In Araguna And Huambisa Bird Names. *Journal Of Ethnobiology, 1*: *238-261*.

Berlin, B. (1992). *Ethnobiological Classification,*. NJ: Princeton University Press.

Bernard, H., R. (2000). *Social Research Methods: Qualitative and Quantitative Approaches*. (Pp 103-375), London: Sage Publications Inc.

Berkes, F. (1999). *Sacred Ecology: Traditional Ecological Knowledge and Resource Management*. (Pp 3-107), London: Taylor and Francis.

Berkes, F., Colding, J., & Folke, C. (2003). Synthesis: Building Resilience And Adaptive Capacity In Social-Ecological Systems. In Berkes, F., Colding, J., & Folke, C. (eds), *Navigating Social-Ecological Systems: Building*

Resilience For Complexity And Change, (Pp 358-387), Cambridge, UK: Cambridge University Press.

Berkes, F. (2012). *Sacred Ecology: Traditional Ecological Knowledge and Resource Management*. (Pp 3-107), London:Routledge.

Black, K. (2010). Business Statistics: Contemporary Decision Making. 6th Edition, Wiley Publishers.

Bonta, M. (2003). *Seven Names For The Bellbird : Conservation Geography In Honduras*. (Pp 1-46), College Station: Texas A & M University Press.

Borgatti, S. P. (1999). Elicitation Techniques For Cultural Domain Analysis. *Enhanced Ethnographic Methods, 3*: *115-151.*

Botero, C.A., Gardner, B., Kirby, K.R., Bulbulia, J., Gavin, M.C., & Gray, R.D. (2014). The Ecology of Religious Beliefs. *Proc. Natl. Acad. Sci.USA 111: 16784-16789*

Boyd, R. & Richerson, P. (1985). *Cultural Transmisson And Evolution: A Quantitative Approach.* Princeton: Princeton University Press.

Braun, V. & Clarke, V. (2006). Using Thematic Analysis In Psychology. *Qualitative Research In Psychology, 3: 77-101*

Cavalli-Sforza, L.L., & Feldman, M.W. (1973). Cultural Versus Biological Inheritance: A Phenotypic Transmission From Parents to Children. (A Theory of The Effect of Parental Phenotypes on Children's Phenotype). *American Journal of Human Genetics 25: 618.*

Cavalli-Sforza, L.L., & Feldman, M.W. (1981). Cultural Transmission and Evolution: A Quantitative Approach. Princeton University Press, Princeton.

Cavalli-Sforza, L.L., Feldman, M.W., Chen, K.H & Dornbusch, S.M. (1982). Theory and Observation In Cultural Transmission. *Science 218: 19-27*

Godoy, R., Reyes-García, V., Byron, E., Leonard, W. R. and Vadez, V. (2005). The Effect of Market Economies on the Well-being of Indigenous Peoples and on their Use of Renewable Natural Resources. *Annual Review of Anthropology 34:121-138*.

Gómez-Baggethun, E.& Reyes-García, V. (2013).Reinterpreting Change In Traditional Ecological Knowledge. *Human Ecology 41*: *643-647*

Guglieimino, R. C., Viganotti, C., Hewlett, B., Cavolli-Sforza, L.L.(1995). Cultural Variation in Africa: Role of Mechanisms of Transmission and Adaptation. *Proc. of the Nat.l Aca. of Sci., 92: 7585-7589*

Henrich, J. & Boyd, R. (2008). Division of Labour, Economic Specialization, and The Evolution of Social Stratification. *Curr. Anthropol. 49: 715-724*

Hewlett, B. S., & Cavalli-Sforza. (1986). Cultural Transmission Among Aka Pygmies. *American Anthropologist, 88*:*922-934.*

Hickey, F. R. (2006). Traditional Marine Resource Management in Vanuatu: Acknowledging, Supporting and Streghthening Indigenous Management Systems. *SPC Traditional Marine Resource Managemnet And Knowledge Information Bulletin#20* (Pp. 11-23).

Hoffmann, S. (2003). Arawakan Women And The Erosion of Traditional Food Production In Amazonas Venezuela. In Howard, P.(ed.), *Women and Plants. Gender Relations in Biodiversity Management and Conservation*(Pp 258-272) London and New York: Zed Press and Palgrave Macmillan.

Huntington, H. P. (2000). Using Traditional Ecological Knowledge in Science: Methods and Applications. *Ecological Applications, 10*: *1270-1274*

Kelly, R. (1995). *The Foraging Spectrum:Diversity In Hunter-Gatherer Pathways.*Clinton Corners, NY: Percheron Press.

Koster, J., Bruno, O., & Burns, J. L. (2016). Wisdom of The Elders? Ethnobiological Knowledge Across The Lifespan.*Current Anthropology, 57*: 113-121.

Ladio, A. H. & Lozada, M., (2004). Patterns of Use And Knowledge of Wild Edible Plants In Distinct Ecological Environments: A Case Study of A Mapuche Community From Northestern Patagonia. *Biodiversity And Conservation, 13: 1152-1173*

Lancy, D. F (2010). 'Learning From Nobody': The Limited Role of Teaching In Folk Models of Children's Development. *Childhood In The Past 3: 79-106*

Little, C. A. J. L. and Lancy, D. F. (2016), How Do Children Become Workers? Making Sense of Conflicting Accounts of Cultural Transmission in Anthropology and Psychology. *Ethos, 44: 269–288.* doi:10.1111/etho.12131

Lozada, M., Ladio, A., & Weigandt, M. . (2006). Cultural Transmission of Ethnobotanical Knowledge In A Rural Community Of North-Western Patagonia, Argentina. *Economic Botany, 60: 374-385*.

McCarter, J., & Gavin, M. C. (2011).Perceptions of The Value of Traditional Ecological Knowledge To Formal School Curricula: Opportunities And Challenges From Malekula Island, Vanuatu. *Journal of Ethnobiology and Ethnomedicine, 7*:38.

Marten, G. (2003).*Perceptions of Nature. In: Human Ecology: Basic Concepts For Sustainable Development* (Pp 256), US/Canada: Earthscan Publishing.

Matthew, S.& Perreaualt, C. (2015).Behavioural Variation In 172 Small-Scale Societies Indicates That Social Learning Is The Main Mode of Human Adaptation. *Proc. R. Soc. B. 282: 20150061.* Http://Dx.Doi.Org/10.1098/Rspb.2015.0061

Mazzocchi, F. (2006).Western Science And Traditional Knowledge. Despite Their Variations, Different Forms of Knowledge Can Learn From Each Other *EMBO Reports, 7*: 463-466.

Moller, H., Berkes, F., Lyver, P. O., & Kislalioglu, M. (2004). Combining Science And Traditional Ecological Knowledge: Monitoring Populations For Co-Management. *Ecology And Society, 9*: 2.

Muiruri, M. N., & Maundu, P. (2010). Birds, People And Conservation In Kenya. In Tidemann, S., &Gosler, A.G. (eds) *Ethno-Ornithology: Birds, Indigenous Peoples, Culture And Society*, (Pp 279-289), London. Washington D.C. Earthscan

Ng'weno, F. (2010). Sound, Sight, Stories And Science: Avoiding Methodological Pitfalls In Ethno-Ornithological Research, With Examples From Kenya. In Tidemann, S., &Gosler, A.G. (eds) *Ethno-Ornithology: Birds, Indigenous People, Cultures And Society*, (Pp 103-113), London. Washington D.C. Earthscan

Odden, H. & Rochat, P. (2004). Observational Learning And Enculturation. *Educational And Child Psychology 21: 39-50*

Ohmagari, K. Berkes, F. (1997). Transmission Of Indigenous Knowledge And Bush Skills Among The Western James Bay Cree Women Of Subarctic Canada. *Human Ecology, 25*: *197-222.*

Pam, G, Zeitlyn, D, & Gosler, A. (2018a). Ethno-Ornithology of the Mushere of Nigeria: Children's Knowledge and Perceptions of Birds. *Ethnobiology Letters* 9: *48-64*

Pam, G, Zeitlyn, D, & Gosler, A. (2018b). Perceptions of the Mushere People on the Dulu-Forest: Implications for Conservation. *Proceedings of 6th NSCB Biodiversity Conference; Uniuyo 2018: 19-22*

Quinlan, M. (2005). Considerations For Collecting Freelists In The Field: Examples From Ethobotany. *Field Methods, 17*: *219-234*.

Quinlan, M.B. & Quinlan, R. J. (2007). Modernization And Medicinal Plant Knowledge In A Carribean Horticultural Village. *Medical Anthropology, 21: 169-192*

Quinlan, M. B., Quinlan, R. J., Council, S. K., & Roulette, J. W. (2016). Children's Acquisition of Ethnobotanical Knowledge In A Caribbean Horticultural Village. *Journal of Ethnobiology, 36*: *433-456*.

Reyes-Garcia, V., Vadez, V., Byron, E., Apaza, L., Leonard, W. R., Perez, E., & Wilkie, D. (2005). Market Economy And The Loss of Folk Knowledge of Plant Uses: Estimates From The Tsimane Of The Bolivian Amazon. *Current Anthropology, 46: 651-656*

Reyes-García, V., Kightley, E., Ruiz-Mallen, I., Fuentes-Pelaez, N., Demps, K., Huanca, T., & Martínez-Rodríguez, M. R. (2010). Schooling and Local Environmental Knowledge: Do They Complement Or Substitute Each Other? *International Journal of Educational Development, 30*: *305-313.*

Reyes-Garcia, V., Paneque-galvez, J., Luz, A. C., Gueze, M., Macia, M. J., Orta-Martinez, M. & Pino, J. (2014). Cultural Change And Traditional Ecological Knowledge: An Empirical Analysis From The Tsimane In The Bolivian Amazon. *Human Organizations, 79: 162-173*

Rogoff, B. (2016). Learning By Observation And Pitching In To Family And Community Endeavours: An Orientation. *Human Development, 56: 69-81*

Salmon, E. (2000). Kincentric Ecology: Indigenous Perceptions of The Human-Nature Relaitonship. *Ecological Applications, 10: 1327-1332*

Peoples, Culture And Society (Pp. 291-300). London. Washington DC: Earthscan.

Saunders, M., Lewis, P. & Thornhill, A. (2012). *Research Methods for Business Students*. 6th Edition, (Pp228), Pearson Education Limited

Sinclair, R. J., Tuke, L., & Opiang, M. (2010). What The Locals Know: Comparing Traditional And Scientific Knowledge Of Megapods In Melanesia. In Tidemann, S., & Gosler, A.G. (eds)*Ethno-Ornithology: Birds, Indigenous Peoples, Culture And Society*(Pp. 116-137). London. Washington D. C: Earthscan.

Somnasang, P., & Moreno-Black, G. (2000). Knowing, Gathering And Eating: Knowledge And Attitudes About Wild Food In An Isan Village In Northeastern Thailand. *Journal of Ethnobiology, 20*:*197-216*.

Smith, E. (2000). T*hree Styles In The Evolutionary Analysis of Human Behaviour*. In: Cronk, L., Chagnon, N. & Irons, W. (Eds), *Adaptation And Human Behaviour: An Anthropological Perspective* (pp 27-46), New York: Aldine de Gruyter

Tongco, D. C. (2007). Purposive Sampling As Atool For Informant Sampling. *Ethnobotany Research And Applications, 5*: *147-158.*

Turner, N. J., Ignace, M. B., & Ignace, R. (2000). Traditional Ecological Knowledge And Wisdom of Aboriginal Peoples In British Columbia. *Ecological Applications, 10*: *1275-1287*.

Turner, N.J. & Turner, K. (2008). 'Where Our Women Used To Get The Food': Cummulative Effects And Loss of Ethnobiological Knowledge And

Practice, A Case Study From Coastal British Columbia. *Botany, 86: 281-299*

Tidemann, S., Chirgwin, S., Sinclair, J. R.(2010) Indigenous Knowledges, Birds That Have 'Spoken' And Science. In: Tidemann, S., & Gosler, A.G. (eds). *Ethno-Ornithology. Birds, Indigenous Peoples, Culture And Society*, (Pp 3-12), London. Washington D.C: Earthscan.

Vining, J., Merrick, M.S., & Price, E.A. (2008). The Distinction Between Humans And Nature: Human Perceptions Of Connectedness To Nature And Elements of The Natural And Unnatural. *Human Ecology Review, 15: 1-11*

Voeks, R. A. (2007). Are Women Reserviours Of Traditional Plant Knowledge? Gender, Ethnobotany And Globalization In Northeast Brazil. *Singapore Journal of Tropical Geography, 28:7-20.*

Warren, J. & Pulliam H.R. (1981). An Intergenerational Transmission Model For The Cultural Evolution of Helping Behaviour. *Human Ecology, 9: 466-493*

Zent, S. (2001).Acculturation And Ethnobiological Knowledge Loss Among The Piaroa of Venezuela: A Demonstration Of A Quantitative Method For The Empirical Study of Traditional Ecological Knowledge Change. In: Maffi, L (Ed), Biocultural Diversity: Linking Language, Knowledge And The Environment (Pp 190-211), Smithsonian Institute Press: Washington, DC.

