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Pipile as a protein source to rural hunters and Amerindians

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Las pavas del género *Pipile* como una fuente de la proteína para los pobladores rurales y nativos. Las dos especies monotípicas del género *Pipile*, la pava de Trinidad también conocida como Pawi, *P. pipile*, y la Jacutinga, *P. jacutinga* son consideradas críticamente en peligro de extinción. Las otras dos especies, *P. cumanensis* y *P. cujubi* tienen rangos de distibución geográfica más amplios y se consideran en menos riesgo de peligro inmediato porque en la mayoría de las regiones donde habitan, los niveles de caza son sostenibles y la destrucción del habitat es mínimo. Éste estudio examina los patrones de uso de las pavas del género *Pipile* en relación a otros Cracidos. El estudio también identifica los patrones de densidad poblacional en las poblaciones que son cazadas de manera no sostenida. Cazadores rurales y pobladores nativos cazan las pavas del género *Pipile* de manera intensa encontrandose estas entre las especies a nivel general mas cazadas; quizas mas alta que cualquier otra specie de ave. Estos patrones son mas visibles cuando se considera el número de individuos con respecto a la biomasa. Además, estudios que han medido niveles de sostenibilidad de cosecha indican que en unos casos *P. cumanensis* es cazada dentro de los límites de sostenibilidad. La proximidad a las grandes ciudades y el número de pobladores rurales que usa las poblaciones de pavas parecen ser parámetros muy importantes en determinar grados de sostenibilidad en las poblaciones de stas especies. De manera similar, los patrones de sostenibilidad cambian dramaticamente cuando son examinados con respecto a especies en peligro. La caracteristica que *P. pipile* y *P. jacutinga* tienen en común es que sus rangos de distribución geográfica es restringida a islas (de habitat rodeado por bosque transformado y oceanicas) lo cual es combinado con una presión de caza extremadamente alta. Aunque los datos son limitados, evidencia indíca que la tasa de cazaría de pavas de monte es mas alta cuando los cazadores usan escopetas que cuando usan armas tradicionales tales como arco y flechas.

Pipile *como uma fonte de proteína para populações rurais e ameríndios.* As duas *Pipile* monotípicas, o Pawi *P. pipile* e a Jacutinga *P. jacutinga*, são consideradas Criticamente em Perigo e Em Perigo, respectivamente. As outras duas espécies, *P. cumanensis* e *P. cujubi*, tem distribuições mais amplas e estão seguras na maior parte das regiões onde o nível de caça é sustentável e a destruição de habitat mínima. Este estudo examina os padrões de caça de *Pipile* em relação a outros cracídeos e espécies cinegéticas, e

identifica padrões de raridade em populações que são caçadas de forma não-sustentável. Populações rurais e de ameríndios na América Latina caçam *Pipile* spp. de tal forma que estas se encontram entre as espécies de aves mais frequentemente capturadas, mesmo entre a totalidade de espécies de animais caçados - talvez sendo mais exploradas que todas as outras aves. Estes padrões são mais evidentes quando se considera o número de indivíduos contra a biomassa bruta. Entretanto, vários estudos quantificando a sustentabilidade da caça indicam que em alguns casos *P. cumanensis* é caçada dentro de limites sustentáveis; a exceção parece ter dois parâmetros estreitamente relacionados à caça não-sustentável: pequena distância de cidades e maiores populações humanas extraindo proteína da floresta. Da mesma forma, o padrão de caça sustentável muda dramaticamente quando se examina a situação dos taxa ameaçados. O padrão comum que *P. pipile* e *P. jacutinga* compartilham é a restrição geográfica a ilhas (de habitat ou costeiras), combinada a extrema pressão de caça. Dados limitados sobre uso de armas para caça indicam taxas de captura muito maiores quando se usa espingarda comparada a zarabatanas e arco e flecha.

Introduction

Cracids consitute an important protein source in the diets of hunters in Latin America and often represent a substantial portion of the prey base (e.g., Yost and Kelley 1983, Ayres et al. 1991, Vickers 1991, Begazo 1997). Unfortunately, the life history of Cracids often will often not sustain consistent or intensive hunting pressure due to characteristics typifying the "K-selelcted" end of the life-history continuum (e.g., low reproductive rate, long generation time, low clutch size, dependence upon specific habitat, and poor dispersal qualities).

There have not been any quantitative studies to date that examine how pervasive hunting is within a particular Cracid clade. Perhaps more importantly, there have not been any studies investigating whether closely related Cracids are affected differentially from hunting pressure when considering separate parameters of threat.

The most recent taxonomic treatments of Piping Guans (*Pipile*) recognizes four species (e.g., del Hoyo 1996, Strahl and Schmitz 1997). The two monotypic taxa, the nominate Trinidad Piping Guan or Pawi (*P. pipile*) and Black-fronted Piping Guan or Yacutinga (*P. jacutinga*), are considered Critically Endangered and Endangered, respectively (e.g., del Hoyo 1996). The other two species, the Blue-throated Piping Guan (*P. cumanensis*) and Red-throated Piping Guan (*P. cujubi*), have wider ranges and are safe in most regions where harvest levels are sustainable. Thus there is apparently variation in susceptibility to extinction among members of the *Pipile* clade. Therefore Piping Guans serve as a good model to test patterns of variation in susceptibility to exctinction within a clade. The fact that Piping Guans play an important role in the diets of rural hunters and Amerindians in Latin America strengthens their suitability as a substantial model even more.

It is with this in mind that the objectives of the study are set, to examine patterns of harvest in the genus *Pipile.* Specifically:

1) to examine *Pipile* harvest patterns in relation to other game (primarily mammalian),

2) to examine *Pipile* harvest patterns in relation to other Cracids,

3) to identify patterns of rarity in non-sustainably harvested populations of *Pipile*.

Methods

The literature was surveyed for all relevant data on *Pipile* harvest. Additionally, a questionnaire was broadcasted by E-mail to as many applicable scientists as possible, who would presumably have some data on *Pipile* harvest. All data were then tabularized and analyzed using the comparative method.

City population estimates were obtained from one reference for standardization (Anon. 1989). Distances from these cities were measured using a standard Atlas (Anon. 1979) complemented with a standard map cyclometer for accurate precision. The distance from cities was obtained by averaging distances measured by major tributaries/rivers and straight a straight line. This was to account for the possibility that different types of people could ostensibly reach the hunting site by different means (i.e., dugout canoe for many ribereños versus cars or airplanes for sport hunters). The exception to this was for the island of Trinidad; in this case the distance from the main city was obtained by taking the mean distance from Port of Spain to each terminal corner of the island.

Results and Discussion

Pipile *harvest patterns*

Most of the data available were for *P. cumanensis*, with very little data available for the other species, especially *P. pipile*. For this reason, it was necessary to pool all species data to compare how frequently *Pipile* is taken in comparison to other game, and other Cracids.

The mean number of individual *Pipile* harvested for studies considering all game (primarily mammalian) was 71, averaging 7th in rank out of 35 species of game (Table 1). The mean biomass (kg) of *Pipile* harvested for studies considering all game was 115, averaging 14th in rank out of 37 species of game (Table 2). Descriptive statistics of range and sample size are summarized in Table 5.

The mean number of individual *Pipile* harvested for studies considering Cracids was 89, averaging 2nd in rank out of 4 species of Cracids (Table 3). The mean biomass (kg) of *Pipile* harvested for studies considering all Cracids was 161, averaging 3rd in rank out of

4 species of game (Table 4). Descriptive statistics of range and sample size are summarized in Table 5.

Analyses suggest that Latin American rural hunters and Amerindians harvest *Pipile* such that it is among the most frequently taken species of gamebird, and ranks high among all game species taken - perhaps higher than any other species of bird overall. These patterns are more pervasive when considering number of individuals versus crude biomass.

Although *Pipile* ranked high when considering only Cracids, it was not the most frequently taken species of Cracid. This pattern is demonstrated when considering both number of individuals and biomass. This corroborates the findings of others (e.g., Silva and Strahl 1991, Begazo 1997) that Cracids as a group experience strong hunting pressure, considering that *Pipile* was a high-ranked species when considering all game taken. Preliminary data suggest that *Mitu tuberosa* and perhaps *Penelope jacquacu* are more frequently taken than *Pipile*, but this awaits future analyses. Nonetheless, in Rondônia both rubber tappers and colonists harvest more *Mitu tuberosa* than any other bird (F. Olmos pers. comm.).

***Patterns of rarity in non-sustainably harvested patterns of* Pipile**

Table 6 reveals two interesting patterns. The first and most apparent are that populations of Endangered taxa are not hunted within sustainable limits. The second is that different populations of the same species (*P. cumanensis*) from the same general region are not always within sustainable limits. At least one of these sites (Brooks unpubl. data) was probably a consequence of recruitment effects (i.e., rescue effect, Brown and Kodric-Brown 1977) from a source population deeper in the forest to a moderately or lighter hunted "sink". These populations were only evidenced during the last year or two of 4 - 5 years of field work, suggesting a recolonizing population, which was intensively hunted until 3 - 4 years ago.

Bearing the above findings in mind, it becomes essential to examine parameters of hunting in finer detail (Table 7). It was necessary to pool all species data for non-sustainably harvested populations due to small sample size.

The first parameter examined was populations size of nearest city, which was considerably different. Sustainably harvested populations contained an average of 600,000 people whereas non-sustainably harvested populations contained 7,130,000 people, differing by nearly an order of magnitude. It is likely that the larger size of São Paulo was a major factor attributing to the larger population size in cities closer to non-sustainably harvested populations.

The average distance (km) from the nearest city also differed substantially. Sites characterized by sustainably harvested populations were 320 km versus 176 km on average at non-sustainably hunted sites. The non-sustainably hunted sites were nearly half the distance of the sustainably harvested sites.

Very limited data were available on human population density at the sustainably hunted site versus non-sustainably hunted site. The site characterized by sustainable hunting averaged 0.13 humans/km^2, whereas the non-sustainably hunted site averaged 2.58 humans/km^2. The human population densities in the non-sustainbly harvested sites are nearly 20 times that of the sustainably harvested sites.

Finally, table 8 compares shotgun hunting to blowgun and bow hunting. The reference for blowgun is 61 takes (34%) versus 61 (66%) for shotgun. The difference taken with a blowgun is nearly half that of shotgun. Differences become even more dramatic when considering number hunted with a bow versus a shotgun. In this case, 52 (96%) were hunted with a shotgun versus on 2 (4%) taken with a bow. Nearly all were taken with a shotgun when comparing bow hunts. Whether these estimates reflect preferred hunting weapon or enhanced efficiency leading to higher rate of take is unknown.

In sum, closer distance to cities, higher populations of people extracting protein from the forest, and perhaps the use of shotguns are the main factors dampening *Pipile* populations. Perhaps there is still another factor (among many) that was not considered strictly for the Endangered *Pipile* taxa. The common pattern that *P. pipile* and *P. jacutinga* share is geographic restriction to islands (habitat or coastal oceanic). As such, their populations will tend to be more vulnerable from exacerbated habitat destruction and more concentrated human population densities.

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Literature Cited

Aleixo, A. and M. Galetti. 1997. The conservation of the avifauna in a lowland Atlantic forest in south-east Brazil. Bird Conserv. Intl. 7: 235-261.

Alvard, M. 1993. Testing the ecologically noble savage hypothesis: Conservation and subsistence hunting in Amazonian Perú. Unpubl. Disser., Univ. New Mexico, Albuquerque, N.M.

Alvarez-Alonso, J. 1997. Estado actual de la fauna silvestre en la propuesta reserva comunal del pucacuro. Pp. 93 - 103 In: Manejo de Fauna Silvestre en la Amazonía (T.G. Fang, R.E. Bodmer, R. Aquino and M.H. Valqui, Eds.).OFAVIM, La Paz.

Anon. 1979. Reader's Digest Wide World Atlas. Reader's Digest Assoc., NY.

Anon. 1989. Fodor's '89 South America. Fodor's Travel Publ., Inc. NY.

Ayres, J.M., D. Magalhães L., E. Souza M., J.L.K. Barreiros. 1991. On the track of the road: changes in subsistence hunting in a Brazilian Amazonian village. Pp. 82-92 In: Neotropical Wildlife Use and Conservation (J.G. Robinson and K.H. Redford, Eds.). Univ. Chicago Press.

Begazo, A.J. 1997a. Uso de las poblaciones de paujiles, pucacungas, pavas de monte y manajaracos (Cracidae - Galliformes) en el noreste Peruano. Pp. 257 - 266 In: Manejo de Fauna Silvestre en la Amazonía (T.G. Fang, R.E. Bodmer, R. Aquino and M.H. Valqui, Eds.).OFAVIM, La Paz.

Begazo, A.J. 1997b. Use and conservation of the Cracidae in the Peruvian Amazon. Pp. 449-459 In: The Cracidae: their Biology and Conservation (S.D. Strahl, S. Beaujon, D.M. Brooks, A.J. Begazo, G. Sedaghatkish, and F. Olmos, Eds.). Hancock House Publ., WA.

Berlin, B. and E.A. Berlin. 1983. Adaptation and Ethnozoological classification: theoretical implications of animal resources and diet of the Aguaruna and Huambisa. Pp. 301 - 325 In: Adaptative Responses of Native Amazonians (R.B. Hames and W.T. Vickers, Eds.). Academic Press.

Brown, J.H. and A. Kodric-Brown. 1977. Turnover rates in insular biogeography: effect of immigration or extinction. Ecol. 58: 445-449.

del Hoyo, J. 1996. Handbook of the Birds of the World, Vol. 2. Lynx Ed.

Hames, R.B. 1979. A comparison of the efficiencies of the shotgun and the bow in Neotropical forest hunting. Human Ecol. 7: 219-251.

Martins, E. 1992. A caça de subsistência de extrativistas na Amazônia: sustentabilidade, biodiversidade e extinção de espécies. Unpubl. Thesis, Univ. Brasília.

Martuscelli, P.S. and F. Olmos. 1997. Cracid conservation in São Paulo state, southeastern Brazil. Pp. 482-491 In: The Cracidae: their Biology and Conservation (S.D. Strahl, S. Beaujon, D.M. Brooks, A.J. Begazo, G. Sedaghatkish, and F. Olmos, Eds.). Hancock House Publ., WA.

Sanches, R.A. 1997. Caiçaras e a Estação Ecológica Juréia-Itatins: uma abordagem etnográfica e ecológica para o estudo da relação homem-ambiente. Unpubl. Thesis, Dept. Ecologia, Inst. Biociências, Univ. São Paulo.

Silva, J.L. and S.D. Strahl. 1991. Human impact on populations of chachalacas, guans, and curassows (Galliformes: Cracidae) in Venezuela. Pp. 37-52 In: Neotropical Wildlife Use and Conservation (J.G. Robinson and K.H. Redford, Eds.). Univ. Chicago Press.

Strahl, S.D. and A. Schmitz. 1997. A Taxonomic Reference of the Family Cracidae for Common Use by Ornithologists. Pp. 1-7 In: The Cracidae: their Biology and Conservation (S.D.

Strahl, S. Beaujon, D.M. Brooks, A.J. Begazo, G. Sedaghatkish, and F. Olmos, Eds.). Hancock House Publ., WA.

Vickers, W.T. 1991. Hunting yields and game composition over ten years in an Amazon Indian territory. Pp. 53-81 In: Neotropical Wildlife Use and Conservation (J.G. Robinson and K.H. Redford, Eds.). Univ. Chicago Press.

Yost, J.A. and P.M. Kelley. 1983. Shotguns, blowguns, and spears: the analysis of technological efficiency. Pp. 189-224 In: Adaptative Responses of Native Amazonians (R.B. Hames and W.T. Vickers, Eds.). Academic Press.

Zent, S. 1997. Piaroa and the Cracidae: game management under shifting culture. Pp. 177-194 In: The Cracidae: their Biology and Conservation (S.D. Strahl, S. Beaujon, D.M. Brooks, A.J. Begazo, G. Sedaghatkish, and F. Olmos, Eds.). Hancock House Publ., WA.

Table 1 - Preference of *Pipile* in relation to other game harvested as measured by individuals

Species	Individuals Harvested	Rank (# Sp. total)	Area/People	Reference
cujubi	6	14 (26)	W BR Ribereños	Ayres 1991
cumanensis	52	2 (53)	VE Ye'kwana	Hames 1979
cumanensis	2	~19 (37)	VE Yanamonö	Hames 1979
cumanensis	82	5 (48)	EC Siona-Secoya	Vickers 1991
cumanensis	181	7 (59)	EC Waorani	Yost and Kelly 1983
cumanensis	19	8 (14)	PE Ribereños	Alvarez-Alonso 1997
cumanensis	158	1 (31)	PE Ribereños	Begazo 1997a
jacutinga	-	1* (-)	BR Guaaní	Martuscelli/Olmos 97
jacutinga	-	11 (12)	BR Mbya	Sanches 1997

*Was most preferred species by Guaraní Indians in Ilha do Cardosa State Park prior to hunting to extinction.

Table 2 - Preference of *Pipile* in relation to other game harvested as measured by biomass

Species	Total Kg. Harvested	Rank (# Sp. total)	Area/People	Reference
cujubi	19.20	12 (26)	W BR Ribereños	Ayres 1991
cumanensis	87.45	11 (53)	VE Ye'kwana	Hames 1979
cumanensis	2.00	30 (37)	VE Yanamonö	Hames 1979
cumanensis	261.80	10 (36)	EC Waorani	Yost and Kelly 1983
cumanenesis	205.40	9 (31)	PE Ribereños	Begazo 1997a

Table 3 - Preference of *Pipile* in relation to other Cracids harvested as measured by individuals

Species	Individuals Harvested	Rank (# Sp. total)	Area/People	Reference
cujubi	6	3 (3)	W BR Ribereños	Ayres 1991
cumanensis	134	2 (5)	VE Campesino/Indig.	Silva and Strahl 1991
cumanensis	52	2 (5)	VE Ye'kwana	Hames 1979
cumanensis	2	3.5 (5)	VE Yanamonö	Hames 1979
cumanensis	9	1 (4)	VE Piaroa	Zent 1997
cumanensis	2	2 (3)	EC Siona-Secoya	Vickers 1991
cumanensis	181	3 (5)	EC Waorani	Yost and Kelly 1983
cumanensis	19	3 (4)	PE Ribereños	Alvarez-Alonso 1997
cumanensis	15	1 (4)	PE Ribereños	Begazo 1997a
cumanensis	559	2 (4)	PE Colonous/Cocama	Gonzalez unpub. data
cumanensis	1	3 (3)	BR Ribereños	Santos unpubl. data

Table 4 - Preference of *Pipile* in relation to other Cracids harvested as measured by biomass

Species	Total Kg. Harvested	Rank (# Sp. total)	Area/People	Reference
cujubi	19.20	3 (3)	W BR Ribereños	Ayres 1991
cumanensis	208.00	2 (5)	VE Campesino/Indig.	Silva and Strahl 1991
cumanensis	90.40	3 (4)	VE Piaroa	Zent 1997
cumanensis	87.45	2 (5)	VE Ye'kwana	Hames 1979
cumanensis	2.00	4 (4)	VE Yanamonö	Hames 1979
cumanensis	261.80	3 (5)	EC Waorani	Yost and Kelly 1983
cumanensis	~26.60	3 (4)	PE Ribereños	Alvarez-Alonso 1997
cumanensis	-	3 (4)	PE Huambisa	Berlin & Berlin 1983
cumanensis	205.40	1 (4)	PE Ribereños	Begazo 1997a
cumanensis	~0.70	3 (3)	BR Ribereños	Santos unpubl. data
cumanensis	712.00	2 (4)	PE Colonous/Cocama	Gonzalez unpub. data

Table 5 - Mean preference of *Pipile* in relation to other game and Cracids

	Game	Cracids
Individuals Harvested	71 (2 - 181) 7	89 (1 - 559) 11
Rank	7 (1 - 19) 9	2 (1 - 3.5) 11
Number Species	35 (14 - 59) 8	4 (3 - 5) 11
Total Biomass (Kg)	115 (2.0 - 261.8) 5	161 (0.7 - 712) 10
Rank	14 (9 - 30) 5	3 (1 - 4) 11
Number Species	37 (26 - 53) 5	4 (3 - 5) 11

+scores are presented as follows: mean (range) N

Table 6 - Sustainability of hunting *Pipile* at different sites

Species	Analysis	Sustainable?	Area/People	Reference
cumanensis	Density est. over time	Yes (?)	VE Camp./Ind.	Silva and Strahl 1991
cumanensis	Compare effort (#/hr.)	Yes	Siona-Secoya	Vickers 1991
cumanensis	Production model	Yes*	PE Ribereños	Begazo 1997b
cumanensis	Surveys over time	Yes*	PE Ribereños	Alvarez-Alonso 1997
cumanensis	Surveys over time	Slightly*	PE Ribereños	Alvarez-Alonso 1997
cumanensis	Surveys over time	No*	PE Ribereños	Alvarez-Alonso 1997
cumanensis	Surveys over time	No*	PE Ribereños	Brooks unpubl. data
cumanensis	Surveys over time	No (extirpated)	BR Rub. Tap.	Martins 1997
jacutinga	Surveys over time	No (extirpated)	BR Guaraní	Martuscelli/Olmos 97
jacutinga	Density est. over time	No (extirpated)	BR Hunters	Aleixo and Galetti '97
jacutinga	Surveys over time	No	BR Mbya	Sanches 1997
pipile	Surveys over time	No	TR hunters	Temple pers. comm.

*All of these sites are in the same general region of the northern Peruvian Amazon, suggesting variability in susceptibility to overhunting regardless of species.

Table 7 - Parameters of hunting sites where *Pipile* is harvested

Nearest City+	City Pop.* (x 10^5)	~km to City+	~Ind./km^2	Reference
		Sustainable Harvest (*P. cumanensis*)		
Bolivar, VE	2.5	250	-	Silva and Strahl 1991
Quito, EC	10.0	300	0.20	Vickers 1991
Quito, EC	10.0	400	0.06	Alvarez-Alonso 1997
Iquitos, PE	1.8	330	-	Begazo 1997b
MEAN	6.0	320	0.13	
		Non-Sustainable Harvest		
Iquitos, PE	1.8	250	-	[C]Alvarez-Alonso 1997
Iquitos, PE	1.8	120	-	[C]Brooks unpubl. data
Cuzco, BO	-	475	-	[C]Brooks unpubl. data
São Paulo, BR	140.0	25	1.50	[J]Sanches 1997
São Paulo, BR	140.0	135	3.75	[J]Martuscelli/Olmos 97
São Paulo, BR	140.0	150	~2.50	[J]Aleixo and Galetti 97
Pt. of Spain, TR	4.0	75	-	[P]Temple pers. comm.
MEAN	71.3	176	2.58	

+Anon. 1979
*Anon. 1989
[C] = *P. cumanensis*
[J] = *P. jacutinga*
[P] = *P. pipile*

Table 8 - Number of *Pipile* taken with shotgun compared to other weapons

Species	Shotgun	Blowgun	Bow	Reference
cumanensis	120 (66%)	61 (34%)	-	Yost and Kelly 1983
cumanensis	52 (96%)	-	2 (4%)	Hames 1979