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## **Genetic Demography of the Amazonian Ticuna Indians**

The Ticuna Indians of Brazil are now a largely acculturated and integrated tribe, situated for the most part in villages along the Solimões river. Demographic information collected in eight of their villages is reported here. For five of them detailed data concerning migration, fertility and mortality were obtained. They are characterized by a relatively large mobility, high fertility (mean number of livebirths per female of age 40 or more: seven), low (2.5%) frequency of sterile couples, and relatively low mortality for groups living at this cultural stage (25% of deaths before the age of reproduction). This low mortality, and a relatively small variance in the number of live-born children in completed families, lead to the lowest index of opportunity for selection obtained thus far in populations of South American Indians (0.54).

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### **1. Introduction**

The Ticuna (or Tukuna) are probably the largest group of descendants from a single tribe still living in Brazil. The number of persons with this affiliation is of the order of 11,000, distributed over a territory of 181,500 km<sup>2</sup>. The limits of their distribution can be set between 2° and 5° S and from 66° to 71° W. It seems that at the beginning of the 17th century they were restricted to the region around the Putumayo river, in the frontier between Colombia and Peru. With the extinction of their traditional enemies, the Omagua, as a result of the expansion of the neo-Brazilian society, the Ticuna gradually occupied the territory in which they live now.

The first historical mention of the Ticuna seems to have been made by Cristobal d'Acuna in 1641. Contact with non-Indians (Spanish and Portuguese) started in the 17th century and were full of episodes of violence. Their spread and ensuing contact with pioneer fronts during the 18th, 19th and the early part of the 20th century, according to Cardoso de Oliveira (1964) lead to two polar situations: (a) the Indians of the igarapés (tributaries of larger rivers), controlled in their relationships with the outside world by rubber dealers; (b) the Indians of the rivers—those living at the Indian post of Umariçu and some other neo-Brazilian communities (like that of Santa Rita do Weil) along larger streams. The exploitation system to which the Indians of the igarapés suffered had at its basis their recruitment as a labor force for rubber extraction. The product of their work was never sufficient to free them from the strong influence of their "patrão". However, when the situation became unbearable they would try to escape through the Colombian

border, or a Messianic movement would appear. At least six of the latter were described by M. V. Queiroz (cited by Cardoso de Oliveira, 1964) at the beginning of this century, that resulted in migration toward the Solimões river region.

Nimuendaju (1948) presented a synthetic description of Ticuna's pre-contact culture. They speak an independent language (see also Loukotka, 1968) and fish has always been of great importance for their subsistence. As for their social organization, they are divided into two exogamous, unnamed patrilineal moieties (Cardoso de Oliveira, 1964). Exogamy between these moieties was in previous times very strict; Nimuendaju (1948) states that the violations were still punished with death in 1941. Infanticide was not common and cases of bigamy rare. The political cohesion between groups was not strong, and there is no record of a chief for the entire nation.

It is important to note that despite three centuries of contacts of different nature with non-Indians, the Ticuna still maintain their ethnical identity and marriages with outsiders are rare. The reasons for this fact could be: (a) the violence that was frequently present in the relations between the Ticuna and the outside world; (b) the low population density of non-Indian persons in the area occupied by this tribe; (c) the rubber exploitation system, that strived to keep them in isolation at the igarapés; (d) the tribe's cultural tradition, which as was mentioned before favors intratribal, exogamic marriages.

Cardoso de Oliveira (1964) performed a detailed census of four groups of these Indians in 1959 and 1962. But the size and composition of these populations has changed dramatically since those censuses, due to the so-called "Holy Cross" movement. This new religion was created by Brother José Francisco da Cruz. This man was born in Minas Gerais, Brazil in 1913 and claims to have received a Celestial Vision in 1934. He started his apostolic work in 1962 and after peregrinations in southern Brazil and Peru he entered the Ticuna area in 1972. Always carrying a cross and a bible, despite the opposition of the Catholic priests he erected, with disciples, 31 crosses at various points on the banks of the Solimões. Seventeen of them were in places inhabited by Ticuna Indians [Umariçu (two crosses), Cleto, Bom Jardim, Sabonete, Capacete, Feijoa, Belém, Palmares, Bananal, Cajari, Vendaval, Santa Rita do Weil, Niterói (two crosses), Nova Itália and Boca do Içá]. They became, then, attraction poles to which many Indian families converged. At present Brother José lives in a place at the margins of the Içá river. The easy conversion of the Ticuna to this religion can be explained in part by the fact that Messianic movements were already a part of Ticuna's cultural heritage.

Recent demographic studies on these Indians were performed by Cardoso de Oliveira (1977) and Pacheco de Oliveira (1977). These and the earlier investigations provide good background material for comparison with the results to be described here. We obtained demographic and genetic data from eight communities; the demography will be detailed in this communication, but due to space problems the genetic marker results will be described elsewhere.

## 2. Materials and Methods

The data were collected from July 14 to August 17, 1976, in eight Ticuna communities distributed along the Solimões river. They are indicated in Figure 1 by numbers as follows: 1. Umariçu; 2. Bom Jardim; 15. Marajá; 16. Feijoa; 20. Belém; 26. Vendaval; 31. Campo Alegre, and 55. Nova Itália. These studies were developed as a part of a

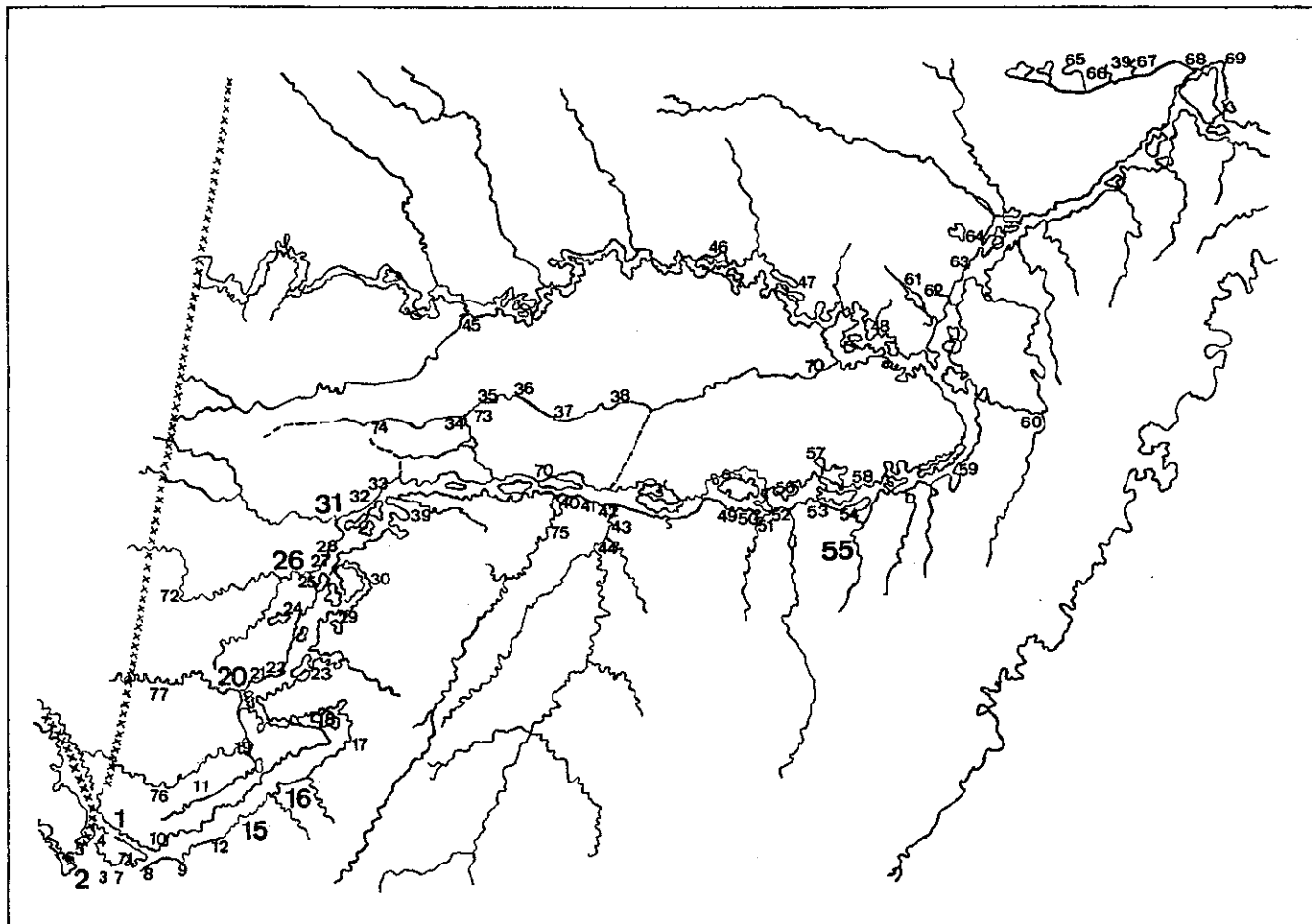


Figure 1. Map of the western region of the Amazonas State where most of the Ticuna Indian communities are located. It extends from 2°5' to 4°5'S and from 67°3' to 70°W. The main river crossing all the region (from lower left to upper right in the figure) is the Solimões. The larger affluent shown at its left margin is the Içá river (called Putumayo in Colombia and Peru). The larger numbers indicate the populations from which demographic data were obtained. A complete list with the names of all communities shown in the map is available on request. [Reproduced, with some changes, from Pacheco de Oliveira (1977).]

multiphased expedition, comprising bio-medical and physical scientific research which utilized the facilities of the vessel *Alpha Helix*. The eight villages were not studied with the same detail. For five of them (Umariçu, Belém, Vendaval, Campo Alegre and Nova Itália) the information is more complete; only data about the nuclear families who were included in the genetic marker and other bio-medical investigations were obtained in Bom Jardim, Marajá and Feijoal.

The more detailed studies involved interviews with one or both members of nuclear families, who generally came to the examination centers with their children. Questions were asked about: (1) name, age and ethnic group of the spouses; (2) birthplace; (3) parents' names and ages; (4) names and sex of the sibs living in the community; (5) number of children alive and dead; (6) stillbirths; (7) names, sex and ages of the living children; (8) ages and sex of dead children; (9) information about those who left the community; (10) other marriages of one or both spouses; (11) other persons living with the family; (12) in marriages without children, number of years of cohabitation.

These interviews were always conducted with the help of interpreters, since even though most of the men were bilingual, they had some difficulty in expressing themselves in Portuguese. The knowledge of this language by the women was even poorer. These interpreters understood Portuguese well and generally were of high status in the community. They also helped in many cases to ascertain the reliability of the information given. The ages of all persons were estimated by visual inspection; comparisons between the figures in parents and children were also done to arrive at a final decision.

### 3. Results

The age and sex distribution of the 3300 individuals recorded in the detailed census is shown in Table 1. Additional information about the 1684 persons sampled or mentioned in the other studies is presented in Table 2. The differences among villages are non-significant. The mean age of about 23 for males and 24 for females is higher than those observed in less acculturated South American Indian tribes; but the percentage of those in the 0-14 category (41%) is about the same as those encountered in these groups [see Salzano (1972) for review]. The number of males and females is about the same, with the expected higher sex ratio at younger ages. The individuals included in Table 2 are generally older, even if we make allowance for the lack of children in the 0-5 year interval. This is of course a sampling artifact; those who volunteer for blood collections generally have higher ages than those who avoid them.

There are relatively few persons of non-Indian or mixed ancestry in the more studied villages: less than 1% and 8%, respectively (Table 3). As for the remaining three, such persons only appeared in Feijoal, with a total frequency of 9%. The higher number of Mestizos observed in Umariçu was expected due to its proximity to Leticia, Tabatinga and Benjamin Constant, relatively large non-Indian communities. On the other hand, when the individuals who designated themselves as admixed or neo-Brazilians were excluded from the sample, there is very little evidence for admixture. For the total tribe, the Gm findings indicate only 0.009 Caucasian and 0.003 Black admixture, the ABO types confirming these findings (Gershowitz *et al.*, unpublished).

As is shown in Figure 1, the Ticuna live scattered over a large number of communities; the tendency to coalesce into larger populations, as mentioned previously, is a recent phenomenon enhanced by the Holy Cross movement. Table 4 shows the information on

**Table 1** Age and sex distribution in five villages of Ticuna Indians

Village and sex	Age interval			Unknown	Total	Estimated average age (M ± SD)
	0-14	15-30	31 and more			
<i>Umariagu</i>						
Men	170	108	129	220	627	23.1 ± 18.6
Women	165	120	124	211	620	23.6 ± 18.5
Total	335	228	253	431	1247	23.3 ± 18.5
%	41.1	27.9	31.0	—	—	—
Sex ratio	103	90	104	104	101	—
<i>Belém</i>						
Men	72	47	60	121	300	24.4 ± 18.3
Women	79	51	58	112	300	22.7 ± 17.8
Total	151	98	118	233	600	23.5 ± 18.0
%	41.1	26.7	32.2	—	—	—
Sex ratio	91	92	103	108	100	—
<i>Vendaval</i>						
Men	81	47	54	92	274	22.6 ± 18.1
Women	58	38	55	72	223	25.1 ± 17.9
Total	139	85	109	164	497	23.7 ± 18.0
%	41.8	25.5	32.7	—	—	—
Sex ratio	140	124	98	128	123	—
<i>Campo Alegre</i>						
Men	106	50	76	169	401	23.0 ± 18.2
Women	79	54	82	119	334	24.7 ± 18.3
Total	185	104	158	288	735	23.8 ± 18.2
%	41.4	23.3	35.3	—	—	—
Sex ratio	134	93	93	142	120	—
<i>Nova Itália</i>						
Men	23	19	25	45	112	26.2 ± 18.8
Women	35	17	26	31	109	23.4 ± 17.6
Total	58	36	51	76	221	24.7 ± 18.1
%	40.0	24.8	35.2	—	—	—
Sex ratio	66	112	96	145	103	—
<i>All villages</i>						
Men	452	271	344	647	1714	23.0 ± 18.4
Women	416	280	345	545	1586	23.8 ± 18.2
Total	868	551	689	1192	3300	23.6 ± 18.3
%	41.2	26.1	32.7	—	—	—
Sex ratio	109	97	100	119	108	—

M, mean; SD, standard deviation.

the degree of exogamy in the five villages studied in this regard. There is a clear dichotomy between Belém and Vendaval on one hand and Umariagu, Campo Alegre and Nova Itália on the other. The first two show a relatively large percentage of marriages in which both partners are locally born (73% and 76% respectively), while in the remaining three this percentage is much lower (5%–16%). But it should be clear that for all of them the number of localities indicated as birthplaces of the spouses is large (from 10 in Vendaval, to 45 in Umariagu; total number, 67).

Additional data on migration patterns are presented in Tables 5 and 6. The distances between the birthplaces of fertile adults and the locality where they live now vary from

Table 2

**Information about other Ticuna Indians obtained in the course of this investigation**

Village and sex	Age Interval			Total
	0-14*	15-30	31 and more	
<i>Bom Jardim</i>				
Men	22	17	24	63
Women	22	21	20	63
Total	44	38	44	126
%	34.9	30.2	34.9	—
Sex ratio	100	81	120	100
<i>Marajá</i>				
Men	19	18	30	67
Women	18	24	33	75
Total	37	42	63	142
%	26.1	29.6	44.3	—
Sex ratio	106	75	91	89
<i>Feijoa</i>				
Men	39	32	43	114
Women	34	37	42	113
Total	73	69	85	227
%	32.2	30.4	37.4	—
Sex ratio	115	86	102	101
<i>Belém</i>				
Men	26	30	89	145
Women	28	36	79	143
Total	54	66	168	288
%	18.8	22.9	58.3	—
Sex ratio	93	83	113	101
<i>Vendaval</i>				
Men	30	44	80	154
Women	26	45	71	142
Total	56	89	151	296
%	18.9	30.1	51.0	—
Sex ratio	115	98	113	109
<i>Campo Alegre</i>				
Men	46	65	120	231
Women	43	72	109	224
Total	89	137	229	455
%	19.6	30.1	50.3	—
Sex ratio	107	90	110	103
<i>Nova Itália</i>				
Men	13	16	46	75
Women	12	23	40	75
Total	25	39	86	150
%	16.7	26.0	57.3	—
Sex ratio	108	70	115	100
<i>All villages</i>				
Men	195	222	432	849
Women	183	258	394	835
Total	378	480	826	1684
%	22.4	28.5	49.1	—
Sex ratio	107	86	110	102

\* Making an adjustment for the lack of children 0-5 years of age.

**Table 3** Non-Indian admixture in five villages of Ticuna Indians

Village	Indian		Mixed*		Non-Indian ancestry†		Total
	N	%	N	%	N	%	
Umariçu	1047	84	193	15	9	1	1249
Belém	539	95	23	4	4	1	566
Vendaval	464	96	19	4	0	0	483
Campo Alegre	711	99	8	1	0	0	719
Nova Itália	215	100	0	0	0	0	215
All villages	2976	92	243	8	13	<1	3232

\* Acknowledged or suspected.

† Neo-Brazilian or Neo-Peruvian.

N, Number of individuals.

0–608 km. Most of the distances, however, are within a radius of 150 km from the community where they have been studied. The exceptions are the values for Nova Itália, where 58% of the adults have been born in places more than 200 km away. As for the averages, it can be seen that the numbers for Vendaval and Belém are very low (7 and 12 km respectively), increasing as we consider the other communities until the highest value of 147 km, found in Nova Itália (see Table 5). The back stochastic migration matrix reflects the large amount of exogamy found. Persons born in Belém contributed to the gene pool of the four other localities. Those born in Vendaval also appear as parents in three of the other four villages. Individuals from Nova Itália, on the other hand, are not represented as parents in the other places sampled, and those from Umariçu and Campo Alegre in only one or two respectively.

**Table 4** Endogamous and exogamous marriages in five villages of Ticuna Indians

Village	Both partners from the village	One partner from another village	Both partners from outside	Total no. of marriages	No. of populations represented
<i>Umariçu</i>					
No.	13	42	71	126	45
%	10	33	57		
<i>Belém</i>					
No.	40	12	3	55	15
%	73	22	5		
<i>Vendaval</i>					
No.	41	11	2	54	10
%	76	20	4		
<i>Campo Alegre</i>					
No.	11	31	26	68	19
%	16	46	38		
<i>Nova Itália</i>					
No.	1	4	16	21	16
%	5	19	76		
<i>All villages</i>					
No.	106	100	118	324	67
%	33	31	36		

**Table 5** Distances between the birthplaces of fertile adults and the locality where they live now

Present residence	Distances from birthplaces (km)								Average ± SE	Total number
	0	1-50	51-100	101-150	151-200	201-250	251-300	301+		
<i>Umariagu</i>										
No. individuals	66	72	47	26	0	17	2	6	67	236
%	28	30	20	11	0	7	1	3	±5	—
No. localities	1	12	7	4	0	6	2	4	—	36
<i>Belém</i>										
No. individuals	86	10	2	1	0	2	1	0	12	102
%	84	10	2	1	0	2	1	0	±4	—
No. localities	1	7	2	1	0	1	1	0	—	13
<i>Vendaval</i>										
No. individuals	88	9	0	1	1	1	0	0	7	100
%	88	9	0	1	1	1	0	0	±3	—
No. localities	1	4	0	1	1	1	0	0	—	8
<i>Campo Alegre</i>										
No. individuals	46	43	20	6	1	3	0	0	32	119
%	39	36	17	5	1	2	0	0	±5	—
No. localities	1	6	5	1	1	1	0	0	—	15
<i>Nova Itália</i>										
No. individuals	6	5	4	2	0	22	1	1	147	41
%	15	12	10	5	0	54	2	2	±16	—
No. localities	1	3	3	1	0	5	1	1	—	15

*Note:* The number of localities included in this table is less than those of Tables 4 and 6 because 15 of the 67 places mentioned could not be exactly located in the map. SE, Standard error of the mean.



**Table 6** Back stochastic migration matrix for five Ticuna Indian populations

Birthplace of parents	Birthplace of progeny					Total
	U	B	VD	CA	NI	
U	237	5	0	0	0	242
B	150	338	18	30	22	558
VD	30	7	318	64	0	419
CA	49	0	23	220	0	292
NI	0	0	0	0	25	25
O	194	8	0	0	16	218
VZ	38	0	0	0	0	38
LA	0	4	0	41	0	45
IP	13	0	0	36	1	50
IA	27	10	0	21	0	58
IC	23	0	0	4	3	30
SJ	20	0	0	0	0	20
SD	0	0	5	24	0	29
RJ	7	0	0	21	7	35
AP	0	0	0	0	28	28
S	16	11	0	0	0	27
IT	0	0	0	0	15	15
Others	274	29	8	58	50	419
Total	1 078	412	372	519	167	2548
No. of populations in "others" category	(33)	(8)	(6)	(7)	(8)	(48)

*Key to localities:* U, Umariapu; B, Belém; VD, Vendaval; CA, Campo Alegre; NI, Nova Itália; O, Ourique; VZ, Veneza; LA, Lago Acarutuba; IP, Igarapé Passé; IA, Igarapé Assacaio; IC, Ilha Cacao; SJ, São Jorge; SD, São Domingos; RJ, Rio Jacurapá; AP, Auati-Paraná; S, Sabonete; IT, Igarapé Tonantins.

Information about fertility and mortality is shown in Tables 7 and 8. These groups are characterized by a high fertility (mean number of livebirths per female with age greater than 15:5; in those who have completed their child-bearing period, 7) and relatively low mortality for persons in their living conditions (from a total of 1683 liveborn children, 421 or 25% died before reproduction). Therefore, the average number of surviving offspring is high: 4 in all families; 6 in the completed ones. But it should be mentioned

**Table 7** Number of liveborn offspring in five Ticuna Indian populations

Localities	All families		Completed families	
	No. females	Mean no. LB $\pm$ SE	No. females	Mean no. LB $\pm$ SE
Umariapu	127	5.5 $\pm$ 0.3	47	7.6 $\pm$ 0.5
Belém	54	5.5 $\pm$ 0.4	22	7.7 $\pm$ 0.6
Vendaval	54	4.6 $\pm$ 0.4	21	7.4 $\pm$ 0.5
Campo Alegre	68	4.7 $\pm$ 0.4	25	6.7 $\pm$ 0.6
Nova Itália	22	5.2 $\pm$ 0.6	10	8.0 $\pm$ 0.5
All groups	325	5.2 $\pm$ 0.2	125	7.4 $\pm$ 0.3

LB, Livebirths; SE, standard error of the mean.

**Table 8** Surviving offspring per female who had at least one liveborn child in five Ticuna Indian populations

Localities	All families			Completed families		
	No. females	Mean no. SO $\pm$ SE	Decrease % LB	No. females	Mean no. SO $\pm$ SE	Decrease %LB
Umariapu	125	4.4 $\pm$ 0.2	20	36	5.8 $\pm$ 0.4	24
Belém	53	3.9 $\pm$ 0.3	29	21	5.4 $\pm$ 0.5	30
Vendaval	51	3.7 $\pm$ 0.3	20	21	5.3 $\pm$ 0.4	28
Campo Alegre	61	4.3 $\pm$ 0.3	9	23	6.0 $\pm$ 0.5	10
Nova Itália	22	4.0 $\pm$ 0.5	23	10	6.0 $\pm$ 0.6	25
All groups	312	4.1 $\pm$ 0.1	21	121	5.7 $\pm$ 0.2	23

SO, Surviving offspring; SE, standard error of the mean; LB, livebirths.

that there is variation in the mortality rates among localities. Campo Alegre presents the lowest value (decrease of 10% only in relation to the mean number of livebirths in completed families) and Belém the highest (30%; Table 8).

Sterility is low: only eight of 320 couples with at least three years of cohabitation seem to be sterile. Surprisingly, six of them are among the 67 marriages recorded from Campo Alegre.

**Table 9** Comparison between the Ticuna and other South American tribes in relation to opportunity for selection

Subsistence pattern and tribe	Reference	Selection potential*			
		$I_m$	$I_f$	$I_f/ps$	$I$
<i>Group A</i>					
Xavante	Salzano <i>et al.</i> (1967)	0.49	—	0.41	0.90
Cayapo	Salzano (1971a)	0.34	0.28	0.37	0.71
Yanomama†	Neel & Weiss (1975)	1.22	1.36	—	4.24
Ayoreo	Pérez Dicz & Salzano (1978) (a)	1.17	1.49	1.99	3.16
"	" (b)	0.33	1.56	2.08	2.41
<i>Group B</i>					
Caingang	Salzano (1961, 1963, 1964)	0.69	0.35	0.59	1.28
Cashinahua	Johnston <i>et al.</i> (1969)	0.79	0.11	0.19	0.98
	Johnston & Kensinger (1971)				
Macá	Salzano <i>et al.</i> (1970)	0.56	0.21	0.32	0.88
Terena	Salzano & Oliveira (1970)	0.27	0.28	0.36	0.63
Ticuna	Present communication	0.33	0.15	0.20	0.54

\* Selection potential:  $I_m = pd/ps$  where  $pd$  = premature deaths and  $ps$  = proportion surviving or  $1-pd$ ;  $I_f = Vf/\bar{x}^2$  where  $Vf$  = variance in offspring number in completed sibships, and  $\bar{x}$  = mean number of live births per woman who completed her reproduction;  $I = I_m + I_f/ps$  = Index of opportunity for selection or potential selection; see Crow (1958).

† Calculated by a method that is different from the original one; see Neel & Weiss (1975).

(a) Including infanticides; (b) not including infanticides.

Group A: Predominantly hunters and gatherers with incipient agriculture; Group B: agriculturalists and tribes somewhat acculturated.

A comparison is made in Table 9 between the Ticuna and seven other South American Indian tribes in relation to Crow's (1958) index of opportunity for the action of natural selection. The Ticuna show the lowest index obtained thus far in populations of this ethnic group (0.54). This is because, as indicated, their mortality rates are low; in addition the variance in the number of liveborn children in completed families (8.3) is only slightly larger than the mean (7.4).

#### 4. Discussion

The general picture obtained from these data is that the Ticuna are at present in an active process of "population explosion". Nimuendaju (1952) estimated the total number of these Indians living in Brazil at 2000 in 1942, with 1000 inhabiting nearby countries. Cardoso de Oliveira (1972), based on demographic data obtained in the years 1959-62, suggested that this total would be 3500-4000 in the Brazilian territory, at that time; and Father E. Schwade, who performed a census among them in 1974 reached at a total value of 11,000 (see Cardoso de Oliveira, 1977). Our results are in agreement with the latter figure: not less than 11,000 Indians of this tribe are living now in Brazil.

Some specific data obtained by Cardoso de Oliveira (1964) in his investigations among some of the populations now studied by us are illuminating. Thus, his census of Belém in 1959-62 yielded a total number of 438 persons, while no less than 888 were recorded by us and 1309 by Cardoso de Oliveira (1977). The increase in size of the Umariáçu community is even more dramatic. Cardoso de Oliveira encountered only 268 persons there in 1959; three years later this number had increased to 510 and we registered 1247 individuals there in 1975! In 1959-62 Cardoso de Oliveira recorded as 399 the persons living in the igarapé Preto or São Jerônimo, and individuals belonging to this group were the main source for the foundation of the Vendaval community in 1972. We counted 793 persons there during our field work. Finally, Cardoso de Oliveira (1964) mentions 137 Ticuna Indians living near Santa Rita do Weil at the time of his studies, while in Campo Alegre situated nearby that town our census (which was not exhaustive) registered 1190 persons.

These large increases in the sizes of communities situated along the Solimões river are to a large extent due to two main causes. First, the liberation of the Indians scattered over the small tributaries of the Solimões from the "custody" of the neo-Brazilians who controlled the mouths of these rivers. As was mentioned in the introduction, all exchanges of goods at one time were made through these dealers. The second factor is related to the rise in that region of the Holy Cross religion. Its leader had an important role in making the Indians conscious of their power. He exhorted them to live in large communities, to protect themselves from the outside world.

But these increases cannot be explained in migration terms only. Their high fertility had already been noted by Cardoso de Oliveira (1964). Although their rate does not reach the Hutterite value of 10 children per woman who completed her reproductive period (Eaton & Mayer, 1953), it is still very high. This factor, coupled with the relatively low mortality for groups living at this cultural stage, and low sterility, must have contributed to the population "boom". Perhaps the proximity with the rivers which provide a rich source of proteins, may be responsible for these events.

As was mentioned in the introduction, exogamic rules were very important for the Ticuna in previous times. To this we should add the facility of transportation provided by

the rivers. Therefore, it is easy to explain the large percentage of marriages contracted with persons born in different localities, as well as the large number of sources contributing to the gene pool of present-day communities. But, there are differences among villages in this regard. These differences are probably related to their history and geographical location. Belém is the oldest community sampled. There is evidence of Ticuna Indians working at this place in the twenties, though the first large movement of people toward it occurred in the thirties only. The foundation of Umariçu can be traced to a donation of her large "fazenda" made by Joana Benage dos Santos to the Indian government agency. This occurred in 1945. The three localities studied in detail by us (Vendaval, Nova Itália and Campo Alegre) were all very recent, being formed in 1972 largely as a consequence of Brother José's peregrination. Belém seems to be an irradiating center, persons born there migrating to many other Ticuna groups. The peripheral location of Umariçu and Nova Itália, on the other hand, is reflected in the migration matrix. They receive migrants from many sources, but are isolated among themselves (i.e. no person born in Umariçu married in Nova Itália, for instance).

Comparison with other South American tribes is hampered both by the scarcity of data and by the different ecological settings of these groups. If we consider, however, just population numbers and distribution ranges, we can compare the Ticuna with five other tribes (pertinent information given in Salzano, 1971*b*). The Ticuna population density ( $11,000/181,500 = 0.061$  inhabitants per km<sup>2</sup>) is high, only the Terena of southern Mato Grosso presenting a higher index (0.089). But the Ticuna can move more easily, and as was mentioned, are culturally predisposed to exogamy.

Agriculturalists and tribes somewhat acculturated seem to present, in general, higher fertilities and high mortalities than groups of hunters and gatherers (cf. Salzano, 1972); but, as was seen in Table 9, the indices of opportunity for selection can be low or high independently of this dichotomy. The Ticuna, who rely heavily on fishing and agriculture for their subsistence, and have a long history of contact with non-Indians, show a surprisingly low index. If we now relate this to their relatively high mobility and large numbers, what emerges is the possibility of significant genetic variability, with reduced inter-village differences.

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