ACTA
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Fishing territoriality and diversity between the ethnic populations Ashaninka and Kaxinawá, Breu river, Brazil/Peru.

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ABSTRACT
This study describes the diversity and the subsistence fishing territoriality of traditional populations of an Ashaninka and two Kaxinawá villages living at the margins of the Breu river (Brazil/Peru). In general, samplings in the dwellings were carried out late in the afternoon, as the fishermen arrived in the village. The data were analysed in an exploratory way through the index of pondered dominance (ID%), by analysis of variance and by a correspondence analysis in order to determine the associations of the fish species and the fishing spots between the villages of the Indigenous Reserve. The results of the analysis of variance demonstrated that differences exist between the fish diversities of the catches. However, *post-hoc* tests only detected differences in diversities between the hand fishhook and the other fishing gears (bow and arrow, castnets and rotenone *tingui*). Although the use of bow and arrow resulted in a low capture (Kg), this fishing strategy is associated with a high fishing diversity, in terms of number of species. These results demonstrate that there is no overlap in the frequency of the visits to the fishing spots between the Ashaninka and Kaxinawá populations. This pattern is the same found for the correspondence analysis for the fish species, which describes the relationship between the deep pools environments exploited by the fishermen Ashaninka and Kaxinawá of Mourão. These ethnic populations still continue to maintain a strong cultural and cosmological tradition with their territories defined in an informal way of the upper Juruá area.

KEY WORDS
Amazonia, Indigenous fisheries, Ashaninka, Kaxinawá, Breu river.

Diversidade e territorialidade pesqueira entre as populações étnicas Ashaninka e Kaxinawá, rio Breu, Alto Juruá, Brasil/Peru.

RESUMO
Este estudo tem o objetivo de descrever a diversidade e a territorialidade pesqueira de subsistência das populações tradicionais de uma aldeia Ashaninka e duas Kaxinawá vivendo à beira do rio Breu. Elas se situam no alto rio Juruá acima de Marechal Taumaturgo (AC, Brasil/Peru) num complexo de unidades de conservação e territórios de diversas populações étnicas. As casas dos moradores das aldeias e as pescarias coletivas são as unidades amostrais nesse estudo. De modo geral, as amostragens nas casas foram realizadas nos fins de tarde, conforme a chegada dos pescadores à aldeia. O monitor de pesca fez a coleta das informações sobre a pescaria e a pesagem do pescado capturado. Os dados foram analisados de maneira exploratória através do índice ponderal de dominância (ID%), pela análise de variância para as diversidades das capturas nas aldeias e pela análise de correspondência para determinar as associações das espécies de pescado e os pontos pesqueiros entre as aldeias da Reserva Indígena. Os resultados das análises de variância demonstraram que existem diferenças entre as diversidades das capturas. No entanto, os testes a posteriori *de comparações somente detectaram diferenças de diversidades entre o anzol de mão e os outros aparelhos (arco/flecha, tarrafa e tingui). Apesar do arco/flecha apresentar baixa captura (kg), sua estratégia de pesca gera alta diversidade de espécies. Os resultados demonstram que não há freqüência de sobreposição das visitas aos pontos pesqueiros entre as etnias Ashaninka e Kaxinawá. Esse padrão é o mesmo encontrado para a análise de correspondência para as espécies de pescado, que descreve a semelhança entre os ambientes de poços explorados entre os pescadores Ashaninka e Kaxinawá do Mourão devido a sua proximidade de localização na Reserva Indígena, mas não há sobreposição na exploração dos recursos pesqueiros. Essas populações étnicas ainda continuam a manter uma forte tradição cultural e cosmológica, com seus territórios definidos de maneira informal e com respeito aos que habitam a região do Alto Juruá.*

PALAVRAS-CHAVE
Amazônia, pescarias indígenas, Ashaninka, Kaxinawá, rio Breu.

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INTRODUCTION

In the area known as the Brazilian Legal Amazônia there are about 364 indigenous territories, with the Juruá river standing as one of the most complexes areas. The upper Juruá river encompass a suite of conservation units with several territories of traditional human populations, like villages of workers exploring rubber trees and the ethnic Ashanikawa, Kaxinawá, Manchineri, Kulina, Katukina, Nukuni, Jaminawá, Arara, Poyanawá, Yawanawá, among others, that has no contact with occidental civilizations.

However, the future of this area still depends on the demarcations of 21 indigenous territories which are connected to three Extrativist Reserves and with the Serra do Divisor National Park, an extension of continuous land with an area of about 2.839.850 ha harbouring a population around 15 thousand inhabitants, corresponding to 18.6% of the State of Acre. The ecosystem in the area of the upper high Juruá river still maintains its structures and natural functions, mainly because it possesses a low demographic density, low gold mining, low farming activity and low use of hydroenergetic resources. An exception to this is the construction of the highway BR-364, which will link the cities of Rio Branco and Cruzeiro do Sul, in Brazil, with possible expansions to the Pacific Ocean, after joining the Transamerican highway in Peru (Aquino, 1997).

In agreement with the Pilot Project for the Conservation of the Tropical Forests - PPG7 of the Ministry of the Environment - MMA/ Indigenous National Foundation - FUNAI, it expects to identify of 42 indigenous territories and demarcate another 58 areas in the Amazon. However, once the demarcations of these territories are completed, it will still be necessary to demarcate another 111 territories in the area. Thus, it is expected that the optimization in the use of the available socio-economic resource to accomplish this work should contemplate the longings established in the Brazilian Constitution of 1988 (GTA & Friends of the Earth, 1997). The objective of this study is to determine the fishing territoriality among fishermen and to compare the diversities of catches in the Ashaninka/Kaxinawá Indigenous Reservation of the Breu river (AC, Brazil/Peru).

MATERIAL AND METHODS

The Ashaninka-Kaxinawá Indigenous Reservation lies in the middle and upper Breu river, with an area of 23.840 hectares in the municipality of Taumaturgo (AC), with a population estimated as having 350 inhabitants (Aquino & Iglesias, 1992). The Reservation lies adjacent to the Extrativist Reservation of Upper Juruá, with the Indigenous Reservation Kaxinawá Jordão river and, along with the Breu river, with the Peruvian Amazon forest (Figure 1).

The regional physiography has a landscape predominately dissected and undulated, encompassing lower plateaus covered by open tropical forest and spots of dense tropical forest. The Breu river is a third-order affluent of the alluvial basins of the Javari and upper Juruá Rivers. The regional climate is defined as having rainy (November to May) and dry (June to November) periods, with annual precipitation around 2220mm (RADAMBRASIL, 1977; Emperaire *et al.* 1992).

Fisheries data sampling in the Indian Reserve encompassed a complete hydrological cycle, and were monitored by an interviewer (November 1995 and September 1996) and by the first author (September 1995 and April 1996). Fishermen dwellings in the villages and the collective fisheries were the sampling units in this study. In general, dwelling samplings were carried out late in the afternoon, as the fishermen arrived in the village. The interviewer sampled the information about the fishery, weighed and counted the fish caught. The inventory of fish species caught in the basin of the Breu river was performed in the summer (August 1995) and winter (April 1996). Species collected were identified and voucher specimens were deposited in the Zoological Museum of the University of São Paulo (MZUSP). Taxonomic identification of specimens caught in the villages, but absent in the inventory, were made with the aid of a list of species for the studied area (Silvano *et al.* 2001).

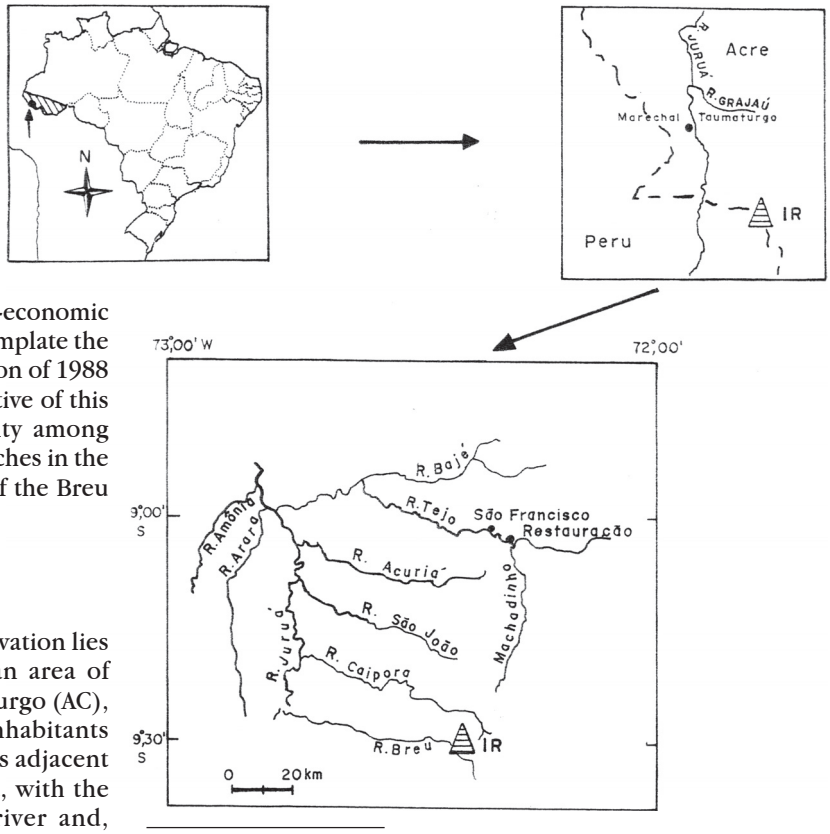

Figure 1 - Study area in the Ashaninka/Kaxinawá Indigenous Reservation. Fonte: RADAMBRASIL, (1977).

The fixation of geographical co-ordinates of the main fishing spots in the Indigenous Reserves was accomplished in the last field trip (September 1996). The GPS was with the configuration in the system UTM, plan, meters and true north.

The index of pondered dominance, ID% = $[(N_i*P_i)/S(N_i*P_i)]*100$, where P_i is the weight (Kg) of the species caught and N*i* is the number of species caught in the fishing spots, was used to obtain data on the main fish species catches as well on the main fishing spots in the Indigenous Reservation (Beaumord, 1991).

The diversity of the species caught (weight and number of individuals) was calculated for each fishing gear used by the Shannon-Wiener H' index (Krebs, 1989). Calculations of the analysis of variance model were accomplished between the diversity presented by the different fishing gears, following the equation $Y_i = m + a_i + e_i$ where: Y_i is the diversity measure H'; m is a constant; a_i identifies the fishing gear with $i = 1, 2, 3$ and 4, where 1=hand fishhook, 2=bow and arrow, 3=net and 4= rotenone "*tingui*"; and e_i is the random error $N(0, s^2)$. The residual analysis was carried out by plotting studentizated residuals and the estimated values, with the random observation of the distributions of values close to zero, that is, the evaluation of the occurrence of tendencies and outliers. Asymmetry (g_1) and kurtosis (g_2) were also calculated. Whenever ANOVA was significant, Tukey test was used a *post-hoc* test (Sokal & Rholf, 1995).

The correspondence analysis (CA) was used to describe the fisheries between the villages, specially to obtain data on the overlap in the use of fishings spots and on the territorial relationships between the villages (Manly, 1986; Ludwig & Reynolds, 1988).

RESULTS

Description of the fisheries in the Indigenous Reserve.

In the inventories realized at the Indigenous Reserve, 41 species of fishes were collected. Other 27 species that were not collected during the sampling period are described in the fish list of the Extrativist Reserve of the Upper Juruá (Silvano *et al.* 2000; Silvano *et al.* 2001). Thus, catches in the Ashaninka/Kaxinawá Indigenous Reservation encompass 59 species plus one species of crab (*Sylviocarcinus devillei*). The fish species belong to the Order Characiformes, with 6 families, Siluriformes, with 3 families, Gymnotiformes and Perciformes, with 2 families each and Rajiformes with the family Potamotrygonidae.

Village fisheries took place in 78 encompassing different fishing spots such as creek mouths, creeks, deep pools, and lakes. The fishermen of the village Ashaninka visited 18 spots, the fishermen of Kaxinawá of Mourão visited 48 and Kaxinawá of Japinim 31.

Total fish production in the Indigenous Reservation was 2,895 kg with a capture of 44,583 specimens of several species. A total of 359 fishing activities were sampled in the Indigenous Reservation, where 96, 176 and 87 trips occurred between the villages. The most common fish species were the "mandi" (35%, *Pimelodus sp.)*, armoured catfishes (25%, *Hypostomus sp.*), curimatã (9%, *Prochilodus sp.)*, "saburu" (8%, Curimatidae), among others.

Fisheries in the villages of the Indigenous Reservations have dominance in catches closely tied to the fishing gears and with the typology of the exploited fisheries environments. In the fishhook (average=0.086 kg/fishermen) fisheries used by Kaxinawá fishermen, there was a dominance of fish species caught such as the "mandi", the "pintadinha", the "piau" and the "piaba" which, in turn, are caught in habitats close to the village harbours. Armoured catfishes were more efficiently caught with bow and arrow. The Ashaninka and Kaxinawá of Mourão fishermen use this gear to exploit rapids habitats, while the Kaxinawá of Japinim fishermen use bow and arrow in the igarapés, as they live near the head streams.

Catching with bow and arrow (average=0.116 kg/fishermen/village) in different habitats are associated with marked differences in the composition catch of fish species. In general, armoured catfishes dominate catches. However, there were subtle differences in species composition and, in fact, the use of bow and arrow is associated with a higher diversity in species. For example, in rapids habitats, male painted and big armoured catfishes are the dominant species caught by bow and arrow, while in creeks the dominant species are the yellow and black armoured catfishes. The use of bow and arrow also favour catch, during the summer, of several other species of armoured catfishes (Loricariidae) and of the crab *Sylviocarcinus devillei*.

In fisheries with castnets (average=0.437 kg/fishermen/village) carried out in deep pools in Ashaninka and Kaxinawá of Mourão villages, the most common species were male catfishes and species of the genus *Pimelodus* sp. ("mandi") and *Prochilodus* sp. ("curimatã"). In the village Kaxinawá of Japinim, fisheries with castnets were associated with igarapés and lakes, with a dominance of species such as armoured catfishes, "piaba" "curimatã" (*Prochilodus* sp.) and "saburu". It should be pointed out that the use of castnets was associated with a high kg/fisherman.

The fisheries carried out with the use of rotenone "*tingui*" (average=0.240 kg/fishermen/village) stands out among Kaxinawá fishermen. Fishermen at the village of Mourão catch several species of Curimatidae and Loricariidae in deep pools during the winter, with a dominance of "piabas" when this gear is used in "igarapés" during the dry period. Fisheries in the village Kaxinawá of Mourão had satisfactory catches (in terms of kg/fisherman) with the use of the rotenone, which is the most common fishing gear among the fishermen of Kaxinawá of Japinim village (Table 1).

Diversity (H') of the catches among different fishing gears.

The calculated values of the diversity indexes (H') can be interpreted for each of the fishing gears according to their strategies of resource allocation (Table 2). The results of the analysis of variance for the diversities of species, calculated in the number of individuals and weight are show in Tables 3a and b and 4a and b. The *post-hoc* Tukey test of comparisons only detected differences of diversities between the hand fishhook and the other gears (bow and arrow, net and rotenone *"tingui"*). Residual analysis indicated that there was no inconvenience in these results.

Fishing territoriality between the villages.

Fishing spots with larger dominance in catches were the Algodão deep pool (46%) in Kaxinawá of Mourão village, the Mulateiro (16%) and Alho deep pool (4%) used by the fishermen of Kaxinawá of Mourão and Japinim villages, while the Cuchirir deep pool (6%) was more frequented by the Ashaninka fishermen. Overlap in the use of spots between the fishermen of Ashaninka and Kaxinawá villages only occurred at the Pedra, Cuchirir and Passarinho deep pools. The visits to the spots with higher overlap in their use occurred between the Kaxinawá of Mourão and Japinim villages in 18 of the fishing spots.

The first factor in the correspondence analysis (CA) was related to the associations of fish species with higher dominances that were caught between villages Kaxinawá of Mourão and Ashaninka (Figure 2 and Table 5). These values excluded those related to extreme associations (> 2.5), which were related only to fish caught by the village.

It is suggested that the number of species associations in this factor is larger between those two villages, due to the exploitation of fishing resources in similar environments, such as deep pools. The second factor describes the associations of species of fish that were caught between the villages Kaxinawá of Mourão and Japinim. It can be noticed that the extreme values of the associations are due to the species caught exclusively in the village Kaxinawá of Japinim. The associations of the second factor describe the fish species that were caught jointly in the villages Kaxinawá, with a predominance of catches in the deep pools, creeks and lakes (Figure 2 and Table 5). Table 6 shows the

Table 1 - Demographic and fishery characteristics of Ashaninka and Kaxinawá villages.

Villages	Ashaninka	Kaxinawá do Mourão	Kaxinawá do Japinim
Characteristics			
Estimated number of inhabitants	44	69	110
Mean age	26 years	34 years	39 years
Average Family size	4	5	6
Kg/Fishing gears/Fisherman			
"Tingui"	0.090	0.542	0.088
Net fishing	0.566	0.588	0.159
Individual fishing	0.087	0.213	0.050
Line and fish-hook	unknown	0.031	0.142

Table 2 - Shannon-Wiener H' diversity index, base 10, based on the number of individuals (H'_N) and in weight ($H'_{W/kg}$) of fish catches.

Villages/Gears	Hook		Bow/Arrow		Castnets		Rotenone	
	H'_W	H'_N	H'_W	H'_N	H'_W	H'_N	H'_W	H'_N
Ashaninka			3.682	3.715	3.896	3.266	3.375	3.360
Kaxinawá do Mourão	2.445	2.368	4.215	3.602	4.111	3.776	4.300	3.786
Kaxinawá do Japinim	2.050	1.912	3.109	3.264	3.572	3.267	3.653	3.321
Mean	2.247	2.140	3.668	3.531	3.835	3.636	3.778	3.536
Standard Deviation	0.197	0.228	0.451	0.195	0.195	0.264	0.384	0.266
Coefficient of Variation (%)	8.76	10.65	12.29	5.52	5.08	7.26	10.16	7.52

associations between the villages as a function of the catches of fish species. It can be seen that in the first factor the highest association is related to the Ashaninka village, while in the second axis the highest association is related to the Kaxinawás village.

This pattern describes the similarity between the deep pools exploited by fishermen of both villages (Ashaninka and Kaxinawá of Mourão), due to their proximity in the Indigenous Reservation. Nevertheless, there was not overlap in the use of fisheries resources and of frequency of visits to the spots between these two villages (see Figure 3). For example, in Figure 3, the first factor makes the distinction between the spots visited by the village Ashaninka with high negative associations loads. The second factor demonstrates the spots visited by the Kaxinawá fishermen, with elevated positive associations' loads for the village Kaxinawá of Japinim. The Kaxinawá of Mourão fishermen were more active in the exploitation of the fishery resources, overlapping with their close neighbours near the heads of the Breu river (Table 7). The results displayed in Table 8 described a similar pattern as those presented in Table 6.

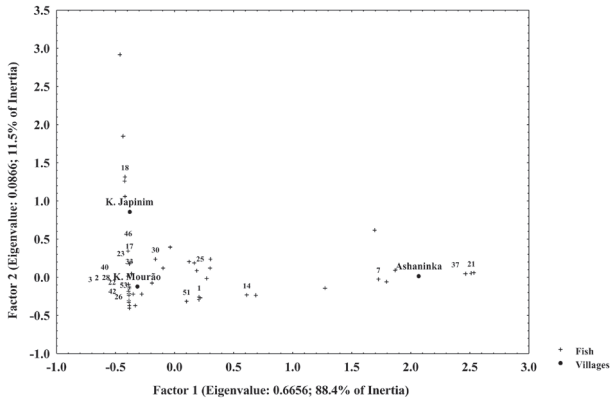

Figure 2 - Correspondence analysis factors of the species weight (mass > 0.01) for the Indigenous Reservation villages.

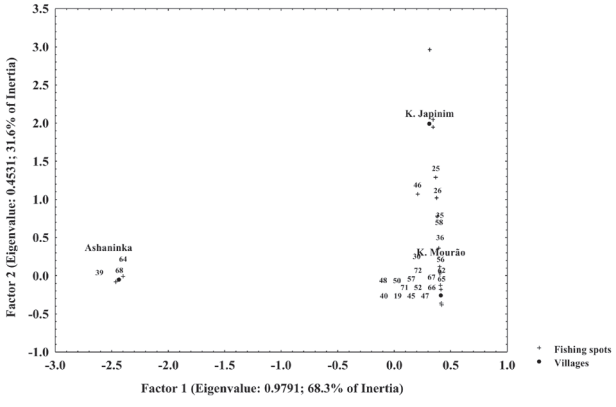

Figure 3 - Correspondence analysis factors of the fishing spots (mass > 0.01) for the Indigenous Reservation villages.

Table 3 - Analysis of Variance with the factor fishing gears for the diversity of fishes species:

a) number of individuals (H'_N) and

Dependent Variable = H'_N			R^2 = 0.851		
Source of Variation	SQ	GL	MQ	F	P
Fishing Gears	2.970	3	0.990	13.276	0.003
Error	0.552	7	0.075		

b) in weight ($H'_{W/kg}$) of fish catches.

Dependent Variable = $H'_{W/kg}$			R^2 = 0.749		
Source of Variation	SQ	GL	MQ	F	P
Fishing Gears	3.839	3	1.280	6.956	0.017
Error	1.288	7	0.184		

Table 4 - Probability of the post-hoc test of multiple comparison of Tukey between the diversities of species:

a) number of individuals (H'_N) and

Gears	Hook	Bow/ Arrow	Castnets	Rotenone
Hook	1			
Bow/Arrow	0.004	1		
Castnets	0.005	0.976	1	
Rotenone "tingui"	0.004	0.998	0.995	1
Adjusted Mean	2. 140	3.527	3.436	3.490

b) in weight ($H'_{W/kg}$) of fish catches.

Gears	Hook	Bow/ Arrow	Castnets	Rotenone
Hook	1			
Bow/Arrow	0.033	1		
Castnets	0.018	0.945	1	
Rotenone "tingui"	0.024	0.989	0.995	1
Adjusted Mean	2.248	3.669	3.860	3.776

There was a division of fishing territory, as well as a distinction in the fish species caught and fishing spots visited between the fishermen of the villages Ashaninka and Kaxinawá of Japinim. The fishermen of the village Kaxinawá of Mourão present a more active foraging behaviour of the fishery resources as they devoted a portion of their time to other activities such as agriculture. The use of the fishery resources was a more efficient and fast way to obtain the necessary protein, at least when compared to the time that was devoted to obtaining the same protein by other activities, such as hunting.

Table 5 - Association loads between the fish species in the Indigenous Reservation.

Nº	Order	Family	Sub-family	Genera/Species	Common Portuguese name	Common Ashaninka name	Common Kaxinawá name	Factor 1	Factor 2
1	Characiformes	Anostomidae		*Schizodon fasciattus**	piau aracú	koana	puke batu	-0,386	-0,146
2				*Leporinus* sp1*	piau	name unknown	mushu batu	-0,386	-0,123
3				*Leporinus* sp2**	piau lavrado	name unknown	batu	0,207	-0,257
4				*Abramites hypselonotus**	piau de pedra	name unknown	isku tsa tsa	-0,390	-0,214
5				*Leporinus* sp3**	piau manteiga	name unknown	batu	-0,465	2,922
6				*Leporinus* sp4**	piau areia	name unknown	batu	-0,385	-0,404
7		Characidae	Characinae	*Roeboides affinis**	madalena	thakiri	shetawa	1,724	-0,021
8			Cynodontinae	*Rhaphiodon aff. vulpinus**	cachorrão	sawirimeki	kamã	-0,280	-0,219
9				*Hydrolycus scomberoides**	manoel besta, cachorro	assana	shau	-0,100	0,123
10				*Boulengerella lucis**	agulha	name unknown	pinu tsa tsa	-0,425	1,259
11			Tetragonopterinae	*Astyanax bimaculatus**	piaba chata	matsistake	yapa	-0,434	1,855
12				*Tetragonopterus argenteus***	matapiri	name unknown	tapaturu	-0,391	-0,176
13			Triportheinae	*Triportheus* sp.*	sardinha	kaparano	yapatetuya	-0,194	-0,071
14			Serrasalminae	*Serrasalmus* sp*	piranha	roma	make	0,610	-0,230
15			Salmininae	*Salminus hilarii**	tubarana	name unknown	shãwãwã	-0,385	-0,404
16		Gasteropelecidae		*Thorocacharax stellatus**	machadinha	name unknown	shepatetu	-0,439	1,850
17		Curimatidae		*Curimatella immaculata***/ *Steindachnerina* sp1*	saburu	thôtho	bue	-0,385	0,180
18				*Steindachnerina* sp2*	piaba	mereto	yapa	-0,422	1,318
19				*Steindachnerina* sp3*	piaba comprida	matsistake	name unknown	2,532	0,061
20				*Potamorhina altamazonica**	mocinha	shimaniroki	tuká	0,123	0,208
21				*Psectrogaster amazonica***	casca grossa	name unknown	beruwã	2,513	0,058
22		Erythrinidae		*Hoplias aff. malabaricus**	traíra	txekori	meshku	-0,391	-0,180
23		Prochilodontidae		*Prochilodus nigricans**	curimatã	shima	kaprimã	-0,376	0,195
24	Suluriformes	Callichthydae		*Hoplosternum litoralle***	tambuatá	name unknown	bashu	-0,385	-0,404
25		Loricariidae	Hypostominae	*Glyptoperychthys punctatus**	bode amarelo	samoto	taxi ipu	0,298	0,122
26				*Glyptoperychthys gibbiceps***	bode grande	name unknown	ipu	-0,336	-0,370
27				*Liposarcus pardalis***	bode seringueira	name unknown	iã ipu	0,688	-0,233
28				*Hypostomus* sp1*	bode praiano	thentsi	mashã ipu	-0,384	-0,117

cont. >

Table 5 - Association loads between the fish species in the Indigenous Reservation. (cont.)

Nº	Order	Family	Sub-family	*Genera/Species*	Common Portuguese name	Common Ashaninka name	Common Kaxinawá name	Factor 1	Factor 2
29	Suluriformes	Callichthydae		*Hypostomus* sp2**	bode machado	kirassaperi	masãkere	1,695	0,621
30		Loricariidae	Hypostominae	*Hypostomus* sp3**	bode preto	txentxemoko	ishki	-0,163	0,242
31				*Hypostomus* sp4**	bode arraia	name unknown	kanitê	-0,389	-0,237
32				*Hypostomus* sp5**	bode pintado	name unknown	buku ipu	0,206	-0,289
33			Loricariinae	*Loricaria* sp1*/ *Spatuloricaria evansii***/ *Limatulichthys punctatus***	bode cachimbo	thopiro	kushpã	-0,385	-0,133
34				*Loricaria* sp2.**	b. cachimbo areia	thopiro	maxi	0,217	-0,269
35				*Sturisoma robustum***/ *Loricariichthys maculatus**	bode bico fino	koshiwa	tautia	1,795	-0,056
36				*Lamontichthys filamentosus**	bode cachoeira	manari	name unknown	2,532	0,061
37			Ancistrinae	*Ancistrus* sp.*/ *Panaque* sp1*	bode mão na cabeça	shimpi	name unknown	2,460	0,049
38				*Panaque* sp2.*	bode barba	name unknown	heshku	-0,393	-0,087
39				*Panaque* sp3.**	bode espinho	name unknown	ipu	-0,386	-0,370
40		Pimelodidae	Pimelodinae	*Pimelodus* sp1*/ *Cheirocerus* sp1.**/ *Pimelodina* sp1.**/ *Pimelodella* sp1.**	mandi	kório	tunu	-0,395	0,017
41				*Pimelodus* sp2.**	mandi igarapé	okonashi	ybu	0,302	0,240
42				*Pimelodus* sp3.**	mandi duro	name unknown	tunu	-0,388	-0,301
43				*Pimelodus blochii***	mandi listrado	name unknown	ixish	-0,385	-0,404
44				*Pimelodella gracilis***	mandi mole	name unknown	ybu	-0,420	1,059
45				*Cheirocerus eques**	mandi liso	tossorentsi	yuma	0,166	0,191
46				*Callophysus macropterus***	pintadinha	mota	tutu	-0,395	0,344
47				*Pinirampus pirinampu**	piranambu, grudado	name unknown	name unknown	2,532	0,061
48			Sorubiminae	** *Duopalatinus peruanus Brachyplatystoma vaillantii*/	piramutaba, mota	name unknown	chistubai	-0,387	-0,327
49				*Brachyplatystoma flavicans***	dourada	name unknown	shatxu	-0,465	2,922
50				*Pseudoplatystoma fasciatum***	surubim	tharawo	bai	1,273	-0,140

cont. >

Table 5 - Association loads between the fish species in the Indigenous Reservation. (cont.)

Nº	Order	Family	Sub-family	Genera/Species	Common Portuguese name	Common Ashaninka name	Common Kaxinawá name	Factor 1	Factor 2
51				*Hemisorubim platyrhynchus**	braço de moça	kirana	bari i	0,101	-0,312
52		Loricariidae	Hypostominae	*Platysilurus barbatus***	barba de arame	name unknown	bixtu bai	-0, 384	-0, 403
53				*Sorubim lima**	bico de pato	sawatari	kushu	-0,350	-0,218
54	Gymnotiformes	Apteronotidae		*Apteronotus bonapartii**	soia	name unknown	ishapu	2,465	0,050
55		Sternopygidae		*Eigenmannia macrops**	sarapó	thewiro	xima	0,187	0,087
56				*Sternopygus macrurus**	sarapó mutum	name unknown	hasixima	-0,385	-0,404
57	Perciformes	Sciaenidae		*Plagioscion* sp.**	pescada	name unknown	maxishau	1,867	0,092
58		Cichlidae		*Aequidens* sp.*	cará	mâyto	mãi	-0,036	0,398
59	Rajiformes	Potamotrygonidae		*Potamotrygon* sp.*	arraia	tsiweta	i	0,271	-0,014
60	Crustáceo			*Sylviocarcinus devillei***	caranguejo	oerontsi	shatxu	-0,368	0,052

***** Inventory in Ashaninka/Kaxinawá Reserve at Breu river.
****** Silvano, *et al.*, (2001)

DISCUSSION

Catch Diversity in the Indigenous Reservations

The wealth of fish species caught and the number of fishery habitats visited by the fishermen in the Indigenous Reservation were high. The use of bow and arrow entails a high diversity in number of species, which is the same as the values associated with the use of more generalists' gears such as castnets and rotenone. Use of hand fishhook entails lower diversity, as this gear is somewhat more specialists in terms of type of species caught. Castro & Begossi (1995) mentioned that the strategies in the use of different fishing gears vary with the objectives of the fishermen. These authors studied the ecology of a community of artisan fishermen in the Grande river (SP/MG) and concluded that the diversity of fish species varied in agreement with the fishery patterns adopted during the hydrological cycle. The subsistence fisheries in the period of low-productivity using castnets leads to higher diversity values in relation to commercial catches, which seeks specific schools during the crop, high-productivity, period. Thus, a gradient can be described in catch diversity among the levels of subsistence fisheries, where the diversity is higher than that of commercial fisheries. A commercial fishery usually catches fish species that have a better acceptance in local markets, and consequently, is associated with a larger income (Petrere, 1978). The subsistence fishermen tend to exploit a larger number of species of fish in the trophic chain, except those related to certain local taboos (Begossi & Braga, 1992; Aquino & Iglesias, 1992; Begossi *et al*., 1999).

In the Indigenous Reservation, fisheries are subordinated to cultural habits. The perceptions of these traditional human populations about the natural resources come in a holistic approach. The knowledge and utilization of natural resources are taught through parental relationships and by the diffusion of information shared by these populations. Many of these perceptions are related to the functional characteristics of the resources. Thus, the inhabitants of the upper Juruá river (AC) classify the rays, snakes and wasps, among other animals that possess poisons, as insects. For centuries, this functional vision has facilitated the sustained coexistence of these traditional populations with the ecosystems of the upper Juruá river. That coexistence is demonstrated by a relationship of respect and adoration, through strong mythological and cosmological traditions with the natural environments (Eid, 1994; Aquino & Iglesias, 1992; Costa, 1995; Begossi, *et al.,* 1999).

Posey (1983) suggested that popular knowledge and the daily practices of traditional populations, coupled with management strategies could be preponderant for the best use and conservation of natural resources. The management of natural resources by traditional populations is an important experience in the Amazon basin, and this experience should be used as a model for the sustainable development and for the maintenance of the biotic integrity of the area (Petrere, 1992).

Territoriality between traditional populations

The traditional populations use the fishing resources in a common way, respecting the fisheries territories of each other. In the case of the populations Ashaninka and Kaxinawá, differences exist in the frequency of use of the different fishing spots. This low frequency of overlap in the use of fishing spots is probably due to the usual trade and war relationships between sub-Andean Arawak and the Panos (Eid, 1994).

Although the property is of common use between the two ethnics, territory delimitation is important as it gives a base for the restriction to the regime of the common property, regulating the transfer, use and distributions of the rights of the common resources (McCay & Acheson, 1987; Berkes, 1985; Begossi, *et al.,* 1995). The territory distinction between the two ethnics is rooted in history. The Ashaninkas are known in the area as possessors of great warring ability, their territory of domain are of difficult access and their organization are in the form of small nomadic groups of high mobility, denominated in the past as " Anti " by the Inca that dominated the oriental areas and its sub-Andean people. Like the sub-Andean Arawak, the Inca Empire (Century XI to XV) maintained exchange relationships without having vassalage power. The ancestors of the Ashaninkas had certain autonomy in the Incan relationships of conquests, or against their main enemies, the ethnics of the language Pano. However, in remote times, the Arawak and the Pano had already possessed alliances in relation to the Spanish expansions in the area, and they blocked the attempts of the colonial conquest towards the oriental forests of Peru. After the onset of the rubber trade, this fact started to exercise strong pressure on the cultural and territorial patterns of the Arawak and Pano populations in the forests of the Amazon area (Eid, 1994).

Nowadays, these populations still continue to maintain a strong tradition of their cultures, with their territories informally and legally defined among the ethnics that inhabit the area of Upper Juruá. However, the definition of territories between traditional populations is a dynamic process, because some ethnic groups are nomadic and the populational growths of these ethnics, as well as of the rubber-gathers, are increasing on the border of the Brazilian/Peruvian Amazon (Eid, 1994; Aquino & Iglesias, 1992).

Management of free-access fisheries resources can include the following vulnerabilities: a low control of the resources by the community, the increase in the fisheries trade, the strong increase in the use of the resources, and the fast changes in technologies (Berkes, 1985). Hames (1982) analyzed the conservation of the exploitation of free-access resources through optimum foraging and conclude that the indigenous hunters of the Amazon area are not concerned with conservation, as they only seek an increase in the efficiency in the way by which animal protein is obtained. Peres (1993) characterized the Kaxinawá of the Jordão river as opportunist fishermen, as they carefully observed the movements of fishes during the reproductive season ("piracema"), placing a strong demand on daily catches in order to supply the necessary intake of animal protein (Begossi & Richerson, 1992; Begossi, 1996). Roberts & Baird, (1995) showed that the Khone fishermen of Mekong river possess fishery areas for generations in the domain of local families.

The possibility of conflicts in the future is the new regional dynamics of territory restriction and the growth of the traditional human populations. Aquino & Iglesias (1992) mentioned that the incorporation of the rubber-gatheres farms Independence and Altamira to the Indigenous Area of Kaxinawá of the Jordão river occurred in order to absorb part of the populational contingent that inhabit the eight rubber-gatheres farms in the area. During 18 years, the population Kaxinawá triplicated. In 1975 the natives were 383 people but in 1992 this number increased to 1.085 in the Kaxinawá villages. In the first ten months of 1993, 63 children were born and only three adults died. Thus, the increase of the traditional populations, and the changes in the patterns of the regional economies, can constitute a greater pressure upon the fishery resources, which are the basic subsistence food for these populations. Eventually, this fact may lead to conflicts in the exploitation of fishing territories, implying tragedy of the commons (Hardin, 1968) on the fishery resources.

McGrath, *et al.*, (1994) mentioned that free-access fishery resources lack any sort of regulation, and only exploitation rights exist in such systems. This type of system is confused with the regime of common property and the term "common" used by Hardin (1968) refers to the regime of free-access (McCay, 1996). However, and much on the contrary, the notion of common property rights excludes and defends the local resources from other exploiters, regulates the number of users and the techniques of resource allocation. The common property systems adopted by the fishermen in the lakes of the Lower Amazon contradict the thesis of Hardin (1968) of the tragedy of the commons, because the dynamics of free interest reconciled with responsibilities in avoiding the "tragedy" is the power underpinning the success of the collective management of the fishery resources.

Hilborn *et al.*, (1995) emphasized that most of the institutional successes in the maintenance of the sustainability of the fishery resources has been happening in communities of traditional fishermen or in private properties. Begossi

Table 6 - Association loads between the villages for the Indigenous Reservation.

Code	Villages	UTM - Wets	UTM - North	Factor 1	Factor 2
1	Ashaninka	723285	92806	2,066	0,018
2	Kaxinawá do Mourão	722997	92909	-0,314	-0,119
3	Kaxinawá do Japinim	722035	93122	-0,380	0,860

Table 7 - Association loads between the fishing spots for the Indigenous Reservation.

Code	Fishing spots (Portuguese)	Fishing spots (Ashaninka)	Fishing spots (Kaxinawá)	UTM West	UTM North	Factor 1	Factor 2
1	Aldeia Ashaninka	Kirinkayne	Name unknown	723285	92806	-2,464	-0,077
2	Aldeia Kaxinawá do Mourão	Name unknown	Kaya	722997	92909	0,418	-0,382
3	Aldeia Kaxinawá do Japinim	Name unknown	Kaya manãkiri	722035	93122	0,314	2,963
4	Boca da Varação	Name unknown	Kapa kea nuwa	722958	92886	0,314	2,963
5	Boca da Avalação	Name unknown	Name unknown			0,314	2,963
6	Boca do Julião	Name unknown	Name unknown			0,314	2,963
7	Cachoeira	Name unknown	Name unknown			0,314	2,963
8	Colocação Vista Boa	Name unknown	Tarame			0,314	2,963
9	Estirão da Casa	Name unknown	Name unknown			0,418	-0,382
10	Estirão da Copaíba	Name unknown	Buxu nuwa			0,418	-0,382
11	Estirão da Ressaca	Name unknown	Buxu nuwa			0,418	-0,382
12	Estirão da Samaúma	Name unknown	Name unknown			0,418	-0,382
13	Estirão de Arraia	Name unknown	Name unknown			0,418	-0,382
14	Estirão do Cumaru	Name unknown	Name unknown	722855	92925	0,418	-0,382
15	Estirão do igarapé Itália	Name unknown	Nuaya nuwa			0,314	2,963
16	Estirão do Julião	Name unknown	Buxu tekeya	722930	92874	0,418	-0,382
17	Estirão do Miguel Neto	Name unknown	Name unknown			0,418	-0,382
18	Estirão do Oro	Name unknown	Buxu nua			0,418	-0,382
19	Estirão do Queixada	Name unknown	Name unknown			0,418	-0,382
20	Estirão do Manoel Ferreira	Name unknown	Deteska nuwa	722073	93024	0,314	2,963
21	Igarapé afluente do Transval	Name unknown	Aibuxa			0,418	-0,382
22	Igarapé Candelaro	Name unknown	Pashku tuaya			0,314	2,963
23	Igarapé da Praia	Name unknown	Name unknown			0,418	-0,382
24	Igarapé da Arraia	Name unknown	Name unknown			0,418	-0,382
25	Igarapé do Casimiro	Name unknown	Buta ya			0,366	1,291
26	Igarapé do Julião	Name unknown	Nawa tekeya	722946	92882	0,382	0,780
27	Igarapé do Miguel Neto	Name unknown	Name unknown	723121	93116	0,395	0,360
28	Igarapé do Patoá	Nhatene patoá	Name unknown	723230	92806	-2,464	-0,077
29	Igarapé da Macambira	Name unknown	Name unknown			0,314	2,963
30	Igarapé do Macena	Name unknown	Pashku amexa	721007	93163	0,405	0,027
31	Igarapé Remarge	Name unknown	Pashku nawaya	722094	93012	0,314	2,963
32	Igarapé Transval	Name unknown	Beru txita xia	722044	93045	0,314	2,963

cont. >

Table 7 - Association loads between the fishing spots for the Indigenous Reservation. (cont.)

Code	Fishing spots (Portuguese)	Fishing spots (Ashaninka)	Fishing spots (Kaxinawá)	UTM West	UTM North	Factor 1	Factor 2
33	Lago	Name unknown	Mexu iã			0,314	2,963
34	Lago da Cigana	Encari thau	Name unknown	723197	92847	-2,464	-0,077
35	Lago do Brasil	Name unknown	Meshku yã	722977	92896	0,402	0,120
36	Lago do Peru	Name unknown	Shua iã			0,404	0,048
37	Poço da Cara Preta	Name unknown	Name unknown	723376	92778	-2,464	-0,077
38	Poço da Arraia	Name unknown	Name unknown			0,418	-0,382
39	Poço da Bandeira	Homotha banderon	Name unknown	723317	92801	-2,464	-0,077
40	Poço da Barreira	Name unknown	Bawa mewe nuwa	721015	93122	0,418	-0,382
41	Poço da Barreira de Cujubim	Name unknown	Kusha menenuwa			0,405	0,041
42	Poço da Casa Velha	Name unknown	Ashutatxa nuwa	722082	93014	0,345	1,946
43	Poço da Copaíba	Homotha cué	Name unknown	723139	92914	-2,464	-0,077
44	Poço da Maparajuba	Name unknown	Name unknown			0,418	-0,382
45	Poço da Pausada	Name unknown	Name unknown	722246	92906	0,418	-0,382
46	Poço da Pedra	Name unknown	Mashash nuwa	723023	92904	0,205	1,074
47	Poço da Pedra Mecado	Name unknown	Name unknown	722856	92892	0,418	-0,382
48	Poço da Pedreira	Name unknown	Mashash nuwa	722048	93056	0,411	-0,177
49	Poço da Praia	Homotha impaneiki	Name unknown	723365	92782	-2,464	-0,077
50	Poço da Ressaca	Name unknown	Pãtu nuwa	722817	92912	0,411	-0,179
51	Poço da Ressaca da Volta Grande	Huangana otaporé	Name unknown			-2,464	-0,077
52	Poço da Ressaca do Casimiro	Name unknown	Mapu nuwa	723019	92902	0,418	-0,382
53	Poço da Ressaca do Patoá	Huangana patoá	Name unknown	723224	92810	-2,464	-0,077
54	Poço da ressaca do Quinho	Huangana quinho	Name unknown			-2,464	-0,077
55	Poço da Volta Grande	Name unknown	Name unknown	723175	92887	-2,464	-0,077
56	Poço do Oro	Name unknown	Nua	722986	92904	0,410	-0,125
57	Poço do Algodão	Name unknown	Nai shapu nuwa			0,418	-0,382
58	Poço do Alho	Name unknown	Buaitsa nuwa	722728	92944	0,395	0,360
59	Poço do Arigó	Homotha arigó	Name unknown	723233	92817	-2,464	-0,077
60	Poço do Barreiro de Papagaio	Name unknown	Bawa mewe nuwa			0,374	1,019
61	Poço do Borfer	Name unknown	Name unknown			0,418	-0,382
62	Poço do Braço de Moça	Name unknown	Bari i nuwa			0,418	-0,382
63	Poço do Capim	Homotha shimbenesar	Name unknown	723321	92806	-2,464	-0,077
64	Poço do Cuchirir	Homotha cuchirir	Cuchirir nuwa	723368	92827	-2,402	-0,009
65	Poço do Cumaru	Name unknown	Kumã nuwa	722717	92900	0,418	-0,382

cont. >

Table 7 - Association loads between the fishing spots for the Indigenous Reservation. (cont.)

Code	Fishing spots (Portuguese)	Fishing spots (Ashaninka)	Fishing spots (Kaxinawá)	UTM West	UTM North	Factor 1	Factor 2
66	Poço do Getol	Name unknown	Baikai nuwa	722961	92882	0,418	-0,382
67	Poço do Mulateiro	Name unknown	Ashu nuwa	722709	92914	0,417	-0,358
68	Poço do Passarinho	Homotha tsimeri	Name unknown			-2,435	-0,044
69	Poço dos Lagos	Homotha encari	Name unknown	723169	92903	-2,464	-0,077
70	Poço Grande	Name unknown	Name unknown	722935	92882	0,314	2,963
75	Poço da T. Embaúba	Name unknown	Bukú tatxa	722048	93107	0,342	2,050
71	Praia da Magiliaba	Name unknown	Name unknown	722281	92914	0,418	-0,382
72	Praia do Capó	Name unknown	Name unknown			0,418	-0,382
73	Praia do Mulateiro	Name unknown	Name unknown			0,418	-0,382
74	Prainha	Name unknown	Name unknown	723219	92835	-2,464	-0,077
76	Name unknown	Name unknown	Ipu nuwa			0,418	-0,382
77	Name unknown	Name unknown	Shubi nuwa			0,418	-0,382
78	Name unknown	Name unknown	Tara nuwa			0,420	-0,379

Table 8 - Associations loads between the villages for the Indigenous Reservation.

Code	Villages	UTM - West	UTM - North	Factor 1	Factor 2
1	Ashaninka	723285	92806	-2,438	-0,052
2	Kaxinawá do Mourão	722997	92909	0,413	-0,257
3	Kaxinawá do Japinim	722035	93122	0,311	1,994

(1996) defined that the property rights or uses of the resources varies in agreement with the different scales of human behavior, with territoriality in its exploitation in an individual, familial way, ghetto, clan, communities, villas, societies, among others. The evolution in the change of the territoriality and the rights of fishing spots are related to the densities of local fisheries, outsiders and sporting fishermen, to the diversities and availability of fishing spots and to the capacity of the fishing technologies.

In the complex of conservation units and indigenous territories in the area of Upper Juruá, there is the need of implementation of management plans for the sustained development of the natural resources of the area. When considering the indigenous area of common use between two populations with different habits, we have to define the priorities that minimize the conflicts between the parts and the gradual retraction of the fishing practices that depreciate the stocks of the river Breu. The maintenance of the biodiversity and the sustained use of the biological productivity of these ecosystems for the traditional populations should constitute the goals of the management to be established in the area. However, the future of these traditional populations depends on its cultural resiliency (Begossi, 1995), that is, of their functional structures, of the exploitation and the conservation of the natural resources and of their cultural habits, of the dissipation of the conflicts and the invigoration of the tribal community organization. Thus, the management of the common resource should be supported by a more realistic and effective co-operation between traditional populations and the western society represented by government and NGOs.

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