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## The Demography of Small-Scale Societies: Case Studies from Lowland South America

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# INTRODUCTION

Kathleen Adams and David Price

The papers in this volume are outgrowths of their authors' participation in the South American Indian Conference, which has been held at Bennington College, at the beginning of every August, since 1977. Ably hosted, since its inception, by Kenneth Kensinger, the conference has become an annual pilgrimage for people who share a bond of fieldwork experience in the same broad geographical region. The conference typically draws thirty to forty scholars who come from all over eastern North America, and sometimes from farther afield. Participants enjoy the quiet and fresh air of Vermont and Bennington College's exceptional food as much as listening to each other's papers. This is a friendly gathering (where no one can help anyone else get a job, since departments do not hire more than one Lowland South Americanist), and intellectual discourse is vigorous and honest. It is a forum in which to try out new ideas, where interpretations can be presented while still embryonic for the reaction of people who have studied similar societies.

Over the years, several demographic papers have been presented, and it finally seemed worthwhile to gather them together in an anthology. The seven papers in this book should be of interest not only to others who work in the same geographical region, but also to those who specialize in the demography of small-scale societies, regardless of their location.

Graduate students in anthropology who are about to go off to the field for the first time are enjoined to "count everything." But of course it is not possible to count *everything*. They have to decide *what* to count. And what they are interested in, as anthropologists (and as people) is people. So people are one of the first things they count.

But the matter is not really that simple. If ethnographers made no distinctions among people, they would only be able to report community size. In practice, they count people according to the events that affect population structure through time: birth, death, and migration. Beyond this, they count according to whatever categories are of interest, from participants in polygynous unions to women who married after their fathers died. Ethnographers expand the universe of categories according to which they count as they come to appreciate variability in the behaviors they observe.

The numbers generated by using categories of age and sex, and the events of birth, death, and migration are of obvious relevance to the traditional interests of anthropologists. Quantitative data of the right sort can provide a sober test of many fanciful notions about how a society works. Sometimes the statistics support a social or economic hypothesis, and at other times they raise more questions than they answer. But quantitative data can have a profound effect on anthropological debate, as in the discussion of female infanticide as a possible regulator of population density in Lowland South America.

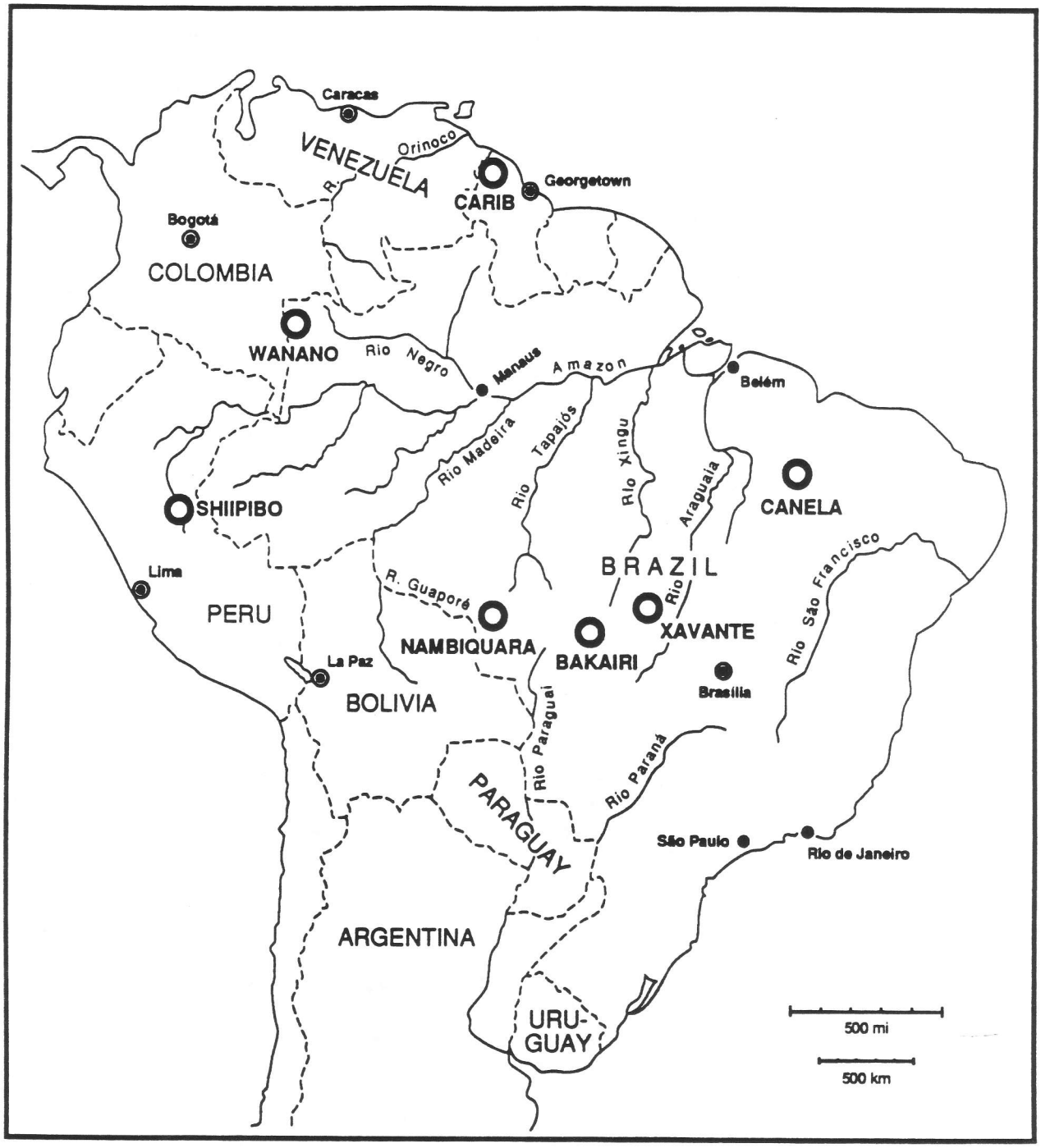
While there is a complex interplay between the dynamics of culture and demographic processes, anthropologists tend to investigate the character of populations by posing questions about culture. Traditional ethnography has paid special attention to aspects of culture that influence fertility. Ethnographers also tend to be interested in the ways in which demographic variables affect people's life decisions, which collectively shape social and political organization. All of these approaches emphasize the flexibility of culture, which may guide demographic behaviors as well as respond to changes in these behaviors.

The groups studied by anthropologists who work in in Lowland South America tend to be small. Some have only a few hundred people—or not even that many. Thus, the demographic data typically collected by anthropologists are not samples drawn from large populations, but an accounting of small populations, surveyed in their entirety. While this accounting is intended to be exhaustive, even extended field trips may yield insufficient data for many demographic questions. Moreover, the low frequency of demographic behaviors in small groups makes it necessary to exercise caution in assessing the validity of inferences based on these data. Nevertheless, small groups—similar to those in which a major portion of the human career has been spent—certainly merit demographic study.

In Lowland South America, local groups that cooperate in productive activities have a variety of marriage patterns. Some groups are strongly endogamous, while others regularly marry beyond the residential population. This challenges anthropologists to discover the links between local groups and the populations that reproduce themselves through time, as well as to explore vital rates within these varying boundaries.

The gene pool of a small, finite population may be markedly affected by cultural principles and the political delineation of relations among constituent groups. Disruptions in a local group may change its relation to the regional population, especially with regard to the frequency of exog-

Northern South America
Showing the Location of Featured Societies



amous unions. Famine, disease, and migration may expose a group to the possibility of extinction, while population growth may result in a reconfiguration of marriage practices, within and between groups.

Some of the societies discussed in this book have barely managed to survive the onslaught of Western expansion. Now, many of these societies are undergoing rapid population growth. High fertility is accompanied by continuing risks to survival along the life course, particularly during childhood. In this respect, these Lowland South American societies and many developing countries share a common problem.

The papers in this anthology vary in focus according to the training and interests of their authors. Some writers are knowledgeable about demography as an academic discipline, while others have no particular sophistication in the subject, but work from the conviction that a well-rounded ethnographic account must contain information on population. The societies described span a vast region, from the forests of Guyana to the savannas of Mato Grosso. All are traditional societies which, until quite recently, lived on their own terms, with varying degrees of economic and political autonomy. They have come into contact with Western society (which has been expanding geographically because of its own population growth), and the consequences are evident in population changes. Unfortunately for students of the human potential, it was not possible to study these societies while their people were still free and independent. But studying them both socially and demographically during the process of transition yields occasional glimpses into the way things were, and provides other insights into the way things change.

Kathleen Adams, the first coeditor of this volume, is trained in both social anthropology and public health. Her paper illustrates the way social organization grows from strategic decisions that are rooted in a demographic context. She focuses on the fortunes of a single family of Barama River Caribs, in Guyana, over the course of four generations. Marriage choices that seem, at first, anomalous turn out to make good sense as responses to changing demographic pressures.

Janet Chernela studies the sociology and ecology of the Northwest Amazon as seen from the perspective of the Wanano, a Tucanoan-speaking people of the Rio Vaupés. She is concerned with the Boasian question of correlation (or lack thereof) among race, language, and culture in an unusual region where congruent linguistic and social units impose no barrier to the flow of genes. She offers a cautionary note to demographers and human biologists with regard to how they define a population.

Nancy Flowers' demographic survey of the Xavante of eastern Mato Grosso at Pimentel Barbosa is noteworthy for the extensive data that she was able to collect. Her persistence and attention to detail yielded impressive results in the notoriously difficult task of recording reproductive histories. The rapport that she was able to develop as well as her concern with the reliability of her findings enabled her to put together a data set that can be confidently interpreted in terms of many traditional demographic concerns.

Debra Picchi studied the Bakairi, who are also located in Mato Grosso, to the west of the Shavante. She presents a community study with data on household and settlement composition, marriage, fertility, and mortality. The Bakairi have been in contact with Western society for a relatively long time, and Picchi is particularly interested in factors that affect overall community size. She suggests that a relatively moderate rate of increase may be due, at least in part, to the Bakairi's retention of fertility-inhibiting cultural practices.

The study of the Canela, a Gê-speaking group in central Maranhão, represents a collaboration between coauthors professionally trained in demography (Margaret Greene) and anthropology (William Crocker). The Canela have a long contact history as well as a tradition of sexual practices that might be expected to produce extremely high fertility. Crocker's field experience is unusually long and his understanding of the Canela exceptionally detailed; Greene's incisive treatment of his demographic data provides a statistical counterpoint for his cultural observations.

David Price, the second coeditor of this volume, presents a discussion of demographic issues among the Nambiquara, who live in western Mato Grosso. While he makes use of every scrap of available evidence, the central corpus is a continual record of births and deaths over the course of a ten year period from 1976 to 1986. Price gives a frank account of the difficulties of reliably registering demographic information over such an extended period. He presents material on fertility and mortality, takes a speculative look into the demographic past, and attempts to make sense of apparent anomalies in the data on female mortality.

Warren Hern's concern with population growth among the Shipibo of the Ucayali River Basin in Peru grew out of his commitment to their welfare. He first worked among them as a young medical doctor. His discovery that women's health and the society's overall prospects were seriously affected by the extremely high rate of fertility led him to go back to school, where he earned a doctorate in demographic anthropology. He is able to show, with a high degree of statistical precision, that the abandonment of traditional cultural practices is contributing to the growth rate.

Three important concerns are interwoven in many of these papers. First, there is attention to the quality of data. Can one get valid data for small-scale societies, just coming into contact with Western society, whose people don't use number systems or calendars, don't want to talk about the

dead, change their names from time to time, and don't understand why anyone would want to know all these personal things anyway? Second, there is a goal, however difficult to achieve, of placing Lowland South American Societies in historical time. The encounters of past generations with historical events are investigated for their consequences, including population change, for the society as a whole. And third, there is an attempt to place individuals in their social context without reducing them to that context. This is a traditional anthropological perspective, enriched by the new demographic data developed here.

In addition, there is a general concern with the welfare of the people studied. It is worrisome that tribal peoples tend to abandon traditional practices that limit population growth at the very time when their available resources are being restricted through the assignment of small, defined reservations for their future use. Perhaps a record of population data about small-scale societies and the trends that affect them during acculturation will be of some help to agencies responsible for their welfare. It may not be long before indigenous people will, themselves, be among the agency personnel concerned with population issues.

# DEMOGRAPHIC CHANGE AND MARRIAGE CHOICES IN ONE CARIB FAMILY

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The Barama River Caribs have taken up the process of reproducing their society without real property, immediate neighbors, or reliable markets for labor or goods. In addition, they have faced a racism that effectively excluded them from opportunities in the coastal centers of Guyana. During the twentieth century, the Barama River Caribs have bridged hard times and entered into relative prosperity. In the following paragraphs, oblique marriage and population change are explored in the transitions from generation to generation in this small population.

During 1932–33, Gillin (1936:113) estimated a Carib population of not more than 600 for the entire Barama River area of what was then British Guiana. Ten of the 33 settlements were located above the falls at Towakaima (Gillin 1936:110). The more remote settlements included Sawari, which Gillin studied in more detail. The people at Sawari had regular contacts with the surrounding settlements, but were out of touch with the settlements further up the river (Gillin 1936:111). The group centered at Sawari called itself Bottomside people in contrast to the Topside people on the headwaters of the Barama River.

The two groups of Caribs in the first twenty-five miles of the Barama River were examples of the minimal-level adaptation common among Caribs in the rain forest. The tendency was for a small population to pioneer an area, seek refuge, or risk a new opportunity for subsistence. In these cases, the population engaged in local productive relations was identical with the reproductive population. Central to social organization was direct marriage exchange resulting in concentrated kinship relatedness. Butt Colson (1971:88) explains that such societies are marked by a "simple, undifferentiated structure, tightly knit yet flexible within its own parts."

While the two Carib groups in the upper Barama River referred to each other as relatives, they remained separate except for occasional visiting. Each group secured subsistence through fishing, hunting, and slash-and-burn cultivation of cassava. Settlements were relocated as new fields were cut. Each group allocated marriage partners in an essentially endogamous manner. Together, the larger Bottomside group and the Topside group, which had fissioned from it, comprised about 200 people in 1932–33.

Economic fortunes for the Caribs have had a boom and bust vacillation, as in other frontiers of South America. Over time opportunities to work in gold mining have been important to this group's demographic change. By 1971, the Carib population was localized around Baramita Air Strip in the Topside region. While some of the Bottomside people had drifted to the Barama mouth, others joined Topside people in a new settlement that numbered 333 in 1971. Carib household patterns (Adams 1979) and reproductive patterns (Adams 1981) changed with the extension of the regional economy into this remote rain forest area.

The goal of this paper is to examine two grandfather-granddaughter marriages which occurred among the Topside Caribs (Adams 1977). The granddaughter marriages of two men, father and son to each other, are placed in the context of demographic adaptation in a small, highly endogamous population. Figure 1 details the immediate relations of those involved in the grandfather-granddaughter marriages. Jack Raymond, a key figure, provides a reference point for these family members. The estimated birth dates, checked through the convergence of many interviews, are included. Two of the individuals were deceased at the time of my fieldwork in 1970–71.

Jack Raymond's father (born ca. 1870) was one of several brothers who left Bottomside and started new settlements in the headwaters. This migration coincided with a flourish of mining activity in these headwaters during the gold rush at the turn of the nineteenth century. By the 1920s, these early claims had been left derelict and the Caribs, who had initially worked for the miners, stayed behind, hoping to gain their subsistence from the rain forest.

Attempts to identify specific individuals in the Topside founding population revealed the way in which family history blended into kinship ideology. Caribs were asked to remember their grandparents' generation to no avail. Individuals knew their own parents' histories but merged other relatives in their parents' generation with the categories of the ideal kinship universe. While men are grouped into fathers, and fathers' brothers, and another category of mothers' brothers in the first ascending generation, in the second ascending generation all men are grandfathers. In addition, Caribs have a tendency to change names, have several names, or use names of reference. I could not determine how many men had been among the group of pioneering "brothers."

The preferred pattern was for a group of brothers to live near each other. Due to small population size, it was usual for them to be married to women who were sisters or classificatory sisters to each other. Remarriages between these same categories repaired rends in the social fabric. As daughters

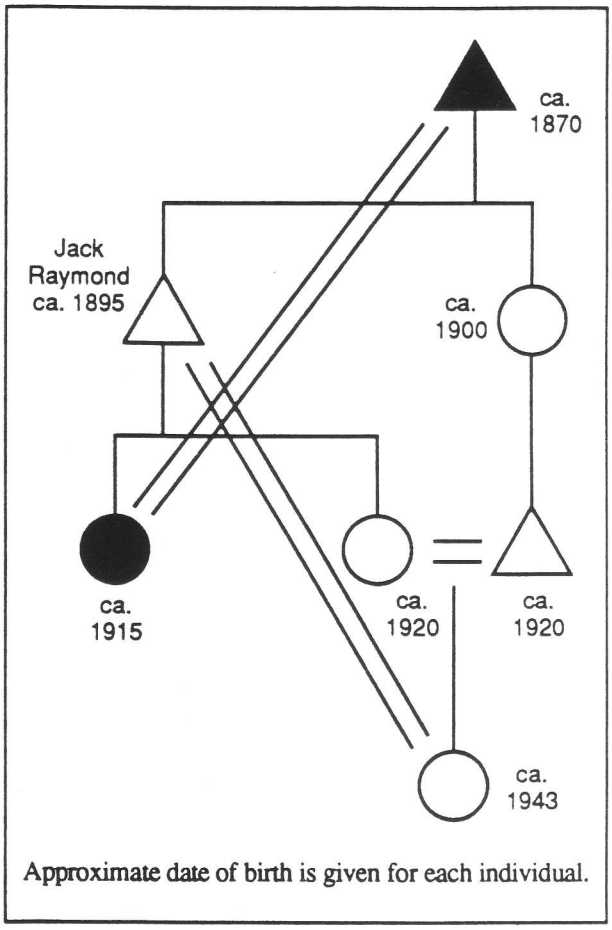
matured, they selected boyfriends from among candidates who were their mother's brothers' sons and usually their father's sisters' sons as well. These young men worked for the family of their bride-to-be. Extra youths were included in plural marriages. As these young couples had children of their own, a new generation of brothers emerged and eventually established its own settlement cluster. In such a small, endogamous population, fertility rates and child mortality rates affected the numbers of those in early adulthood making the life course transition to marriage. As would be expected, contingencies in available marriage partners and vagaries in subsistence resources intervened in the realization of ideal social relations.

The earlier grandfather-granddaughter marriage occurred after the death of the wife in a small family of parents and two daughters. The cause of this death was not recalled, but the Caribs described the 1920s, when it happened, as a time of hardship. In a highly unusual reaction, the husband, Jack Raymond (born ca. 1895), left the Topside area. Accordingly, his own father and mother took care of the couple's older daughter, who was about five years old at the time. The younger daughter was a nursing infant. Jack Raymond's younger sister (born ca. 1900) had just had a baby of her own, and she took care of this orphaned infant as well.

In less than ten years, Jack Raymond's mother died. Jack Raymond's father was then in his sixties and kept as his own wife the granddaughter he was raising (as his daughter). At least at first, the couple removed to a remote part of the forest to seek relief from group discontent about their marriage. Just as Jack Raymond chose to leave the headwaters after his wife's death because there were no available marriage partners, his father faced the same dilemma with regard to his own prospects for a wife and for a son-in-law for his granddaughter. Within ten years of initiating their marriage, both the grandfather and granddaughter had died. Their two surviving children were raised by relatives.

Baird, an entrepreneur from the coast, chronicled his activities to reinstate gold mining in the Topside area in 1932: "The Amerindian men complained of fever, and from the fat-bellied appearance of a small boy it appeared that they were suffering from round worm and maybe other parasites" (Baird 1982:23). In his reconnaissance of Topside, Baird noted about 35 people near the abandoned mining camps. Malaria accompanied the initial gold workings and remained after the first miners left. Baird (1982:22) reported that the Topside population continued to be severely affected by malaria: "Due to illness, mothers had no milk to breast feed their offspring, and most of the new babies did not survive the fever." Baird and his partners hired Carib men, including Jack Raymond's father, to haul supplies, cut trails, and do other tasks preliminary to gold mining. Before these men could work, Baird often gave them medicine for malaria.

Figure 1.
Grandfather-Granddaughter Marriages




Approximate date of birth is given for each individual.

Another glimpse of the Caribs in the 1930s is gained in Gillin's (1936) ethnography of Sawari. The ideal of a set of brothers who took the leadership of a cluster of settlements remained strong, while the group itself absorbed those who had survived the death of their spouse and subsequent disruptions of social organization (Adams 1983–84). Men who had lost their wives and had little prospect of remarriage within their category of cross cousins tended to seek out real or classificatory sisters. These female relatives were a second line of defense for the men left widowed during the hard times of the 1930s. More than a wish to be included in the subsistence enterprises of a local population, the strategy was to secure a spouse, usually a sister's daughter.

Jack Raymond, who had left Topside after the death of his wife, appeared in Sawari at this time. He was about 35 years of age (Gillin 1936:111, 115, 126), and had a new family. He was married again, and he and his wife had two sons. His relation to the headman was figured through deceased females in the ascending generation. The direct relationship which led him to join this settlement in the 1920s had been erased in the death of relatives by the time of Gillin's ethnography. No kinship information was re-

corded about Jack Raymond's second wife. As one who pursued a second chance among those who were not close relatives, Jack Raymond remained in the periphery of political relations among the Bottomside group.

While the local gold mining economy was building in the Topside region, the Caribs in Bottomside continued to face economic hardship. Peberty visited the Bottomside Caribs in late 1945 and early 1946. He reported on morbid conditions and high infant mortality (1948:15): "The upper Barama River Caribs are the most impoverished and traumatic group that I have encountered throughout the length and breadth of British Guiana" (Peberty 1948:20).

In contrast, the Caribs in the headwaters were experiencing the beginning of another economic boom by the late 1930s. When Jack Raymond's younger daughter came of age in the 1930s, she married the age mate with whom she had grown up. While her spouse was her cross cousin, an ideal match, they had been raised as siblings. Her husband's true sibling, a younger sister, married her own mother's younger brother. This was one of five sister's daughter marriages among the Baramita Air Strip population in 1971. Another 22 men had married their direct cross cousin.

Among Carib groups with larger populations, sister's daughter marriage affects the terms of brideservice (Thomas 1982). Among Carib groups more isolated from cycles of the market economy, political dimensions between father-in-law and son-in-law take precedence in this marriage pattern (Rivière 1984). A measure of success in recovering population size seems to have permitted the Barama River Caribs to reduce their reliance on oblique marriage to allocate marriage partners.

Jack Raymond's younger daughter entered childbearing in the 1940s when conditions had greatly improved for the Topside people. Subsistence production was supplemented by regular employment in gold mining again. Through the 1940s until the curtailment of his mining activities in 1969, Baird hired Carib men. This daughter's husband was a steady employee and eventually a foreman. Women with employed husbands stopped participating in subsistence horticulture. They used their husband's wages to purchase supplies at the mine's store. Other households satellite to the mine turned to the production of cassava and hunting to supply the trade store.

Unlike her adoptive mother who had two surviving children, Jack Raymond's younger daughter had ten surviving children. This level of fertility emerged as a pattern among her generation of women at Topside. A married state continued to be common for all adults. Those who had been widowed or divorced were remarried. For women this sometimes meant joining a sister's or a classificatory daughter's marriage. Young women tended to become pregnant for the first time between the ages of 18 and 22. After this women tended to give birth to a child every 20 to 30 months for about 25 years. According to this pattern, every fertile woman had the potential to have about 12 children. The women in monogamous as well as polygynous unions tended to realize this potential.

Table 1.
Reproductive Careers of the Women
at Baramita Air Strip, 1971

| Age | N | Range in no. of surviving children | Mean | Standard deviation |
|---|---|---|---|---|
| under 25 | 18 | 1–4 | 1.8 | 1.0 |
| 25–39 | 27 | 1–8 | 4.0 | 1.9 |
| 40–54 | 7 | 4–12 | 9.1 | 2.4 |
| 40–44 | 4 | 4–12 | 8.3 | 2.0 |
| 45–54 | 3 | 10–11 | 10.3 | 0.4 |
| 55 and older | 7 | 2–5 | 4.3 | 1.0 |

Among the population at Baramita Air Strip in 1971, 62 women had borne children. The reproductive histories of 59 of these women, including all of the women surviving from the 1930s Topside group, are summarized in Table 1. These data, as well as the estimated birth dates presented earlier, were double-checked and cross checked in many interviews. It is clear that the reproductive careers which occurred after 1940 are different from earlier careers. Women in the age category 40 to 54 evidence a new pattern of 20 to 30 month intervals between births. The fertility of the Carib women was affected by the reintroduction of employment and market opportunities with gold mining. In the 1960s, new nationhood for Guyana brought regular malaria control and access to medical care for the Caribs.

The number of children surviving range between 2 and 5 for those women who are 55 and older. The range is 4 to 12 for the women between 40 and 54. In other words, the 7 women 55 years of age and older had had a total of 37 children, of which 30 survived to adulthood. By 1971, the 7 women aged 40 to 54 had had a total of 81 children, of which 64 survived. The mean is 4.3 (s = 1.0) children surviving to adulthood for the women 55 and older. Some of their reproductive years occurred in the time of economic prosperity which began in the 1940s. Almost all of the reproductive years of the women aged 40 to 54 coincided with the economic boom ushered in with the reinstatement of gold mining in the 1940s. For the women 40 to 54, the mean is 9.1 (s = 2.4) surviving children. This is more than double the previous rate.

Of course the above portrait of the Topside population is limited by the dynamic nature of population processes. For a group which has no written or oral records, it is difficult to inquire into the fertility of those who are deceased. The comparison of fertility among adult women is based on those who are survivors at one point in time. In addition, some of the younger women had not finished their reproductive careers. This age category is divided in the table so that further potential for reproduction is evident.

The increased number of children affected many aspects of Carib life. During the earlier period of hardships, children were available for adoption only when parents died. During the 1920–30s, a mother usually had too few children to release any for childless relatives. As mentioned, Jack Raymond's younger daughter, who began her reproductive career in the 1940s, had ten surviving children, and she and her husband shared some of their female children with relatives. In this way, her father and his second wife obtained two daughters.

About 25 years after his departure, Jack Raymond returned to Topside and the renewed economy of jobs in gold mining. He brought with him his second wife and an adolescent son who would be seeking a wife. Jack Raymond and his immigrant wife adopted his daughter's two daughters (born ca. 1941 and 1943). Eventually, Jack Raymond's son became the husband of the older daughter. Jack Raymond outlived his second wife. At that time he was in his 60s as his father had been when he had faced a similar situation. Jack Raymond kept his co-resident granddaughter, the younger of the two granddaughters he was raising as daughters, for his own wife.

The earlier grandfather-granddaughter marriage took place under conditions in which survival was at issue due to high mortality, the burden of disease, and meager subsistence opportunity. The later grandfather-granddaughter marriage took place as the first wave of children born in the new pattern of increased fertility and reduced mortality reached maturity. The age structure of the Baramita Air Strip population is presented in Table 2. The marked increase in births and surviving children occurs first among the cohort which had been born from about 1942 to 1946 and were about 25 to 29 years of age at the time of this inquiry. Jack Raymond's granddaughter (born ca. 1943) was in this larger size cohort. The fertility change affected the number of males as well as females, but the marriage pattern remained one of husbands seeking first wives who were several years younger than they. Consequently, there was reduced pressure for wives on the increased number of females in the initial larger cohort. Also, in the serendipity of a small population, there were 15 males in contrast to 26 females among those aged 30 to 49, the adjacent cohorts of adults. In these circumstances, the second grandfather-granddaughter marriage took place.

The domestic activities of his wife and the support of his extended family certainly helped Jack Raymond achieve the distinction of being the oldest person at Baramita Air Strip in 1971. Jack Raymond's prospects for obtaining his own wife among age mates would have been dim, at least among the survivors in 1971. In the group 55 years of age and older, there were approximately two men for every woman (sex ratio 185.7). Once Jack Raymond and his granddaughter began to have children, they were accepted as a couple.

Table 2.
Age Structure of the Baramita Air Strip Population, 1971

| | male | | female | |
|---|---|---|---|---|
| | N | % | N | % |
| 70–74 | 1 | .6 | 1 | .6 |
| 65–69 | 2 | 1.1 | 2 | 1.3 |
| 60–64 | 5 | 2.9 | 1 | .6 |
| 55–59 | 5 | 2.9 | 3 | 1.9 |
| 50–54 | 2 | 1.1 | 1 | .6 |
| 45–49 | 4 | 2.3 | 3 | 1.9 |
| 40–44 | 4 | 2.3 | 9 | 5.7 |
| 35–39 | 4 | 2.3 | 6 | 3.8 |
| 30–34 | 3 | 1.7 | 8 | 5.0 |
| 25–29 | 16 | 9.2 | 15 | 9.4 |
| 20–24 | 11 | 6.3 | 13 | 8.2 |
| 15–19 | 13 | 7.5 | 16 | 10.1 |
| 10–14 | 17 | 9.8 | 21 | 13.2 |
| 5–9 | 33 | 19.0 | 22 | 13.8 |
| 0–4 | 54 | 31.1 | 38 | 23.9 |
| Totals | 174 | | 159 | |

Population total 333

At first, there were fist fights over Jack Raymond's marriage during the drinking at parties, but Jack Raymond did not take part in any of them. Small in stature and physically frail at this point in his life, Jack Raymond was no match for any of the younger men who fought among themselves about his marriage. Everyone remembers, however, that Jack Raymond was regularly present. He was the only accomplished fiddle player among the Topside people, and was sought out for all get togethers.

The two couples, the second grandfather-granddaughter pair and his son and son's wife, who was the older sister of the wife just mentioned, had their households in a shared clearing. The father and son had remained together into the adulthood of the son as was common among those who obtained employment in the gold mining economy (Adams 1979). The sisters helped each other with child care and domestic chores. Together they frequently visited their mother and brought along their many children. The fertility of these young mothers was similar to that of their peers.

In 1941, 44.1 percent of the Baramita Air Strip population was under 10 years of age. From July 1970 through June 1971, 25 children were born to the group. All survived. This high rate of population growth arose from the youth of the women as a subgroup; 85.9 percent of the women 15 years of age and older were under age 45. Expressed as a crude rate of birth, there were 81.2 births per 1000 population. Expressed as a general rate of birth, in this case the ratio of births to women between ages 15 and 44, this was 373.1 births per 1000 population. Informal reports indicated that the population growth rate has declined in the aftereffects of the shutdown of mining since 1971.

It goes without saying that the Caribs themselves realize that the two grandfather-granddaughter marriages did not measure up to social ideals—their own or those of others. The Caribs were particularly careful to mention the reservations that existed at the initiation of each marriage. A focus on group process may come closer to placing these oblique marriages in social context than attention to prowess in exchange or political relations. When the earlier grandfather-granddaughter marriage occurred in the 1930s, the Topside Caribs were a remnant group facing extinction. In contrast, the second grandfather-granddaughter marriage took place at the height of an economic boom accompanied by rapid population growth. In both cases the individuals involved in the marriages acted in conjunction with family members, including groups of mothers, daughters, and sisters, who shepherded relations among themselves toward the goal of inclusive survival.

There is a considerable risk of extinction for a very small, endogamous population, and this no doubt has occurred time and again among groups in the interior rain forests of the Guianas. Wobst has calculated a minimal equilibrium size, "the number of people which can consistently provide group members with suitable mates upon reaching maturity" (1974:157). This is not a constant, but influenced by sex ratios, rates of fertility and mortality, and the rules for marriage. Wobst has determined that a minimal size of 175 to 475 will allow most individuals to find a spouse.

In the 1930s, the Topside Caribs numbered about 35, well below a minimum size to maintain social continuity. But this small group of Caribs did survive this difficult period in their history, and by the 1960s their population was growing rapidly. The oblique marriage initiated during the return of prosperity points to a Carib habit of including everyone. Unlike his father's granddaughter marriage initiated in the 1920s, Jack Raymond's granddaughter marriage was not strategic to society building or to group survival. This was an older man's third marriage with a second daughter. This later oblique marriage was accommodated in a society recovering population size and a resource base for subsistence.

The grandfather-granddaughter marriages described here can be understood in the context of group process and population change. Patterns of adopting children, availability of marriage partners, and economic opportunity converge differently for each example. The individuals in the two oblique marriages were differently situated in their cohorts, yet both the men and the women were at similar life-course stages when seeking a marriage partner. Certainly many motivations and strategies could be listed for the initiation of these marriages. These grandfather-granddaughter marriages received both support and opposition, but no one was ostracized, for long, from the group.

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# WHAT IS A POPULATION?
# SPOUSE IMPORT IN THE NORTHWEST AMAZON[1]

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All too often, scholars who conduct research on human social groups rely on short-hand devices in order to compare units of analysis.[2] One of the most frequently used, but rarely defined, concepts is "population." Assumptions underlying the term suggest an equivalence or close relationship among geography, language, effective breeding population, and group name that may not be tenable. The Wanano provide a case in point. They and similar groups in the Northwest Amazon challenge our notions of language groups as localized pools of in-marrying individuals. They raise important questions about language-sharing populations as bounded entities and overturn the commonplace assumption that linguistic differences impede the interaction of personnel and the flow of genes.

Societies in the Northwest Amazon counter these assumptions because, there, diverse groups share an imperative to marry *across* linguistic and geographic barriers. Drawing on the example of the Wanano[3] of the Brazilian Northwest Amazon, who speak a language of the Eastern Tukanoan family, I will outline the principles governing descent, marriage, and residence, and discuss their consequences for village composition. Specifically, I will discuss the implications of spouse importation in three Wanano villages. I will then return to the problem addressed at the outset: To what extent is the term "population" a useful concept in comparative studies?

## Language and Marriage in the Northwest Amazon[4]

The Wanano homeland is part of the Central Northwest Amazon, which consists of the drainage basin of the Uaupés River and adjacent areas in Colombia, Venezuela, and Brazil (see Figure 1). The Wanano who live in Brazil number between 500 and 600. When we add the approximately 180 Wanano who live on the southern (Colombian) bank of the Uaupés, and the 800 Wanano said to live in the Colombian Vaupés[5] Territory (Waltz n.d.), we can estimate the total number of Wanano at approximately 1,500 to 1,600.

Wanano settlements are situated from 3 to 24 kilometers apart along the middle course of the main river, from Jandhú Cachoeira in Brazil to Uarucapury in Colombia.[6] These settlements, which are located at permanent sites on high ground along the river margin, contain from 17 to 160 persons.[7] At each settlement a path leads from the river through the cleared occupational area to the surrounding forest and gardens.

The Wanano are sedentary fisher-horticulturalists, with fish providing the principal source of protein, and manioc the principal source of carbohydrates. Men specialize in fishing activities, while women specialize in manioc cultivation and preparation. Minimal exploitation of resources characterizes day-to-day life; periods of intensive exploitation occur prior to occasional exchange ceremonies.

The Wanano are one of 15 to 20 unilineal kin groups or tribes[8] in the Central Northwest Amazon. Each group possesses its own language, yet all share a common cultural framework and are linked in a network of intermarriage. The speakers of each language are seen as a descent group, with rules of exogamy requiring that members marry speakers of a different language.[9] In this broad regional network, marital and kin ties unite some 14,000 Indians[10] of diverse languages over an area of approximately 150,000 square kilometers.[11]

The cluster of Eastern-Tukanoan-speaking societies to which the Wanano language group belongs is located in an area roughly delineated by the Uaupés River and its affluents along the Brazilian-Colombian frontier. Arawakan-speaking groups live to the north, south, and northeast, and Cariban-speaking groups to the west. These neighboring groups occasionally enter the Tukanoan system of extratribal marriage but do not subscribe to rules of linguistic exogamy (Chernela 1989).

Sorensen (1967) suggests that the Eastern Tukanoan languages differ from each other somewhat more than languages of the Romance or Scandinavian groups. He identifies 13 languages as members of the Eastern Tukanoan family: Tukano, Tuyuca, Yuruti, Paneroa, Eduria, Karapana, Tatuyo, Barasana, Piratapuyo, Wanano, Desano, Siriano, and Kubeo.

The cluster of groups speaking Eastern Tukanoan languages constitutes one of the world's few stable multilingual settings. The rules of linguistic exogamy produce an overarching unity among diverse and sometimes distant language groups, resulting in a coherent culture complex with unilineal descent and cross-cousin marriage as major integrating structural principles.[12]

## Social Organization

The language group, embedded in a nested hierarchy of exogamous patrilineal groupings, is the fundamental unit of Northwest Amazon identity. Distinguishing relatives linked through father from those linked

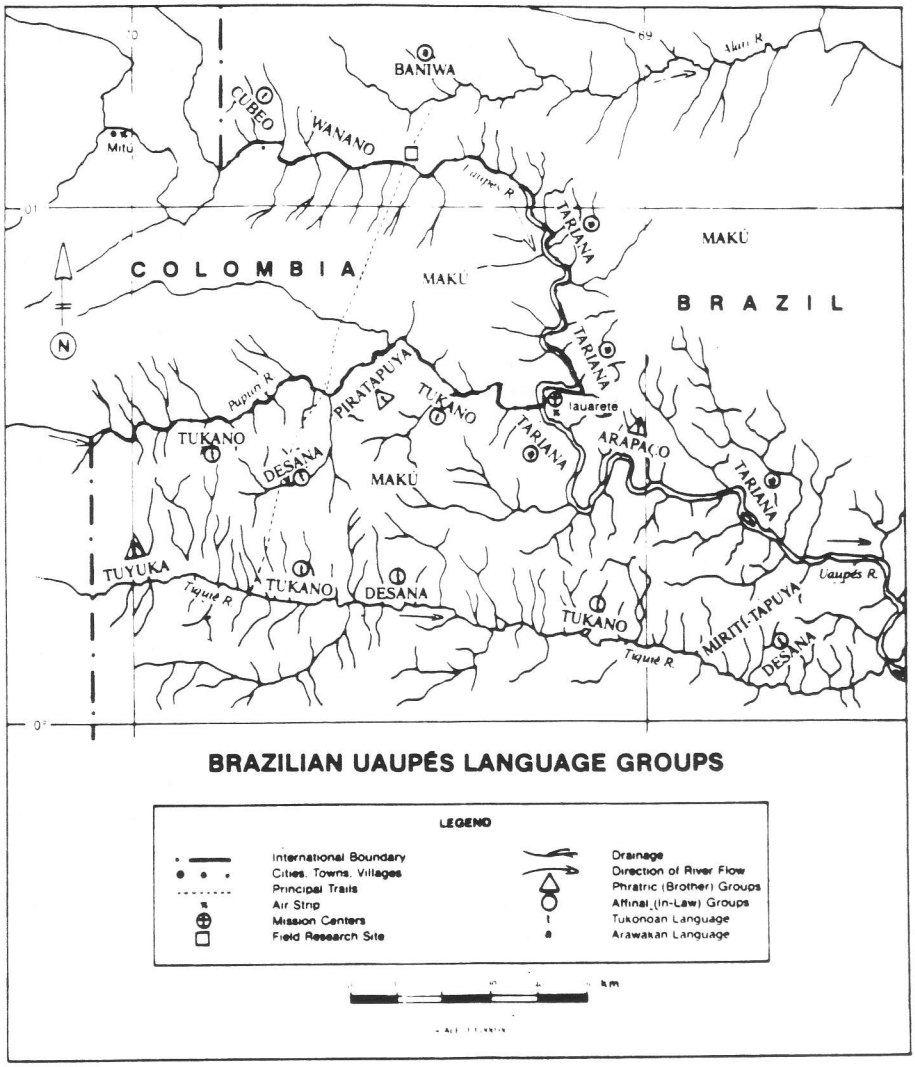


Figure 1.
Map showing location of language groups in the Brazilian portion of the Uaupés basin. Groups in phratric relation to the Wanano are indicated by triangles; groups in affinal relation to the Wanano are indicated by circles.

through mother, the Wanano recognize three increasingly inclusive levels of organization: the sib, the language group, and the phratry.

1. The *sib* is a patrilineal descent group having corporate functions. The sib performs daily subsistence activities and makes ceremonial exchanges. The sib is generally localized, and postmarital residence is usually patrilocal, although there is some degree of situational variation.[13] The sib, as well as the language group and the phratry, described below, is an exogamous unit.

2. The *language group* is a nonresidential association having common identity, language, ancestry, and group name. Membership, based upon the sole criterion of patrilineal descent, is ancestor-oriented, although ancestors are designated rather than demonstrated. Membership in the language group is mutually exclusive.

The settlements of a language group are often, but not always, geographically continuous. The language group may, in theory, perform ceremonies as a corporate unit. However, large ceremonies that called together Wanano from all nearby settlements drew attendance from a river distance that never exceeded, during my visit, 25 kilometers. While Wanano recognize all other Wanano as kinsmen, they may in fact have little or no contact with the Wanano of distant settlements.

3. The *phratry* is a nonresidential association of several (ideally five) language groups. The phratry that includes the Wanano also includes four other language groups: the Piratapuyo, Arapaço, Siriano,[14] and Tuyuka (see Figure 1). Members of a phratry share a concept of common brotherhood, prohibit intermarriage, and employ kin terms in address.

Each of these three categories (the sib, the language group, and the phratry) constitutes an "in-group," phrased in terms of kinship, of increasing magnitude. Social ties are stronger in the smaller, more intimate groups, and weaker in the larger, more impersonal groups. But even though relations at the highest level (the phratry) are weak in practice, they remain strong in a normative sense. The metaphor of siblingship unites agnatic groups at every level. Each level of agnation is conceptualized by its members as siblings who trace descent from a set of ancestral founding brothers, with the founding Eldest Brother the focal ancestor of the entire group. Bonds of brotherhood are seen as permanent, with the sentiment of fraternal solidarity characterizing relations between members.

From the perspective of the Wanano and all other members of their multilanguage phratry, the world is divided into two complementary units: "siblings," who are "our people," comprising lineal and parallel kin, and "others" or outsiders, who are marriageable. Since marriage or sexual relations with anyone in one's own language group (or phratry) is considered incestuous, one may only marry a member of a *different* language group. Sibs of language groups belonging to other phratric associations continually renew their relationship through marriage exchange.

Kinship terms reflect this system of unilineal descent and out-marriage. Wanano kin terminology is of the cross-cousin or two-line type (Dole 1991), a pattern found with frequency in all parts of the world.[15] Wanano of the same generation address and refer to one another as siblings. Those in ego's sibling category include the children of father's actual brothers, as well as the children of all Wanano males of father's generation. This system of kin classification does not segregate cousins of differing degrees of collaterality to ego. For participants in such a system, kin "proximity" is a consequence of descent group membership rather than the genealogical distance between individuals (Chernela 1992, 1993).

Two strongly stated preferences govern marriage practices: marriage with a patrilateral cross-cousin and sister exchange. The rule is that spouses be taken only from among father's sisters' children and mother's brothers' children, who constitute the cross-cousin category, or *tanyu/o*. Members of this category include father's or mother's actual siblings' offspring as well as the offspring of any one of father's classificatory sisters, or mother's classificatory brothers. This amounts to all cousins in mother's language group and no cousins in one's own group.[16]

Patrilateral cross-cousin marriage carries with it no obligation or compulsion to perpetuate exchange (Lévi-Strauss 1969), for each direct marital exchange, once balanced, is final. However, the Wanano combine this "discontinuous exchange" with a preference for marriage into the same sib over generations. Sibs both maintain ongoing marriage alliances with other sibs and may also forge new marriage alliances where ongoing affinity has not been previously established. In such a system new populations are easily accommodated as in-laws. Oral histories provide evidence that existing affinal groups were formerly at war, and sentiment and ritual still characterize the relations among in-laws as hostile. Unlike brotherhood, in-lawhood is seen as artifice, a contractual arrangement subject to the fluxes of history.

*Sister-exchange* marriages are considered to be exchanges between sibs and are arranged by the sib seniors. When a simultaneous exchange of women occurs, the marriage is called *coto taricoro*, "woman exchange." When the negotiation is not immediately reciprocal, it is called *pubuhseri manenicoro*, "no woman given in exchange," indicating that until a return is made, the debt is outstanding. During my stay in Yapima in 1978, a woman whose daughter had married four years earlier complained because no return had yet been made, and her 18-year-old son was wifeless. A claim is made when a wife is needed; otherwise, a debt may remain outstanding for many years. In this case the debt was repaid when a female became eligible in 1981, three years after the claim was issued. Once the exchange is reciprocated, the term implying indebtedness is no longer used.

Because of strict adherence to rules of patrilocality, males inhabiting the same settlement are members of one language group. In contrast, because of the rule of linguistic exogamy, all in-marrying females are members of *other* language groups. In the Wanano village of Yapima, where I conducted fieldwork, the eight in-marrying wives derived from five different language groups.

Since descent is reckoned through the father and the language group is conceptualized as a descent group, the term Wanano refers to persons born of Wanano fathers. This includes Wanano females who will leave their native villages to live among their husbands' groups—speakers of other languages. Their children will belong to their husbands' groups and speak their husbands' languages. The children will be regarded as *paye masono*, a term meaning "others," as they are not Wanano. Yet they are, more often than not, the sons and daughters of Wanano mothers.

The daughters of out-marrying females are expected to "marry back" and become the in-marrying wives in a Wanano settlement. Older wives try, when possible, to have a brother's daughter marry one of their sons.[17] This is a favorable arrangement for both the older and younger woman, for they are from the same village of origin and speak the same language. Moreover, the younger woman's mother-in-law is her aunt, and the two refer to one another with reciprocal address terms of intimacy. When this practice is carried on over generations, the women are said to be "marrying back."

The village of Yapima, in which I was based, consisted of two sibs: the Wekbea and Yahuri. Of a total of eight marriages in this settlement, all but two men had taken as first wife their father's sister's daughter at the sib level—i.e.,

the daughter of a woman from their own sib. However, these non-Wanano, in-marrying women came from six different settlements, each of which maintains ongoing marital ties with the Wekbea and Yahuri. In the exceptional cases, one man married a father's sister's daughter of greater kinship distance (her mother, although Wanano, was not from the husband's sib), and the other married his mother's brother's daughter.[18] One 23-year-old Yahuri man married a 40-year-old father's sister's daughter: the discrepancy in age was less important than the suitability of category.

The practice of cross-cousin marriage has significant implications in terms of language usage. If a man marries his father's sister's daughter, he is assured a spouse whose mother speaks his own language; with mother's-brother's-daughter marriage, a man is assured a wife whose own language is the same as his mother's. Sibs that maintain ongoing marital ties with more than one other sib attribute this practice to ancestral precedents and the maintenance of affinity. One member of the Diani sib told me: "[The ancestor] Diani married a Desano woman, but his brothers married Baniwa women."

### Residence, Marriage, and Demography: Case Studies of Spouse Importation

The implications of the rules and preferences governing marriage choice and constraint are realized differently throughout the field of marriageables. One important factor affecting the marriage game is village size. Mo, a village located along the middle Uaupés River, is one of the largest Wanano villages. In 1980 the number of individuals in residence was 94. Over half of these, 53, were children under 20 years old. Apart from the Baniwa children of a visiting Baniwa son-in-law, all children in Mo spoke the Wanano language and identified themselves as Wanano.

The ethnic profile of adults contrasts with that of the children. Of the 41 residents who were over 20 years of age, 19 were non-Wanano spouses (18 females and 1 visiting male). Only one adult woman was considered Wanano; she was an unmarried 24-year-old still living with her parents. All other Wanano women over the age of 20 had married and moved to their husbands' villages. Apart from the single woman and the visiting daughter, the adult women in Mo were all in-married wives who represented, and came from, six other language groups: Tukano, Tariano, Baniwa, Desana, Cubeo, and Arapaço.

A village is "Wanano," then, insofar as a core of Wanano male sib-mates recognizes it as a site belonging to their sib. But while the adult males and children are Wanano, the majority of adult females are in-marrying wives imported from non-Wanano-speaking groups. Rather than assimilating, the non-Wanano members of a Wanano community retain, and often emphasize, their linguistic and ascribed differences of identity.

Figure 2.
Population of Mo Village
Uaupés River, Brazil, 1980

| | Males | Females |
|---|---|---|
| 70+ | X | T |
| 61–70 | XXXX | UUB |
| 51–60 | XX | R |
| 41–50 | XXXXX | CADRD |
| 31–40 | XX | XDC |
| 21–30 | BXXXXXX | XTRRDU |
| 11–20 | XXXXXXXX | XXXXXXXXXXXXX |
| 3–10 | XXXXXXXXXXXXX | XXXXXXXXR |
| 0–2 | XXX | XXXXXXXXX |

| | |
|---|---|
| TOTAL POPULATION: | 93 |
| Males: | 45 |
| Females: | 48 |
| Total number of Wanano: | 74 |
| Total Non-Wanano: | 19 |

X = Wanano, B = Baniwa, R = Tariana, T = Tukano, C = Cubeo, D = Desana, A = Arapaso, U = Unknown

In order to function smoothly for everyone, the marriage system requires that females and males be available equally at all loci in the field of intermarrying sibs. This is not always the case. Vulnerabilities inherent in the marriage system may be demonstrated in the case of the small village known as Buhpoara.

Located on an island not far from Mo, Buhpoara had 29 residents, barely a third of the size of Mo. Only 7 residents were under the age of 15. Of the 22 adults over the age of 15, 7 were women and 15 were men. While 5 of the 7 adult women were married, only 5 of the 15 men were married. The remaining 10 men were unmarried—as compared with only 2 unmarried females in this same age set. These 10 never-married men ranged in age from 15 to 35. Their mean age was 27. There were, apparently, no wives available for these elegible bachelors.

The 5 in-marrying wives in Buhpoara came from four different villages, belonging to two different language groups: Tariana and Baniwa. Both of the wives' language groups belong to the Arawakan, rather than Tukanoan, language family, although nowadays most Tariana speak Tukano, one of the Eastern Tukanoan languages. The three Baniwa wives were born in the same village on the Aiarí river, an affluent of the Içana River, located to the north of the Wanano villages and linked to them by forest trails. The two Tariana wives came from two principal Tariana villages, one located at the confluence of the Uaupés with the Tiquié, the other at the confluence of the Uaupés with the Papuri (see Figure 1).

Figure 3.
Population of Buhpoara Village
Uaupés River, Brazil, 1980

| | Males | Females |
|---|---|---|
| 70+ | | |
| 61–70 | X | B |
| 51–60 | X | B |
| 41–50 | | |
| 31–40 | XXXXX | BR |
| 21–30 | XXXX | XXR |
| 11–20 | XXXX | |
| 3–10 | XX | XXX |
| 0–2 | XX | |

| | |
|---|---|
| TOTAL POPULATION: | 29 |
| Males: | 19 |
| Females: | 10 |
| Total number of Wanano: | 24 |
| Total Non-Wanano: | 5 |

X = Wanano, B = Baniwa, R = Tariana

The case of Buhpoara is not unique. In the nearby village of Umunoa, with a total population of 17 (10 males, 7 females),[19] only 2 of the 8 adult males were married. Six males between the ages of 16 and 39 were bachelors, as compared with one unmarried woman in the same age class. The mean age of the 6 never-married men, 2 of whom were away when I visited the village, was 29.

In Umunoa, one couple, with three eligible bachelor sons (aged 19, 31, and 36), was raising a niece from a nearby village. In Buhpoara, another family with the same number of younger bachelor sons (ages 15, 18, and 30), was raising a young girl from an adjacent sib settlement. When these young girls are of marriageable age, they will contribute to the necessary currency in women with which the unmarried males of the maiden-scarce villages at Buhpoara and Umunoa will negotiate for incoming wives.

## Spouse Imbalance

A number of possible scenarios might explain the bachelor surplus in the 15-to-45 age set in the smaller Wanano villages. Infant and child mortality might contribute to the imbalance in sex ratios, although in Buhpoara only five infant deaths[20] were reported in a total of thirty-four births, and in Umunoa there were two infant deaths (1 male, 1 female) in a total of 14 reported births (over the lifetimes of the persons interviewed). Such levels of mortality would not account for the observed discrepancy in the ratio of males to females in the adult population, unless unreported deaths were a hidden factor.

Yet another potential factor is out-migration. Female out-migration to wage-labor centers may reduce the availability of marriageable females. One young woman from Buhpoara was reported to have migrated to Colombia to seek employment. More important for Wanano bachelors is the out-migration of women from wife-importing sibs of other language groups. For example, between 1960 and 1980 large numbers of young women were sent from two of Buhpoara's marriage-partner villages to serve as domestic servants in the Brazilian city of Manaus. This out-migration of unmarried women, facilitated by the air strips located at the two prominent Tariana sites, may have contributed to a shortage of marriageable women in certain parts of the Uaupés river basin.

Still other theories must not be discounted. A reputation for ill luck, sorcery, or disease might make it hard to arrange marriage trades. Since a descent group can choose from among a number of intermarrying sibs, the males of a local descent group must be able to attract females to the village. Several generations ago, bride capture would have provided a possible solution to this problem.

Finally, and most probably, stochastic fluctuation alone could explain the discrepancy in the sex ratios in this small population, pointing up the vulnerability of small local descent groups to temporary imbalances.

The marriage dilemma at Buhpoara and Umunoa may have resulted from a combination of factors occurring simultaneously. Measures to remedy the situation, such as the adoption of girl children from other villages, suggest strategies that villages faced with crises in spousal availability may adopt to avoid future shortages. In the long run, a village can reduce risk by maintaining ongoing marriage ties with several sib settlements at different locations in the basin, a strategy followed by many descent groups.

## Discussion and Conclusions

This paper has raised questions regarding the fundamental assumptions that underlie the term "population." The named language groups of the Eastern Tukanoan family of the Uaupés river confound two facile methods of identifying populations: linguistic distinctions and intermarriage. Here, the fundamental marker that maintains group boundaries is linguistic distinctness (Jackson 1974; 1983). Language is not only a symbol matrix; it is itself a symbol, a marker of identity and filiation. All exogamous units are defined by descent and identified by language, so that the descent group is coterminous with the language group and language is seen as a manifestation of descent. Both language and women are objects of exchange: the first through dialogue, the second through marriage. As such, each is both a marker of differentiation and an agent of articulation.

The combined practices of patrilocality and linguistic exogamy result in a pattern in which adult males of the same

ethnicity are concentrated in space, while adult females are dispersed through marriage. Special problems arise when a cohort of male sibmates lacks daughters to trade, or is otherwise unable to attract outside females, but sibs devise strategies to keep themselves solvent in the exchange of spouses.

A number of papers concerned with population dynamics among Amerindians have utilized tribal identity or linguistic affiliation as an indicator of genetic relatedness (see, for example, Salzano et al. 1986 for the Içana River) without considering the pattern of linguistic exogamy as it obtains in the Northwest Amazon. This is a questionable practice, for as this study indicates 1) kinship and kin proximity are defined and organized by cultural rules, and 2) kinship (as culturally-recognized), language, and residence may not correspond directly to genetic relatedness.

One of the most frequently applied assumptions in population genetics is that of random mating within a prescribed geographic zone or linguistic unit (Hartl 1991:184). This simplification is a pragmatic alternative to the gathering of detailed information on mate choice that would be required to produce a more realistic model. However, it is important to be aware that gene flow follows patterns that may be in marked contrast to geographic proximity or linguistic affiliation. The example of the Northwest Amazon presents a case of extreme departure from simple geographic or linguistic definitions of populations and suggests the need for caution in the application of these assumptions.

A more appropriate model of the "local population" within Tukanoan society, for example, should reflect ongoing marital relations among sibs over time. By this criterion, the the term "local population" might be applied to two intermarrying, "parallel," villages of different language groups in different portions of the river basin.

The Wanano pattern and others like it throughout the Northwest Amazon challenge our notions of language groups as pools of in-marrying individuals that may be contrasted with other populations. They challenge the belief that language-sharing populations are bounded entities and that linguistic differences impede the interaction of personnel and the flow of genes.

The Northwest Amazon case presents several possible models for gene flow that do not conform to the conventional model of random gene flow within a prescribed territory. They point to the shortcomings in our reliance on conventions attached to the term population—seen as a gene pool—and to the potential for inaccuracy and loss of precision that may result from broad-scale application of the concept. This paper suggests the importance of investigating further the cultural determinants of population dynamics in order to develop a set of models that better approximate the conditions of human demographic behavior.

## Notes

1. I would like to thank Steve Mount, David Price, and Kathleen Adams for their thoughtful and constructive comments on earlier drafts of this article.

2. Recent advances in human genetics have renewed interest in the biological comparison of small-scale populations (see, for example, Sokal, et al. 1986; Salzano et al. 1986; Smouse and Long 1992). Yet, too often these studies are based upon unexamined assumptions about units of analysis.

3. The alternate spellings, Uanano, and Guanano, for the *lingua geral* name are also found in the literature. The Tukano name, by which the group identifies itself, is Kotira. I have chosen to use the term Wanano on the basis of convention established in the anthropological literature.

4. This study is based upon field research conducted between 1978 and 1981 in the Brazilian (southeastern, or downriver) section of the Uaupés basin.

5. The conventional spellings of the river name take a *U* in Brazil and a *V* in Colombia: Uaupés (Brazil) and Vaupés (Colombia).

6. Since I did not visit the Colombian Wanano settlements, I take the upriver limit of Wanano occupation from the literature.

7. In each village some individuals, considered to be residents, are away. Therefore, the number of individuals counted in a given settlement depends on the methodology used to collect the data.

8. The number of groups varies according to definition of area. I follow Jackson (1974; 1976; 1983) in referring to the 15-to-20 named, exogamous, descent groups of the northwest Amazon as "language groups." They have also been referred to as "tribes" (Goldman 1963), but language is the marker by which they are most clearly recognized in an otherwise culturally homogeneous setting.

9. The Cubeo (Goldman 1963), Makuna (Ärhem 1981, 1989), and Arapaço (Chernela 1988, 1989) are exceptions to the pattern of linguistic exogamy.

10. The figure of 14,000 is based upon the 1987 reported census figure of 14,164, compiled by the Centro Ecumênico de Documentação e Informação (CEDI), Museu Nacional, Rio de Janeiro. It exceeds by 5,000, the estimates of Sorensen (1967) and Jackson (1976).

11. The figure of 150,000 square kilometers is the sum of 90,000 $km^2$ reported by Jackson (1976) for the Colombian Vaupés, and 60,070 $km^2$ reported by the Centro Ecumênico de Documentação e Informação (CEDI), Museu Nacional, Rio de Janeiro, for the Brazilian Uaupés.

12. For further discussion of Eastern Tukanoan Uaupés social organization see the following: Ärhem 1981; Chernela 1982, 1993; Goldman 1963; C. Hugh-Jones 1979; S. Hugh-Jones 1979; Jackson 1976, 1983; and Reichel-Dolmatoff 1971. For comparative material on the nearby Arawakan groups on the Aiarí River, see Hill 1983, 1984 and Wright 1981.

13. The ideal of complete patrilocality is not fully realized and the degree of correspondence of the local group and the unilineal descent group varies. In fact, a settlement may include more than one resident sib; it may also house several non-sib residents, who are considered to be visitors.

14. The Siriano, located in Colombia, are not shown in Figure 1.

15. The pattern, also called Dravidian, is associated with unilineality and cross-cousin marriage practice. See Dole 1991 for discussion.

16. I have simplified Wanano zero generational terminology here. For a more detailed discussion, see Chernela 1993.

17. From the point of view of the sons, this marriage fulfills the preference for marrying the father's sister's daughter.

18. In later marriages, especially in the case of widows or widowers with children, expediency is given primary consideration.

19. Every village has a number of residents who are considered temporarily away, although there may be no limit to time away. This is because the village is conceived of as a local descent group. Members of the local descent group, wherever they are, are considered to be "belonging ones" (Wanano *macari mahsa*), that is to say, as villagers who are away. In this survey, I include two persons (35 and 39) whose absence was said to be short-term. One individual, for example, was in a nearby mission hospital.

20. The sexes of the infants are not reported.

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# DEMOGRAPHIC CRISIS AND RECOVERY: A CASE STUDY OF THE XAVANTE OF PIMENTEL BARBOSA

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The immediate effect of contact on Amazonian Indian groups has been well documented. Introduced diseases, social disruption, often with increased feuding, as well as fighting to resist territorial incursion, usually lead to a demographic crisis. The result of this crisis has often been the extinction of the group (Ribeiro 1956; Denevan 1976; Hemming 1978:487–501).

However, some groups that have survived this initial demographic shock have not only recovered to their pre-contact population level, but continue to increase in numbers as a result of very high fertility and reduced mortality. The Shipibo (Hern 1977), the Kayapó (Black et al. 1978; Werner 1983), and the Xavante are examples of such rapidly increasing groups. The doubling time for such populations may be 15 years or less.

Rapid population growth brings both advantages and problems. It assures the physical survival of the group, if not necessarily its cultural continuity. But increasing population may put pressure on land, which is often limited to a reservation of inadequate size. And in the early stages of a population rebound, when half the population may be under 15 years old, there are many young mouths for working adults to feed. Both these situations may encourage greater involvement in the outside economy through wage labor, or cash cropping, or both (Gross et al. 1979). As young people increasingly outnumber their elders, there may be a weakening of tradition, and conflict between generations. On the other hand, population increase brings new confidence in the group and its future, and larger numbers augment the options for political action. Leadership may pass to younger members, who often have wider knowledge of the outside world than their elders, enabling them to make informed political and economic choices.

It has often been suggested that hunting-and-gathering and proto-agricultural groups tend to have low birth rates and medium death rates (see, for example, Salzano and Callegari-Jacques 1988:45–46). The implication is that these demographic patterns are consistently maintained and relate to the resources and technological level of these groups. But in many cases the group may have already been experiencing the effects of contact when the information was collected. Longitudinal evidence suggests that the fertility and mortality patterns of such groups may vary, depending on the time when they are observed (Early 1985; Early and Peters 1990; Leslie and Gage 1989; Caldwell et al. 1987; Weiss 1976).

In this paper I will present data derived from information collected in a Xavante community demonstrating how censuses and reproductive histories can reveal demographic change and instability. My data indicate that before the 1960s, when the Xavante were seminomadic, they had moderately high fertility and low child mortality. The effect of contact, which brought disease and social disruption, was an abrupt increase in child mortality and some decline in fertility. More recently the situation was reversed: as mortality, especially that of children, decreased, fertility rose, leading to rapid population growth.

## The Community

In the early eighteenth century, when the Xavante first came in contact with white society, they lived in what is now Goiás state. Letters from colonial governors to Lisbon (Subsídios para a história da Capitania de Goyaz 1918) demonstrate that they resisted the invasion of their lands by attacking mining camps and raiding the settlers' cattle and crops. The colonial government succeeded in "pacifying" and settling a number of Indians, including Xavante, in mission villages, but at the end of the eighteenth century, when the gold mines were exhausted and part of the settler population of Goiás emigrated, most Indians abandoned the missions.

Around the middle of the nineteenth century, a group, or groups, of Xavante moved westward, crossing the Araguaia and settling in eastern Mato Grosso. For some eighty years they remained isolated, defending their territory so effectively that it became a mysterious "no man's land" to the outside world until the 1940s (Fleming 1934:17–18). During this period isolation largely protected the Xavante against epidemic disease. What contagion occurred may have been through the neighboring Karajá, who were in contact, and whom the Xavante said they feared because they brought sickness (Neel et al. 1964:124).

During the 1940s the Brazilian government made a concerted effort to pacify the Xavante and open their lands to settlement. One of the first groups to make peaceful

contact was led by Apowẽ, the headman of the group I studied, who was still living in 1977. When Maybury-Lewis first visited this group in 1957 they still had little contact with outsiders. Maybury-Lewis noted that Apowẽ's group was "the most powerful, the most numerous, and the least acculturated of all the Downstream Xavante" (Maybury-Lewis 1974:27).

In 1962 Maybury-Lewis returned with a group of investigators, including J. V. Neel, F. M. Salzano, P. C. Junqueira, and F. Keiter. They carried out extensive genetic, epidemiological, and demographic studies at São Domingos, a government Indian post on the Rio das Mortes, (Neel et al. 1964). The investigators were impressed by the generally good physical and nutritional status of the Xavante. At the same time it was apparent that they were undergoing considerable stress from epidemic disease and social disruption. Maybury-Lewis found that the population of São Domingos had declined from disease, killings, and from a split in the group. A number of the young men had visited Brazilian cities from which they may well have brought back the diseases that were beginning to affect the community. "...the Shavante had learned by now of their comparative impotence, and they were acutely conscious of their own dwindling numbers, a topic to which they returned again and again in conversation with me, who had known the village in the days when it was numerous and strong" (Maybury-Lewis 1974:29). The investigators found evidence, from the presence of antibodies to measles and whooping cough, that these epidemic diseases had reached the group. The Xavante were in the midst of a crisis of contact.

By 1976–77, when I lived with the group for 14 months, conditions had improved somewhat. They had been settled for four years in a single village near the western boundary of their reservation, known as Pimentel Barbosa. Their staple subsistence crop was upland rice which was also the main commercial crop grown on the large ranches that surrounded the reserve. A number of the younger men worked periodically on the ranches. Nevertheless, the community was self sufficient in food, since people kept enough rice for their own needs, and hunting and fishing were still relatively productive (Flowers 1983).

By 1977 the Pimentel Barbosa Xavante were engaged in a struggle to resist the encroachments of ranchers who claimed title to land within the boundaries of the reservation. Taking land from Indians is, of course, an old story in Brazil, but this time the land grabbers were unsuccessful. The Pimentel Barbosa Xavante forced the settlers off the land they had illegally occupied and made common cause with Xavante leaders from other communities. In 1980, a delegation of Xavante leaders went to Brasilia and practically held the president of the Indian agency hostage in his own office as they denounced corruption within FUNAI to the delight of the press and the political opposition (Maybury-Lewis 1985). This forceful action eventually produced results: the boundaries of the Pimentel Barbosa reservation were guaranteed and the ranchers removed (they were indemnified).

When I returned to Pimentel Barbosa in 1988 I found the reservation almost 50 percent larger than in 1977. Also the population had grown from 249 in 1977 to 411 (by 1990 it would be 461). There were now three villages on the reservation: the old main village near the FUNAI post, and two smaller "satellite" villages on parts of the reservation that were occupied by ranches in 1977.

A commercial rice-growing project that FUNAI officials were promoting in 1977 had fizzled, like so many other FUNAI plans for economic development on Indian reservations, and the agricultural machinery was rusting on the cerrado. But this did not seem to bother the Xavante. If anything, people seemed more committed to traditional values: they were celebrating the initiation of a large age set of young men and were again living in "beehive" houses rather than the Brazilian style houses they had favored in 1977.

Xavante society has undergone many changes and made many adjustments to the wider society of which it is now a part (Gross et al. 1979). But up to the present it has preserved a strong sense of identity. An interesting aspect is that the younger leaders, aware of the potential for support from Brazilian and international environmentalist groups, proclaim a traditionalist and conservationist ideology, while the older men, accustomed to making "deals" with the FUNAI bureaucracy (Graham 1986), take a more pragmatic view.

**Data Collection**

During the fourteen months I spent with the Pimentel Barbosa community in 1976–77, I censused the village [1], collected reproductive histories of all women in the village, kept birth and death records, observed the health and measured the growth of young children, as well as making systematic observations of time allocation, crop and hunting productivity, and food consumption. In 1988 I returned to the community with Daniel Gross for two weeks, and made a new census. Finally in 1990, together with medical anthropologist Carlos Coimbra and physical anthropologist Ricardo Santos, I returned for several weeks. While the biological anthropologists carried out medical and genetic studies I censused the population for a third time, and again collected reproductive histories. For comparative purposes I also used information from Maybury Lewis's (1974) genealogy and from the pedigree and demographic data collected by Neel et al. (1964).

Figure 1.
Xavante Population at Pimentel Barbosa, July 1977

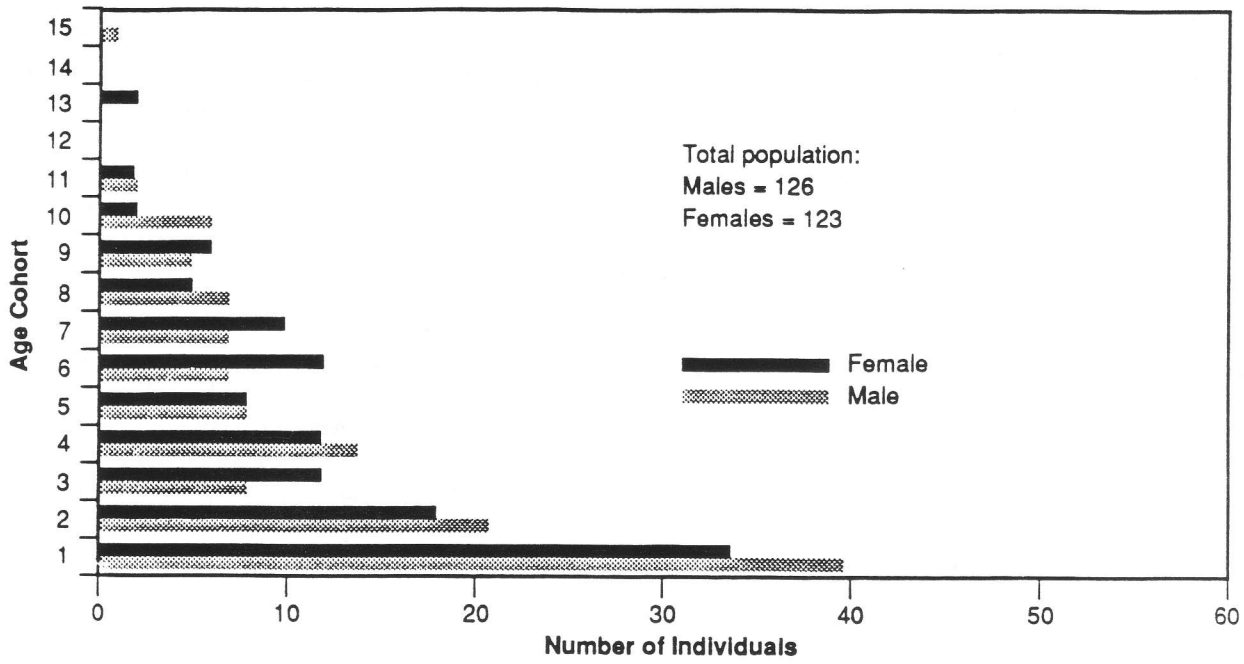
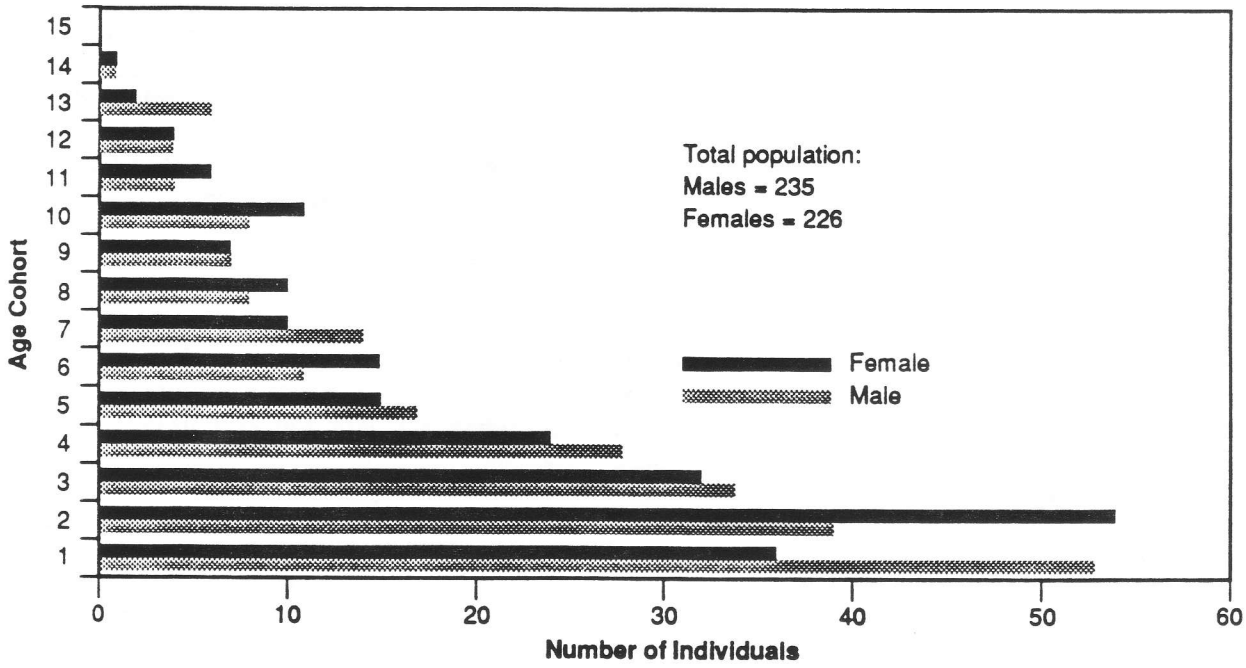



Figure 2.
Xavante Population at Pimentel Barbosa, June 1990




**Recent Population Changes**

Figures 1 and 2 show the distribution by age cohort and sex of the population in 1977 and 1990. Thirteen years are counted between the censuses, since I made the last 1977 census at midyear, in early July, and the 1990 census was taken in June. The 13 years' space includes the last six months of 1977 and the first six months of 1990. In 13 years the population has very nearly doubled from 249 to 461. Almost all population growth is due to natural increase, as there has been little migration to or from other Xavante communities.

Table 1.
Changes in the Population of Pimentel Barbosa
Comparing 1977 Census with 1990 Census

| | | | |
|---|---|---|---|
| POPULATION 1977 | 249 | | |
| Deaths | | 18 | |
| Missing | | 3 | |
| Moved Away | | 6 | |
| TOTAL DECREASE | | 27 | |
| Births | | | 221 |
| Moved In | | | 18 |
| TOTAL INCREASE | | | 239 |
| POPULATION 1990 | | | 461 |

Table 1 shows the specific ways the population changed between 1977 and 1990. Most striking was the increased number of people: 221 children had been born into the community, 185 in the main village at the 1977 site, and 36 in two small satellite villages founded on land gained in the territorial revision.

Comparing a new census with the one I made in 1977 showed that 18 people enumerated in the earlier census died before 1990. These included the old chief, Apowẽ, who died in 1978, the older of Apowẽ's two wives who died soon after, and his eldest son Warodi, who succeeded Apowẽ as chief and died in 1988. I could not ascertain the exact year of death of the other adults, but judging by their age in 1977, I estimated that five were elderly when they died, and three were middle-aged. Two young married men and a crippled boy in his teens had died. The remaining seven people, who were under five years old in 1977, died before reaching adulthood. According to their mothers, two died at around one year of age, one at five and another at eight.

Migration was a relatively minor element of population change. Six people had moved away, four from Pimentel Barbosa to other Xavante communities. One young man was studying in Goiânia and an older man, who became mentally ill in 1977, had disappeared. Seventy-six people had gone to the satellite villages but continued to have frequent contact with their relatives in the main village. Three people were missing— they were probably in one of the villages, but escaped the census.

Eighteen people had moved in. These included seven young men who were away at school in 1977, who had returned and were now married. Five people from other Xavante reservations had arrived to settle with their Pimentel Barbosa kin and had married in the community. Five immigrants consisted of the white wife of a Xavante man and their four children. The Xavante generally frown on mixed marriages. Perhaps for this reason, this family in 1988 was living in an isolated homestead on the reservation; by 1990 they were living in the village. Finally, one young Xavante man had married a college-educated woman of the Karajá tribe when he was at school in Goiânia and the couple now had a house in the village.

Not only was the village larger than in 1977, dooryard trees had grown up to give it an air of permanence. When I asked if it was not now a long way to walk to the gardens, whose location is usually shifted every two or three years, I was told that people now traveled to their gardens, as well as on fishing and hunting trips, in the community's trucks. However, what gave me the greatest sense of the passage of time was identifying the children I had known in 1977, now grown and with children of their own.

**Recent Birth and Death Rates**

By comparing the earlier with the later census it is possible to approximate the current birth and death rates of this community. However, using information from the censuses alone would underestimate both deaths and births, since this is a population with relatively high infant mortality, and a certain number of children were born after the 1977 census, but did not survive to be censused in 1990. To obtain this information I interviewed the 109 women living in the main village. I asked them to describe the outcome of each pregnancy, including the age or stage of development at death of those no longer living. According to the women's reports, 24 children were born and died in the thirteen years between the censuses. These children must, of course, be counted both as births and as deaths.

Unfortunately, the count is incomplete for the total population, for I was only able to interview the women living in the main village and missed 18 women in the satellite villages. For that reason I have used only the population of the main village in calculating crude birth and death rates.

The population of the main village was 249 in 1977 and 385 in 1990; that is a mean population of 317. The women interviewed reported 212 births between 1977 and 1990: 185 children living in the main village, three living in satellite villages, plus 24 who were born and died between censuses. The average of 16.3 births per year is equivalent to a crude birth rate of 51.4. This birth rate is similar to that of some of the world's fastest growing populations (Palmore and Gardner 1983:62).

For the crude death rate I added to the 18 deaths known by comparing the censuses the 24 deaths of children who were born and died between the censuses—giving 42 deaths over 13 years. The crude death rate is 10.2, which is surprisingly low. The explanation is that this is a very young population. In 1977 only seven people, or 2.8 percent of the population, were over 50 years of age. Of these, five died before 1990. By 1990, 25 people, or 6.5 percent of the main

Table 2.
Age Distribution of Deaths, 1977–1990
(Including births and deaths
of children between censuses)

| AGE COHORT | NUMBER |
|---|---|
| 60+ | 5 |
| 40–59 | 3 |
| 30–39 | 0 |
| 20–29 | 2 |
| 15–19 | 0 |
| 10–14 | 2 |
| 5–9 | 4 |
| 1–4 | 11 |
| <1 | 15 |
| TOTAL | 42 |

village population, were 50 years or older, indicating that the population had an increasing number of older people. Table 2 shows the distribution of deaths, including children that were born and died between censuses, by age group.

The infant mortality rate is the number of deaths per year of infants under one year of age divided by the number of births per year times 1000. Since 212 babies were born during the 13 year period to women interviewed, and 15 died under one year of age, this is 70.8 per 1000, which seems relatively low for such a population, but as I had learned from interviewing the women, the infant death rate was much higher in the years following contact. Both in 1977 and in 1990, more than half the population was under 15, indicating that it was growing very rapidly. This contrasts with the 1962 estimate of Neel et al. (1964:92) that 39.3 percent of the population was under the age of 15; this could be due either to lower fertility or to higher child mortality at that period. Child mortality is still high: of the 42 deaths between 1977 and 1990, 32 were of children under 15. The age-specific death rate for this age group can be calculated on the basis of a mean 0–14 population of 190.5. The death rate for this age group is 12.9.

**Factors Affecting Fertility**

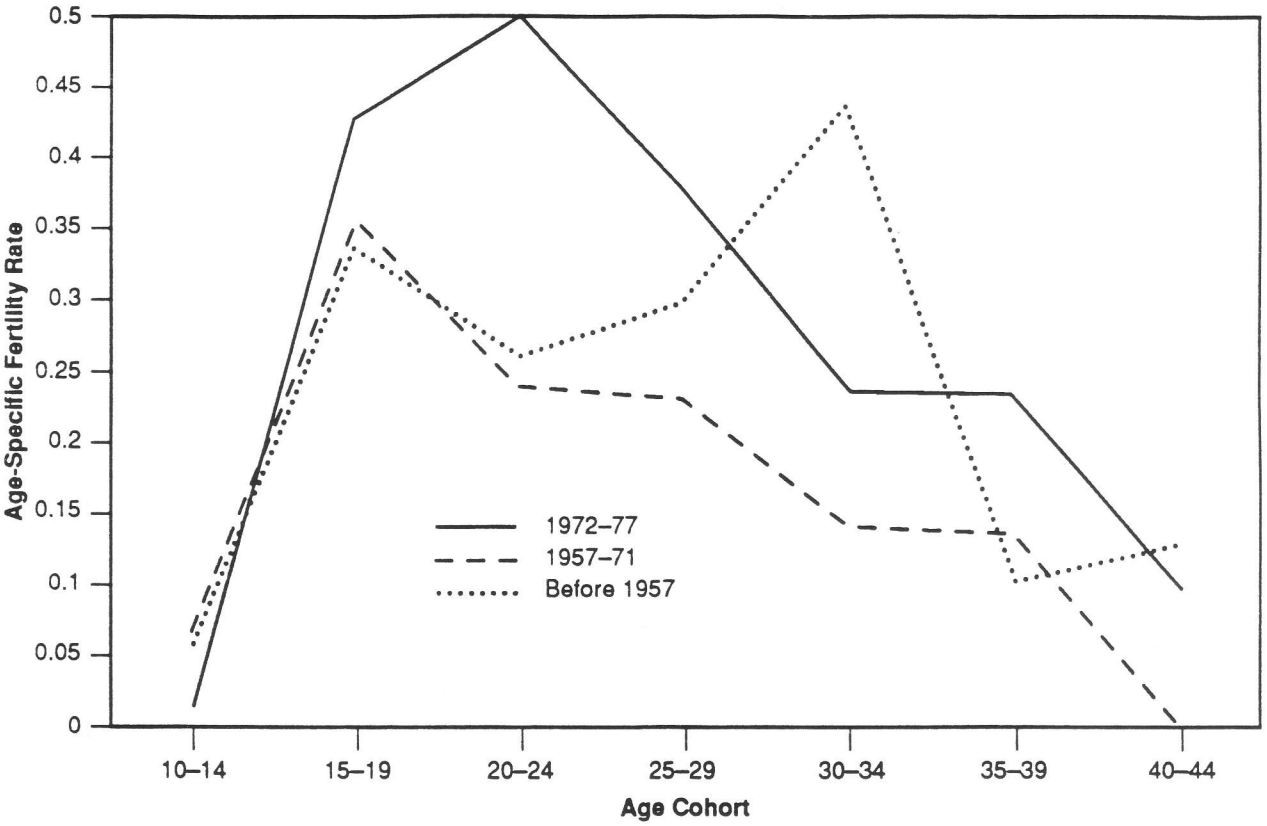
Even though current Xavante fertility is high, with a total fertility rate around 8.5, it does not approach the maximum recorded for natural fertility populations. Gage et al. (1989:51) show the wide variation in the level of fertility among natural fertility populations, with the mean number of children born to a woman who had, at some time, been married ranging from 5.1 to 11. The highest mean fertility recorded is that of the Hutterites, which according to Gage et al. may be due partly to the historical decline in infectious disease and partly to the fact that, like other European populations in North America, the Hutterites were a "frontier population" expanding into a new environment.

One factor that may lengthen birth intervals is the postpartum sex taboo which the Xavante say they keep for the baby's well-being, but it is hard to tell whether this is strictly adhered to. Older people told me that a baby should be walking before another one is started, and the interval should be longer if the baby is a girl, as girls are "softer." It is not clear whether the effect of this taboo is to actually lengthen the birth interval. Because I had records of exact birth dates only for about three years, from 1974 to 1977, this was the only period for which I was able to accurately determine birth intervals. During the 33 months of accurate record-keeping, 42 of the 65 women between the ages of 15 and 44 gave birth at least once (not counting stillbirths). Fourteen women gave birth twice, and one woman a third time. The mean birth interval for women whose babies lived at least a year was 20.9 months, and for women whose babies died it was 16.6 months.

It was not possible to obtain data on the rate of abortion, either induced or spontaneous, among Xavante women. Induced abortion was not admitted to by any of the women. The frequency of spontaneous early abortion could not be estimated, as it is apparently not distinguished from a menstrual period. Like Kayapó women (Black et al. 1978; Werner 1983), Xavante women do not perceive menstruation as a normal regularly-occurring phenomenon. While they know that it occurs among women who have not had a baby for some time, they apparently consider it pathological. A FUNAI medical attendant who had experience in several Xavante villages told me that women often came to the infirmary to ask for medicine to "stop the bleeding." Harrell (1981) has shown that menstruation may be a relatively rare occurrence among women who lactate for long periods. Xavante women lactate almost continuously throughout their reproductive lives, sometimes sharing the breast between a new baby and the previous child (see also Black et al. 1978:123). Harrell has also shown that the longer lactation lasts, the longer the period of postpartum amenorrhea and anovulation tends to be. Also, as lactation is prolonged it becomes more likely that ovulation—and possibly pregnancy—will precede the first menstrual period.

Xavante women may also have a relatively high rate of fetal wastage because of their strenuous lifestyle, though it is probably less so than in more nomadic times when women were the burden-bearers who carried household goods as well as babies from camp to camp. Older women often gave different village locations for the birth of each of their children and reported that some were born "on trek." In 1977, women's reports suggested that around seven percent of pregnancies ended in stillbirths,

Figure 3.
Age-Specific Fertility Rates
Xavante Women — 1977 Data




while the rate was three percent in 1990. However, a comparison of women's reports of births in 1977 and of the same births in 1990 indicates that the distinction between a child born dead and one that died immediately after birth is not very clearly made.

Xavante women do not curtail their activities to any extent even in the last weeks of pregnancy. The only adult death at Pimentel Barbosa during my 1976–77 stay was a young woman who took part in a log race—a ceremonial relay race in which women carry logs weighing up to 80 pounds—when she was eight months pregnant. The woman slipped and fell when carrying a log, and both she and the baby died.

### Changes in Fertility

In 1977, it was already apparent that the fertility of women between the ages of 15 and 29 was increasing. Figure 3 and Table 3, based on data collected in 1977, show the age-specific fertility rate of women at three periods: the years before 1957, when contact was sporadic and the Xavante were still semi-nomadic; the years between 1957 and 1971 when they experienced the most disruptive effects of contact; and the years from 1972 to 1977 when they settled at their present location, infant mortality from acute diseases declined, and population recovery began. The 1977 data include information from four elderly women who died before 1990. However, the sample size is small, and age-specific fertility rates before 1957 are subject to sampling error, since few women could report on their later fertility for that period. As Table 5 shows, only 10 percent of woman/years surveyed for the "pre-contact" period are for women who were 30 to 39 during those years. Nevertheless, these data do appear to indicate that during the period of social disruption and high mortality after contact, fertility was lower than it was before contact, but rose after the acute crisis passed.

Xavante often begin childbearing at 13 or 14 years of age, so the 10–14 age group is included in the tables. On the other hand, they appear to cease childbearing at a relatively early age. I found few instances of childbirth after 40.

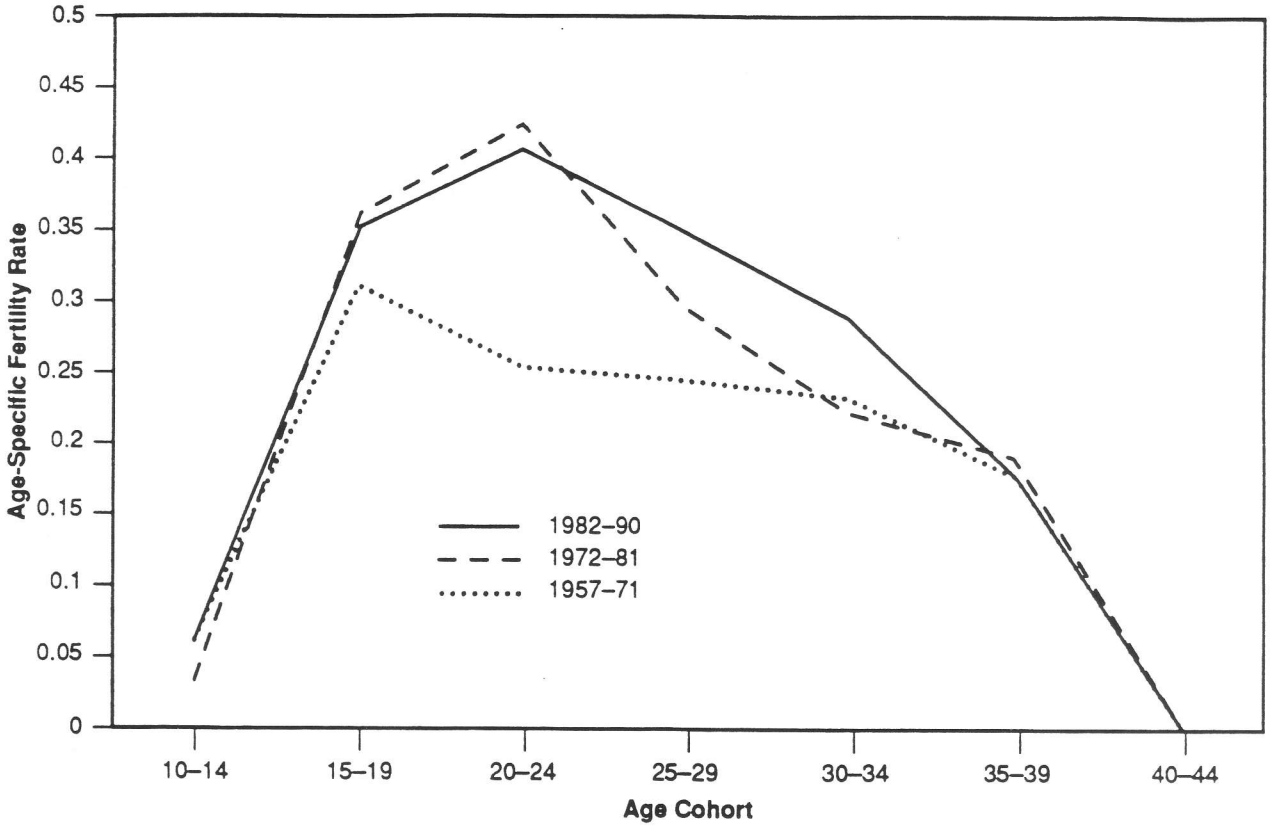
During the 15 years from 1957 to 1971, when the group was feeling the most severe effects of contact, fertility was highest in the 15–19 age group. My interviews with women revealed that during this period 129 children were born to them and 67 died. Some women

Table 3.
Age-Specific Fertility Rates for Xavante Women, Ages 10–44,
at Different Periods, 1942 to 1977

| | 10-14 | | | 15-19 | | | 20-24 | | | 25-29 | | | 30-34 | | | 35-39 | | | 40-44 | | | TOTALS | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | W/Y | B | ASFR | W/Y | B | ASFR | W/Y | B | ASFR | W/Y | B | ASFR | W/Y | B | ASFR | W/Y | B | ASFR | W/Y | B | ASFR | W/Y | B | GFR | TFR |
| **TOTAL FOR RECENT** | | | | | | | | | | | | | | | | | | | | | | | | | |
| **1972-77** | 69.5 | 1 | 0.014 | 60.5 | 26 | 0.43 | 46 | 23 | 0.5 | 58 | 22 | 0.379 | 55 | 13 | 0.236 | 30 | 7 | 0.233 | 21.5 | 2 | 0.093 | 341 | 94 | 0.276 | 9.431 |
| **TOTAL** | | | | | | | | | | | | | | | | | | | | | | | | | |
| **1967-71** | 54 | 2 | 0.037 | 41 | 13 | 0.317 | 53 | 13 | 0.245 | 51 | 13 | 0.255 | 25 | 4 | 0.16 | 19 | 3 | 0.158 | 12 | 0 | 0 | 255 | 48 | 0.188 | 5.861 |
| **TOTAL** | | | | | | | | | | | | | | | | | | | | | | | | | |
| **1962-66** | 41 | 4 | 0.098 | 53 | 19 | 0.358 | 51 | 10 | 0.196 | 25 | 7 | 0.28 | 19 | 3 | 0.158 | 12 | 1 | 0.083 | 6 | 0 | 0 | 207 | 44 | 0.213 | 5.867 |
| **TOTAL** | | | | | | | | | | | | | | | | | | | | | | | | | |
| **1957-61** | 53 | 4 | 0.075 | 51 | 20 | 0.392 | 25 | 8 | 0.32 | 19 | 2 | 0.105 | 12 | 1 | 0.083 | 6 | 1 | 0.167 | 2 | 0 | 0 | 168 | 36 | 0.214 | 5.714 |
| **TOTAL FOR CONTACT** | | | | | | | | | | | | | | | | | | | | | | | | | |
| **1957-71** | 148 | 10 | 0.068 | 145 | 52 | 0.359 | 129 | 31 | 0.24 | 95 | 22 | 0.232 | 56 | 8 | 0.143 | 37 | 5 | 0.135 | 20 | 0 | 0 | 630 | 128 | 0.203 | 5.880 |
| **TOTAL** | | | | | | | | | | | | | | | | | | | | | | | | | |
| **1952-56** | 50 | 2 | 0.04 | 25 | 10 | 0.4 | 20 | 5 | 0.25 | 12 | 2 | 0.167 | 6 | 1 | 0.167 | 2 | 0 | 0 | 8 | 1 | 0.125 | 123 | 21 | 0.171 | 5.742 |
| **TOTAL** | | | | | | | | | | | | | | | | | | | | | | | | | |
| **1947-51** | 23 | 1 | 0.043 | 19 | 6 | 0.316 | 12 | 3 | 0.25 | 6 | 3 | 0.5 | 2 | 2 | 1 | 8 | 1 | 0.125 | 0 | 0 | 0 | 70 | 16 | 0.229 | 11.171 |
| **TOTAL** | | | | | | | | | | | | | | | | | | | | | | | | | |
| **1942-46** | 18 | 2 | 0.111 | 12 | 3 | 0.25 | 6 | 2 | 0.333 | 2 | 1 | 0.5 | 8 | 4 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 | 46 | 12 | 0.261 | 8.472 |
| **TOTAL FOR PRE-CONTACT** | | | | | | | | | | | | | | | | | | | | | | | | | |
| **1942-56** | 91 | 5 | 0.055 | 56 | 19 | 0.339 | 38 | 10 | 0.263 | 20 | 6 | 0.3 | 16 | 7 | 0.438 | 10 | 1 | 0.1 | 8 | 1 | 0.125 | 239 | 49 | 0.205 | 8.099 |
| **OVERALL TOTAL** | 309 | 16 | 0.052 | 262 | 97 | 0.371 | 213 | 64 | 0.3 | 173 | 50 | 0.289 | 127 | 28 | 0.22 | 77 | 13 | 0.169 | 49.5 | 3 | 0.061 | 1210 | 271 | 0.224 | 7.311 |

NOTES: W/Y, or Women/Years, is the number of years spent by women of this age category during the specified interval of time.
ASFR, or Age-Specific Fertility rate, is the number of births to women of this age category during the specified time interval divided by the number of Women/Years
GFR, or General Fertility Rate, is the total number of births during this time interval divided by Women/Years for all reproductive age categories.
TFR, or Total Fertility Rate, is a sum of all the Age-Specific Fertility Rates for this time interval. It represents the average number of children a woman would bear during her lifetime at the Age-Specific Fertility Rates for this interval of time.

Figure 4.
Age-Specific Fertility Rates
Xavante Women, 1990 Data




indicated that after seeing so many of their children die, including some who had already passed babyhood, they "lost heart to have children." Though they denied practicing induced abortion or infanticide, the age-specific fertility rate of each age cohort in this period has an unusual shape for a natural fertility population. After a peak at 15–19 it falls off rapidly and is lower for each succeeding age bracket.

The mechanisms of lowered fertility may be partly cultural and partly physiological. Wasser (1990) suggests that psychosocial stress may lead to reproductive failure through various physiological mechanisms that may inhibit the reproductive process at any of several different stages.

Another cause of lowered fertility was probably social disruption, with instability of marriage and early widowhood for some women. Eleven women, while still in their twenties, were widowed or divorced during the 1960s and there was a space without childbearing before they remarried. Even though the Xavante are polygynous, some women remain single after widowhood or divorce and, while they may have one or two further children, their fertility is much lower than women in established unions. Werner (1983) has shown that for the Kayapó before pacification, warfare and the absence of husbands on long-distance raids lowered fertility.

Table 4 and Figure 4, based on fertility interviews in 1990, show that in recent years the age-specific pattern of childbearing approaches that considered typical for natural fertility populations with early marriage, peaking at 20–24 and declining gradually to age 40.

### Parity and Infant Mortality

Table 6, derived from 1977 and 1990 data, shows the parity for 31 women with completed fertility. There are no women with zero parity, and only one has borne fewer than four children. While the completed fertility is similar for each cohort, the number of surviving children is very different. For the six women born between 1910 and 1929 the average number of children that survived was 5.7, that is, 81 percent of their children lived to 15 years or older. The oldest woman in the community in 1977 was Arẽwai'õ, Apowẽ's wife, born around 1912, who had eight grown sons and daughters living in the village and said she had lost no children. Two other women in that cohort claimed that all their children had grown up, though they bore only four and seven children respectively because they were both

Table 4.
Age-Specific Fertility Rates for Xavante Women, Ages 10–44
at Different Periods, 1947 to 1990

| | 10-14 | | | 15-19 | | | 20-24 | | | 25-29 | | | 30-34 | | | 35-39 | | | 40-44 | | | TOTALS | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | W/Y | B | ASFR | W/Y | B | ASFR | W/Y | B | ASFR | W/Y | B | ASFR | W/Y | B | ASFR | W/Y | B | ASFR | W/Y | B | ASFR | W/Y | B | GFR | TFR |
| TOTAL FOR 1987-1990 | 90 | 6 | 0.067 | 64.5 | 26 | 0.403 | 35.5 | 14 | 0.394 | 50 | 18 | 0.36 | 21 | 7 | 0.333 | 23.5 | 3 | 0.128 | 36.5 | 0 | 0 | 321 | 74 | 0.231 | 8.426 |
| TOTAL FOR 1982-1986 | 103 | 6 | 0.058 | 55 | 16 | 0.291 | 68 | 28 | 0.412 | 36 | 12 | 0.333 | 31 | 8 | 0.258 | 50 | 10 | 0.2 | 35 | 0 | 0 | 378 | 80 | 0.212 | 7.762 |
| TOTAL FOR 1977-1981 | 56 | 2 | 0.036 | 69 | 22 | 0.319 | 35 | 12 | 0.343 | 31 | 6 | 0.194 | 51 | 13 | 0.255 | 35 | 7 | 0.2 | 23 | 0 | 0 | 300 | 62 | 0.207 | 6.729 |
| TOTAL FOR 1972-1976 | 68 | 2 | 0.029 | 36 | 16 | 0.444 | 31 | 16 | 0.516 | 50 | 18 | 0.36 | 35 | 6 | 0.171 | 23 | 4 | 0.174 | 15 | 0 | 0 | 258 | 62 | 0.24 | 8.477 |
| TOTAL FOR POST-CONTACT 1972-1990 | 317 | 16 | 0.05 | 225 | 80 | 0.356 | 170 | 70 | 0.413 | 167 | 54 | 0.323 | 138 | 34 | 0.246 | 132 | 24 | 0.183 | 110 | 0 | 0 | 1257 | 278 | 0.221 | 7.860 |
| TOTAL FOR 1967-1971 | 36 | 1 | 0.028 | 31 | 9 | 0.29 | 45 | 11 | 0.244 | 40 | 12 | 0.3 | 23 | 5 | 0.217 | 15 | 4 | 0.267 | 5 | 0 | 0 | 195 | 42 | 0.215 | 6.733 |
| TOTAL 1962-1966 | 31 | 2 | 0.065 | 50 | 16 | 0.32 | 35 | 8 | 0.229 | 23 | 5 | 0.217 | 15 | 3 | 0.2 | 5 | 0 | 0 | 3 | 0 | 0 | 162 | 34 | 0.21 | 5.152 |
| TOTAL 1957-1961 | 50 | 5 | 0.1 | 35 | 11 | 0.314 | 23 | 7 | 0.304 | 15 | 2 | 0.133 | 5 | 2 | 0.4 | 3 | 0 | 0 | 0 | 0 | 0 | 131 | 27 | 0.206 | 6.260 |
| TOTAL FOR CONTACT 1957-1971 | 117 | 8 | 0.068 | 116 | 36 | 0.31 | 103 | 26 | 0.252 | 78 | 19 | 0.244 | 43 | 10 | 0.233 | 23 | 4 | 0.174 | 8 | 0 | 0 | 488 | 103 | 0.211 | 6.406 |
| TOTAL 1952-1956 | 35 | 1 | 0.029 | 23 | 10 | 0.435 | 15 | 6 | 0.4 | 5 | 1 | 0.2 | 3 | 1 | 0.333 | 0 | 0 | 0 | 0 | 0 | 0 | 81 | 19 | 0.235 | 6.983 |
| TOTAL 1947-1951 | 23 | 2 | 0.087 | 15 | 4 | 0.267 | 5 | 1 | 0.2 | 3 | 1 | 0.333 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 46 | 8 | 0.174 | 4.435 |
| TOTAL FOR PRE-CONTACT 1947-1956 | 58 | 3 | 0.052 | 38 | 14 | 0.368 | 20 | 7 | 0.35 | 8 | 2 | 0.25 | 3 | 1 | 0.333 | 0 | 0 | 0 | 0 | 0 | 0 | 127 | 27 | 0.213 | 6.767 |
| OVERALL TOTAL | 492 | 27 | 0.055 | 379 | 130 | 0.343 | 293 | 103 | 0.352 | 253 | 75 | 0.296 | 184 | 45 | 0.245 | 155 | 28 | 0.181 | 118 | 0 | 0 | 1872 | 408 | 0.218 | 7.364 |

NOTES:W/Y, or Women/Years, is the number of years spent by women of this age category during the specified interval of time.
ASFR, or Age-Specific Fertility rate, is the number of births to women of this age category during the specified time interval divided by the number of Women/Years
GFR, or General Fertility Rate, is the total number of births during this time interval divided by Women/Years for all reproductive age categories.
TFR, or Total Fertility Rate, is a sum of all the Age-Specific Fertility Rates for this time interval. It represents the average number of children a women would bear during her lifetime at the Age-Specific Fertility Rates for this interval of time.

Table 5.
Number and Percent of Woman/Years
in Age Group by Period

| | 10-19 | | 20-29 | | 30-39 | |
|---|---|---|---|---|---|---|
| | N | % | N | % | N | % |
| **1977 DATA** | | | | | | |
| 1972–77 | 130 | 38.2% | 104 | 30.5% | 85 | 25.0% |
| 1957–71 | 293 | 46.5% | 224 | 35.6% | 93 | 14.8% |
| 1942–56 | 147 | 61.5% | 58 | 24.3% | 26 | 10.9% |
| **1990 DATA** | | | | | | |
| 1972–90 | 541.5 | 43.1% | 336.5 | 26.8% | 269.5 | 21.4% |
| 1957–71 | 233 | 47.7% | 181 | 37.1% | 66 | 13.5% |
| 1947–56 | 96 | 75.6% | 28 | 22.0% | 3 | 2.4% |

widowed, one in her twenties and the other in her early thirties, and did not remarry.

Women born between 1930 and 1939 saw only an average of 2.8 children, or 38 percent of live births, survive to 15 years or older. Women born between 1940 and 1949 had an average of 4.3 surviving children, or 60 percent of live births; this reflects an improvement for women born after 1945. The five women born between 1940 and 1945 had a survival rate of only 42 percent.

Tables 7 and 8 compare the parity and the survival rate of children by mother's age group according to my data collected in 1977 and 1990 with data collected by the group of scientists that studied them in 1962 (Neel et al. 1964:97–98). What is striking in the 1962 data is the relatively small average number of children born to women in the 20–29 age group, when women usually are at the height of their fertility curve. This appears to be in agreement with my finding that during the "contact years" fertility dropped off after an early peak.

Table 8, showing the comparative survival rate of children born to women in different age groups, reveals the time at which infant mortality began to increase. In 1962, mothers under 30 years old had a "decrease as a percent of live births" of over 35 percent and it appeared to be highest for the youngest group. It was this observation that prompted the comment in Neel et al. (1964:95) that infant mortality rates were rising. They concluded that the population appeared to be replacing itself but "there are ominous signs that this situation may not persist." Fifteen years later, those women, now in their middle years, had seen half to two-thirds of their children die, while the child survival rate of younger women was now improving. By 1990, the "decrease as percent of live births" was 20 percent or under for all women under the age of 40.

**Changes in Life Expectancy**

Except for recent years, I do not have data on adult deaths. However, from the fertility histories it is possible to construct partial life tables for the survival of children up 10 years old during three periods. The method followed is described in Howell (1979:84–85), and Werner (1983).

Table 9 gives an abridged life table showing probability of surviving to age 10 for male and female children born before 1957. Tables 10 and 11 give the same data for children born 1957–1971 and for those born after 1971. As we would expect, the probability of survival for children born during the contact period is considerably lower than for those born earlier or later. During the first two periods, the survivorship for girls was lower than that for boys; only in the recent period is there an equal likelihood of survival. Moreover, during the contact period fewer girls were born than boys. While this might suggest that under stress male children receive more care, and even the possibility of sex-biased infanticide, the numbers are small and the differences may be artifacts of random variation. Female infanticide seems unlikely in this matrilocal society where both women and men say they welcome daughters as much as sons. Daughters bring sons-in-law into the household who are expected to hunt and work for their wife's family.

Table 6.
Parity of Women with Completed Fertility by Birth Cohort

| | | NUMBER OF LIVE BIRTHS | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BIRTH COHORT | N. OF WOMEN | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | X |
| 1910–1929 | 6 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 1 | 2 | 0 | 0 | 1 | 0 | 7.0 |
| 1930–1939 | 8 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 3 | 0 | 2 | 0 | 0 | 7.3 |
| 1940–1949 | 17 | 0 | 1 | 0 | 0 | 1 | 3 | 3 | 2 | 0 | 3 | 1 | 2 | 1 | 7.2 |
| TOTAL | 31 | 0 | 1 | 0 | 0 | 4 | 5 | 3 | 3 | 5 | 3 | 3 | 3 | 1 | 7.2 |

Table 7.
Comparative Parity by Age Group

| | 15–19 | 20–29 | 30–39 | 40–49 | 50–59 | 60+ | ALL AGES |
|---|---|---|---|---|---|---|---|
| SÃO DOMINGOS, 1962* | | | | | | | |
| N. of Women | 15 | 9 | 4 | 5 | 1 | 1 | 35 |
| Percent of Women | 42.9% | 25.7% | 11.4% | 14.3% | 2.9% | 2.9% | 100.0% |
| N. of Live births | 18 | 25 | 22 | 35 | 8 | 1 | 109 |
| Mean N. Live births | 1.2 | 2.8 | 5.5 | 7 | 8 | 1 | 3.1 |
| PIMENTEL BARBOSA, 1977 | | | | | | | |
| N. of Women | 14 | 19 | 18 | 7 | 3 | 2 | 63 |
| Percent of Women | 22.2% | 30.2% | 28.6% | 11.1% | 4.8% | 3.2% | 100.0% |
| N. of Livebirths | 17 | 80 | 101 | 48 | 15 | 19 | 280 |
| Mean N. Livebirths | 1.2 | 4.2 | 5.6 | 6.9 | 5.0 | 9.5 | 4.4 |
| PIMENTEL BARBOSA, 1990 | | | | | | | |
| N. of Women | 23 | 25 | 15 | 17 | 9 | 2 | 91 |
| Percent of Women | 25.3% | 27.5% | 16.5% | 18.7% | 9.9% | 2.2% | 100.0% |
| N. of Livebirths | 23 | 96 | 99 | 122 | 61 | 15 | 416 |
| Mean N. Livebirths | 1.0 | 3.8 | 6.6 | 7.2 | 6.8 | 7.5 | 4.6 |

Table 8.
Surviving Offspring by Age Group

| | 15–19 | 20–29 | 30–39 | 40–49 | 50–59 | 60+ | ALL AGES |
|---|---|---|---|---|---|---|---|
| SÃO DOMINGOS, 1962 * | | | | | | | |
| N. of Women | 12 | 9 | 2 | 4 | 1 | 1 | 29 |
| Surviving Offspring | 8 | 16 | 15 | 19 | 8 | 1 | 67 |
| Mean N. Surviving | 0.7 | 1.8 | 7.5 | 4.8 | 8.0 | 1.0 | 2.3 |
| Decrease as Percent of Live Births | 41.7% | 35.7% | 11.8% | 31.4% | 0.0% | 100.0% | 25.8% |
| PIMENTEL BARBOSA, 1977 | | | | | | | |
| N. of Women | 14 | 19 | 18 | 7 | 3 | 2 | 63 |
| Surviving Offspring | 11 | 60 | 54 | 16 | 10 | 13 | 164 |
| Mean N. Surviving | 0.8 | 3.2 | 3.0 | 2.3 | 3.3 | 6.5 | 2.6 |
| Decrease as Percent of Live Births | 35.3% | 25.0% | 46.5% | 66.7% | 33.3% | 31.6% | 41.4% |
| PIMENTEL BARBOSA, 1990 | | | | | | | |
| N. of Women | 23 | 25 | 15 | 17 | 9 | 2 | 91 |
| Surviving Offspring | 19 | 85 | 82 | 79 | 22 | 9 | 296 |
| Mean N. Surviving | 0.8 | 3.4 | 5.5 | 4.6 | 2.4 | 4.5 | 3.3 |
| Decrease as Percent of Live Births | 17.4% | 11.5% | 17.2% | 35.2% | 63.9% | 40.0% | 28.8% |

* Data from Neel et al. 1964:97–98

Table 9.
Abridged Life Table for Males and Females Born before 1957

MALES

| Year | Age | Entering Interval | Still in Interval | Subtotal | Deaths | Number Surviving | Percent Surviving | qx | lx | dx |
|---|---|---|---|---|---|---|---|---|---|---|
| 1956 | 0-1 | 28 | 2 | 26 | 2 | 24 | 92.3% | 0.077 | 1000 | 77 |
| 1955 | 1-2 | 24 | 3 | 21 | 0 | 21 | 100.0% | 0.000 | 923 | 0 |
| 1954 | 2-3 | 21 | 1 | 20 | 2 | 18 | 90.0% | 0.100 | 923 | 92 |
| 1953 | 3-4 | 18 | 0 | 18 | 0 | 18 | 100.0% | 0.000 | 831 | 0 |
| 1952 | 4-5 | 18 | 1 | 18 | 1 | 17 | 94.4% | 0.056 | 831 | 46 |
| 1951 | 5-6 | 17 | 1 | 16 | 0 | 16 | 100.0% | 0.000 | 785 | 0 |
| 1950 | 6-7 | 16 | 1 | 15 | 0 | 15 | 100.0% | 0.000 | 785 | 0 |
| 1949 | 7-8 | 15 | 0 | 15 | 0 | 15 | 100.0% | 0.000 | 785 | 0 |
| 1948 | 8-9 | 15 | 1 | 14 | 0 | 14 | 100.0% | 0.000 | 785 | 0 |
| 1947 | 9-10 | 14 | 1 | 13 | 0 | 13 | 100.0% | 0.000 | 785 | 0 |
| 10 | | | | | | | | | 785 | |

FEMALES

| Year | Age | Entering Interval | Still in Interval | Subtotal | Deaths | Number Surviving | Percent Surviving | qx | lx | dx |
|---|---|---|---|---|---|---|---|---|---|---|
| 1956 | 0-1 | 35 | 5 | 30 | 3 | 27 | 90.0% | 0.100 | 1000 | 100 |
| 1955 | 1-2 | 27 | 1 | 26 | 2 | 24 | 92.3% | 0.077 | 900 | 69 |
| 1954 | 2-3 | 24 | 4 | 20 | 1 | 19 | 95.0% | 0.050 | 831 | 42 |
| 1953 | 3-4 | 19 | 1 | 18 | 1 | 17 | 94.4% | 0.056 | 789 | 44 |
| 1952 | 4-5 | 17 | 3 | 14 | 0 | 14 | 100.0% | 0.000 | 745 | 0 |
| 1951 | 5-6 | 14 | 0 | 14 | 1 | 13 | 92.9% | 0.071 | 745 | 53 |
| 1950 | 6-7 | 13 | 1 | 12 | 0 | 12 | 100.0% | 0.000 | 692 | 0 |
| 1949 | 7-8 | 12 | 1 | 11 | 0 | 11 | 100.0% | 0.000 | 692 | 0 |
| 1948 | 8-9 | 11 | 3 | 8 | 0 | 8 | 100.0% | 0.000 | 692 | 0 |
| 1947 | 9-10 | 8 | 0 | 8 | 0 | 8 | 100.0% | 0.000 | 692 | 0 |
| | 10 | | | | | | | | 692 | |

**Infanticide**

Infanticide is not likely to be openly reported by Xavante women as they are aware that outsiders do not approve of it, and it seems unlikely that it is practiced at present. One women told me that formerly it was not customary to keep both of a pair of twins born. When I asked Warodi, Apowẽ's son, about keeping twins he told me rather indignantly that twins were welcomed; although he remembered a case of a women who bore twins and killed one, it was because her husband was away hunting at the time—if he were present he would have prevented it.

Between 1975 and 1977 three births of twins were recorded at Pimentel Barbosa. In each case both the twins were raised, though in two instances one of the pair died later. Sex-preferential infanticide favoring males in the past might be inferred from an unusually high sex ratio at birth. For births before 1957 the sex ratio was 80, but it was 122 for the period from 1957 to 1971, during the same period when girls had the lowest likelihood of surviving infancy. For births after 1971 the sex ratio is 107.

Another indication of female infanticide might be a preponderance of female stillbirths reported, but this is not the case. In 1977, women reported 20 stillbirths, of which seven were male, three female, and ten of unknown sex. Twelve of these occurred during the contact period, possibly because of increased illness and stress at that time. Older Xavante women tend to be ambiguous about whether an infant was born dead or died immediately after birth. Some who were interviewed in 1977 and again in 1990 defined the same birth differently. This might indicate that infants of either sex who did not appear vigorous at birth were rejected.

Table 10.
Abridged Life Table for Males and Females Born 1957–1971

MALES

| Year | Age | Entering Interval | Still in Interval | Subtotal | Deaths | Number Surviving | Percent Surviving | qx | lx | dx |
|---|---|---|---|---|---|---|---|---|---|---|
| 1971 | 0-1 | 73 | 3 | 70 | 15 | 55 | 78.6% | 0.214 | 1000 | 214 |
| 1970 | 1-2 | 55 | 3 | 52 | 5 | 47 | 90.4% | 0.096 | 786 | 76 |
| 1969 | 2-3 | 47 | 8 | 39 | 2 | 37 | 94.9% | 0.051 | 710 | 36 |
| 1968 | 3-4 | 37 | 3 | 34 | 3 | 31 | 91.2% | 0.088 | 674 | 59 |
| 1967 | 4-5 | 31 | 5 | 26 | 3 | 23 | 88.5% | 0.115 | 614 | 71 |
| 1966 | 5-6 | 23 | 4 | 19 | 1 | 18 | 94.7% | 0.053 | 543 | 29 |
| 1965 | 6-7 | 18 | 2 | 16 | 0 | 16 | 100.0% | 0.000 | 515 | 0 |
| 1964 | 7-8 | 16 | 2 | 14 | 0 | 14 | 100.0% | 0.000 | 515 | 0 |
| 1963 | 8-9 | 14 | 2 | 12 | 0 | 12 | 100.0% | 0.000 | 515 | 0 |
| 1962 | 9-10 | 12 | 3 | 9 | 1 | 8 | 88.9% | 0.111 | 515 | 57 |
| | 10 | | | | | | | | 515 | |

FEMALES

| Year | Age | Entering Interval | Still in Interval | Subtotal | Deaths | Number Surviving | Percent Surviving | qx | lx | dx |
|---|---|---|---|---|---|---|---|---|---|---|
| 1971 | 0-1 | 60 | 2 | 58 | 11 | 47 | 81.0% | 0.190 | 1000 | 190 |
| 1970 | 1-2 | 47 | 5 | 42 | 3 | 39 | 92.9% | 0.071 | 810 | 58 |
| 1969 | 2-3 | 39 | 7 | 32 | 5 | 27 | 84.4% | 0.156 | 752 | 118 |
| 1968 | 3-4 | 27 | 4 | 23 | 1 | 22 | 95.7% | 0.043 | 635 | 28 |
| 1967 | 4-5 | 22 | 2 | 20 | 1 | 19 | 95.0% | 0.050 | 607 | 30 |
| 1966 | 5-6 | 19 | 1 | 18 | 3 | 15 | 83.3% | 0.167 | 577 | 96 |
| 1965 | 6-7 | 15 | 1 | 14 | 2 | 12 | 85.7% | 0.143 | 481 | 69 |
| 1964 | 7-8 | 12 | 3 | 9 | 0 | 9 | 100.0% | 0.000 | 412 | 0 |
| 1963 | 8-9 | 9 | 2 | 7 | 0 | 7 | 100.0% | 0.000 | 412 | 0 |
| 1962 | 9-10 | 7 | 2 | 5 | 0 | 5 | 100.0% | 0.000 | 412 | 0 |
| | 10 | | | | | | | | 412 | |

**Comparison of Fertility Surveys**

In 1977 I collected fertility histories from 71 women; in 1990 I interviewed 109 women, 52 of whom were also covered in the 1977 survey (Table 12). In both cases I was assisted by a male interpreter, in 1977 a FUNAI employee who was raised among the Xavante and spoke the language well, and in 1990 by one of the young Xavante who had spent several years at school and had recently returned.

Demographers have found that women, especially older women who have lost a number of their children at a young age, tend to be vague about the date of birth and age at death of those who died very young, and may fail entirely to mention them (Leslie and Gage 1989). Demographers have even devised correction factors to compensate for these assumed omissions (Som 1973).

Xavante women are willing to talk about their children who have died, even though remembering them causes sadness. However, there are other difficulties. Xavante reckoning is largely in terms of what follows what, not enumeration—they think ordinally rather cardinally, so to speak. A question such as "How many children have you had?" does not translate well into Xavante. Rather one asks, "Which of your children was born first... and the next one.... and the one after that?"

In order to evaluate how consistent the responses obtained in the two surveys were, I compared the accounts of the birth and fate of children born in 1977 or before to 37 women who were interviewed for both surveys and were 20 or older in 1977. Since the second interview was 13 years after the first, it might be expected that in 1990 some women would fail to recall some children they had mentioned in 1977, especially those that were born and died in the more distant past.

Table 11.
Abridged Life Table for Males and Females Born 1972–1990

MALES

| Year | Age | Entering Interval | Still in Interval | Subtotal | Deaths | Number Surviving | Percent Surviving | qx | lx | dx |
|---|---|---|---|---|---|---|---|---|---|---|
| 1990 | 0-1 | 159 | 8 | 151 | 17 | 134 | 88.7% | 0.113 | 1000 | 113 |
| 1989 | 1-2 | 134 | 10 | 124 | 5 | 119 | 96.0% | 0.040 | 887 | 36 |
| 1988 | 2-3 | 119 | 8 | 111 | 0 | 111 | 100.0% | 0.000 | 852 | 0 |
| 1987 | 3-4 | 111 | 11 | 100 | 0 | 100 | 100.0% | 0.000 | 852 | 0 |
| 1986 | 4-5 | 100 | 8 | 92 | 1 | 91 | 98.9% | 0.011 | 852 | 9 |
| 1985 | 5-6 | 91 | 9 | 82 | 1 | 81 | 98.8% | 0.012 | 842 | 10 |
| 1984 | 6-7 | 81 | 3 | 78 | 0 | 78 | 100.0% | 0.000 | 832 | 0 |
| 1983 | 7-8 | 78 | 9 | 69 | 0 | 69 | 100.0% | 0.000 | 832 | 0 |
| 1982 | 8-9 | 69 | 5 | 64 | 1 | 63 | 98.4% | 0.016 | 832 | 13 |
| 1981 | 9-10 | 63 | 8 | 55 | 0 | 55 | 100.0% | 0.000 | 819 | 0 |
| | 10 | | | | | | | | | |

FEMALES

| Year | Age | Entering Interval | Still in Interval | Subtotal | Deaths | Number Surviving | Percent Surviving | qx | lx | dx |
|---|---|---|---|---|---|---|---|---|---|---|
| 1990 | 0-1 | 148 | 5 | 143 | 13 | 130 | 90.9% | 0.091 | 1000 | 91 |
| 1989 | 1-2 | 130 | 9 | 121 | 5 | 116 | 95.9% | 0.041 | 909 | 38 |
| 1988 | 2-3 | 116 | 8 | 108 | 0 | 108 | 100.0% | 0.000 | 872 | 0 |
| 1987 | 3-4 | 108 | 9 | 99 | 1 | 98 | 99.0% | 0.010 | 872 | 9 |
| 1986 | 4-5 | 98 | 2 | 96 | 0 | 96 | 100.0% | 0.000 | 863 | 0 |
| 1985 | 5-6 | 96 | 8 | 88 | 0 | 88 | 100.0% | 0.000 | 863 | 0 |
| 1984 | 6-7 | 88 | 8 | 80 | 1 | 79 | 98.8% | 0.013 | 863 | 11 |
| 1983 | 7-8 | 79 | 14 | 65 | 1 | 64 | 98.5% | 0.015 | 852 | 13 |
| 1982 | 8-9 | 64 | 4 | 60 | 0 | 60 | 100.0% | 0.000 | 839 | 0 |
| 1981 | 9-10 | 60 | 9 | 51 | 0 | 51 | 100.0% | 0.000 | 839 | 0 |
| | 10 | | | | | | | - | 839 | |

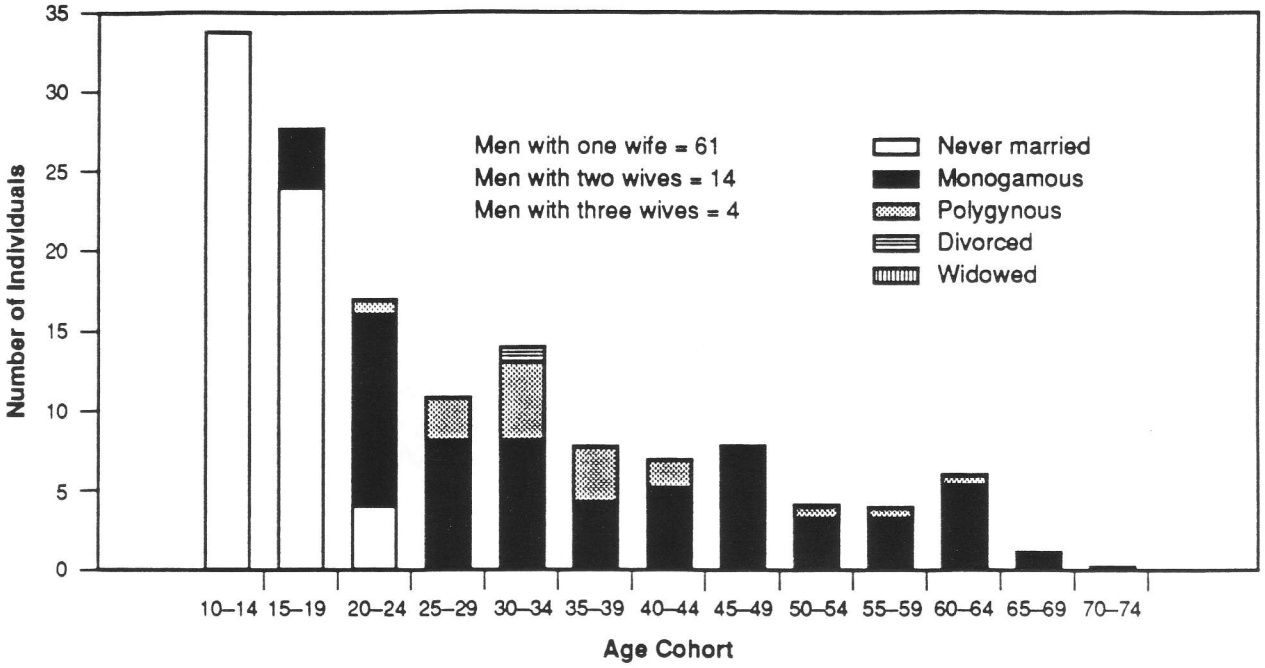
Table 12.
Xavante Fertility Surveys: Pimentel Barbosa
Women interviewed in 1977 and 1990

| | Included in both surveys | Died 1977–1990 | Moved 1977–1990 | Total 1977 | 1990 survey only | Total 1990 |
|---|---|---|---|---|---|---|
| Ages in 1977 | | | | | | |
| 10–40 | 45 | 1 | 13 | 59 | | |
| 40+ | 7 | 4 | 1 | 12 | | |
| Total | 52 | 5 | 14 | 71 | | |
| Ages in 1990 | | | | | | |
| 10–40 | 25 | | | | 56 | 81 |
| 40+ | 27 | | | | 1 | 28 |
| Total | 52 | | | | 57 | 109 |

When the women's responses were tabulated and compared, however, they did not show the anticipated direction. Overall, these women in 1977 reported 188 live births, and 191 in 1990 for the same period of time. Seven women reported nine fewer live births in 1990 than they did in 1977; four of these were described as born alive in 1977 but reported as stillbirths in 1990. Five children that were reported as having been born alive in 1977 were omitted in the 1990 interviews. The opposite also occurred: nine women remembered more live births than in 1977. Nine children that were not mentioned at all in 1977, and three previously described as stillbirths, were remembered as having been born alive and died soon after birth. Of the 25 women over 40, thirteen were completely consistent in their accounts, while eight of the twelve younger women were consistent.

There were also some discrepancies in the reported age at death. I believe that I obtained more accurate

Figure 5.
Marital Status by Age: Males, 1990




information in 1990 by asking the mothers to describe age at death in terms of development stages: turns over alone, sits up, crawls, walks, and so on.

In all, the comparison does not indicate a systematic tendency for Xavante women to forget their dead children. The differences are probably related more to my ability and that of my interpreter to elicit thoughtful and complete responses from the informants. I believe that the 1990 survey was probably the more reliable, in part because I had a native interpreter.

### Population Growth and Marriage Practices

The Xavante are polygynous, and marry between two exogamous clans. Even though in this group at present the sex ratio of individuals over the age of ten is approximately equal, rapid population growth permits the continuation of a relatively high rate of polygynous marriage (Figures 5 and 6). This is because young men are married five to ten years later than young girls, and there is a larger number of potential spouses in the younger age cohorts. In 1977, 24 percent of married men had more than one wife, in 1990, 23 percent. In 1990, 41 percent of women were in polygynous unions, hardly varying from the 1977 figure of 40 percent.

Young men are not permitted to marry until their age set is initiated, when most of them are 14 to 18 years old. Toward the end of the elaborate initiation ceremonies each youth is betrothed to a girl of the proper clan affiliation, but she is often so young that he must wait several years before his "wedding hunt" is held. The young man then goes out hunting with a number of his age mates, returning only when they have accumulated an impressive amount of game which the bridegroom presents to the household of his future father-in-law. After this ceremony the young man can visit his bride at night, but only after their first child is born does he take up residence with her in her father's house.

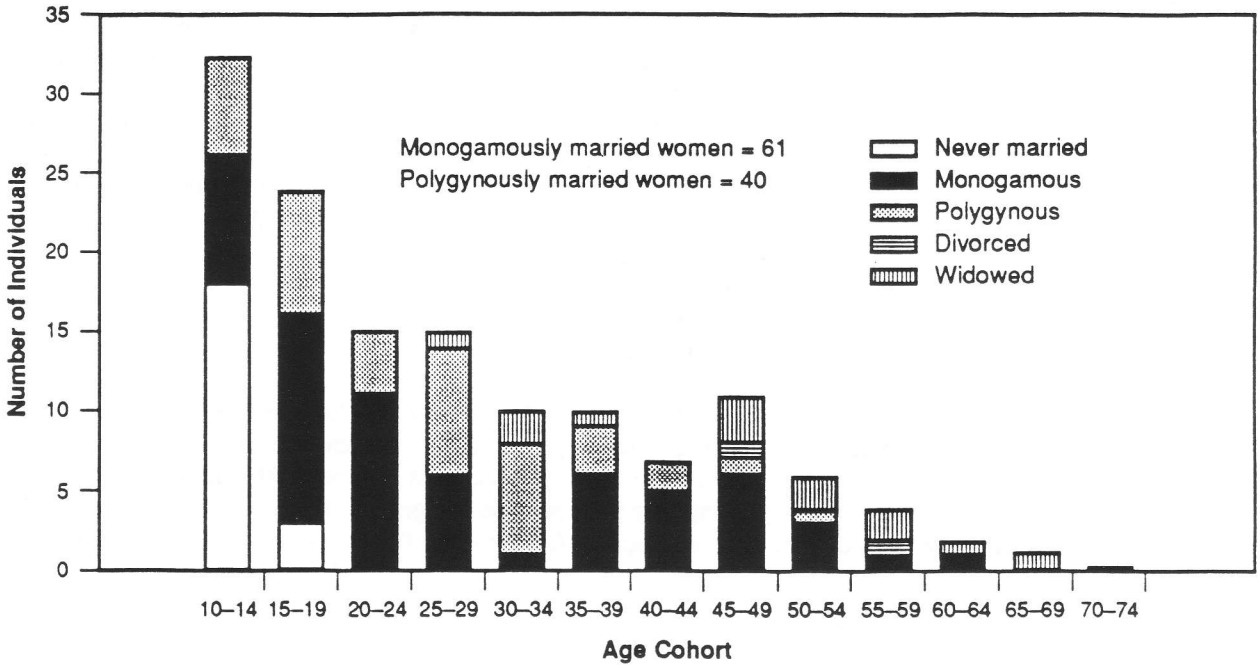
Since polygyny is largely sororal, if a young man marries into a household where there are several daughters, he may marry first the eldest, then the younger sister or sisters as they become of marriageable age. However, brothers often marry into the same household, so a frequent arrangement is for two or more brothers to be married to the daughters of the household. Some men, after years of monogamous marriage, or after the death of the first wife, acquire a much younger wife. Women who are widowed after the age of 30 or so usually do not remarry (see Figure 6).

### Health Changes

In 1962 the team of scientists that studied the São Domingos Xavante was impressed by their excellent physical status, especially that of the young men, who were described as "superb physical specimens" (Neel and Salzano 1967). However, women appeared to age early and the investigators were puzzled by the lack of elderly people in the population.

The mean height and weight of adults in São Domingos (estimated age greater than 18) was 168.1cm and 67.2k for males and 154.7cm and 54.0k for females (Neel et al.

Figure 6.
Marital Status by Age: Females, 1990




1964:65), showing them to be among the tallest and heaviest of Lowland South American Indians. Some specific physical characteristics of Xavante populations in São Domingos and other villages were "the musculature, the keen vision, the lack of dental caries, the slow pulses, and the low blood pressures" (Neel and Salzano 1967). At the same time immunologic studies revealed a high frequency of antibodies to pertussis and measles viruses, indicating that outbreaks of these diseases had already occurred.

By 1977 the health picture had changed considerably. With the exception of colds and flu, to which Xavante of all ages seemed especially subject, acute infectious diseases were no longer highly prevalent, and the infant mortality rate appeared to be dropping, even though young children were not vaccinated. Periodic measurement of the growth of babies under two showed that they grew well, though there was some seasonal variation in the growth rate of those older than 12 months (Flowers 1983). The mean height and weight of adults was very similar to that found by Neel et al. in 1962. The major threat to health was tuberculosis, which was absent in 1962. Several individuals also suffered from pemphigus, a serious autoimmune disease endemic in the Mato Grosso and Goiás regions (Friedman et al. 1992).

By 1990 FUNAI had initiated a vaccination program that was sporadically maintained. My colleagues Carlos Coimbra and Ricardo Santos, with the help of a FUNAI health worker, carried out a complete vaccination series while we were at Pimentel Barbosa, including BCG, measles, Sabin polio, and tetanus vaccines. Previous to our visit no vaccinations had been done for about three years, placing the youngest members of the community at risk. Coimbra and Santos also carried out extensive immunological tests and physical examinations and took anthropometric measurements. These studies are now being evaluated and compared to those done in 1962 to give a picture of health changes associated with contact and acculturation in this population.

## Summary

From the above evidence it seems clear that the "demographic crisis" of this population was largely due to introduced diseases, raising infant mortality rates to a level that threatened population replacement. It appears that fertility was relatively high in pre-contact times, dropped somewhat during the crisis due to social disruption and disease, but recovered as infant mortality declined. There is now a large cohort of young people in their reproductive years resulting in rapid population growth.

## Conclusions

Because Brazilian Indian groups have experienced both the direct and indirect effects of contact throughout the historical period, it is probably unrealistic to assume a stable relationships between these groups and their physical and social environments. The very existence of the frontier implies unpredictability. For example, the history of the Xavante and other Gê groups suggests that they must have experienced repeated population crashes and recoveries

since early colonial times. Epidemics of measles and smallpox were frequent in colonial Goiás, with high mortality among settlers as well as native groups (Cunha Mattos 1874:298–307; Paula Ribeiro 1848:311).

Semi-nomadic groups such as the Xavante may have survived these epidemics better than those dependent on agriculture, because when hit by disease they consistently abandoned the aldeias in which they had been settled by colonial governors and retreated to areas far from the whites. The apparent increase in numbers and aggressiveness of the Indians of colonial Goiás after they abandoned the aldeias (Cunha Mattos 1874:18) and the expansion of the Xavante after they withdrew from contact and migrated into Mato Grosso in the mid-nineteenth century imply rapid population growth during these periods.

Historical evidence therefore indicates that native populations have probably been fluctuating since the time of first contact. Some became extinct or their remnants were absorbed by other groups. Others increased in numbers and budded off, occupying the territory of those that had disappeared.

Whether an indigenous group will survive the multiple shocks of contact or succumb to them is determined by the interaction of many factors external and internal to the group. Perhaps the most important external factor is the pace at which the native group is forced to adapt to new conditions. This in turn depends on the speed and magnitude of settler penetration and whether the native group retains a sufficiently large land base to buffer it to some extent from the effects of contact.

Among internal factors, I have suggested that high fertility is important in assuring group survival, but this in turn appears to be influenced by social and physical conditions. Equally important may be social and political contacts, whether friendly or hostile, among population units of the same tribe. The Xavante and the Kayapó, in the context of factionalism which led to frequent interaction and exchange of individuals among communities, developed political abilities which they have adapted to dealing effectively with outsiders while retaining a solid concept of their own identity.

The Xavante are among the few Brazilian Indian groups that have succeeded in regaining control over some of the land that was once theirs. Even so, it seems likely that, if the present rate of population growth continues, it will soon be difficult for them to make a living by their present subsistence practices (see Gross et al. 1979).

In 1989 (CEDI/Museu Nacional 1990), the latest date for which I have figures, the overall Xavante population was 6231, up from 3340 in 1977 (Graham 1986). At this rate of increase, the 1993 population must be approaching 7000. There are seven Xavante reserves, all in eastern Mato Grosso. The distribution of population relative to land is unequal. Pimentel Barbosa, with 328,966 ha, is the largest reservation and probably has the least population pressure, which is said to be becoming acute in São Marcos and Parabubure.

It seems likely that, as a whole, the Indian population of Brazil will tend to increase, but most of this increase will be due to the rapid growth of some groups, while others may fail to reproduce at replacement level. The demographically "successful" groups will probably have to make changes to cope with their larger numbers. Inevitably the result will be a loss of cultural and genetic diversity.

## Notes

1. As all those who have collected demographic data in preliterate societies know, one of the most difficult, yet essential, tasks is to establish with the greatest accuracy possible the ages of individuals in the population surveyed (see Howell 1979). When I carried out my first census in 1976 one of the tools I used to estimate ages was an event calendar, which was especially useful in questioning parents about the birth date of their children. When this could be ascertained for one child, the relative ages of parents and children, brothers and sisters could be approximated. Maybury-Lewis's genealogy (Maybury-Lewis 1974: Appendix) provided the names and relationships among adults living in the community at the time of his research. Inquiry was also facilitated by the Xavante age set system. A group of boys, roughly between the ages of eight and thirteen, enters the "bachelors' hut" where they live together until their initiation about five years later. This group takes the name of one of the eight age sets which are successively rotated, and keeps identification with that age set through life. Since women belong to the same age set as their male age mates, one can estimate that people who, for example, say they belong to the Tirowá age set are, on the average, five years older than those who belong to the Nodzö'u age set. The Xavante themselves use this system, saying that such and such an event occurred when the Nodzö'u were in the bachelors' hut, or when the Atẽpá were Ritai'wa, that is they were in the young men's age grade. However, I had exact birth dates only for those children born between 1974, when the Indian agent began registering births, through July 1977 when I left the village. When I took my 1990 census I was able to use those dates to make more accurate statements about the age at which childbearing begins among Xavante women. Lastly, Dr. James Neel kindly gave me copies of field notes giving the names and estimated ages of people examined for the team's medical studies (Neel et al. 1964) and these allowed me to revise my estimate of the ages of some older people, since it is clearly easier to tell if a person is one or five years old than it is to tell if he is thirty or thirty-five.

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I should like to thank my colleagues, Carlos Coimbra and Ricardo Santos, not only for their work in the field, which was primary, but also for their efficient organization of the project and for their companionship.

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# OBSERVATIONS ABOUT A CENTRAL BRAZILIAN INDIGENOUS POPULATION: THE BAKAIRI

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Anthropologists frequently avoid gathering demographic data on relatively isolated, nonindustrial societies because their populations are small. Conclusions drawn from these data are limited when compared with those we can draw from studies done on larger state societies. Yet a better understanding of the demographic variables that affect small populations allows us to formulate responses to many important questions. Researchers can develop scenarios about the rates of natural increase of indigenous groups and how changes in these rates affect available resources, health status, and long-term adaptation.

Indigenous South American peoples pose a special challenge for those interested in demographic research. Following contact with Europeans in the sixteenth century, some populations were decimated and became extinct. Others currently teeter on the brink of extinction as their population levels plummet below what is necessary for cultural transmission. Still others survived enslavement and epidemics and are now rapidly increasing. They confront new obstacles to their survival in the form of economic and political pressures, many of which are associated with modernization and development. A better understanding of the demographic processes that affect these populations may allow national policy makers and administrators to anticipate future trends more effectively.

This study focuses on population changes that occur in complex social and historical contexts. It posits that contact and development trigger an intricate interaction of many variables that vary from society to society. Its goal is to untangle, and make comprehensible, these factors (Johnson 1990, Campbell and Wood 1988, Peacock 1986, Romaniuk 1981, Bari-Kolata 1974).

Although it is difficult to specify a single, typical level of fertility for small societies in contact, cross-cultural studies suggest that the range of four to eight children for the average woman, with a mean of six, is the norm (Campbell and Wood 1988:45). Societies with fertility rates higher than eight tend to be "colonizing" populations, in that they are rapidly expanding into new territories. It is believed that such groups abandon or alter fertility-inhibiting practices which, up to that point, have kept their population growth rates at low or moderate levels. These fertility-inhibiting practices are the constellation of factors responsible for population size. They may involve factors that are internal to the population, such as average age of onset menses, average age of marriage, post-partum taboos on intercourse, use of wet nurses, or preference for lactation verus bottle feeding. Yet fertility-inhibiting practices may also concern external factors such as nutritional levels (Romaniuk 1981).

This article examines some demographic characteristics of a small South American Indian society that has been in regular contact since the 1920s. (See Figure 1.) It has, as predicted, a moderate fertility rate. After undergoing a grueling period of initial contact and concomitant population loss, this group did not begin a period of rapid increase as many other traditional societies have (Romaniuk 1981, Neel and Weiss 1975, Henripin 1954, Eaton and Mayer 1953). Rather, while their population size increased, some fertility-inhibiting practices remained in place. The result was steady, but not high, population growth rates.

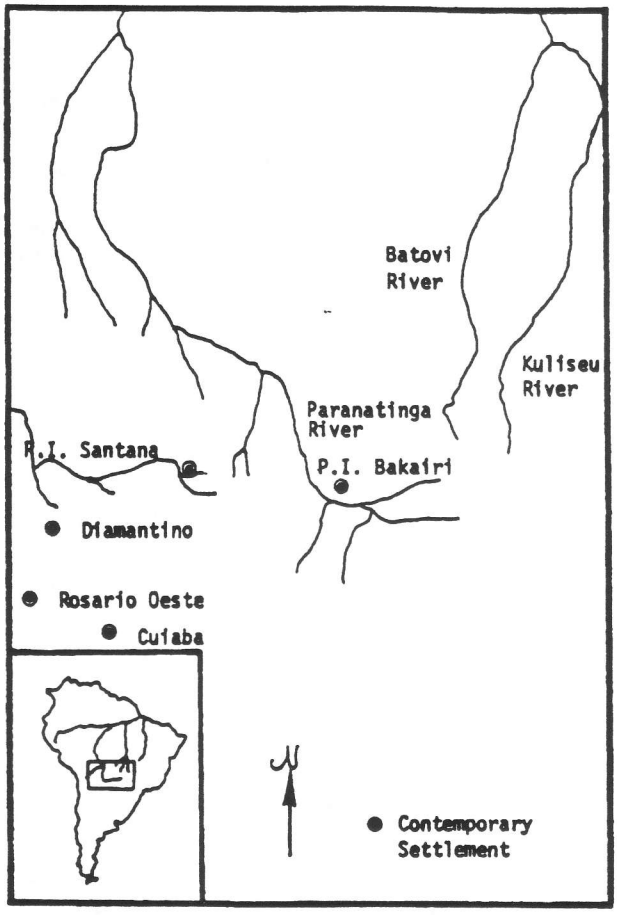


Figure 1.
The Bakairi Reservation, Mato Grosso, Brazil

This study briefly describes household and settlement composition, marriage traditions, fertility and reproduction patterns, and causes of death. It then goes on to distill from these descriptive sections certain observations about the presence or absence of specific fertility-inhibiting practices. After reviewing recent population trends, it concludes by suggesting that an important reason Bakairi fertility rates have remained moderate lies in the population's relation to its resource base.

## A Brief Bakairi History

Central to our understanding of both the dynamics of the Bakairi Indians' population and their relation to their environment is an awareness of their recent history. Although the Bakairi were originally contacted in the middle of the eighteenth century by Portuguese *bandeirantes* in search of minerals and slaves, there are broad gaps in their history between this early point of reference and the time they began to migrate to their present location (Picchi 1982, Campos 1862, Torres 1738). I believe, however, that they migrated west from villages on the Xingu River, where they had lived for some time between 1890 and 1920. They then settled on the Paranatinga River, where remnants of a previous Bakairi village existed.

Between 1918 and 1921, a 50,000 hectare reservation was demarcated for the Bakairi and an Indian Post named Simões Lopes was established. This development protected indigenous lands from settlers entering the Mato Grosso frontier, but the proximity of Brazilians administering the Indian Post in the reservation led to forced culture change. For example, the Bakairi were forbidden to make their traditional elliptically-shaped houses or to organize their villages in circles. They had to wear clothes and to provide the Brazilian Indian agents with labor for the production of goods, which were sold to support the reservation's economy.

Rapid acculturation coupled with several epidemics resulted in depopulation. By the late 1920s and 1930s, researchers and explorers who visited the area predicted the Bakairi would shortly be extinct (Schmidt 1947, Petrullo 1930). In the 1940s, however, the Bakairi began to recover. Despite later problems with tuberculosis and other diseases, the indigenous population continued to increase and is still increasing today.

The Bakairi, however, are not the only people in Mato Grosso whose population is growing. The Brazilian frontier has pushed northwest of Mato Grosso and the state is so populated that it recently split into two parts. The Bakairi reservation is surrounded by two major ranches and several smaller ones. Squatters have invaded the southern part of the reservation and it is unclear how the Indians and National Indian Foundation (hereafter referred to as FUNAI) will deal with the problem.

Exacerbating this situation is the composition of the reservation. Only 15 percent of the land is made up of gallery forest, the only place adequately fertile to support slash-and-burn horticulture. The other 85 percent of the land is made up of *cerrado*, or dry prairie, where agriculture is not possible.

It would seem that the Bakairi are confronting a situation that is the antithesis of the one described by Campbell and Wood (1988). Instead of facing the option for colonization and expansion, they are, in fact, confronting a somewhat limiting set of circumstances. This context is important for understanding the demographic dynamics we shall see in operation in the reservation.

## Methodology

Initial field research with the Bakairi Indians took place between 1979 and 1981. During that period, I collected base-line demographic data. Although a more recent field trip in 1989 showed the extent to which the demographic situation had altered, I will depend on the 1979-1981 data set for analysis because it is more complete.

An initial census involved determining the sex and age of the people who lived in each house. Ages of the Bakairi were ascertained in several ways. First, individuals were asked how old they were. Many claimed to know their birthdays. However, whether they knew or did not, the information was checked with another adult and/or with the elderly Bakairi *atendente*, or medic, who knew a great deal about the people of the reservation. Official records, kept by FUNAI agents, were also studied. I found them to be incomplete but helpful in suggesting questions.

Fertility data are notoriously difficult to collect. With Brazilian Indians, problems are compounded by fears that FUNAI will punish them for abortions and infanticides which field agents officially discourage. In addition, although some Indians understand the concept of Western time, it is often difficult for them to remember exactly when and how many times they were pregnant or when a child died. Therefore, the fertility data used in this chapter were collected in three ways, which, when used together, allowed for self-correction and verification.

First, I interviewed the individual women in the village alone. In order to help them pinpoint time of pregnancies and deaths of children, I asked them how old the child would be if it had been born or if it had lived. For example, would the child be as old as Maisa, who was three, or as old as Maiare, who was 20. This method had good results as the children in the village are apparently lumped by the women into groups based on proximity of age.

The second method of data collection was to interview the old women of the village in order to verify the results of the individual interviews. They reviewed the materials making corrections and suggestions. I checked these addi-

tions later with the younger women. The older women often remembered pregnancies and deaths that the younger women did not mention. On further questioning, the young women frequently remembered too. (If a young woman denied the allegation, I threw the case out.)

The third method used was to consult FUNAI death-birth records. As already mentioned, these records were incomplete, but often furnished leads that I discussed with members of the community.

This information about pregnancies, births, and deaths was combined with other kinds of materials about sexual taboos, marriage traditions, and census data in order to provide a demographic context from which we may make observations about the fertility-inhibiting behaviors in operation among the Bakairi.

### Bakairi Village and Household Composition

Approximately 288 Indians inhabit the Bakairi reservation, where they live in a small village made up of 54 households. Five additional houses are located outside of the settlement. (See Figure 2.) Due to Brazilian interference, the contemporary Bakairi village forms a "T," rather than the traditional circle. A men's house occupies the center of the village.

From Figure 2, the general layout of the village is clear. Since the FUNAI administers the Bakairi reservation, housing for this organization's agent as well as a school, a garage, and an infirmary make up one part of the village. This section is normally referred to as the Bakairi Indian Post (P.I. Bakairi.) The Bakairi Indians, supervised by officials from an organization that preceded FUNAI, constructed the buildings between 1940 and 1947.

The part of the village associated with FUNAI is quiet and empty when compared to the second part of the village. A lively atmosphere characterizes the 54 households and the men's house. During the dry season, people participate in many activities, such as ritual dancing, visiting, and going to the gardens or to the river. Even during the rainy season when people stay indoors more often, groups of individuals congregate to talk or to work on projects such as hammock weaving.

Household composition data indicate that the majority of households consist of between three and six individuals

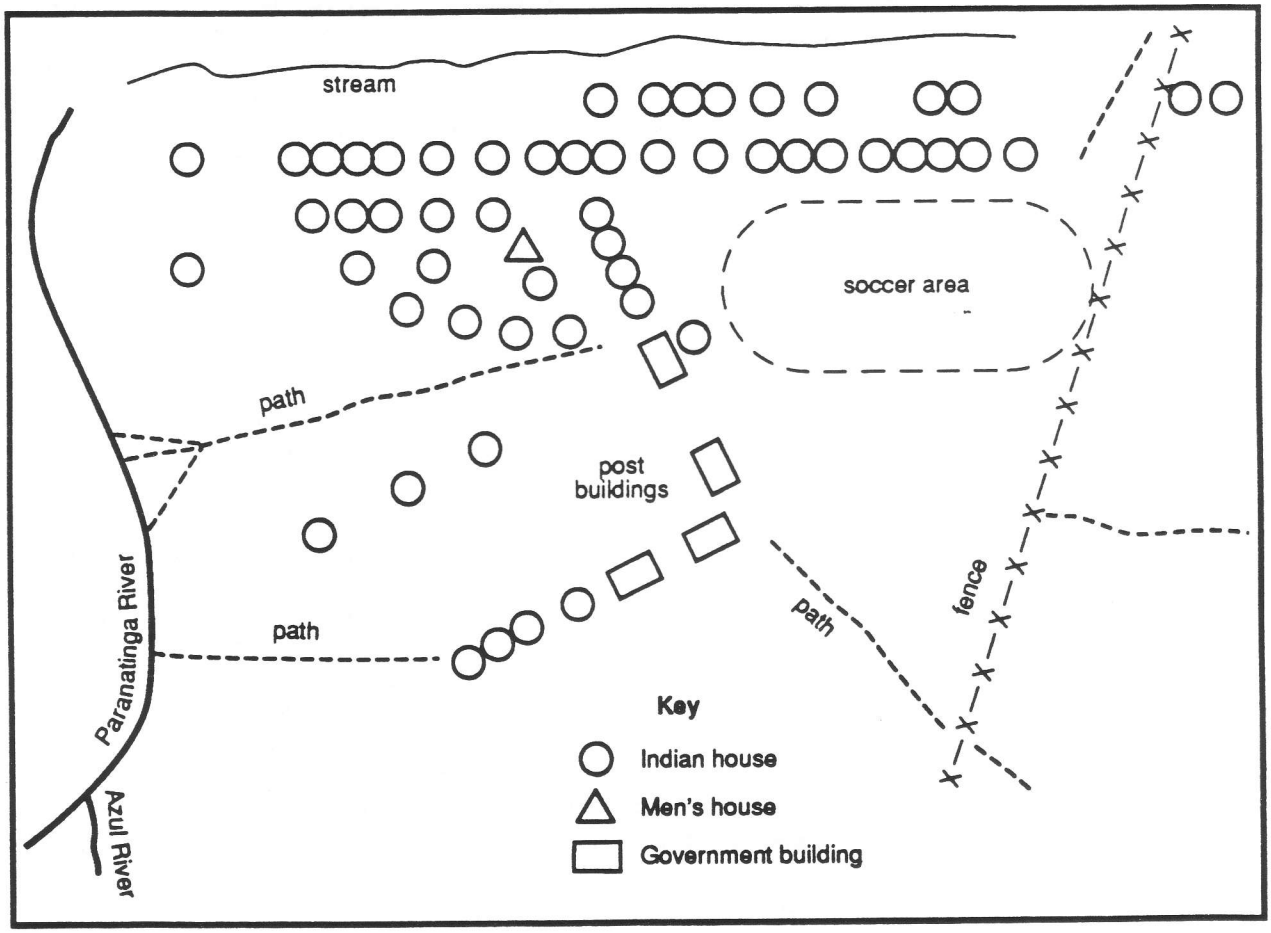


Figure 2.
The Bakairi Village

Table 1
Bakairi Household Composition by Number of People

| Households | | | |
|---|---|---|---|
| Number of People in Household | N | % | Cum. % |
| 1 | 1 | 1.7 | (1.7) |
| 2 | 1 | 1.7 | (3.4) |
| 3 | 12 | 20.3 | (23.7) |
| 4 | 15 | 25.4 | (49.1) |
| 5 | 9 | 15.3 | (64.4) |
| 6 | 14 | 23.7 | (88.1) |
| 7 | 2 | 3.4 | (91.5) |
| 8 | 2 | 3.4 | (94.4) |
| 9 | 1 | 1.7 | (96.6) |
| 10 | 1 | 1.7 | (98.3) |
| 11 | 1 | 1.7 | (100.0) |
| Total | 59 | 100.0 | (100.0) |

with a mode and median of four individuals. (See Table 1.) The mean is only slightly higher, 4.88 ± .478 people. In each household, a married male and female constitute the core. Their children, their grandchildren if they have any, and the parents of one or both of the partners make up the peripheral individuals.

Of the total 59 Bakairi households, 47 (80 percent) are made up of a married couple, six (10 percent) have two married couples living on the premises, and six (10 percent) include a widow or widower. In the six cases where two married couples live together in one house, two consider the situation to be temporary. In both instances, the daughters of the core couple recently married and are waiting to give birth to their first children before moving into their own homes. In the other four cases, aging parental couples live with middle-aged daughters and their husbands.

**Bakairi Marriage**

Bakairi women do not marry immediately after they begin to menstruate. Rather, they are allowed a period of freedom during which they experiment with a number of different sexual partners. The average age of onset of menses is 11.9 ± 0.4, while the average age of marriage is 16.2 ± 3.3.

Although having a series of affairs appears to be a natural part of a girl's development, getting married and having children are key aspects of a Bakairi woman's role. Of the 99 menstruating or post-menopausal women in the village, 60 are married. (See Table 2.) One woman had been divorced but remarried, three are divorced and living with

Table 2.
Marriage among Bakairi Women

| Type | N | % |
|---|---|---|
| Married women | 60 | 61 |
| Divorced - remarried 1 (1%)<br>Widowed - remarried 5 (5%)<br>Married one time 54 (55%) | | |
| Unremarried widows | 7 | 7 |
| Unremarried divorcees | 3 | 3 |
| Unmarried marriageable women | 29 | 29 |
| Total | 99 | 100 |

their families of orientation, seven are unremarried widows, and five are remarried widows.

Marriage occurs after the parents of a couple agree that a marriage is acceptable to both families. Sometimes this takes place without the couple knowing about it. For example, one couple who had been seeing each other for only three days found that their widowed mothers had decided they would marry. Couples also elope. The two individuals flee to a distant garden for several days until the villagers learn about the union. When the gossip dies down, the couple returns to the village.

There are 29 women who are old enough to marry, according to Bakairi standards. (See Table 3.) However, only 20 of the 27 men in the same age group are older than 15 years of age, the age at which it is believed they can care for their own gardens and support a family in a responsible manner.

In 1981, only four of the women old enough to marry remained unmarried. When I returned to the reservation in 1989, only one of these women had married; the other three remained single. Two of them did have children, however,

Table 3.
Bakairi Men and Women of Marriageable Age

| | Women | | | Men | | |
|---|---|---|---|---|---|---|
| Age | N | % | Cum. % | N | % | Cum. % |
| 12 - 14 | 7 | 24.1 | (24.1) | 6 | 22.3 | (22.3) |
| 15 - 17 | 7 | 24.1 | (48.2) | 7 | 25.9 | (48.2) |
| 18 - 20 | 7 | 24.1 | (72.3) | 7 | 25.9 | (74.1) |
| 21 - 23 | 4 | 13.9 | (86.2) | 2 | 7.4 | (81.5) |
| 24 - 26 | 2 | 6.9 | (93.1) | 3 | 11.1 | (92.6) |
| 27 + | 2 | 6.9 | (100.0) | 2 | 7.4 | (100.0) |
| Total | 29 | 100.0 | (100.0) | 27 | 100.0 | (100.0) |

and while this is not unusual, it is considered problematic. In the case of pregnancy without marriage, a woman may try to abort the child using herbs, or she may kill the child when it is born. Few women opt to raise a child without a husband's support because of the economic burden. Additionally, caring for the child removes the woman from the marriage pool for two or three years, thus reducing her chances for securing a permanent mate.

After marriage, a couple has several options. They may temporarily live with one of the spouses' families and then build their own house or they may live indefinitely with the spouse's family. The majority of Bakairi couples prefer to set up their own households, although relatives may routinely join them for short or lengthy visits.

Divorce occurs among the Bakairi, but it is rare for individuals to remain unmarried for any length of time. Only four divorced women, and no divorced men, live in the village. When divorce takes place, it is because the husband has taken a lover and she has become pregnant. An extramarital affair is not grounds for divorce, but pregnancy is. When a married man impregnates a woman, one of two things may happen. The husband may flee with the woman to a garden until his wife moves back to her family's house or the wife may leave all of her husband's belongings in front of the house, thus informing him and the village that she has divorced him.

**Bakairi Fertility and Reproduction**

Calculating age-specific fertility rates and total fertility rates provides information about reproductive levels of females in certain age groups and females in general. (See Table 4.) The total fertility rate for the Bakairi is estimated

Table 4.
Age-specific Fertility Rates
and Total Fertility Rates of Bakairi Women

| Age Group | N | Children/Group* | ASFR |
|---|---|---|---|
| 15 - 19 | 16 | 2 | .125 |
| 20 - 24 | 11 | 4 | .364 |
| 25 - 29 | 15 | 5 | .333 |
| 30 - 34 | 13 | 0 | .000 |
| 35 - 39 | 8 | 2 | .250 |
| 40 - 44 | 6 | 0 | .000 |
| 45 - 49 | 6 | 0 | .000 |
| Total | 75 | 13 | 1.072 |
| | | | X 5 |
| Total Fertility Rate | | | 5.362 |

* Number of children born to women in age group during previous year

Table 5
The Results of Fertility Interviews
with 72 Mature Bakairi Women

| Variable | Mean | Std. Dev. |
|---|---|---|
| Avr. Age of First Pregnancy | 16.2 | 3.3 |
| Number of Pregnancies | 4.5 | 2.7 |
| Number of Abortions | 1.3 | 1.8 |
| Number of Miscarriages | 0.2 | 0.4 |
| Number of Live Births | 3.0 | 2.0 |
| Number of Infanticides | 0.1 | 0.3 |
| Number of Dead Children | 0.4 | 0.6 |
| Number of Living Children | 2.5 | 1.7 |

to be 5.36 children. That is, in a woman's lifetime she can be expected to give birth to five live children. It is interesting to note that the Bakairi men commonly say that an ideal number of children is five.

The total fertility rate given in Table 4 is calculated from childbirth data collected at the field site between 1979 and 1981. If we compare this information with data presented in Table 5, which was gathered through interviews with women of all ages, including those in the post-menopausal category, a discrepancy emerges. The increase in the mean number of live births from three to more than five suggests that Bakairi families are growing larger.

Pregnancy, birth, and infant mortality among the Bakairi constitute an enormously complex area. The results of fertility interviews are tabulated in Table 5. Of the 86 women interviewed, 72 (83.7 percent) had been pregnant at least once. While the average number of pregnancies is 4.5, the number of living children is only 2.5. (The average number of years between pregnancies is 3.8 and the average number of years between live children is 4.2.) The average number of reported abortions is 1.3 with a maximum value of ten in several older women. During the 1980 calendar year, six abortions, that I knew of, took place in the village.

The average number of reported infanticides, which are socially accepted among the Bakairi, was .1 with a maximum value of 2. Only one male infanticide by burying occurred, but three cases of benign neglect appeared to be in progress.

**Causes of Bakairi Deaths**

Most infectious diseases that occur in the Bakairi village are the result of the Indians' contact with non-Indians. Measles, tuberculosis, sexually transmitted diseases, polio, smallpox, yellow fever, meningitis, whooping cough, diphtheria, and typhoid are only some of the Old World diseases that have decimated New World popula-

tions. FUNAI personnel try to ensure that the Bakairi are well vaccinated against all such diseases. But, extreme heat, jarring, and absence of refrigeration reduce the efficacy of the vaccines.

In addition, the Bakairi do not always cooperate with the medical staff; they often go to their gardens or go fishing at the time of vaccinations. Political conflicts between the community and the *atendente* also discourage some people from going to the infirmary where the inoculations are given.

In Table 6, I tabulate the causes of death among the Bakairi during a 30-year period. The FUNAI agents did not record the causes of death in some of the cases, especially in the early years (from 1945 to 1950). Furthermore, FUNAI cannot always ensure that an agent will be present in the reservation. This results in incomplete or vague records.

However, of the 90 deaths listed and accounted for, 37 (41.1 percent) are the result of lung infections of one kind or another. These diseases are particularly dangerous for children. Of the 44 children whose deaths are recorded, over one half died as a result of a respiratory infection.

Tuberculosis has always been listed as a major killer of the Bakairi and deaths from this disease are evenly distributed over the 30-year interval. Four cases of tuberculosis currently exist in the reservation; individuals are periodically taken from the reservation and treated in hospitals in Cuiabá, the capital of Mato Grosso.

Sometimes the treatments are not successful due to resistance on the part of the Indians. For example, if the victim is an adult, spouses do not want him or her absent for a long time because of the economic impact on the household. Families also are reluctant to allow children to be treated in the city.

Table 6.
Causes of Bakairi Deaths (Children and Adults)
between 1945 and 1975

| | | | Child | | Adult | |
|---|---|---|---|---|---|---|
| Disease | T | (%) | N | (%) | N | (%) |
| Lung Infection: | 37 | (41.1) | 25 | (27.8) | 12 | (13.3) |
| *Tuberculosis* | *14* | *(15.6)* | *4* | *(4.5)* | *10* | *(11.1)* |
| *Whooping Cough* | *13* | *(14.4)* | *13* | *(14.4)* | *0* | *(0)* |
| *Pneu./Bronch.* | *10* | *(11.1)* | *8* | *(8.9)* | *2* | *(2.2)* |
| Liver-Heart Disease | 11 | (12.2) | 0 | (0) | 11 | (12.2) |
| Accidents | 8 | (8.9) | 0 | (0) | 8 | (8.9) |
| Fevers | 5 | (5.6) | 2 | (2.2) | 3 | (3.4) |
| Intestinal Disorders | 2 | (2.2) | 2 | (2.2) | 0 | (0) |
| Measles | 2 | (2.2 | 2 | (2.2) | 0 | (0) |
| No Reason Cited | 25 | (27.8) | 13 | (14.4) | 12 | (13.4) |
| Total | 90 | (100.0) | 44 | (48.8) | 46 | (51.2) |

Table 7.
Deaths among the Bakairi Indians
between 1945 and 1975 by Sex and Age

| Total Number | Female | Male |
|---|---|---|
| 90 (100.0) | 46 (51.1%) | 44 (48.9%) |
| Total Number | Children under 12 | Adult |
| 90 (100.0) | 48 (53.3%) | 42 (46.7%) |

In 1960, a whooping cough epidemic killed 10 Bakairi. After the epidemic passed, the disease did not reappear, presumably, because of the vaccination program.

Liver and heart diseases are the cited cause of death of 11 (12.2 percent) persons during a 30-year period. It is difficult to assess the accuracy of this particular diagnosis because symptoms of liver or heart disease can be easily confused by laymen, and no autopsies were performed in order to establish cause of death.

Accidents such as burning, drowning, murder, suicide, and wounds killed eight (8.9 percent). Fevers and intestinal disorders caused the death of seven (7.8 percent). The data suggest that, in the recent past at least, diarrhea has not been as great a threat to young children as lung infections.

To care for children with fevers and diarrhea, the Bakairi bundle them up in blankets and place them in a hammock over a smoldering fire. They believe that this treatment drives out the spirits that cause the sickness; however, if the illness does not pass rapidly or if the child is weak from the disease, death from dehydration may ensue.

Only one measles epidemic occurred in the Bakairi reservation in the last 30 years: in 1962, directly after the whooping cough epidemic. Only two people died, suggesting that the Bakairi had been previously exposed to the disease.

In Table 7, deaths among the Bakairi are tabulated by sex and age. Over a 30-year period, slightly more females (51.1 percent) than males (48.9 percent) died. More children (53.3 percent) than adults (46.7 percent) died during the same interval.

## RECENT POPULATION TRENDS

Table 8 shows the age and sex composition of the Bakairi population. One hundred and thirty-seven (47.6 percent) males and 151 (52.4 percent) females inhabit the reservation. Due to the small size of the population, it is difficult to draw conclusions about the distribution of individuals across age cohorts.

The Bakairi crude birth rate is estimated to be 45.1

Table 8.
Bakairi Population by Sex and Age

| Age in Years | Male N | Male % | Female N | Female % | Total N | Total % |
|---|---|---|---|---|---|---|
| 0-5 | 21 | (7.3) | 24 | (8.3) | 45 | (15.6) |
| 6-10 | 17 | (5.9) | 14 | (4.9) | 31 | (10.8) |
| 11-15 | 13 | (4.5) | 22 | (7.6) | 35 | (12.1) |
| 16-20 | 15 | (5.2) | 16 | (5.6) | 31 | (10.8) |
| 21-25 | 13 | (4.5) | 11 | (3.8) | 24 | (8.3) |
| 26-30 | 12 | (4.2) | 16 | (5.6) | 28 | (9.8) |
| 31-35 | 6 | (2.1) | 11 | (3.8) | 17 | (5.9) |
| 36-40 | 8 | (2.8) | 7 | (2.4) | 15 | (5.2) |
| 41-45 | 6 | (2.1) | 6 | (2.1) | 12 | (4.2) |
| 46-50 | 7 | (2.4) | 6 | (2.1) | 13 | (4.5) |
| 51-55 | 3 | (1.0) | 1 | (0.4) | 4 | (1.4) |
| 56-60 | 1 | (0.4) | 3 | (1.0) | 4 | (1.4) |
| 61-65 | 0 | (0.0) | 0 | (0.0) | 0 | ( 0.0) |
| Over 60 | 11 | (3.8) | 9 | (3.1) | 20 | ( 6.9) |
| Questions* | 4 | (1.4) | 5 | (1.7) | 9 | ( 3.1) |
| Total | 137 | (47.6) | 151 | (52.4) | 288 | (100.0) |

*Difficulty estimating age in any meaningful way.

births per thousand inhabitants. The crude death rate is 10.4 deaths per thousand inhabitants. Therefore, the crude rate of natural increase is 34.7 per thousand, or 3.47 percent. Doubling time of the population is calculated to be only 20 years. If abortions and infanticides are figured into the crude birth rate, then the rate on natural increase and the doubling time of the population may be even higher than estimated above.

In Figure 3 I chart the increase of the Bakairi population over a 27-year period. Table 9 provides additional details. Note the column on the right which shows the population increase during each year. Except for periods in the early sixties and seventies, the Bakairi population has streadily grown. Part of this phenomenon is related to better control of infectious diseases. The last epidemic was in 1962, and since that time, FUNAI has had tremendous success in managing such diseases as measles, whooping cough, and yellow fever. Even the flu, colds, and diarrhea are taken seriously by FUNAI medics.

The decrease in population between 1971 and 1972 cannot be accounted for by disease. Neither death records nor interviews with older Indians uncover any significant health problems in the reservation at that time. One possible explanation is out-migration. However, the problem needs to be investigated further.

Figure 3.
Bakairi Population Increase (1954–1981)

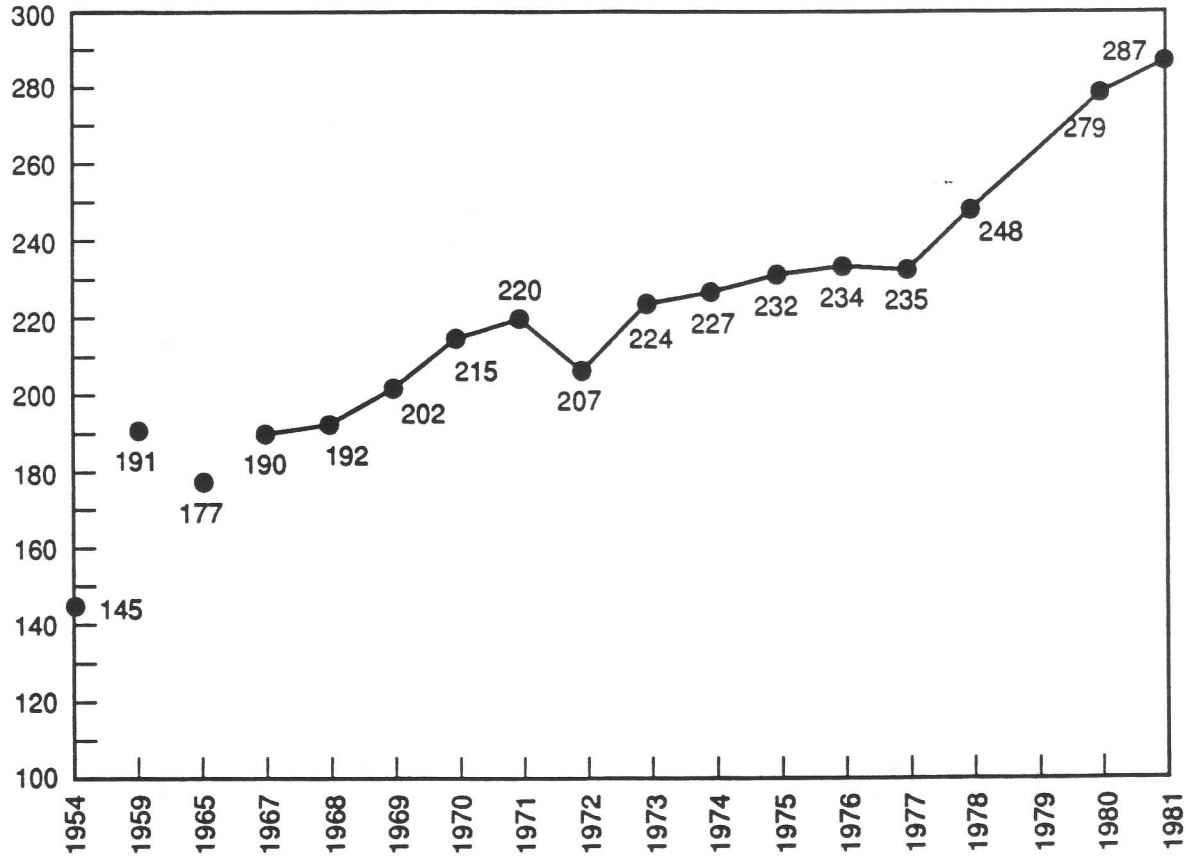

Table 9
Bakairi Population, 1954–1981

| Year | Children* | | Adult | | Total | | Change |
|---|---|---|---|---|---|---|---|
| | N | % | N | % | N | % | % |
| 1954 | 75 | 51.7 | 70 | 48.3 | 145 | 100.0 | --- |
| 1959 | 96 | 50.3 | 95 | 49.7 | 191 | 100.0 | 31.7 |
| 1965 | 79 | 44.6 | 98 | 55.4 | 177 | 100.0 | -7.3 |
| 1967 | 94 | 49.5 | 96 | 50.5 | 190 | 100.0 | 7.3 |
| 1968 | 98 | 51.0 | 94 | 49.0 | 192 | 100.0 | 1.1 |
| 1969 | 70 | 34.7 | 132 | 65.3 | 202 | 100.0 | 5.2 |
| 1970 | 83 | 38.6 | 132 | 61.4 | 215 | 100.0 | 6.4 |
| 1971 | 89 | 40.5 | 131 | 59.4 | 220 | 100.0 | 2.3 |
| 1972 | 79 | 38.2 | 128 | 61.8 | 207 | 100.0 | -5.9 |
| 1973 | 91 | 40.6 | 133 | 59.4 | 224 | 100.0 | 8.2 |
| 1974 | 97 | 42.7 | 130 | 57.3 | 227 | 100.0 | 1.3 |
| 1975 | 104 | 44.8 | 128 | 55.2 | 232 | 100.0 | 2.2 |
| 1976 | 98 | 41.9 | 136 | 58.1 | 234 | 100.0 | 0.9 |
| 1977 | 98 | 42.1 | 135 | 57.9 | 233 | 100.0 | -0.4 |
| 1978 | 99 | 39.9 | 149 | 60.1 | 248 | 100.0 | 6.4 |
| 1980 | 84 | 30.1 | 195 | 69.9 | 279 | 100.0 | 12.5 |
| 1981 | 82 | 28.6 | 205 | 71.4 | 287 | 100.0 | 2.9 |

*Under 12 years of age

**Summary of Findings**

The total fertility rate for the average Bakairi woman can be classified as moderate when compared with other traditional societies. The figure 5.36 falls well within the range of between 4 and 8 defined by Campbell and Wood (1988). Apparently, we need not account for any epidemiological factors, which might cause the population to increase at an unusually slow rate, as is the case in the sub-Saharan African "infertile crescent" where there is high prevalence of sterility (Caldwell and Caldwell 1983). Nor is the fertility rate abnormally high, as it is in the case of the Yanomamo (TFR 8.2) who are expanding into new areas (Neel and Weiss 1975).

What observations can we make about the presence or absence of specific fertility-inhibiting practices that might account for the Bakairi's modest rate of increase? Certainly age of marriage affects fertility rates. Although in many cultures women marry within a short time after the onset of menses, women in some societies wait until they are older. Such late marriages have been correlated with low fertility rates in preindustrial Europe (Smith 1988) and in traditional societies in New Guinea (Johnson 1990).

In a study of preindustrial societies, the mean age of first marriage was determined to be between 16 and 18 years of age (Coale 1986:8). The Bakairi fall into this range, although somewhat on the young side of it. Bakairi women are allowed to experiment after the onset of menses which occurs at about 11.9 ± 0.4 years of age. Then most of them marry at the average age of 16.2 ± 3.3 years of age.

The age of onset of menses is another factor that affects overall fertility rates. It is affected by both culture and environment. The wide range of ages found in cross-cultural surveys show the extent to which menstruation and fertility are affected by external factors. For example, the women of the Gainj tribe in New Guinea begin to menstruate at the mean age of 20.9 years (Johnson 1990), while Western girls commence menstruation at the average age of 13 years (Diggory et al. 1988). As noted above, the mean age at which menstruation begins among the Bakairi is 11.9 years.

Nutrition appears to play an important role in determining the age of puberty. Although the exact mechanism responsible for lowering the age of puberty in Western society is not completely understood, the connection between the energy demands associated with pregnancy and lactation on one hand and availability of excess calories on the other is believed to be responsible for the trend (Lunn 1988). This hypothesis has been supported by data gathered from contacted hunting-and-gathering societies (Bari-Kolata 1974). As their diet includes greater percentages of fats and carbohydrates, the onset of menses occurs earlier. The Bakairi have a high-carbohydrate diets, and their weights for heights compare favorably with general standards (Picchi 1982). In fact 26 of 29 (89.7 percent) adolescent females weighed above the standard weight for height. None weighed less than the standard.

Lactational anovulation has probably been cited as the most significant single factor affecting birth spacing and overall fertility rates. McNeilly et al. (1988) describe the mechanical connection between lactation and menstruation. They explain that frequent daily feeding of at least ten minutes per episode results in the suppression of the secretion by the hypothalamus of one of the gonadotrophins. Without this particular hormone, ovulation ceases, and pregnancy is impossible.

Howell's (1976) work with the !Kung showed that birth intervals of about three years are possible without birth control when mothers nurse their children for extended periods of time. Johnson's (1990) research on the Gainj supports this conclusion. She calculates the median interbirth interval among this population to be 36.5 years and concludes that anovulation as a result of nursing is responsible. Romaniuk's (1981) research shows that when traditional indigenous groups switch from lactation to bottle feeding, their population growth rates may dramatically increase, as they did with the Canadian Indians over a seventy-year interval.

The Bakairi breast feed their children for about three years. Weaning takes place gradually; it is not unusual to see four-year-old children aggressively trying to nurse and being equally aggressively rebuffed by their mothers. Mean interbirth interval is about four years. An additional

factor that may account for the long average length of this interval is post-partum sex taboos and fasting. Couples are ideally supposed to fast and refrain from having sexual relations for between five and seven months after the birth of a child. Many factors, such as age and health, may affect whether these requirments are observed. However, the taboos may affect the mean length of the birth interval over the long run.

The connection between the moderate fertility rate and the adaptation of the Bakairi Indians may be more a matter of explaining why a high rate of increase does not exist than accounting for the relatively low rate. Maintenance of modest rates may be related to the circumscribed nature of the Bakairi reservation, which was demarcated almost as soon as the Indians settled there in the early twentieth century. Additionally, the reservation is made up mainly of *cerrado* rather than gallery forest, where the Indians make their gardens. Both the limited size of the reservation and the small percentage of arable land may discourage the development of the higher-than-average fertility rates that we see among colonizing groups.

The Bakairi Indians are in many ways a "demographic success story" in that they are increasing rather than decreasing within a reservation that is their own. Many other indigenous populations exist under appalling conditions that threaten their very survival. However, it is important to utilize the demographic concepts discussed in this paper to monitor the Bakairi as they move into the twenty-first century. We need to continue to pay attention to changes in the size of their population so as to understand how alterations will affect available resources, health, and long-term adaptation.

## Note

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# SOME DEMOGRAPHIC ASPECTS OF THE CANELA INDIANS OF BRAZIL

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## Introduction

The Canela are Gê-speaking Indians who live in the município of Barra do Corda in the center of Maranhão state. This location places them in sandy cerrado countryside just east of the Amazon River watershed and just west of the dry Northeast of Brazil (see Figure 1). There were originally three tribes referred to as "Canela," but the third of these groups, the Kenkateye, was disbanded in 1913, following an attack by local ranchers who killed most of the adult males, leaving only the Ramkokamekra and Apanyekra. The smaller Apanyekra-Canela group numbered about 250 by the mid-1970s. They live in the village of Porquinhos, which is 50 kilometers west of the larger Canela village of Escalvado. This study focuses on the larger group, the Ramkokamekra-Canela living at Escalvado.

Although the all-too-familiar trauma of pacification had reduced the Canela population to below 100 by 1840, the Canela have been relatively fortunate compared to other tribes. The Canela have survived 240 years of contact since 1750 because they were so situated geographically that they could evade the principal pioneer thrusts by escaping to the north into their hills, because no rivers or highways facilitated outsiders' access, and because no valuable resources on their lands tempted Brazilian settlers. The Canela benefitted from a century of relatively light contact with settlers between 1840 and 1940, when they were able to adjust to the settlers so that their population numbers gradually increased. They were not forced into rapid change during this period, partly because settlers could live only on streams which were far enough apart to provide the Canela with sufficient living space. The Canela had time to evolve a gratifying post-pacification adaptive culture. This culture has been amply documented by the German-born Brazilian anthropologist Curt Nimuendajú and by Crocker in his monograph *The Canela (Eastern Timbira), I: An Ethnographic Introduction* (1990). The Canela suffered a major setback in 1963, however, when a messianic movement led them to provoke the surrounding backlanders with large-scale thefts of cattle. The prophetess leading the movement demanded ever-increasing amounts of cattle for feasting. The backlanders mounted an attack on the Canela which would have eliminated them if they had not been saved by a few brave Brazilian officials. The Canela were moved to the Guajajara Indian reservation at Sardinha for their own protection. The dense dry forests of the reservation affected hunting and farming conditions, and even the sanitation practices of the tribe. A period of demoralization and disease followed. Our study begins when the Canela had returned to their homelands and analyzes population change from 1970 to 1988.

The data for this study come entirely from a series of censuses done by Crocker over the years he was in the field with the Canela. This research centers on the 1970 census, the only official one, as it was conducted for the Brazilian equivalent of the Census Bureau, the IBGE, but uses information collected in 1975, 1979, and 1988. The census manuscripts, with their rich information on kinship, as well as considerable basic demographic information on age, sex, relationships within the household, residence, marital status, fertility histories, and so on, were coded and analyzed by Greene.

The 1970 census was taken on the first of September of that year so that it would be consistent with the census taken in the rest of the country. For the 1970 census, Crocker was instructed by local IBGE personnel in Barra do Corda to take the fertility histories of one in three women, but he took somewhat more than that, adding up to about 40 percent of women in their reproductive years. The censuses for 1975 and 1979 were also taken as of the first of September. The 1988 census was taken by the Indian agent over a longer time period.

Our study traces some of the population changes the Canela underwent over the period of nearly twenty years, between 1970 and 1988. The 1960s, with the ranchers' attack and the forced move to Sardinha, was a disastrous period for the Canela. In this decade the population actually decreased slightly. After the return from exile in the late 1960s, the group began to increase in size, and their overall numbers changed from 437 in 1970 to 836 in 1988. The dramatic growth rate of the 1970s appears to have been maintained during the late 1980s at a level of nearly 4 percent.

Matrilocality and matrilaterality among the Canela have important implications for the status of women, an intangible concept that demographers recognize as influencing fertility, child survival, and household resource allocation (Caldwell and Caldwell 1987). The rationale is

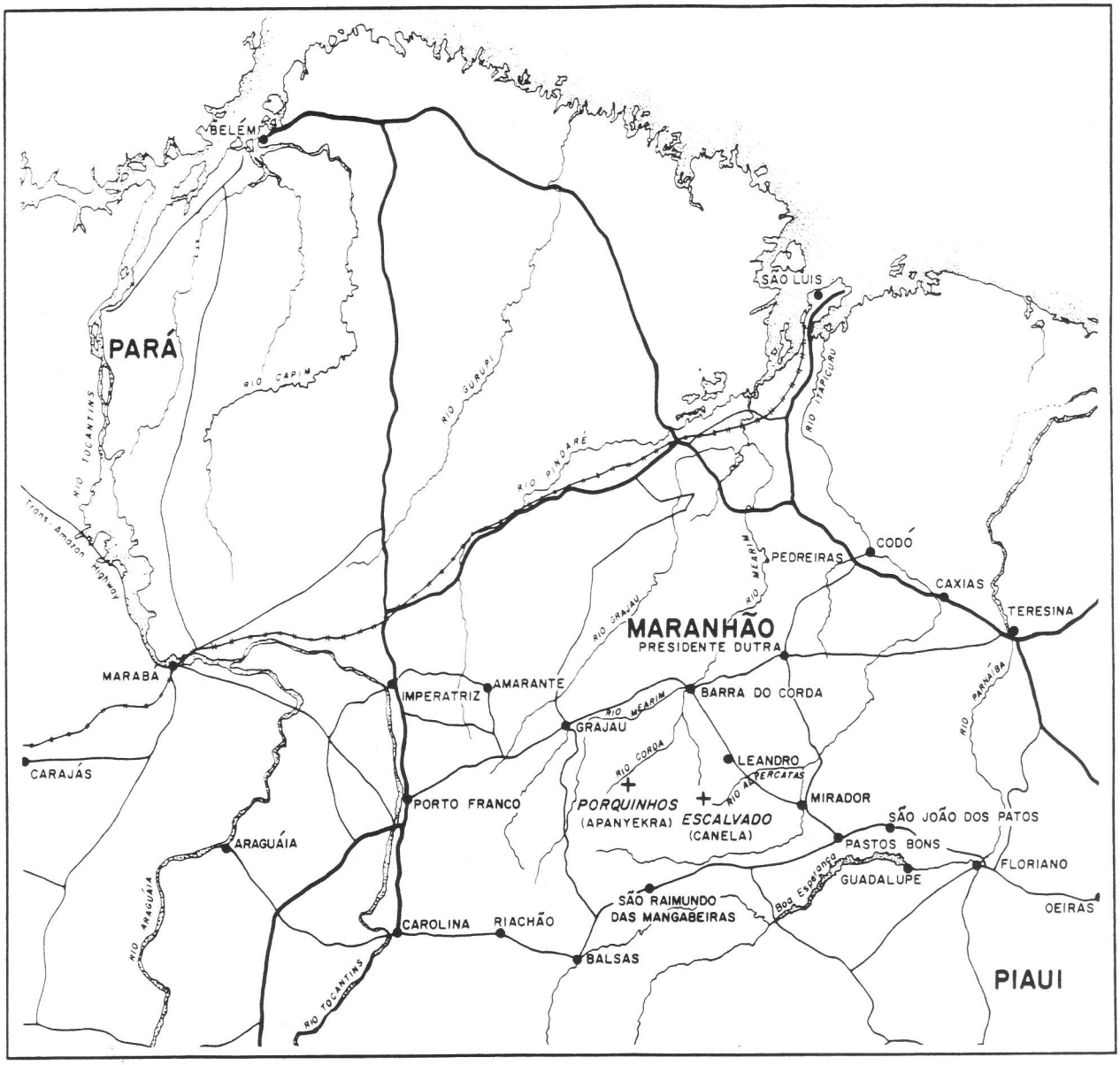



Figure 1.
Maranhão and Neighboring States, Showing the Canela Region

that women who are able to control household resources increase the chances for survival of their children. We will see how this may play into the Canela demographic experience.

Probably as a result of a decline in mortality, particularly among infants and children, the Canela age distribution became increasingly "young" over the period of study, with larger and larger proportions at the youngest ages. Between 1970 and 1979, age at marriage increased for both men and women, but the several-year age gap between husband and wife remained fairly stable. The lack of substantial change in fertility patterns actually reflects a combination of factors that may have canceled each other out: a decline in breast feeding and improvements in health and nutrition, which would increase fertility, and a decline in extramarital sex and an increase in the age at marriage, which would decrease fertility.

The main change of note was the decline in overall mortality and child and maternal mortality in particular. The crude death rate fell from 53 deaths per 1000 for the period 1970–1975, to 29 deaths per 1000 population for 1975–1979. This decline was concentrated heavily among women, and the explanation that Crocker offers is that the combination of the eradication of tuberculosis and general improvement of medicine had an especially beneficial effect on women in their childbearing years. The child survival curves also show a dramatic decline in mortality, particularly between 1975 and 1979. The reduction of dysentery and

infectious disease through the efforts of Sebastião, an agent of the Indian service, was almost certainly the major contributing factor to this trend.

### Population Size and Age Distribution

Before 1700 and the destructive contact with European settlers, the Canela probably numbered between one and two thousand, all living in one village. Reports about Canela population in the last century are unreliable, but the small size of 19th century village sites, a dozen of which Crocker visited and measured during the late 1950s, leads us to believe that numbers were low. While the villages were consistently smaller in diameter and the house sites fewer, more individuals lived in each house. Crocker's guess is that the Canela population dipped well below 100 during the early to middle part of the last century, but that since 1840, with the geographic stabilization of the tribe, the number has been growing. During and since the time of Nimuendajú, reliable counts are available. In 1936, a year after a smallpox epidemic, there were about 300 Canela (Nimuendajú 1946:33), and for the next 24 years their numbers grew, slowly but steadily, to about 412. Their forced stay in the dry forest of the Guajajara Indian reservation after the messianic movement and the attack by ranchers reduced them to about 397 in 1969 (Crocker 1972: 239). Indian service personnel found the numbers of Canela lower than before the move, and the Canela themselves kept saying that they were dying because of the living conditions in the forest. Indeed, their morale was very low, they were listless, and many preferred semi-starvation to working. After moving home, their population increased dramatically between 1969 and 1979 (to about 600) as a result of increased confidence and better medicine. It reached 836 in 1988 according to a census and list of names produced by the local Indian agent. These trends are summarized in Table 1.

The Canela, and other groups for whom the calendar is not very important, present a special challenge to the task of recording age. As early as the late 1950s, Crocker reconstructed a history of the various old villages with the intention of creating a series of benchmarks (see the Canela timeline, p. 61). The Canela shifted village sites about every five years. Among the most important early dates were the joining of the Cakamekra and Canela (1900), the fighting against the Guajajara (1901), the killing of the Kenkateye (1913), and the great drought (1915). Individuals were asked questions such as: "since you say you came with the Cakamekra when they joined the Canela, how big were you then? Did your mother say she carried you, or did you walk from Mucura?"

Table 1.
Overall Population Size and Growth Rates

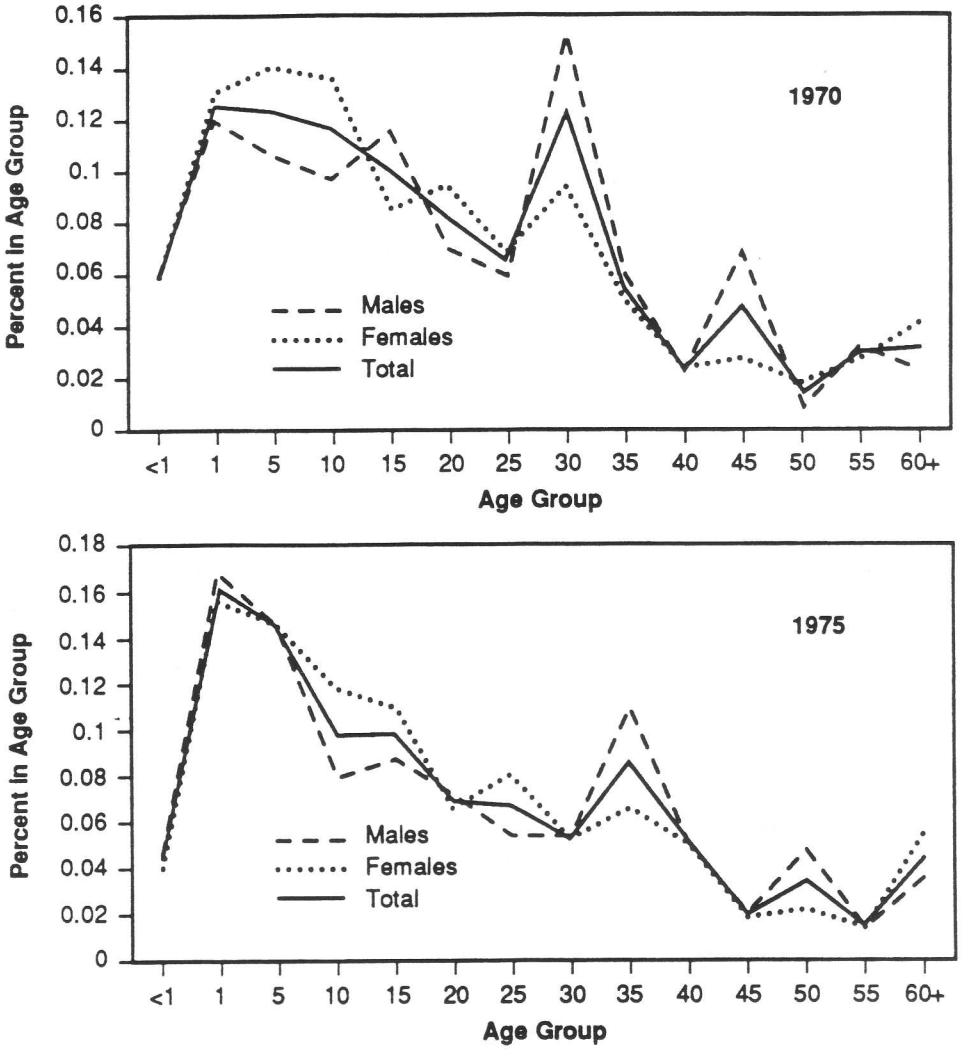
| Year | 1936 | 1960 | 1969 | 1970 | 1975 | 1979 | 1988 |
|---|---|---|---|---|---|---|---|
| **Total** | @300 | @412 | 397 | 437 | 508 | 600 | 836 |
| **Females** | -- | -- | -- | 219 | 256 | 291 | 421 |
| **Males** | -- | -- | -- | 218 | 252 | 309 | 415 |
| **Period Growth Rate** | .023 | -.002 | .048 | .030 | .042 | .037 | |

For the period between 1915 and 1929 Crocker turned to the sequence of important social events: 1923, for example, was the end of an age-set cycle, a ten-year cycle of rituals and traditions for each cohort. Moreover, different kinds of festivals were held in different villages, so the question of how many and which festivals were remembered for each village site was also useful. Other events to remember were the festivals that occurred during the eight-year period during which Nimuendajú spent six summers among the Canela (1929–36). Indian agents began to be a presence among the Canela starting in 1938, so it was possible to ask whether Senhor Olímpio or Dona Nazaré was living at the post at the time of a birth, for example. Two other important fixed points were the death of an old chief in 1951, and the arrival of Crocker himself in 1957.

A result of this method of estimating age is that Crocker gives ages of older people in approximate terms of years rather than dates. With births since 1970 more exact information is known, as most dates were recorded by Crocker or the Indian agent. One way of seeing how reasonable the estimates of age are, particularly for older people, is to examine the age distribution of men and women in the tribe. Figures 2a-2d present the Canela-population size and age distribution by sex in 1970, 1975, 1979, and 1988. Note the increasing smoothness of these age distributions in each subsequent year, indicating a greater accuracy in reporting ages with the passage of time. For the later censuses, Crocker was building on age information he had collected earlier, as well as documenting births that had taken place since his arrival.

Two main characteristics call for our attention in these graphs. The first is the high proportion at the youngest ages, and the change in shape of this portion of the curve. The population in 1970 is fairly young, but in 1975 we see a clear increase in the proportion of the population made up by infants and young children (which could result from more births and their survival). In 1979, there are still many young children, and in 1988 we see the continuation of this trend, with consistently high proportions from ages 0 to 10. This suggests that during this later period children's chances of survival increased, surely due to better health care. Note the corresponding relative dearth of older people in the population, particularly in 1988.

Figures 2a and 2b.
Population Age Distribution by Sex and Five-Year Age Groups in 1970 and 1975

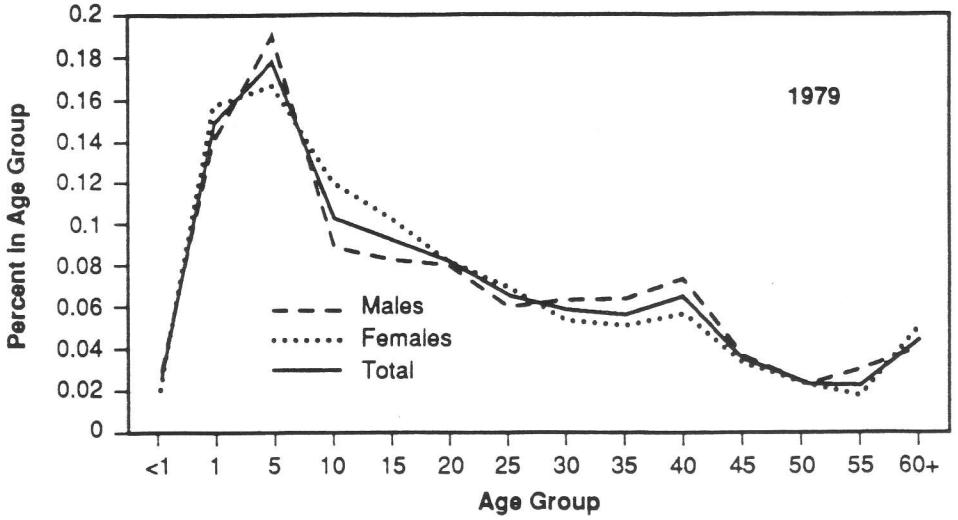



Other features of note in these graphs are the peaks in the population at ages 30–34 and 45–49 in 1970. We can follow these peaks in 1975, when at ages 35 and 50, somewhat lower peaks are observed, and in 1979, when age 39–40 is still slightly higher than the surrounding ages. By 1988, these bumps are gone altogether. The most likely explanation for these anomalies is that adults who did not know their ages related themselves to a memorable event, thereby heaping their ages on a particular year. Additionally, it was Crocker's tendency to group males together by "age-set," Chief Kaarà?khre's or the older Kaapêltùk's, and this too contributed to these distinctive bumps in the age distribution. The alternative explanations seem less probable: that something happened to increase the mortality in a certain age group, or that particular ages had a social significance in 1970 that has declined with time. Of course, in a small population, chance alone may be playing a role in determining the age distribution.

Crocker did document single events that had important implications for the population; for example, the deaths of three men in the age-set of the older Kaapêltùk in the 1963 battle with the ranchers. Between 1963 and 1968 he hypothesizes that a higher number of old people died in exile in the forest than would have died if the tribe had been in the savannah.

The high proportions at the younger ages, particularly in 1988, affect the ratio of productive adults to children and old people (the dependency ratio) substantially. Most change in the age pattern of work has occurred at the younger ages: Crocker found that before 1940, male adolescents were slower to begin working fully, while the Canela have always maintained high levels of activity through their fifties. Women continue to carry heavy baskets of manioc throughout their 50s and even later, while men race with logs until they are about 50. Although the Canela become weaker in their sixties, they continue to work in the fields. Table 2 shows

Figures 2c and 2d.
Population Age Distribution by Sex and Five-Year Age Groups in 1979 and 1988



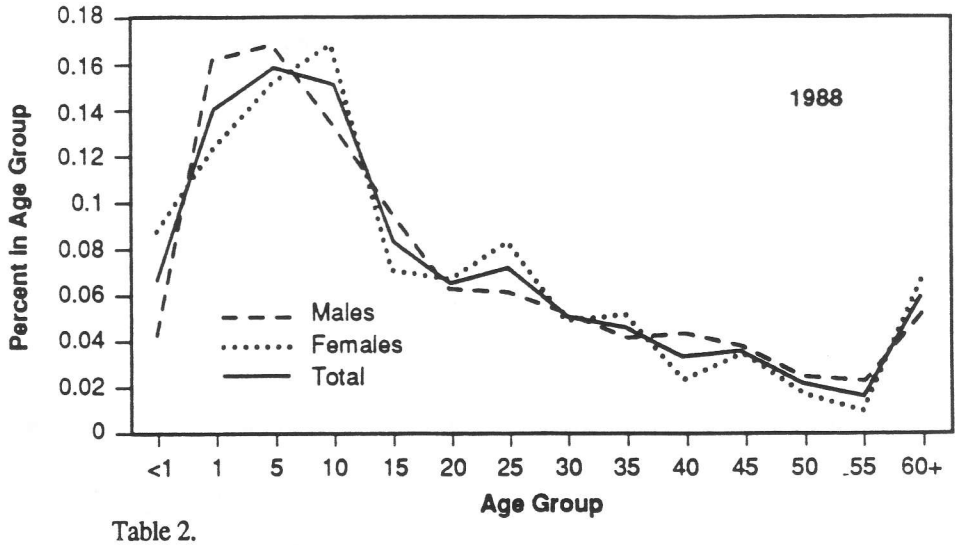




Table 2.
Population Age Groupings and Dependency Ratios by Sex

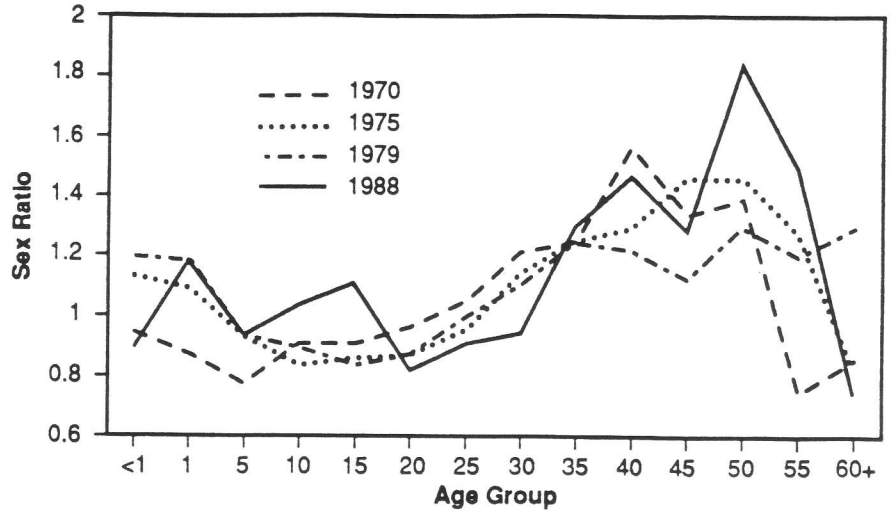
| | 1970 | 1975 | 1979 | 1988 |
|---|---|---|---|---|
| Total, Percent in Age Group | | | | |
| Under 15, 60 and Over | 45.64 | 49.60 | 52.84 | 58.01 |
| 15 to 59 | 54.36 | 50.40 | 47.16 | 41.99 |
| Dependency Ratio | 0.840 | 0.984 | 1.121 | 1.382 |
| Males, Percent in Age Group | | | | |
| Under 15, 60 and Over | 40.55 | 48.24 | 51.72 | 56.14 |
| 15 to 59 | 59.45 | 51.76 | 48.28 | 43.86 |
| Dependency Ratio | 0.682 | 0.932 | 1.071 | 1.280 |
| Females, Percent in Age Group | | | | |
| Under 15, 60 and Over | 50.68 | 51.00 | 53.90 | 59.86 |
| 15 to 59 | 49.32 | 49.00 | 46.10 | 40.14 |
| Dependency Ratio | 1.028 | 1.041 | 1.169 | 1.491 |

the proportions of the population under age 15 and over age 60, and between the ages of 15 and 59. The striking fact to be seen in this table is that the proportion in the middle years (15–59) decreases from 54 percent in 1970 to 42 percent in 1988, while the proportions under age 15 and aged 60 and over increase from 46 to 58 percent. The dependency ratio, calculated as

$$\frac{\text{(Under 15 + Over 60)}}{\text{(Ages 15 to 60)}}$$

increases from .84 to 1.38. We can understand this more intuitively to mean that while in 1970, each adult had to provide for one other person in addition to him or herself, by 1988, each adult was providing for closer to one and a half other people, on average. The dependency ratio for men increases dramatically, but reaches an even higher level for women, indicating that women may have experienced a greater decline in mortality, particularly in their 40s and 50s.

Figure 3.
Sex Ratios by Age Group and Year




A final point to be made about the age distribution of the population can be seen in Figure 3. The graph shows the ratio of males to females in each age group and shows a consistent pattern in each of the four years for which we have information. In most populations about 106 males are born for every 100 females, and so in the first year of life we might expect to see a ratio slightly exceeding 1. Females generally have lower mortality than males, a pattern which would lead to a sex ratio that declines with age. In the Canela population, however, the sex ratio dips below 1 only for people ages 5 through 24, and then rises to exceed 1 by far until the last age group. There are two possible explanations for this phenomenon: The first is that female mortality does exceed male mortality, perhaps as a result of the risks of childbearing, leaving fewer and fewer females relative to males at each successive age. The second explanation is that the ages of Canela men were more likely to be exaggerated in the process of estimation than the ages of women. In a growing population, there are fewer people in any older age group than in any younger age group. If men exaggerated their ages, they would disproportionately place themselves in smaller, older age groups, where there are relatively few females. This process would produce the pattern of sex ratios we observe in Figure 3. The 1988 age distribution is almost certainly skewed upward, particularly by men, because of their wish to be considered *aposentado* (retired) farm hands earning government pensions. This new source of funds, available since the mid-to-late 1970s, has changed Canela behavior. However, this change was sufficiently significant to be captured only in the 1988 data which were recorded by the agent in the village. The Indian service agents collaborate in this exaggeration in order to help the Canela receive pensions. Whether a real difference in mortality also contributes to the high sex ratios will be discussed later in this analysis.

**Marriage and Marital Status**

Canela marriage, somewhat like marriage in sub-Saharan Africa, takes place through a series of steps and becomes relatively more complete over time. Marriage is matrilocal and almost always endogamous to the tribe. The village circle is composed of longhouses whose resident women are related through female consanguineal links, and marriage is exogamous to the longhouse for three or more generations (see Crocker 1990:240-243).

If a virginal woman sleeps with an unattached young man, they are by definition wife and husband. Lasting marital relationships may start from such sexual involvements, in which case the young man goes to live in the house of his wife. A child traditionally cements a marriage until the youngest child is a mid-adolescent. "Divorce" occurs when a man leaves his *children*, not his wife. Childless couples can take other partners easily, and this does not constitute divorce. An examination of the few cases of men leaving their children on their own initiative revealed exceptional circumstances until 1975, when a slow trend toward divorce from children seems to have begun. This was influenced by the legalization of divorce in Brazil during the late 1970s, after which Indian service personnel gave their permission for Canela divorces. Most older couples remain married until death takes one of them.

To summarize the processual style of marriage among the Canela, we present simple proportions Single, Married, Separated, and Widowed, by age and sex in Table 3. Note the contrast between men and women in the 15 to 19 age group in the level of marriage and singlehood. Women were much more likely to marry at this age than men in all three census years of the 1970s, with men more likely to marry between ages 20 and 29. Men are also

Table 3.
Percentage Distribution in Marital Status, by Year, Sex, and Age Group

| | Males, 1970 | | | | | Females, 1970 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | N | Single | Married/ Remar | Wid | Sep/ Div | N | Single | Married/ Remar | Wid | Sep/ Div |
| 0-9 | 57 | 100.0 | 0.0 | 0.0 | 0.0 | 70 | 100.0 | 0.0 | 0.0 | 0.0 |
| 10-14 | 21 | 95.2 | 4.8 | 0.0 | 0.0 | 30 | 73.3 | 26.7 | 0.0 | 0.0 |
| 15-19 | 25 | 68.0 | 32.0 | 0.0 | 0.0 | 19 | 10.5 | 89.5 | 0.0 | 0.0 |
| 20-29 | 26 | 11.5 | 88.5 | 0.0 | 0.0 | 36 | 13.9 | 86.1 | 0.0 | 0.0 |
| 30-39 | 41 | 0.0 | 92.7 | 0.0 | 7.3 | 32 | 0.0 | 93.8 | 3.1 | 3.1 |
| 40+ | 34 | 2.9 | 91.2 | 2.9 | 2.9 | 24 | 0.0 | 66.7 | 29.2 | 4.2 |
| | Males, 1975 | | | | | Females, 1975 | | | | |
| | N | Single | Married/ Remar | Wid | Sep/ Div | N | Single | Married/ Remar | Wid | Sep/ Div |
| 0-9 | 92 | 98.9 | 1.1 | 0.0 | 0.0 | 87 | 100.0 | 0.0 | 0.0 | 0.0 |
| 10-14 | 21 | 95.2 | 4.8 | 0.0 | 0.0 | 28 | 53.6 | 46.4 | 0.0 | 0.0 |
| 15-19 | 23 | 43.5 | 56.5 | 0.0 | 0.0 | 29 | 6.9 | 93.1 | 0.0 | 0.0 |
| 20-29 | 34 | 2.9 | 97.1 | 0.0 | 0.0 | 35 | 5.7 | 88.6 | 0.0 | 5.7 |
| 30-39 | 42 | 2.4 | 92.9 | 2.4 | 2.4 | 30 | 0.0 | 90.0 | 0.0 | 10.0 |
| 40+ | 40 | 2.5 | 95.0 | 2.5 | 0.0 | 35 | 0.0 | 68.6 | 28.6 | 2.9 |
| | Males, 1979 | | | | | Females, 1979 | | | | |
| | N | Single | Married/ Remar | Wid | Sep/ Div | N | Single | Married/ Remar | Wid | Sep/ Div |
| 0-9 | 107 | 99.1 | 0.9 | 0.0 | 0.0 | 104 | 100.0 | 0.0 | 0.0 | 0.0 |
| 0-14 | 26 | 100.0 | 0.0 | 0.0 | 0.0 | 35 | 71.4 | 28.6 | 0.0 | 0.0 |
| 15-19 | 24 | 50.0 | 50.0 | 0.0 | 0.0 | 30 | 16.7 | 83.3 | 0.0 | 0.0 |
| 20-29 | 40 | 2.5 | 97.5 | 0.0 | 0.0 | 44 | 4.5 | 95.5 | 0.0 | 0.0 |
| 30-39 | 31 | 3.2 | 96.8 | 0.0 | 0.0 | 29 | 0.0 | 86.2 | 3.4 | 10.3 |
| 40+ | 54 | 1.9 | 90.7 | 3.7 | 3.7 | 49 | 0.0 | 67.3 | 24.5 | 8.2 |

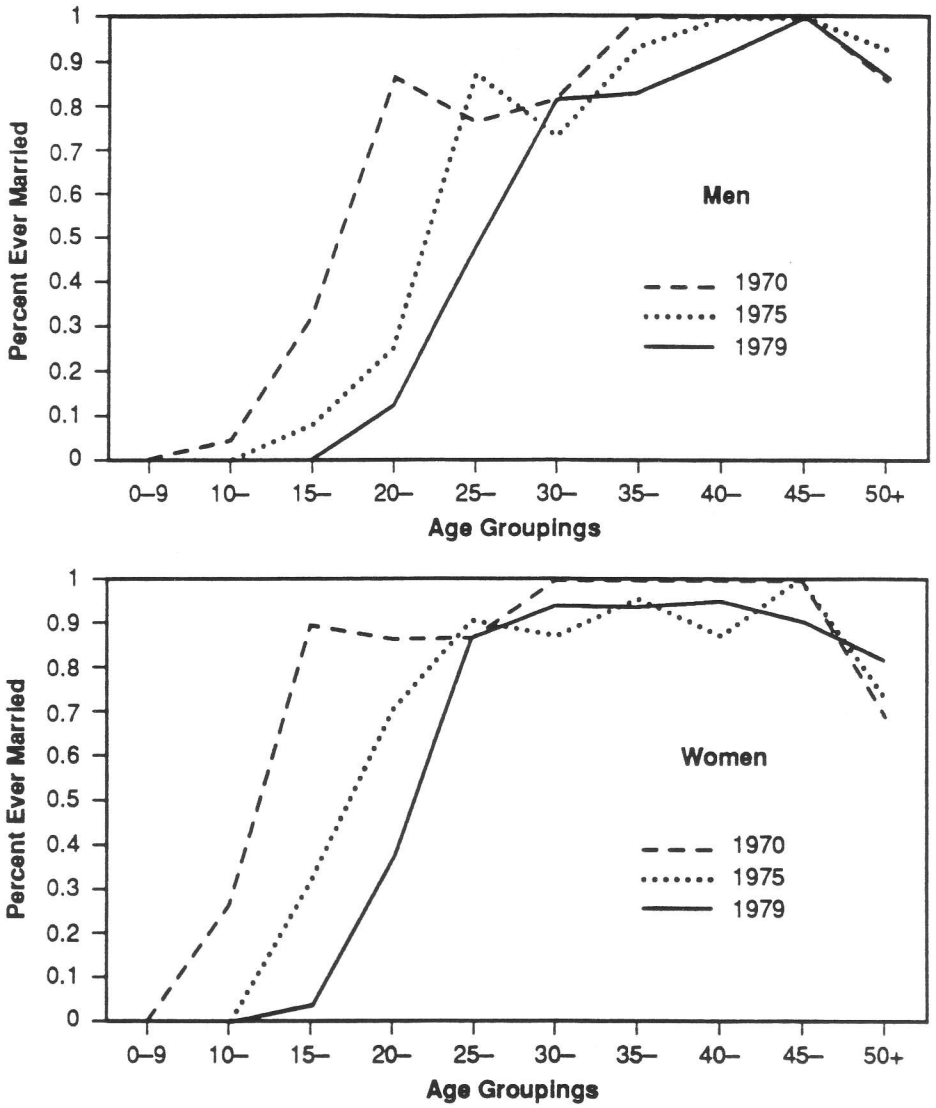
considerably less likely to be widowed than women, which lends support for our view that men's ages are more exaggerated than women's, because *they* should be widowed more than women if they are in fact outliving women. This pattern among men does not change much over time.

Also of note is the rate of divorce or separation for women, which increases over time but remains low or even declines for men. This decline suggests that it is somehow easier for men to remarry, and to marry much younger women the second time around. An alternative explanation is that men have an increased risk of dying in the divorced state which is plausible given that husbands are several years older than their wives on average.

Figures 4a and 4b present the ages at which men and women in the population marry in each of the three years of the 1970s for which we have data. We can see that while the general shape of the curve has remained stable, the Canela have come to marry slightly later as time has passed during the decade of the 1970s. A large increase took place between 1970 and 1975, and a smaller one between 1975 and 1979. Figures 5a through 5c graph the proportions ever married for men and women in 1970, 1975, and 1979. The age gap between men and women at the time of marriage remains about the same (approximately four years), even though marriage is occurring at somewhat older ages at each date. This is particularly interesting in view of Crocker's earlier work on marriage (1984:70) which indicated that previous to about 1940 Canela men and women had married at older ages and had a greater age difference.

Because Canela postmarital residence is matrilocal,

Figure 4.
Proportion Ever Married




men are essentially adjuncts in the households of their wives. A husband's economic responsibility is just one part of the balance of power:

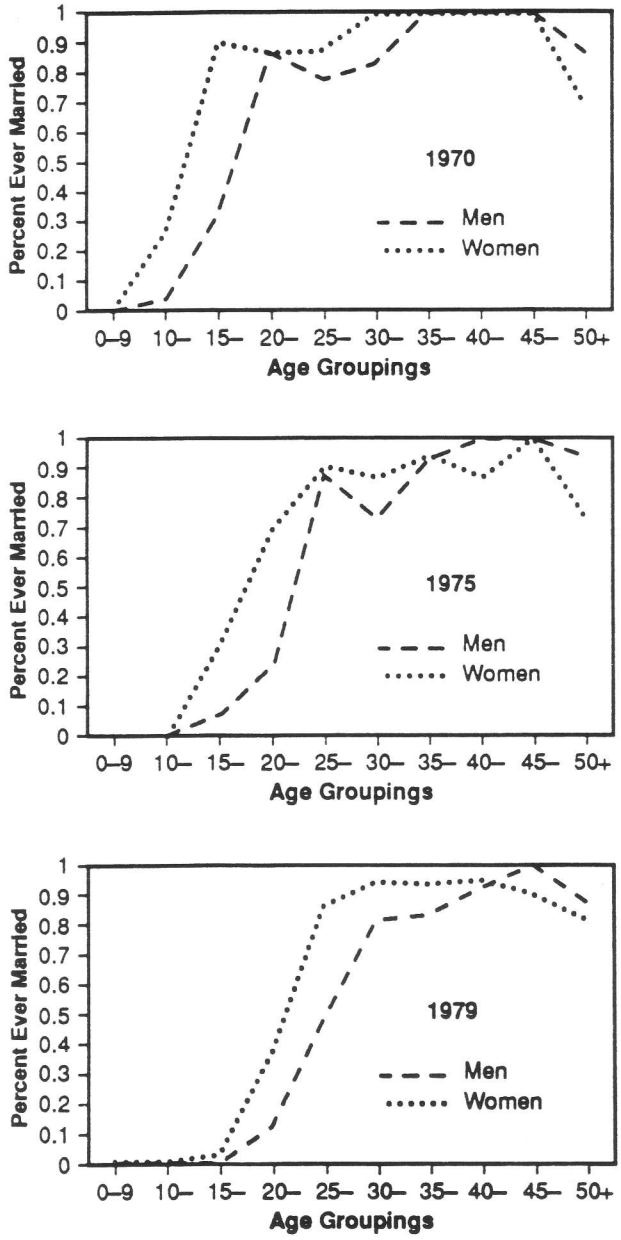
> In the marital balance, the women are seen as suffering more. . . . Consequently, the husband is continually rebalancing the marital "scales" by working hard and making small payments to his wife's family (Crocker 1984: 68).

While both parents are responsible for providing food, the mother is responsible for distributing it within her nuclear family. With this pattern of nuclear families separating from the extended family for the purpose of eating, it is especially unfortunate for children if their mother dies and their father leaves the household to remarry elsewhere. Consequently, when a woman dies her family tries to find a younger sister or a cousin for the widower to remarry so that he may remain in the same household with his children. A direct analogy to the father's relatively loose link with his wife's family is enacted in the social dances that take place almost daily: the women stand in one place, bending their knees, swinging their arms and raising their upper bodies, while the men walk, lope, hop and skip independently before the women. Men's relationships with their sisters and mothers are more important and stronger than those with their wives until they have had several children.

### Fertility

Populations in which births are controlled tend to have fertility that declines after women have a certain number of children. A concave curve is produced when the age-specific fertility rates are graphed. In contrast, natural fertility is the same regardless of the number of births a

Figure 5.
Proportion Ever Married, by Sex




woman has had already (Henri 1979). Thus, women who breastfeed for the same length of time after each birth are demonstrating natural fertility behavior, even if the breastfeeding may ultimately reduce the overall number of children they have.

We expect to find natural fertility among the Canela and not much change in the level of fertility over the period 1970–79. A number of different customs govern and influence women's sexual activity and thus their risk of pregnancy. Crocker has documented the association of girls with male societies, so that they will learn to like to receive nonrelated men sexually in amorous trysts.

> Women take the initiative and choose men for these quick sexual encounters at least as often as men choose women. . . . A Canela's sexuality is considered among her or his most valuable assets in interpersonal relations. Thus no one should be stingy when somebody else wants or needs the pleasure their cooperation can give (Crocker 1990: 106).

The Canela concept that one's body is a possession which should be shared with others significantly influences sexual behavior, and thus the chances of becoming pregnant and bearing children. First sex occurs between ages 10 and 13; between the ages of 13 and 18 girls are generally married but childless.

Pregnancy does not change a woman's behavior much, and no restrictions exist on sexual relations during pregnancy. Intercourse may continue with any "other husbands" until the seventh or eighth month. The possibility of having sex is broader than just with the contributing fathers, who must have sex many times with the prospective mother, or they would not be named as such by her. During the pregnancy a woman begins to think about whom she wants as contributing co-fathers for the "biological" formation of the fetus and life-long contributors of support to the child. She looks around for chances to have love trysts with such men. If any man with desirable characteristics (which are thought to be transmitted through the semen to the fetus) shows reluctance to have intercourse with her, she may say that she is pregnant. The reluctant man cannot refuse because the Canela believe the rejection might cause a miscarriage.

Among the Canela, extramarital practices, and the acceptance of multiple ethnobiological paternity put the onus of sterility or barrenness on women. If conception does not occur, the problem must be the woman's, not her husband's, because her several "other husbands" would make up for the social husband's sterility or homosexual orientation. Several homosexual men were identified in the tribe and they were not teased or criticized extensively. By the late 1970s, however, homosexuality was increasingly disapproved of because of backlander influences.

The practice of having multiple sex partners accounts for the very low proportion of women who remain childless once they are well into their child-bearing years. The age distributions of the proportions of women who are childless and the numbers of children ever born to women, by age group, appear in Figures 6a and 6b. The proportion childless appears to drop more precipitously to near zero in 1979, the last year for which we have data, than it does in earlier years.

Childbirth is the final step in achieving adult female status and is a principal time of transition for women, especially if the first birth survives and another follows. The birth ties a woman down to her mother's and sisters' household and reduces her extramarital sexual freedom.

Figure 6a.
Proportion Childless, by Age

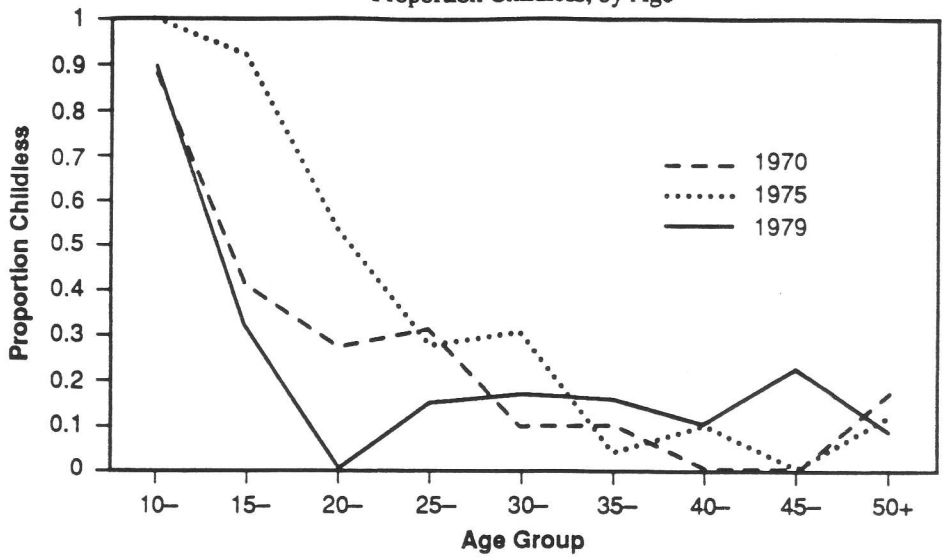
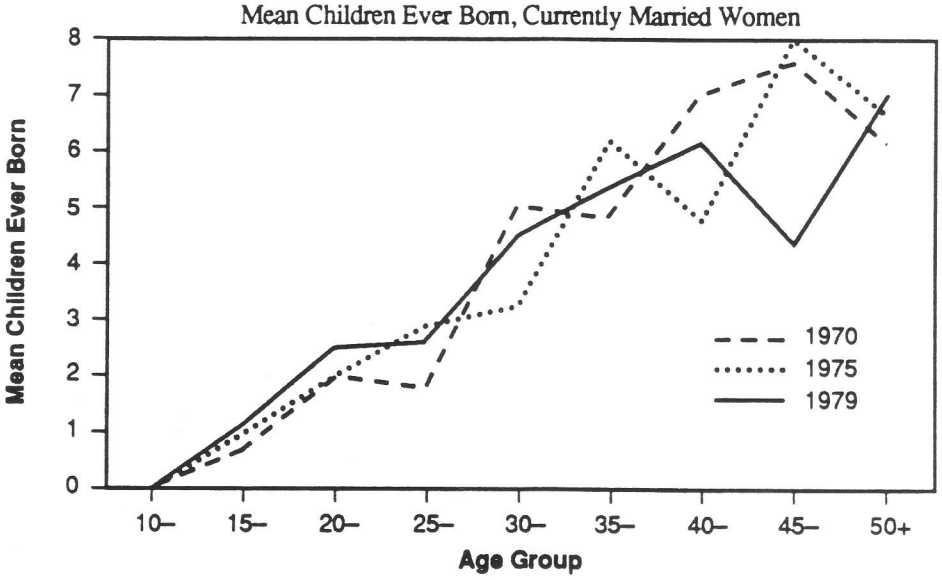



Figure 6b.
Mean Children Ever Born, Currently Married Women




While young husbands now live with their wives, guaranteeing more sustained sexual relations between spouses and greater chances for producing the first birth, there was a decline in extramarital sexual activity between 1970 and 1979 which might have had the opposite effect on overall fertility. No clear trend is visible from Figure 6b, which graphs the mean number of children ever born, partly because of the erratic distribution of women in the different age groups.

Figure 6c graphs the proportion of women, by their age group, who have had six or more children. At the older ages there is a clear trend downward. The proportion of women ages 20–39 who had six or more children declined in 1975 and increased in 1979. This may show the influence of the

Table 4.
Mean Children Ever Born: Proportion Having Had a Child By Age Group of Women Aged 10 and Over in 1970

| Age | N | Mean CEB | % had child |
|---|---|---|---|
| 10-14 | 30 | 0.17 | 0.02 |
| 15-19 | 19 | 0.82 | 0.32 |
| 20-24 | 21 | 1.88 | 0.65 |
| 25-29 | 15 | 1.80 | 0.67 |
| 30-34 | 21 | 4.69 | 0.85 |
| 35-39 | 11 | 4.71 | 0.84 |
| 40-44 | 5 | 5.95 | 0.80 |
| 45+ | 25 | 6.83 | 0.87 |

Figure 6c.
Percentage with Six or More Children

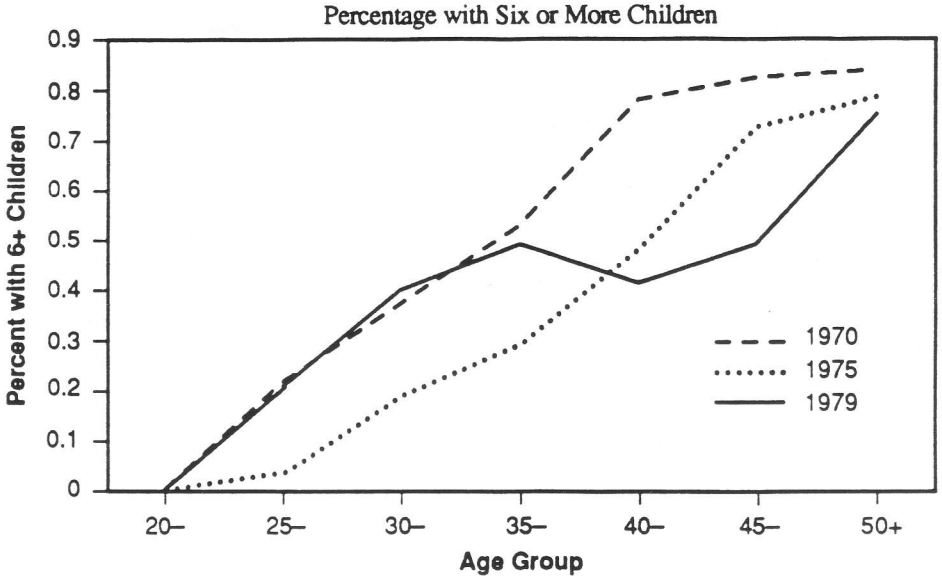
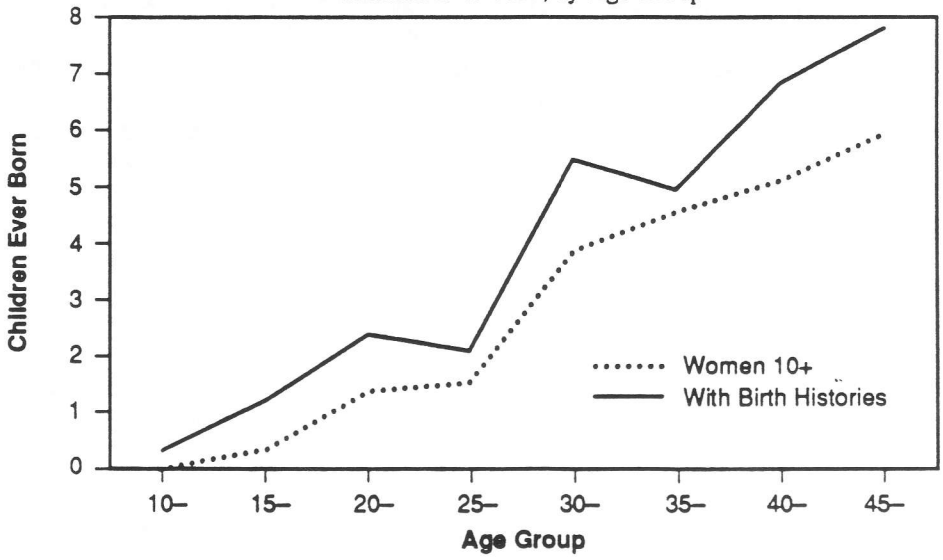



Figure 6d.
Children Ever Born, by Age Group




decline in prolonged breastfeeding, for example, on the spacing of births. With shorter periods of breastfeeding, young women may be experiencing shorter birth intervals. Figure 6d graphs by mother's age the number of children ever born. The first of each of the pairs of lines uses data on all women over age 10 for whom we have information, the second includes only women for whom we have birth histories. The data based on birth histories indicate slightly higher and earlier fertility, probably due to the greater accuracy of these data. This information is also presented in Table 4. Information on dead children in particular would often have been missed for women with whom Crocker did not sit down to work out the details of their entire childbearing experience, as he did to obtain birth histories in 1970.

**Infants, Children and Adoption**

The Canela formerly breastfed their children on demand and for extended periods during the day for two to four years. In recent times, however, this period has declined to considerably less than two years, and the proper time for weaning is considered to be between teething and walking. At two to four months the baby begins eating mashed foods, and by nine months the mother might give it soft cooked meat. Traditionally, the husband was not to return for regular sexual relations until after nursing was over. More recently it seems that husbands may be less observant of this proscription. If the mother becomes pregnant in spite of the practice of avoiding intercourse while actively nursing, she

quickly weans the baby, believing that it would become sick if it continued to nurse while a new pregnancy is in progress.

The organization of Canela households, with mothers' sisters and mothers' mothers permanently in place, insures the care of orphaned children. However, it may still make a difference for children's survival if their mother dies. Even though their mother's sister or their mother's mother takes charge of such children, it is likely that they receive less attention than if their mother were alive. Adoption (*criação*) includes the completely automatic adoption of children by the mother's sister, who is already a "mother," when the mother dies, as well as sending children to an old couple, most likely the child's patrilateral kin. If we were to look for those adopted children who are suffering hardships, we would most likely find them away from their natal homes. Adoptions among the Canela seem to occur based on the need of the adoptive parents for someone to help them (e.g., old people) rather than on a surplus of resources in their household. Our data show a very slight decline in adoption with time, which may indicate lower parental mortality, better nutrition, and a change in data quality. Adoption appears to have little effect on household composition and size with time for the three periods for which we have data, and the proportion of all individuals who were living with adoptive parents was between 2 and 5 percent; the same figure for children up to 19 years of age was between 4 and 9 percent.

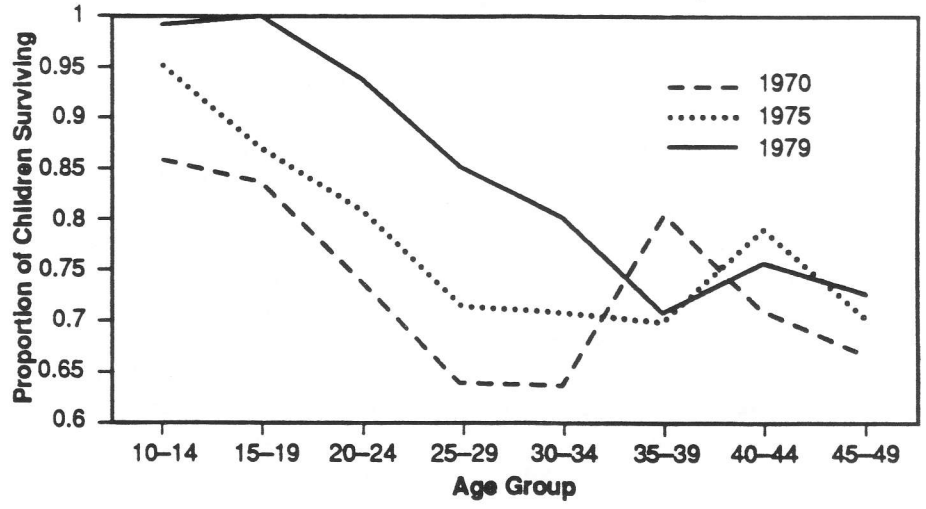
Table 5.
Child Survival Ratios by Age Group of Mother

| Age of Mother | 1970 | 1975 | 1979 |
|---|---|---|---|
| 10-14 | 0.000 | 1.000 | 1.000 |
| 15-19 | 0.857 | 0.950 | 0.992 |
| 20-24 | 0.836 | 0.872 | 1.000 |
| 25-29 | 0.738 | 0.808 | 0.939 |
| 30-34 | 0.640 | 0.713 | 0.852 |
| 35-39 | 0.636 | 0.707 | 0.799 |
| 40-44 | 0.804 | 0.697 | 0.708 |
| 45-49 | 0.709 | 0.787 | 0.756 |
| 50+ | 0.666 | 0.702 | 0.724 |
| Total N | 164 | 201 | 239 |

## Health and Mortality

Canela practices that affect health have changed over time, and it is worth noting some of the more important health landmarks of the period under study. Among the most important events was the arrival of a particularly influential agent of the Indian service. Sebastião Pereira first came to the Canela in 1970 as a trained nurse. He had also received training in anthropology in Brasília. While ample medicines, including antibiotics, had been available to the Canela through Indian service personnel since the late 1950s, they had not been applied well. Canela individuals had to come to the Indian service post to receive their medications, and the agents went to the village only to see the most serious cases. While the Canela believed in the efficacy of injections, they thought that once they were feeling better, they did not need to continue the required course of medication. Thus during the 1960s many died who could have been saved, especially adult tubercular patients and children suffering from dysentery and dehydration. Sebastião dramatically reduced infectious disease among children through his genuine caring for the Canela. Every morning, Sebastião took a basket of medicines from door to door throughout the village, winning the trust of most mothers so that dysentery

Figure 7.
Proportion of Children Surviving, by Age Group of Mother



among young children was largely cured. His persistence in returning each day, and often more than once, was the important factor.

Table 5 and Figure 7 show the proportion of children surviving by the age group of the mother in 1970. The information on child survival for the population in 1970 is more reliable because that was the year that the birth histories were collected, but 1975 and 1979 survival rates are presented for contrast. From the graph we can see an increase in child survival between 1970 and 1975, and a more substantial one between 1975 and 1979. The decline in child mortality is somewhat less clear at the older ages, perhaps in part due to the complicating effect of the mortality of women themselves. Women who had given birth fewer times would presumably have greater chances of living to advanced ages—but their children had experienced the risky first years of life well before they could benefit from the medicines available for children born later.

The treatment for tuberculosis called for changes in Canela behaviors. Remaining in the village and resting instead of engaging in vigorous activity went against Canela values. Thus, when Canela had taken the tuberculosis medicines at the Indian service post for three months and were feeling recovered, they were tempted to leave the village and return to activities that required heavy physical exertion. Leaving the village meant terminating medical treatment, and log racing or carrying manioc baskets meant disturbing the healing process in the lungs, usually resulting in coughing up blood. When the patient returned to the post to be cured the second time around, the same medicines were usually ineffective, so the patient eventually died. To solve this medical problem Sebastião had to convince the Canela tubercular patient to stay in the post village for eight to ten months, until completely cured, and not to log race or carry heavy baskets when feeling well. Social pressures to log race or help carry supplies are extraordinarily compelling and effective in this group-oriented society, and few individuals could resist such pressures.

During the early 1970s the great sing-dance leader, the younger Tààmi, lost his wife to tuberculosis. He had lost a son to this disease about five years earlier and had recently lost a daughter to a fallopian pregnancy. When another daughter began withering away with tuberculosis, Tààmi, who was confined to the village by mourning and by his employment in the Indian service, listened to Sebastião and obeyed him. Sebastião insisted that Tààmi's sick daughter come daily to the post for medications for at least eight months. He also insisted that she be relieved of heavy family duties and be fed well with special foods from Barra do Corda during this period. Tààmi was able to buy the special foods with his Indian service salary.

Tààmi's daughter survived, and eventually Tààmi returned to leading his people in daily social sing-dancing. Subsequently, he convinced the elders of the tribe to issue orders that tubercular patients should submit to the full treatment recommended by Sebastião. Sebastião won the battle against tuberculosis through the cooperation of the whole tribe.

Table 6.
Crude Death Rates

| | Total | Women | Men |
|---|---|---|---|
| 1970–75 | 53 | 64 | 42 |
| 1975–79 | 29 | 18 | 40 |

As we would expect, these improvements in Canela health are reflected in the mortality data. The roughest measure of mortality, the crude death rate, is sensitive to the population age distribution, as a population dominated by children will naturally show fewer deaths. Table 6 presents the crude death rate (expressed in deaths per 1000) for the two intervals 1970–75 and 1975–79, first for the total population, and then for women and men considered separately. The whole population had a substantial decrease in mortality between the two periods, from 53 to 29. The remarkable fact that emerges, however, is that the decline was concentrated among women, who had substantially higher mortality than men in the first period, and substantially lower mortality than men in the second. Cause-of-death statistics taken in the mid-1960s, when the Canela were riddled by tuberculosis and dysentery, indicate that many women were dying during childbirth. It is Crocker's sense that more women died during childbirth in this earlier period than after 1975 because they were weakened by tuberculosis. We hope to use the Sardinha data to explore this hypothesis at a later date.

Another health problem for the Canela was alcohol. During the 1950s and 1960s, two leaders who were employees of the Indian service spent much of their monthly salaries on alcohol. Their poor example was widely followed, and drinking was heavy throughout the tribe. In 1964, however, Chief Kaarà?khre experienced a conversion which spread through the tribe. He got lost while hunting in the dry forests around Sardinha, and climbed a tree as protection from jaguars. During the night he ran a high fever from a bad cold. As it started to rain, he was first cold and then hot with fever; his predicament terrified him. He promised God that if he survived the forest, the jaguars and the fever, he would stop drinking. Kaarà?khre's conversion to sobriety was followed by many Canela males, so drinking was much lighter during the 1970s.

Another landmark in Canela health was the arrival of an S.I.L. missionary couple in 1968 in the village of Sardinha who moved with the last Canela group to Escalvado later in

the year. With the help of others, he installed wells at several places in the village and the post. He also helped a great deal with medical treatments, having had extensive training in this area. He even showed a film that was an animated portrayal of germ theory which many Canela came to understand, with the result that some even began to wear sandals when in the village.

## Conclusion

The small size and irregularities of the Canela population have made the use of both demographic and ethnographic methodology essential to this study. In this analysis, the demographic and ethnographic information have not simply confirmed each other; rather, each has provided its own evidence of population change among the Canela. One of the weaknesses of using externally defined demographic concepts, though these allow for comparability across populations, is that the same levels of fertility or mortality may conceal vastly different underlying features. For example, stable fertility among the Canela could reflect the opposing forces of decreasing extramarital sex, which reduces the chances of conception, and a shortening of the period of breastfeeding, which increases the chances of conception.

We call upon ethnography to document and explain differences in behavior, regardless of how they are reflected in our crude demographic measures. The ethnographic material shows up the inadequacy of our definition of marriage, for example, and permits a richer understanding of the marital power balance; we then situate this material within our understanding of kinship and changing Canela life over the past few decades. With regard to marriage, for example, sons-in-law have become increasingly important as independent economic providers. A weakening of intergenerational pressures has changed the balance of power within marriage.

The Canela tribe as a whole has been influenced by population change. The improvements in health and increases in population size are accompanied by better morale, but growth also has its negative implications. Population growth has indirectly shifted power to the younger men at the expense of the elders. Young men are increasingly divorcing wives with children still in their care, as shown in limited but reliable information received in 1990 and 1991. Before 1975, men could not divorce and leave their children easily. The current ability to do so gives young men leverage against their wives' families and gives the younger age-sets more power against the older age-sets, some of whose members constitute the Council of Elders. As the baby boomers of the 1970s reach their 30s, during the first decade of the next century, this age-set of young men may no longer obey the Council of Elders they have grown to far outnumber. Consequently, this younger cohort may take over the political control of the tribe or cause a tribal schism, founding a village largely of their own on some part of the reservation. This would accelerate the loss of traditional values and practices.

Field data from 1991, supported by earlier information from the SIL missionaries, suggests that two strong former chiefs of the tribe were undertaking procedures to found a new village at the beginning of the next agricultural cycle—June/July 1992. They were doing this because they were out of political favor, because the Indian service post was offering fewer advantages to remain at the old village of Escalvado, and because members of the younger age-sets, most of whom were to remain in Escalvado, were becoming increasingly numerous and powerful. If the schism of the late 1950s can be taken as a model, a new schism would result in considerable ill will and demoralization between the two villages thus formed and throughout the whole tribe. The Canela need to have daily, or quite frequent, meetings of the elders of the whole population to resolve a problem before it grows too large.

By the 1950s the Canela had become quite dependent on the Indian service and on the backlanders. However, self reliance is growing among the younger generations, and the Canela belief, from the mid-19th century onward, that the Brazilian owes the Indian total support for having taken his lands and spoiled his way of life, which justified this dependence, has partly disappeared. The Canela have been putting in more extensive farms, but the extent of the stream-edge gallery forests on the reservation is limited, and eventually, with the population increasing, the Canela will have to turn to other resources than agriculture to support themselves. With the Indian service currently in disarray, it is hard to see how new forms of economic support will be introduced. Greater economic dependence on backlanders and on the Indian service will contribute to continued cultural change among the Canela. We mentioned that the Canela are now more disapproving of homosexual behavior. Through the influence of the backlanders, the Canela may largely abandon their extramarital practices as well. There are other signs that the Canela are moving toward a more rigid and Western definition of sex roles, contrary to the flexibility that has characterized the Canela ways in the past.

Potential solutions, particularly for economic problems, may lie with a number of young Canela who have learned to read and write. Three descendents of former chiefs attend schools in Barra do Corda, one of them a high school. This advanced student, especially, shows great academic promise and will probably go on to college in São Luis, the state Capital. These students are totally supported by their extended families, whose members receive salaries from the Indian service. Other Brazilian Indians who become educated often leave their people and forget them. In this case, the supportive Canela kinship patterns and social structure may draw back tribal members who spend time away, as has happened in years past.

**Canela Timeline since 1957**
(developed from Crocker 1990: 10–12)

| | |
|---|---|
| 1957 | Received first visit of ethnologist William Crocker |
| 1961 | Graduated age-set of Kôham |
| 1963 | Suffered messianic movement, massive attack of backland ranchers, and relocation to dry forests |
| 1964 | Experienced anti-alcoholic "conversion" of chief |
| 1968 | Returned officially to their cerrado homelands; rejoined five tribal segments from different places into present large Escalvado village |
| 1969 | Construction of road bridge enabling army vehicles to move directly into Canela region to protect them after their return to their homelands |
| 1970–74 | Construction of three "permanent" large Indian service buildings in Escalvado: post, school house, and infirmary |
| 1970–74 | Began high population growth after near elimination of endemic infant and childhood dysentery |
| 1971 | Rejoiced in demarcation of their lands (legal in 1978 and final in 1983) |
| 1971 | Completion of direct road from Barra do Corda |
| 1972 | Graduated age-set of Koyapàà |
| ca. 1973 | Installation of gasoline generator for electricity for light and radio transmission to summon aid |
| ca. 1974 | Converted by Indian service agent to belief in pharmacy medicine to cure and nearly eradicate tuberculosis |
| 1975 | First divorce in which children were involved granted by the service and the tribal council |
| ca. 1981 | Installation of an Indian service store for buying material artifacts for resale throughout Brazil, facilitating self-sufficiency |
| 1986 | Benefitted from extensive farm project |
| 1986 | Split into twelve farm communities with Escalvado having no leader and being almost abandoned |
| 1987–89 | Stabilized politically by appointment to chieftainship of the younger Kaapêltùk |

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# NOTES ON NAMBIQUARA DEMOGRAPHY

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## Introduction

The people who have come to be called Nambiquara include speakers of three different but related languages who live in an area of approximately 50,000 square kilometers in western Mato Grosso, Brazil. The overall similarity in economic practices and social customs among the people who live in this area allows them to be treated as a single population, although they have not seen themselves, until recently, as sharing an ethnic identity, and the name "Nambiquara" is not indigenous.

The Nambiquara practice subsistence agriculture, with maize and manioc as staples. Meat is supplied by hunting. A few collected foods, such as pequi (*Caryocar braziliense*), also form an important part of the diet. The supply of vegetable foods is primarily the responsibility of women, while men furnish most of the animal foods (Price 1977).

The Nambiquara live in widely scattered local communities averaging about 30 individuals. These communities may be single villages or clusters of nearby homesteads. The political core of a community is typically a group of men who regard themselves as brothers, and one of their number is usually accepted as the community's leader. The kinship system is Dravidian and cross-cousin marriage is preferred. Because local communities are small, marriage is generally exogamous, and brother-sister exchange is usually practiced. Residence is uxorilocal when the bride's father is alive, although men marry orphans when they can and then reside virilocally (Price 1981, 1987).

Available evidence suggests that the Nambiquara settled much of the area where they now live during the nineteenth century, after the prior inhabitants had been virtually wiped out by slaving expeditions. The Brazilian frontier contracted after 1800 and the Nambiquara, who had a probably-undeserved reputation for ferocity, were left largely undisturbed as they moved into their present homeland. They began coming into permanent contact with Western society after 1910, when a telegraph line was built through their region (Price 1983).

Travel with pack animals along the telegraph line was slow and difficult. For thirty years few outsiders had reason to go to the Nambiquara—notable exceptions were missionaries, who began arriving in the 1920s, and the anthropologist Claude Lévi-Strauss (1948, 1955), who visited the region in 1938. Sudden demand for wild rubber after the Japanese invasion of Malaya led to the establishment of an extractivist network that lasted for more than twenty years, with disastrous consequences for many of the Indians. But Nambiquara villages were small and widely scattered, so that while some of the people were enslaved by *seringalistas*, others remained independent and economically self sufficient. A road driven through the region in 1960 and paved in the early 1980s finally brought all the Nambiquara into the world economic community (Price 1989).

## Limitations of the Population Data[1]

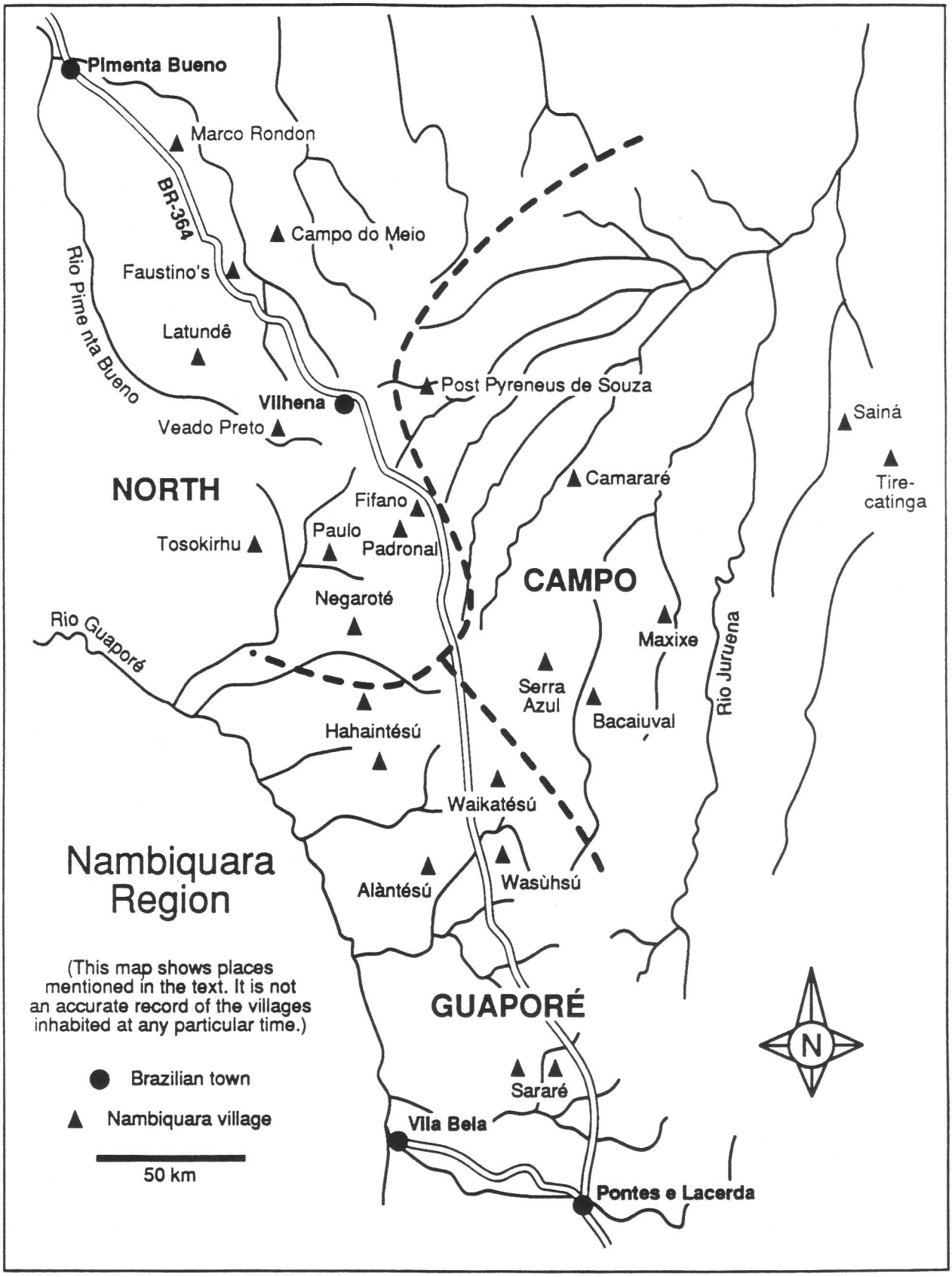
The earliest demographic material that is of any value for most purposes began to accumulate in 1943, when Indian Agent Afonso da França founded Post Pyreneus de Souza a few kilometers east of Vilhena (see Figure 1). For the next 26 years, Afonso made monthly and yearly reports on the Indians under his care. Most of the time, these data refer only to the Indians living at the post, a group averaging about 55 individuals whose composition did not result from the free practice of Nambiquara social customs. (Indian labor was used to extract rubber, and coersion was used to keep Indians at the post.) Births and deaths were recorded in a large record book, which was the only document to escape a fire that occurred in 1969, just before Afonso's removal from office.

That same year, I attempted to conduct a systematic census of the Nambiquara. I visited most of the reasonably accessible settlements and received an accounting of four remote communities from people who knew them well.[2] Unfortunately, the survey was cut short when a wheel fell off my vehicle. This prevented me from visiting any of the groups in the Guaporé Valley except the Wasùhsú. A subsequent attempt to finish the census was frustrated by a medical emergency, and my desire to study one community in greater depth prevented me from spending any more time on survey work.[3] For the rest of my time in the field (until June, 1970) I recorded all the births and deaths that I knew of.

I returned to the field in December 1973, and spent three months in Camararé. By asking about births and deaths that had occurred since I went away, I updated my census for Camararé, and to some extent, surrounding communities. Births and deaths that were said to have happened more than a year earlier were assigned to 1971 or 1972.

From 1974 through 1976, I coordinated a "Nambiquara Project," aimed at alleviating the pains of acculturation, for the National Indian Foundation. In the course of this work,

Figure 1.


Pimenta Bueno
Marco Rondon
BR-364
Campo do Meio
Faustino's
Rio Pimenta Bueno
Latundê
Vilhena
Post Pyreneus de Souza
Veado Preto
Sainá
Tire-catinga
Camararé
NORTH
Fifano
Paulo
Padronal
Tosokirhu
CAMPO
Negaroté
Rio Guaporé
Maxixe
Rio Juruena
Serra Azul
Bacaiuval
Hahaintésú
Waikatésú
Nambiquara Region
Alàntésú
Wasùhsú
(This map shows places mentioned in the text. It is not an accurate record of the villages inhabited at any particular time.)
GUAPORÉ
N
Brazilian town
Nambiquara village
Sararé
Vila Bela
50 km
Pontes e Lacerda

I divided the Nambiquara region into three districts and appointed an Indian agent to each. The Campo district included all the villages in the Juruena drainage; The Guaporé district included all the Southern Nambiquara speakers in the Guaporé Valley; and the North included speakers of all three Nambiquara languages living in the northern part of the Guaporé Valley and on the extreme headwaters of the Rios Roosevelt and Machado. I asked the three Indian agents to conduct a detailed census. This was done with varying degrees of diligence.[4] This census covered all of the Nambiquara groups except Veado Preto, of which we acquired news through people at Pyreneus de Souza, and the Latundê and Tosokirhu, who had not yet come into contact. I encouraged the Indian agents to keep me informed about births and deaths, even deaths of newborn infants, and received what is probably quite good data, under the circumstances, until I left the Nambiquara Project in August, 1976.

I visited the Nambiquara briefly in July 1977, and took the opportunity to update my material, on the basis of records kept by the Indian agents. I encouraged them to continue supplying me with census material after I returned to the United States later that year, but it was hard to get them to send me reports of deaths when they were busy trying to save lives. I did receive several reports with good material, however, especially for the Campo and Guaporé districts.

When I returned to the Nambiquara region for the World Bank in October 1980, I tried to bring my census up to date. Detailed records had been kept for the Guaporé Valley;[5] records for the North were less precise, but some lacunae were filled through an interview with the Indian agent and his wife.[6] The agent in charge of the Campo[7] had left the area to pursue his education, but he had kept detailed records up to the time of his departure in 1979.[8]

In 1982, I learned that Pe. Antônio Iási, a Jesuit priest with whom I was acquainted, had begun working with the Nambiquara. In response to my request for demographic information, he sent me a letter[9] detailing births and deaths since my last update for most of the Nambiquara region.[10]

Shortly thereafter, I received a census of the Nambiquara made by an Indian agent recently appointed to the Campo district.[11] It contained a list, by village and family, with sex, age, and relationship, for all the Nambiquara except the people of Tirecatinga, the Latundê, and the Tosokirhu. The age of older people was greatly exaggerated—so that they could receive the Brazilian equivalent of Social Security, no doubt. Also, dates of birth including day and month were given for many people whose year of birth could not possibly have been known. Apart from these imaginative elaborations, the material appeared quite good. Unfortunately, no record of deaths was made, so there is no way of evaluating the rate of infant mortality except in the regions for which Pe. Iási supplied material.

I continued to receive demographic information from correspondents through 1985. It was clear that the agent in charge of the Campo district at this time did not take record keeping very seriously. Also, the number of deaths was so low that I suspected underreporting. I was assured, however, that the figures were correct; health care temporarily improved during the paving of the highway due to the involvement of the World Bank, which helped fund the project.

In June 1986, I visited Vilhena for three days and made a concerted effort to get missing data.[12] I found that there was no central registry of deaths during 1981 and 1982, but I managed to get some data from the individual posts by radio. I also tapped the memories of Indian agents and health workers.[13] Even so, there were probably more deaths during these years than I know about. From 1983 on, good records had been kept, and I incorporated them into my material. The Latundê figure in these records, but the people of Tirecatinga do not. I was able, however, to keep track of Tirecatinga through correspondence.[14]

Gleaned from all these sources are records of over 1,100 Nambiquara. The data were accumulated under difficult circumstances, however, and must be used with caution. The material from Afonso da França's reports and the record book at Post Pyreneus de Souza has only limited utility. The data that I collected in 1969 and 1973 have somewhat greater value, but they cover only a part of the Nambiquara region and are mostly based on surveys conducted at particular points in time. In contrast, the material for the period from 1976 through 1986 is quite good; whatever its shortcomings may be, events such as births, deaths, and marriages were recorded as they occurred.

For most purposes, some subset of the total corpus must be used. In all studies, I exclude persons who have gone off to marry Brazilians or have been adopted into Brazilian households. Such people do occasionally return, but until and unless they do, they cannot be counted as members of the traditional society. In some studies, I look at figures for the three districts separately, as the Campo, the Guaporé, and the North have been affected in quite different ways by their contact with Western society. The people of the Campo have been in contact with the greater world for 60 or 70 years, but during this time they have been able to lead their lives more or less as they liked—the main constraints being imposed by the (to them) peculiar demands of missionaries. In contrast, the people of the Guaporé Valley (who are linguistically and culturally very similar) were left pretty much alone until the mid-1960s to early 1970s, when their lands suffered a brusk invasion by developers. Thus, the people of the Guaporé are less acculturated, but they have been harder hit by recent contact.

The people of the North have been in contact the longest and with the most devastating consequences. This district includes speakers of all three Nambiquara languages. What they have in common is that they lived near the telegraph line, where they were exposed to infectious diseases at an early date. Also, from the 1940s to the end of the 1960s many

of them were enslaved by *seringalistas*, who used their labor for the extraction of latex. Two small groups situated in the North do not figure in any of my analyses. They are the Latundê, who did not come into contact until 1977, and the Tosokirhu, who were apparently massacred as they were coming into contact in 1985 (see Price 1989:185–88).

The ages of all people born before 1976 are estimated, except for a relatively few people whose birth was recorded by Afonso da França or by missionaries. The births of a few older people were correlated with events whose dates were known, but in most cases the estimate was based on appearance only. I have found that there has been some tendency to underestimate the age of children and to exaggerate the age of older people. It also seems that mature women must appear older than mature men.

Throughout the period under study, or right up until the last two or three years of it, the vast majority of the Nambiquara relied very little on economic ties with the outside world, and managed to follow their own customs in social life. Thus, while their numbers may have been reduced by exposure to Western diseases, the sample can still be expected to show the demographic consequences of traditional social practices.

**Total Population**

Estimates of the Nambiquara population at the beginning of this century, just before contact, have run as high as 20,000 (Anonymous 1916:302).[15] This seems too high for a region that is, in large part, inhospitable savanna, and I have looked for ways to arrive at a more reasonable estimate. One approach involves making assumptions and working backward, and another approach involves making assumptions and working forward.

Darcy Ribeiro (1970), an authority on the acculturation of Brazilian Indians, gives the population of several indigenous groups at the time of contact and after a period of years. These data suggest that such groups typically fall to about ten percent of their precontact population in ten to twenty years, and that their population holds constant or declines very slowly thereafter. The total Nambiquara population in 1970 (the earliest year for which we can get a reasonably good fix on it) must have been between 575 and 600, so if the trend applies, precontact population would have been 6,000 or perhaps a bit more.

Another approach depends on the fact that all the Southern Nambiquara speak virtually the same language, although they are spread out over an enormous area. This makes it seem likely that they are descended from a rather small, homogeneous speech community that entered the region in the not-too-distant past. Historical evidence suggests that the date of entry would have been around 1800. If

Table 1.
Population on January 1 of Each Year

| Year | Total | Guap | Campo | North | Mm-Ng | Lat |
|---|---|---|---|---|---|---|
| 1976 | 556 | 176 | 183 | 124 | 73 | ? |
| 1977 | 557 | 181 | 179 | 121 | 76 | ? |
| 1978 | 572 | 184 | 180 | 125 | 83 | 10 |
| 1979 | 583 | 189 | 185 | 125 | 84 | 10 |
| 1980 | 596 | 187 | 192 | 129 | 88 | 10 |
| 1981 | 619 | 196 | 196 | 134 | 93 | 10 |
| 1982 | 642 | 204 | 206 | 137 | 95 | 11 |
| 1983 | 670 | 210 | 216 | 141 | 103 | 11 |
| 1984 | 707 | 227 | 226 | 146 | 105 | 11 |
| 1985 | 734 | 238 | 233 | 152 | 111 | 12 |
| 1986 | 768 | 254 | 236 | 159 | 119 | 13 |

Table 2.
Births during Each Year

| Year | Total | Guap | Campo | North | Mm-Ng | Lat |
|---|---|---|---|---|---|---|
| 1976 | 22 | 14 | 2 | 1 | 5 | 1 |
| 1977 | 37 | 15 | 7 | 5 | 10 | 0 |
| 1978 | 28 | 16 | 9 | 3 | 0 | 0 |
| 1979 | 43 | 18 | 14 | 7 | 4 | 0 |
| 1980 | 32 | 12 | 5 | 7 | 8 | 0 |
| 1981 | 33 | 15 | 10 | 4 | 4 | 1 |
| 1982 | 37 | 9 | 13 | 6 | 9 | 0 |
| 1983 | 40 | 20 | 11 | 5 | 4 | 0 |
| 1984 | 34 | 12 | 9 | 8 | 5 | 1 |
| 1985 | 42 | 18 | 8 | 7 | 9 | 1 |

Tabel 3.
Deaths during Each Year

| Year | Total | Guap | Campo | North | Mm-Ng | Lat |
|---|---|---|---|---|---|---|
| 1976 | 21 | 9 | 6 | 4 | 2 | 0 |
| 1977 | 22 | 12 | 6 | 1 | 3 | 0 |
| 1978 | 19 | 11 | 4 | 3 | 1 | 0 |
| 1979 | 31 | 21 | 7 | 3 | 0 | 0 |
| 1980 | 10 | 4 | 2 | 1 | 3 | 0 |
| 1981 | 10 | 7 | 0 | 1 | 2 | 0 |
| 1982 | 8 | 3 | 3 | 1 | 1 | 0 |
| 1983 | 5 | 3 | 1 | 1 | 0 | 0 |
| 1984 | 7 | 1 | 2 | 2 | 2 | 0 |
| 1985 | 8 | 2 | 4 | 1 | 1 | 0 |

*Note: The Mamaindê and Negarotê (Mm-Mg) groups are kept separate from the other groups in the North because they differ in terms of acculturative experience, having lived independently while the others were in the Indian posts and in rubber camps. Data on the Latundê (Lat) are not included in the totals because they merit little confidence. People from Pyreneus de Souza who moved to Campos Novos during the period are treated as residents of the North during the whole time.*

Figure 2.
Birth Rate

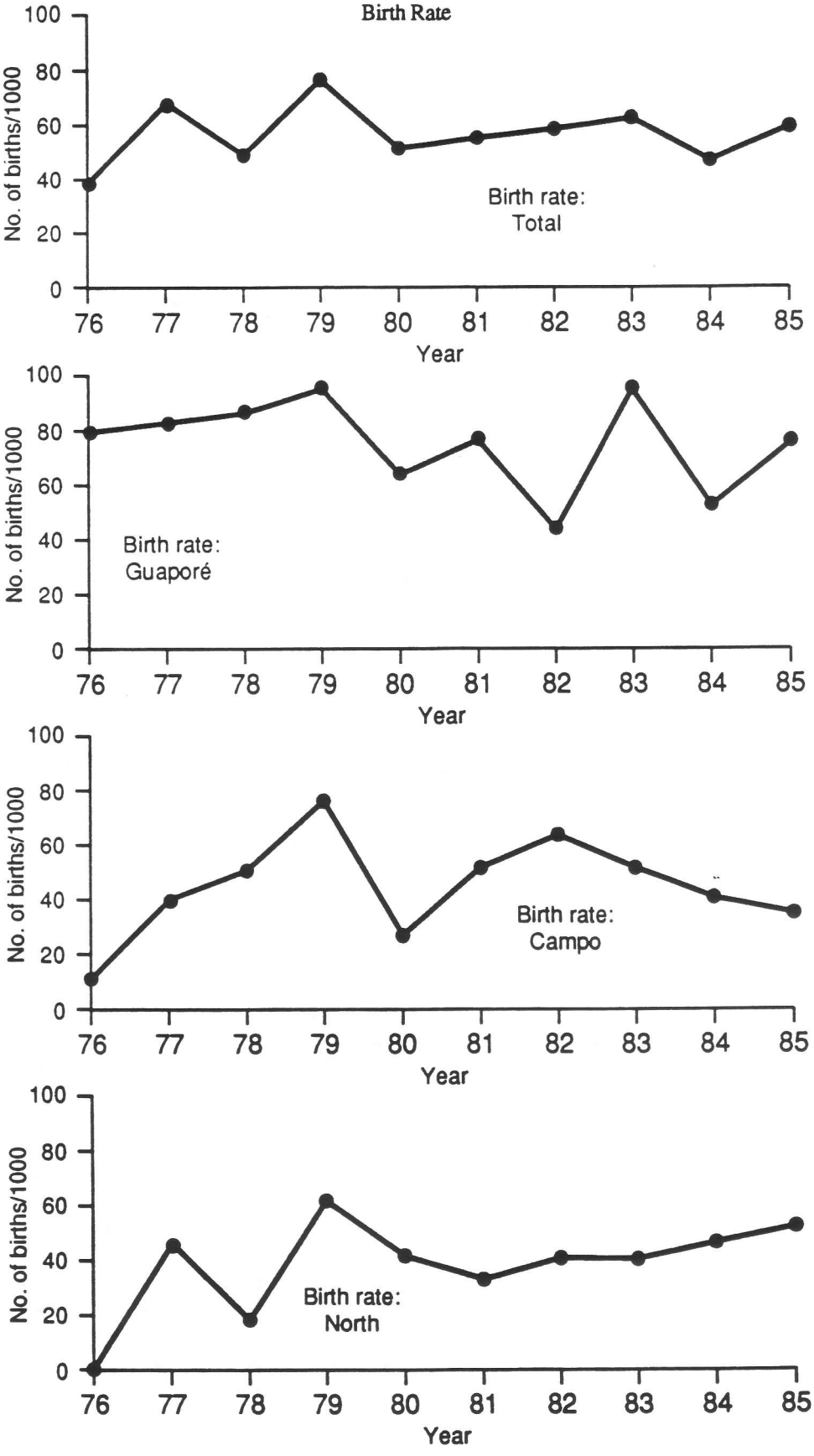
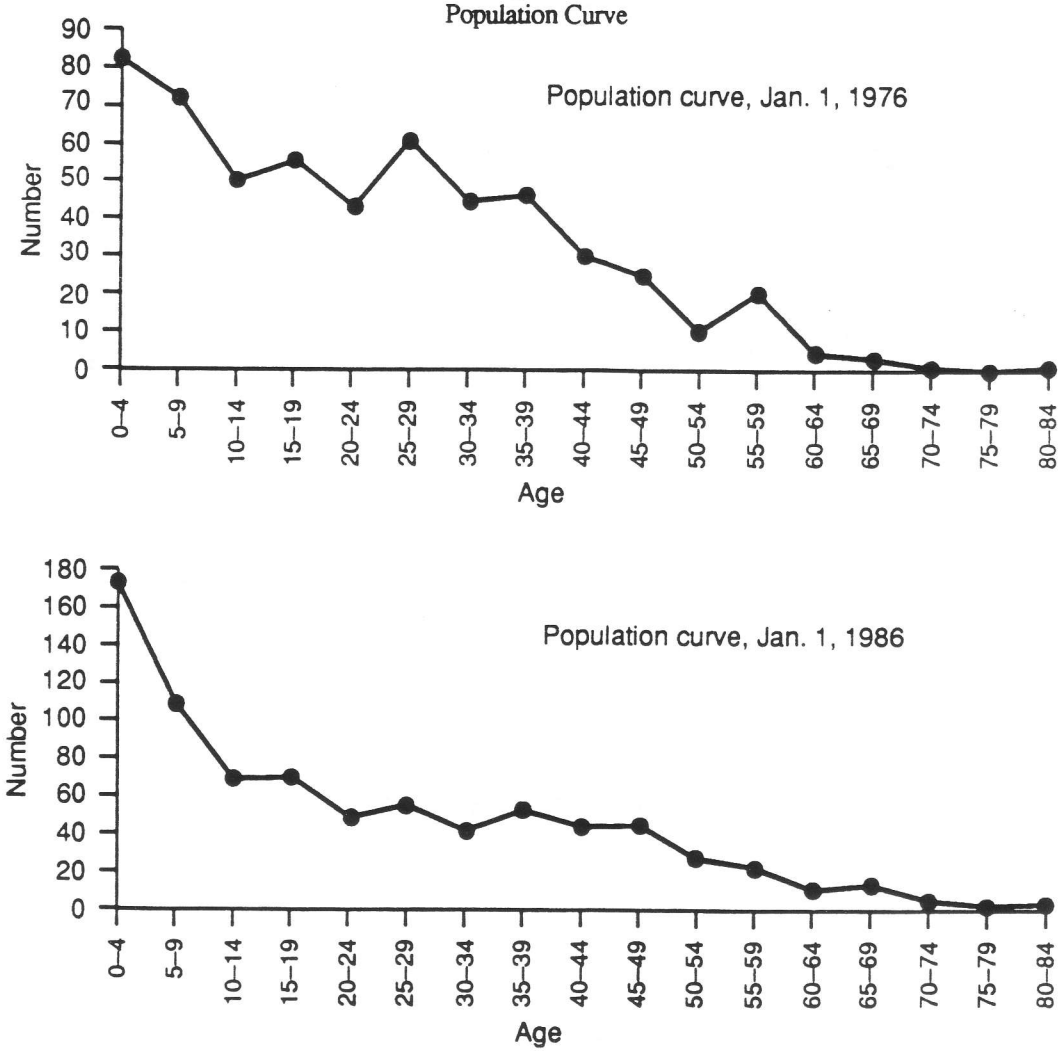


Figure 3.
Population Curve




we suppose that Southern Nambiquara speakers numbered about 500 at this time and had a rate of increase of 2.5 percent for the next century, they would have numbered something over 6,000 by 1910.[16]

Neither of these approaches can be taken very seriously, but I think an estimate placing Nambiquara population at the beginning of this century in the vicinity of 6,000 or 7,000 would not be unreasonable.

The population may have been falling slowly during the period between the intensification of rubber gathering and the beginning of the Nambiquara Project (1943–1974). The death rate at Pyreneus de Souza, from 1943 through 1965, averages about 53 per thousand; and among the people I kept track of from 1969 through 1974, the figure was about 60 per thousand. The birth rate at the beginning of the Nambiquara Project (1975–76) was 45 per thousand. If this is typical of the preceding decades, the population was falling at a rate of about one percent per year.

More recently, the population has been growing. From 1976 through 1985, the average yearly birth rate (per 1,000) was 55.7 for the whole sample, 74.8 for the Guaporé, 44.1 for the Campo, and 37.6 for the North. (Birth rates are shown graphically in Figure 2.) The death rate for the same period was 22.8 for the whole sample, 36.6 for the Guaporé, 17.5 for the Campo, and 13.9 for the North. Natural increase is 32.9 for the whole sample, 38.2 for the Guaporé, 26.6 for the Campo, and 23.7 for the North.

The increase in the population from 1976 through 1985 is shown in Table 1. Table 3 shows that the death rate has been falling. The temporary rise in the death rate in 1979 correlates with a low point in funding for the Nambiquara Project. When founded in 1975, the project was understaffed and underfunded; after my departure in 1977 funding slid, and, despite the best efforts of the Indian agents, the effects began to appear in the data. After 1980, there was exorbitant funding, as a consequence of the World Bank's concern about the effects of the Polonoroeste Project on the native population.[17]

Figure 3 shows the composition of the Nambiquara population, by age, in 1976 and 1986. The dips in the 1976 curve may be the consequences of epidemics correlated with completion of the telegraph line, the intensification of rubber gathering, and the building of the road through the Nambiquara region. The 1986 curve shows that a large number of children born in the preceding decade had survived, and the irregularities in the rest of the curve are less evident.

### Fertility

It is difficult to determine with precision the age at which Nambiquara women have their first child, since for most of the women in my study the precise date of their own birth is unknown, and moreover, it is not clear that their first surviving child was in fact their first child. There is, however, a group of 25 women whose dates of birth were registered (by missionaries or Indian agents) and who have come of age during the period when we have been able to keep track of births. The age at which these women gave birth to their first child ranges from 12 years and 8 months to 20 years and 1 month, with a mean of 15 years and 7-1/2 months.

Utilizing all the cases (207) where women gave birth two or more times during the ten-year period of the study, I have calculated that the average spacing between children is 30 months.[18] I did not collect the birth histories of individual women and date them in relation to memorable events, as other authors in this volume have done, although this would be a good check on the mean interval as I have calculated it, and might show change over time.

I have also attempted to determine the duration of the period during which Nambiquara women bear children, and their relative likelihood of giving birth during this period. Figure 4 shows the age of mothers at the birth of children for all the births recorded from 1943through 1985. Figure 5 shows the percentage of women who gave birth at various ages during the years 1976–85. Figure 6 shows the mean age of women who gave birth each year during the ten-year study; it appears to show a slight rise, although this may not be significant.

Since the birth rate was highest in the Guaporé, and lower in the Campo and the North, I surmised that there must simply be more women in their child-bearing years in the Guaporé population. During the first harsh years of contact, only the strong survive—the older folks tend to die, as do the children. Thus, I reasoned, women in their child-bearing years should constitute a higher percentage of the adult population in the most recently contacted group, and this would account for the higher birth rate.

To test this hypothesis, I determined that the most productive years were those from 13 to 34 (inclusive) by inspecting Figure 5. I considered the adult population to include everyone 13 years of age or older. On this basis, I

Figure 4.
Age of Mother at Birth of Child, 1943–85

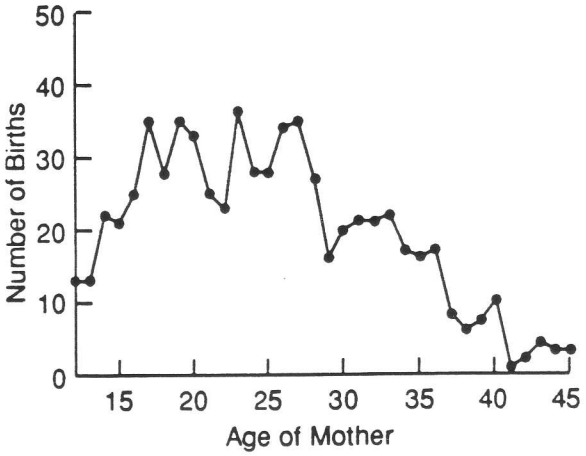



Figure 5.
Fertility in Relation to Age, 1976–85

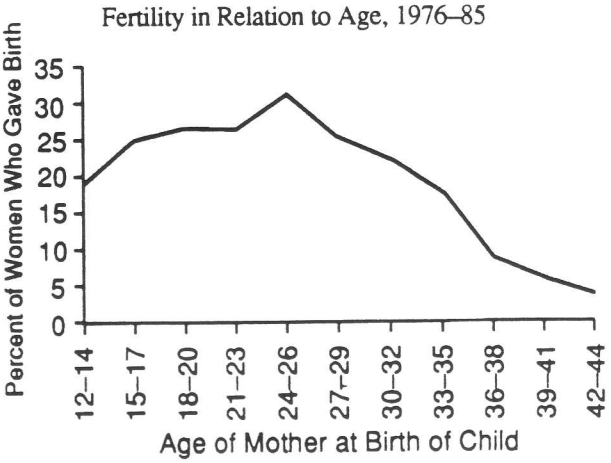



Figure 6.
Mean Age of Women Giving Birth,1976–85

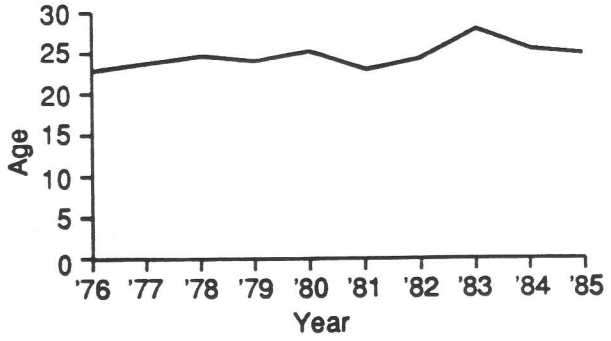


Table 4.
Mean Age at Death

| | 1943-65 | | | 1969-75 | | | 1976-86 | | |
|---|---|---|---|---|---|---|---|---|---|
| | All | Male | Female | All | Male | Female | All | Male | Female |
| From birth: | 23.7 | 23.1 | 26.3 | 21.0 | 22.9 | 21.2 | 17.7 | 22.0 | 16.6 |
| Age 13 and older: | 42.8 | 41.8 | 43.5 | 43.2 | 46.2 | 39.5 | 46.1 | 48.8 | 43.9 |

The number of cases upon which these means are based:

| | 1943-65 | | | 1969-75 | | | 1976-86 | | |
|---|---|---|---|---|---|---|---|---|---|
| | All | Male | Female | All | Male | Female | All | Male | Female |
| From birth: | 55 | 21 | 31 | 58 | 31 | 24 | 144 | 53 | 83 |
| Age 13 and older: | 29 | 11 | 18 | 25 | 14 | 11 | 52 | 23 | 29 |

developed the data in Figure 7. It will be seen that the percentage of women in their childbearing years in the adult population of the Guaporé district has, in fact, been greater than in either the Campo or the North, although this percentage is diminishing. In contrast, the percentage holds reasonably constant in the Campo, and rises (except for the last two years) in the North. This finding for the North is also expected; the worst of times having passed, more surviving babies now make it to the point where they can reproduce. (I am unable to account for the drop in the last two years, however.)

Finally, it seemed reasonable to look at the number of births in relation to the number of women in their childbearing years. I have calculated summary figures for this measure. In the overall population, there were 0.313 births per year per woman in her childbearing years (13–34). For the Guaporé, this figure is 0.367; for the Campo, 0.314, and for the North, 0.209. Thus, the difference in the birth rate for the three regions is not merely a reflection of the proportion of women in their childbearing years in the population. Besides being more numerous, the women in the Guaporé are having more babies. Perhaps this is a matter of attitude; years ago women in the North told a researcher that they simply did not want to bring children into the world because life was just too hard, and perhaps something of this feeling remains. In contrast, a very cheerful and optimistic Indian agent was active in the Guaporé throughout the ten-year period, and perhaps his enthusiasm helped encourage the people to replenish their population.

### Differential Mortality

The data suggest that Nambiquara women have died in disproportionate numbers, for among 245 recorded deaths there are 105 males and 138 females. These statistics seem to support the Nambiquara belief that men are strong and resistant, while women and children are more fragile, easy prey to disease, and quick to succumb. It is not clear, however, why women should be at such a disadvantage.

Women also seem to have died at a younger age. Because I suspect differences in reliability, I divided the data into three parts to calculate mean age at death. These are: deaths reported in the record book from Post Pyreneus de Souza, deaths among the people I was able to keep track of from my original census in 1969 through the end of 1975, and deaths reported in the relatively complete 1976–85 material. To distinguish between the perils of childhood and the perils of adulthood, a separate figure was calculated for people past puberty. The break was made at age 13 because some women give birth at this age.

When these three groups of figures are compared (see Table 4), life expectancy at birth appears to be going down, while life expectancy for those who make it to puberty appears to be going up. It seems likely that these paradoxical trends reflect better reporting of infant deaths, on the one hand, and improving medical care, on the other.

A more interesting feature of these figures is the difference between mean age at death for males and females. As determined from the post book (a small data set whose reliability is not worthy of any great confidence), female life expectancy, both at birth and at puberty, was slightly greater than male life expectancy. This changes, however, in the figures for the subsequent time periods, both of which show females dying younger than males, on the average, and apparently by an interval that has been increasing.

At what stage or stages of life does female mortality exceed that of males? Figure 8 shows the proportions of males and females that have died at different ages. The table is based on all recorded deaths for which the sex of the decedent was reported. Female mortality seems to be greater than male mortality at all ages, but among children the difference is quite notable. Mortality in the zero-to-four-year old category is extremely high for children of both sexes, but markedly higher for females than males.

Figure 7.
Women of Childbearing Age as a Percentage of the Adult Population

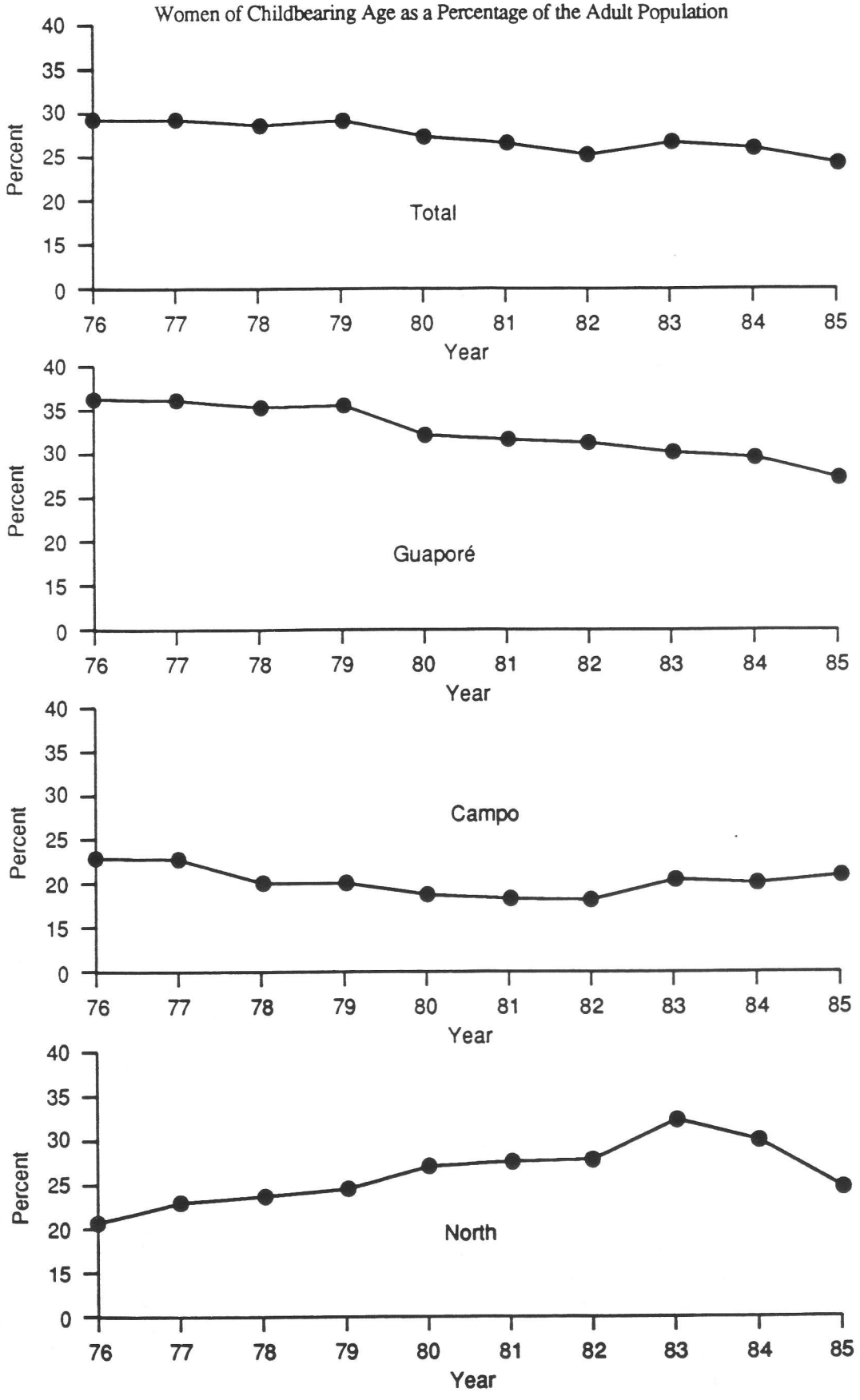


Figure 8.
Age at Death, 1943–1985

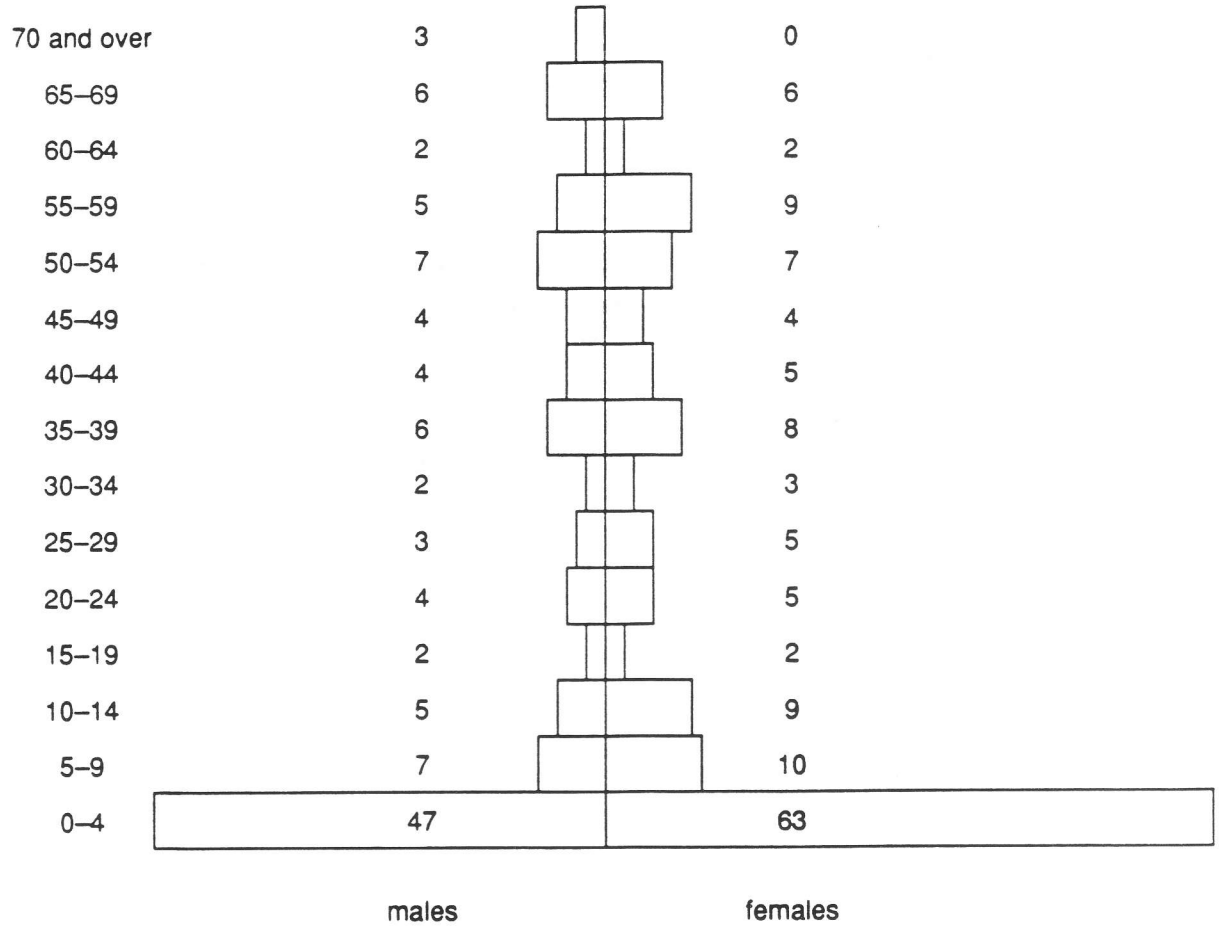



Figure 9 shows the obverse of Figure 8: the composition of the living population by sex and age. The disproportion between the sexes in the older age categories, as of January 1, 1986, may be a consequence of errors in the estimation of people's ages, but the disproportion in the three youngest five-year categories, which include people born since 1970, cannot be explained in this manner. Males predominate in the 0-to-4- and 10-to-15-year-old categories, while females, surprisingly, predominate in the 5-to-9-year-old category.

Most interesting, however, is the fact that the disproportion between the sexes among the living (where males outnumber females by only 384 to 367) is not as great as the disproportion among the dead. Indeed, among all recorded deaths, the sexual disproportion is 6.33% away from equilibrium, while among those living on January 1, 1986, the disproportion was only 1.13% away from equilibrium.

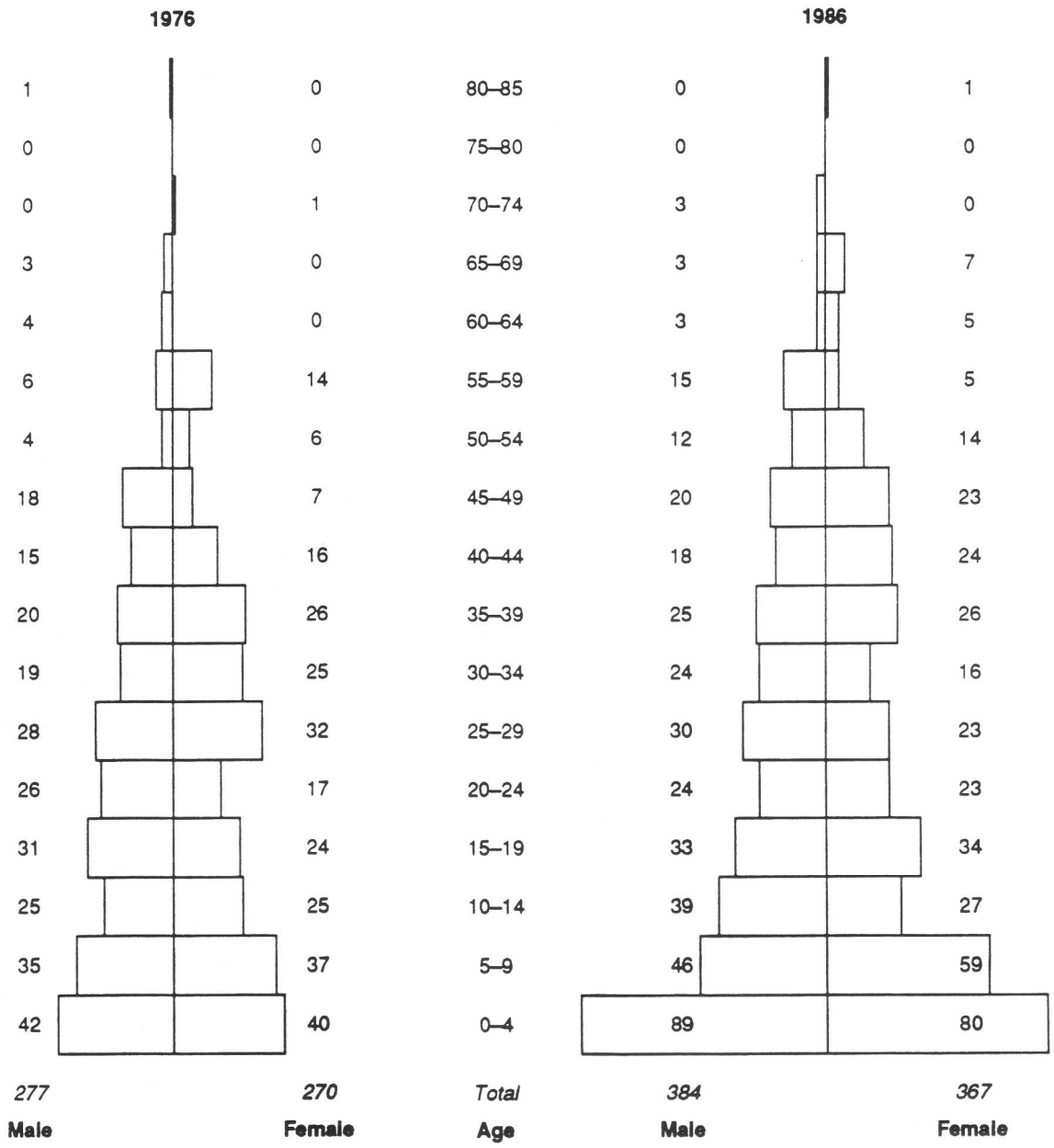
If more females than males die, and the proportion of the sexes in the population is not out of balance any farther than it is, either more females than males are born, or (more likely) infant mortality for males is underreported. Indeed, excess perinatal and early neonatal mortality for males seems to be a universal phenomenon.[19] It would not be unreasonable to suppose that the Nambiquara are failing to report a certain number of male infants who are born dead.[20]

If this were the case, reported female births would be expected to exceed male births. In fact, for the ten years when data were recorded most rigorously, from 1976 through 1985, 169 male births and 180 female births occurred (see Table 6). Reported female births exceeded reported male births in seven of these ten years, and cases to the contrary seem to be years when records were poorly kept.[21]

If it is true that more males than females are miscarried or stillborn, the disproportion is readjusted during the first two years of life, when death claims more females than males. The data contain 69 deaths under the age of two where sex is reported; of these, 38 were female and 31 male.

It would seem that the females most at risk were those born into relatively large families. The females who died

Figure 9.
Living Population, by Sex and Age




under the age of two had a mean of 1.68 living siblings at the time of their birth, whereas the males had a mean of 1.16. In cases where there was only one older sibling, newborn males with older sisters were less likely to die than females with older brothers (5, 11), while males with older brothers and females with older sisters were the same (8, 8).

One can understand that, in times of scarcity, another child would be a liability for a family that already has many mouths to feed. And the Nambiquara are pragmatic in the way they value human life; if forced to chose between saving a baby and saving an older child, they would save the older child. But it is unclear why a girl should be a greater liability to an overburdened family than a boy.

Nor is it likely that the disproportionate mortality can be attributed to infanticide. Traditionally, the Nambiquara did practice infanticide in certain limited circumstances. When twins were born, one was buried; and babies with serious physical defects were not encouraged to live. But there is no reason why girls should be appreciated any less than boys, even in relatively large families.

In societies where male children are valued more highly

Table 5.
Reported Deaths, by Sex,
in Six-Year Periods

| | Male | Female |
|---|---|---|
| 1944–49 | 8 | 15 |
| 1950–55 | 13 | 15 |
| 1956–61 | 3 | 3 |
| 1962–67 | 1 | 1 |
| 1968–73 | 23 | 14 |
| 1974–79 | 45 | 67 |
| 1980–85 | 21 | 25 |
| Year-by-Year, 1974–79 | | |
| 1974 | 7 | 2 |
| 1975 | 6 | 12 |
| 1976 | 7 | 15 |
| 1977 | 6 | 14 |
| 1978 | 7 | 10 |
| 1979 | 13 | 14 |

Table 6.
Reported Births, by Sex,
1976–85

| | Male | Female |
|---|---|---|
| 1976 | 7 | 17 |
| 1977 | 15 | 21 |
| 1978 | 11 | 15 |
| 1979 | 19 | 21 |
| 1980 | 14 | 17 |
| 1981 | 21 | 13 |
| 1982 | 18 | 19 |
| 1983 | 22 | 18 |
| 1984 | 21 | 15 |
| 1985 | 21 | 24 |

than female children, "Differential parental care given to female children results in large numbers of malnourished children who succumb easily to episodes of diarrhoeal diseases and respiratory illnesses" (Bhatia 1983:175). But the Nambiquara generally express no preference for children of either sex—nor would one expect them to, in a society where marriages are arranged as brother-sister exchanges. One man did tell me, however, that girls are preferable, because they will bring in sons-in-law.

To see whether there had been any change in proportional mortality over time, I looked at recorded deaths, 1944 through 1985, in six-year increments (Table 5). This showed the sexes as dying in relatively equal proportions, except in three periods. In the first, 1944–49, 8 male deaths and 15 female deaths were reported. These small numbers may be unreliable and may mean very little. The second disproportionate period was 1968–73, when 23 male deaths were reported, versus 14 female deaths. Since the data from this time depended on what I could learn after the fact, the difference is probably due to a reporting bias: male informants were more likely to tell a male ethnographer about male deaths than female deaths.[22] Subsequently, in the 1974–79 period, when reporting was relatively good, recorded female deaths outnumbered recorded male deaths 67 to 45. Closer examination reveals that the disproportion is greatest for the years 1975–77, when I was running the Nambiquara Project. During these years, mortality was excessive for women of all ages.

It might seem, at first, as if the Project hurt the Nambiquara more than it helped them. But this was also a time when a stream of settlers was beginning to pour into the Nambiquara region. There were repeated epidemics of communicable diseases, which affected both sexes. This was part of the crisis that the Nambiquara Project was supposed to alleviate, and to the extent that it succeeded, the death rate fell in subsequent years.

But why were women especially at risk? In some societies, a higher death rate for women seems to be correlated with "culturally accepted discriminatory attitudes and behavior" associated with a pervasive difference in the status of the two sexes (Bhatia 1983:175–76). But the status of women in Nambiquara society is comparatively good. The sexual division of labor is not as rigid as in many societies, and Nambiquara men value the economic contributions of their wives. By and large, men respect their wives' opinions when making decisions, and they decry mistreatment of women in the surrounding Brazilian population.

The Nambiquara men's concern for the well-being of their women and children may, paradoxically, be the very factor that is responsible for the women and children's greater susceptibility to disease. Since the men believe that women and children are fragile, they protect them from things that are seen as strong and dangerous. When I was living in the village of Camararé, my neighbor was happy to accept some smoked partridge that I had foolishly allowed to get high by trying to keep it for a second meal, but he explained that only a strong man could eat high meat—that it would be dangerous for women and children.

The Nambiquara believe that children are subject to a form of illness called *sawã?tsu*, which is caused by the spirits of game animals. Mothers of small children are constantly bathing them with infusions made from different kinds of plant, each of which is specific for the *sawã?tsu* caused by a particular kind of animal. Just which animals are dangerous, and how they affect their victims, seems to be a subject of speculation, upon which different individuals have different opinions. But some kinds of meat are denied to children, and also to both parents during the latter part of

pregnancy. This reduction in protein consumption would, of course, have a greater effect on the gestating woman and the fetus than on the man.

When people are healthy, nobody worries about food taboos; indeed, the Nambiquara are known for their willingness to eat practically anything.[23] But when people become ill, they think about what they have eaten and what they should avoid. The causes given for the death of infants under two years old are interesting in this regard.

Cause of death is only reported in general terms, when it is reported at all, and it does not, at first, appear to be particularly revealing. Similar numbers of male and female children died of pulmonary (8,9) and gastrointestinal (3,4) illness during the first two years of life, and a greater number of females died from "malaria" (1,6) and "other" (6, 9) causes. But "malaria," it turns out, is the term that the Nambiquara use, when they speak Portuguese, for "*sawã?tsu*," the illness caused by game animals. It may be that frail women and children eat less meat, through fear of this disease.

Similarly, men's concern for the welfare of women may be the reason why women died in greater numbers during the clash with Western society in the mid-1970s. It seems probable that Nambiquara men, believing that women were more fragile, protected them from Western medicine. It would have been very much in the Nambiquara manner for men to try out the unknown medical practices of the foreign invaders on themselves before letting them be used on their wives. There is no way of demonstrating that this was in fact the case, but after the first years of the Nambiquara Project, the number of males and females reported as dying each year became more nearly equal.

Whatever is responsible for the "fragility" of women, the fact that they die in greater numbers than men only slightly overbalances the presumed tendency for a greater number of males to die at birth. Whether there was a sexual differential in mortality in the past, before the Nambiquara were exposed to Western diseases, cannot be known. But the relatively great number of men with two wives mentioned in the early literature suggests that women were more numerous, for Nambiquara men usually do not take a woman as a second wife when there is a single man available who can legitimately marry her.

## Notes

1. Many people have helped me keep demographic records of the Nambiquara. I especially want to thank Dudley Kinsman, Menno Kroeker, Edwin Pedersen, and the nuns of Utariti for sharing records they had kept before my arrival on the scene, and Sílbene de Almeida, Ariovaldo José dos Santos, Marcelo dos Santos, Maria Aurora da Silva, Alba Lucy Giraldo Figueroa, Pe. Antônio Iási, and Pe. Adalberto Holanda Pereira, for keeping me abreast of changes after my departure.

2. The inhabitants of Sainá were enumerated by Maxixi and João, who knew them well. I received an accounting of the people at Campo do Méio from the people at Faustino's Seringal. Fifano's village was empty when I arrived, but I mapped it and asked the people at Padronal, which I visited next, who lived in each house. Working through the Wasùh-sú, I got an indirect census of the Alàntésú, who apparently numbered about 47 individuals.

3. Ultimately, this survey included all the Nambiquara villages in the Juruena drainage, all the villages in the North except the Negaroté and two groups that had not yet come into contact, and a part of the people in the Guaporé Valley.

4. Ariovaldo José dos Santos and Sílbene de Almeida made good censuses of the Campo and Guaporé regions. The agent in charge of the North was remiss, and the work was eventually done through the combined efforts of Jorge Falca, Alba Lucy Giraldo Figueroa, and Ariovaldo.

5. Agent in charge was Sílbene de Almeida.

6. Marcelo dos Santos and his wife Gigi.

7. Ariovaldo José dos Santos

8. There may be a short lapse in the information recorded in the Campo after Ariovaldo's departure.

9. Written 10 June 1982.

10. Groups for which he had no information were the Sararé, Pyreneus de Souza, Tirecatinga, the Latundê, and the Tosokirhu.

11. José Eduardo F. M. Costa; accompanied by a letter written 8 July 1982.

12. During the previous two or three years, Dra. Rejane Messias Domiciano had been keeping good records on the Nambiquara, and she was kind enough to let me copy them.

13. I supplemented this material by talking to Ariovaldo (Sarare), Sílbene (Valley), and Gigi and Elza (North).

14. A few months previously, I had written to Pe. Adalberto and arranged an exchange of information; he said that births and deaths had not been registered systematically since the closing down of Utariti, but nevertheless, he managed to give me a pretty good list. There may be a couple of unrecorded infant deaths, but by and large, the Utariti data are acceptable.

15. This is said to be Rondon's minimum estimate, but so far as I know, Rondon gives no such figure in any of his signed reports.

16. In 1982 I calculated that there were 427 people who spoke Southern Nambiquara as a first language, 152 who spoke Northern Nambiquara, 25 who spoke Sabanê, and 42 younger people whose first language was Portuguese.

17. The Nambiquara were the focus of efforts by an international community of Indian advocates concerned over the effects that the Polonoroeste Project would have on native peoples in the area to be "developed."

18. In 1976 the only material I had to work with was that from the calendar year 1975. For that period, I counted 127 women in their reproductive years (which I reckoned arbitrarily as lasting from the age of 15 to 45). Of these, 24 had given birth during the year. This was an average of 0.19 births per woman. At this rate, the average woman would have 5.7 children during her reproductive life, and the spacing between them would average 5.3 years.

These earlier calculations differ considerably from those based on the more recent, ten-year data set. While the new figures may merit greater confidence because they are based on a larger population studied over time, they also may reflect changed circumstances.

19. I am familiar with this from Hammoud (1977), who cites several other studies.

20. A reader has pointed out that they could also be changing the sex of the child in the act of reporting it. I know of no reason why this would be done.

21. In 1981, for example, 21 male and 13 female births were reported. This was a year when many births were recorded after the fact, and the likelihood that some female births were neglected is supported by the fact that the male figure is similar to that for nearby years, while the female figure is much lower.

22. The number of male deaths for the period is similar to those for a well-documented period, 1980–85, when male and female deaths were about equal. This lends support to the idea that the figure for female deaths in 1968–73 is depressed, rather than the figure for male deaths being inflated.

23. But the Nambiquara insist that they do not eat spiders, as reported by Lévi-Strauss (1948:14).

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# CULTURAL CHANGE, POLYGYNY, AND FERTILITY AMONG THE SHIPIBO OF THE PERUVIAN AMAZON[1]

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## Introduction

In my early studies of the health effects of cultural change among the Shipibo, I found one of the highest fertilities ever reported for a human group—a gross reproduction of 4.933 for the years from 1964 through 1969 (Hern 1977). This tribe is experiencing rapid cultural change, one aspect of which is a decline in the prevalence of polygyny. I decided to test the hypothesis that polygyny limits the fertility both of individual women and of the community as a whole through post-partum sexual abstinence and longer birth intervals. I found that the birth intervals of polygynously married women are indeed longer and their fertility lower. Moreover, the community's overall fertility rate is negatively associated with the proportion of polygynous birth intervals.

Worldwide, disruption of traditional cultural controls on fertility may provide an important explanation for the increased fertility that has been reported in some ethnic groups experiencing rapid cultural change (Nag 1980). Contributing factors would be a reduction in the length of breastfeeding and shorter post-partum sexual abstinence on the part of women. Such changes have certainly ocurred in Africa, although some contrary results have also been published (Dorjahn 1958; Caldwell and Caldwell 1977; Aborampah 1987; Chojnaka 1980; Cleveland 1987; Isaac 1980; Handwerker 1987; Page and Lesthaeghe 1981; Sembajwe 1979; Olusanya 1971). Polygyny has commonly been associated with longer post-partum sexual abstinence on the part of women, and this would logically lead to longer birth intervals (Whiting 1964; Schoenmaeckers, Shah, et al. 1981).

A flaw in many published studies is the lack of information on individual fertility that relates polygynous status to birth-interval length. In only a few studies has the fertility of polygynously and monogamously married women been compared within the same society. This is because cultural changes that affect fertility are most likely to occur in tribal or peasant societies without adequate records, and information about these societies tends to be collected by anthropologists who have not been trained in the collection of demographic data (Peterson 1975; Caldwell, Caldwell, and Caldwell 1987). In their study of the Sereer, Garenne and Van De Walle (1989) show lower fertility among polygynous women. Outside Africa, studies of groups as disparate as Mormons, residents of Bangladesh, and New Guinea tribes have shown that polygyny reduces women's fertility (Smith and Kunz 1976; Anderson and Emigh 1989; Bowers 1971; Van Arsdale 1978; Wood, Johnson, and Campbell 1985; Shaikh, Aziz, and Chowdhury 1987). A significant exception is the work of Borgerhoff Mulder (1989), whose study of the Kipsigis showed no important differences between the fertility of polygynous and monogamous women.

In lowland South American societies, polygyny is common (Siskind 1973; Jackson 1983), but its impact on fertility has not been well documented. Nearly all South American rates of polygyny are based on the number of polygynously married men, and a rate of 27 percent has been found in Cashinahua families, together with a tribal "population policy" that encourages fertility (Johnston, Kensinger, and Jantz 1969; Johnston and Kensinger 1971). Chagnon has noted polygyny rates as high as 50 percent among the Yanomamö, who observe strict post-partum sexual abstinence and among whom birth intervals are consequently longer (mean of 3.4 years) (Chagnon 1977, 1979:305). Birth intervals among the Xavante, who also favour sororal polygyny, are similarly long, and fertility is low—although this may be due to infanticide in both tribes (Neel and Chagnon 1968; Neel and Salzano 1970). Early and Peters (1990) have ascribed long birth intervals among the Mucajai Yanomama to prolonged lactation and induced abortion.

In my own early studies of the Shipibo, I noted a household polygyny rate of 7.1 per cent, with 9.8 percent of all women of reproductive age (aged 15 years or more) in polygynous unions. According to local accounts, the prevalence of polygyny was declining. Herbal contraceptives, which were widely used by Shipibo women, accomplished their putative effect by being associated with sexual abstinence (Hern 1976).

Polygyny does not affect women's fertility directly, but through its influence on post-partum sexual abstinence and frequency of coitus (Bongaarts 1978; Bongaarts and Potter 1983). Another proximate factor that affects fertility is postnatal infecundability caused by lactation-suppressed anovulatory amenorrhea—which appears to have been important among the !Kung (Konner and Worthman 1980; Lee 1980). Lactation is an uncertain method of suppressing ovulation, but it is probably more effective in tribal societies in which the infant can suckle at frequent intervals, as is the case among the Shipibo. In this study, polygynous status is

regarded as a proxy control variable (Greenland and Neutra 1980) for post-partum sexual abstinence, which is assumed to be one of the most important independent behavioural variables that affect fertility.

## Background

The Shipibo-Conibo are horticulturalists who rely on fishing and hunting for the satisfaction of their protein needs and who are increasingly entering the Peruvian cash economy through rice crop cultivation (Behrens 1984 1989; Bergman 1980; Lathrap 1970). About 25,000 members of the tribe live in the Ucayali River Basin in the eastern Peruvian Amazon near the city of Pucallpa (Figure 1). They have maintained their cultural identity in spite of more than 300 years of western contact. By the early twentieth century, fewer than 3,000 remained. Somehow they escaped further decimation or complete extinction, while other Amazonian tribes succumbed to European diseases, enslavement, and intertribal warfare sponsored by rubber tappers. The last smallpox epidemic was in 1964. But now, in addition to modern plagues of tuburculosis and cholera, the Shipibo have a new health problem: high fertility, which places pressure on resources and takes a heavy toll on women's health.

Postmarital residence is matrilocal (Abelove 1978), and sororal polygyny is the common and preferred form of polygyny. A man may take as a second wife any woman whom his first wife calls sister, but in practice only the younger full sisters of first wives are married. Typically, each wife has her own household or at least her own hearth, usually adjacent to the hearths of other wives.

During the past 40 years, the Shipibo have experienced rapid cultural change and have increasingly participated in the Western economic system. The Shipibo are sometimes difficult to distinguish from their mestizo neighbors. Often the only remaining distinction is the ability to speak the Shipibo language. A private health facility, the Hospital Amazonico 'Albert Schweitzer', was established near Pucallpa, the nearest city, in 1962; more recently a high school was opened in Paoyhän, the largest village. My first experience of working with the Shipibo was as a third-year medical student at the Hospital Amazonico in 1964, followed by field trips to conduct censuses and health surveys

Figure 1.
Pisqui and Central Ucayali Region

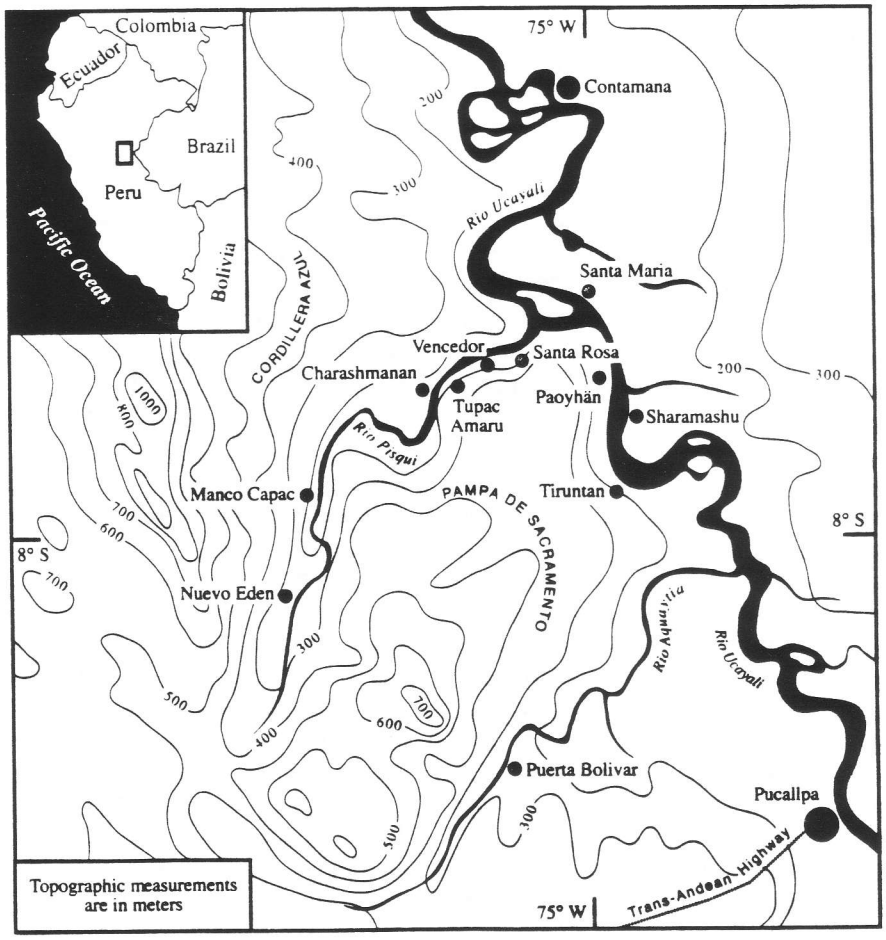


Table 1.
Population by Village

| | |
|---|---|
| Charashmanan | 203 |
| Vencedor | 114 |
| Tupac Amaru | 111 |
| Irazola | 84 |
| Santa Rosa | 127 |
| 9 de Octubre | 48 |
| Paococha | 173 |
| Paoyhan | 585 |
| Total | 1,445 |

in 1964, 1969, 1974, and 1979, as well as a field study in 1983–84 (the subject of this report), for a total of about 20 months.

One of the most striking observations is the apparent decline in the prevalence of sororal polygyny (Hern 1988). Missionaries have discouraged polygyny since their earliest contacts with the Shipibo, and Protestant missionaries have continued this effort with apparent success, as I observed during a field trip in 1983-84. The Shipibo are now sensitive about their image and endeavor to be as *civilizado* as their mestizo neighbors.

## Methods

I conducted a universal household interview in eight Shipibo communities on the Ucayali and Pisqui Rivers over a 14-month period in 1983 and 1984, and obtained a complete reproductive history from each woman aged 13 years or older (N=386). I identified each birth event and defined the length of birth intervals to the extent possible in each woman's reproductive span. I determined ages, durations of marriages, and timing and sequence of birth events. I made independent checks for accuracy through parallel estimates for sisters and other relatives, examination of existing birth records, and wide consultation with family members and neighbours.

Three definitions of polygynous effects were constructed:

(i) a woman was classified according to whether she had ever been in a polygynous marital relationship at any time;

(ii) a particular birth interval was classified according to whether it had occurred within the context of a polygynous relationship;

(iii) the mean length of closed birth intervals was calculated for each woman, as well as the proportion of each woman's closed birth intervals that were polygynous.

Table 2.
Age Structure of Population by Sex

| | Males | | Females | | Total | |
|---|---|---|---|---|---|---|
| Age | N | % | N | % | N | % |
| 0–4 | 152 | 20.6 | 136 | 19.2 | 288 | 19.9 |
| 5–9 | 114 | 15.5 | 120 | 16.9 | 234 | 16.2 |
| 10–14 | 94 | 12.8 | 97 | 13.7 | 191 | 13.2 |
| 15–19 | 82 | 11.1 | 77 | 10.9 | 159 | 11.0 |
| 20–24 | 68 | 9.2 | 61 | 8.6 | 129 | 8.9 |
| 25–29 | 43 | 5.8 | 45 | 6.4 | 88 | 6.1 |
| 30–34 | 46 | 6.2 | 38 | 5.4 | 84 | 5.8 |
| 35–39 | 30 | 4.1 | 42 | 5.9 | 72 | 5.0 |
| 40–44 | 33 | 4.5 | 36 | 5.1 | 69 | 4.8 |
| 45–49 | 21 | 2.8 | 11 | 1.6 | 32 | 2.2 |
| 50–54 | 19 | 2.6 | 16 | 2.3 | 35 | 2.4 |
| 55–59 | 14 | 1.9 | 9 | 1.3 | 23 | 1.6 |
| 60–64 | 7 | 0.9 | 13 | 1.8 | 20 | 1.4 |
| 65–69 | 6 | 0.8 | 4 | 0.6 | 10 | 0.7 |
| 70+ | 8 | 1.1 | 3 | 0.4 | 11 | 0.8 |
| Total | 737 | 100.0 | 708 | 100.0 | 1445 | 100.0 |

## Results

Of a total of 1,445 individuals enumerated in *de jure* censuses of eight villages, more than one-third, 585, were located in Paoyhän (Table 1). The total population sex ratio was 104 men per 100 women, with considerable variation among villages. Table 2 shows an extremely young population, with nearly half (49.3 per cent) under the age of 15 and 60.3 percent under 20.

Crude birth rates for the census year ranged from 42.6 to 89.6 per 1000 (Table 3), and crude death rates from 14 to

Table 3.
Vital Rates by Village

| Village | Midyear Population | Crude Birth Rate | Crude Death Rate | Rate of Natural Increase |
|---|---|---|---|---|
| Charashmanan | 201.5 | 59.6 | 44.7 | 14.9 |
| Vencedor | 112.5 | 44.4 | 17.8 | 26.2 |
| Tupac Amaru | 109.5 | 45.7 | 43.8 | 1.9 |
| Irazola | 83.0 | 84.3 | 60.2 | 24.1 |
| Santa Rosa | 124.0 | 80.7 | 32.3 | 48.4 |
| 9 de Octubre | 48.5 | 42.6 | 63.8 | –21.2 |
| Paococha | 167.5 | 89.6 | 23.9 | 65.7 |
| Paoyhan | 572.5 | 57.6 | 14.0 | 43.6 |
| All Villages | 1419.0 | 62.7 | 26.1 | 36.6 |

Table 4.
Fertility Rates by Village

| Village | General Fertility Rate | Child/ Woman Ratio* | Total Fertility† | Gross Reprod. Index | Mean Compl. Fertility |
|---|---|---|---|---|---|
| Charashmanan | 0.255 | 0.787 | 8.355 | 3.805 | 7.6 |
| Vencedor | 0.148 | 0.926 | 7.715 | 6.000 | 9.0 |
| Tupac Amaru | 0.217 | 0.826 | 5.865 | 2.665 | 6.8 |
| Irazola | 0.353 | 0.941 | 10.835 | 5.415 | 10.0 |
| Santa Rosa | 0.400 | 1.160 | 7.265 | 4.095 | 8.4 |
| 9 de Octubre | 0.182 | 0.546 | 2.500 | 1.250 | 6.0 |
| Paococha | 0.378 | 1.108 | 13.835 | 8.750 | 8.0 |
| Paoyhan | 0.271 | 0.943 | 8.145 | 4.385 | 6.9 |
| All Villages | 0.278 | 0.932 | 8.467 | 4.379 | 7.6 |

* Children aged 0–4 per woman aged 15–49
† Sum of age-specific fertility rates

63.8 per 1000. The overall infant mortality rate was 138 per 1000. General fertility rate, total fertility rates, and gross reproduction rates also varied widely (Table 4). Mean completed fertility was lowest in the Pisqui village of 9 de Octobre, in which one of the highest rates of polygyny was found, and mean completed fertility was highest in Irazola, where the polygyny rate was low.

The median reported age at menarche (N=307) was 13, and the median reported age at first marriage (N=271) was 14 years (Tables 5 & 6). There was no difference in the mean age at menarche by polygynous status (13.2 monogamous v. 13.1 polygynous; p=0.144), but polygynous women tended to get married a year earlier (13.2 v. 14.1) than monogamous women (p = .001). The mean age of first delivery for all parous females with complete reproductive histories (N = 237) was 15.6 years, with a median of 15 and mode of 14. Mean age at first delivery was lower for polygynous women (15 years) than for monogamous women (15.8 years) (p < 0.01).

Table 5.
Frequency Distribution of Ages at Menarche, by Polygynous Status

| | Monogamous | | Polygynous | | Total | |
|---|---|---|---|---|---|---|
| Age | N | % | N | % | N | % |
| 11 | 3 | 1.2 | 1 | 1.6 | 4 | 1.3 |
| 12 | 44 | 18.0 | 12 | 19.4 | 56 | 18.2 |
| 13 | 117 | 47.8 | 35 | 56.5 | 152 | 49.5 |
| 14 | 57 | 23.3 | 11 | 17.7 | 68 | 22.1 |
| 15 | 21 | 8.6 | 3 | 4.8 | 24 | 7.8 |
| 16 | 3 | 1.2 | 0 | 0.0 | 3 | 1.0 |
| Total | 245 | 100.0 | 62 | 100.0 | 307 | 100.0 |

Table 6.
Frequency Distribution, Ages at First Marriage, by Polygynous Status

| | Monogamous | | Polygynous | | Total | |
|---|---|---|---|---|---|---|
| Age | N | % | N | % | N | % |
| 8 | 0 | 0.0 | 1 | .4 | 1 | .4 |
| 9 | 2 | .7 | 0 | 0.0 | 2 | .7 |
| 10 | 1 | .4 | 3 | 1.1 | 4 | 1.5 |
| 11 | 6 | 2.2 | 2 | .7 | 8 | 3.0 |
| 12 | 24 | 8.9 | 11 | 4.1 | 35 | 12.9 |
| 13 | 61 | 22.5 | 21 | 7.7 | 82 | 30.3 |
| 14 | 42 | 15.5 | 12 | 4.4 | 54 | 19.9 |
| 15 | 32 | 11.8 | 7 | 2.6 | 39 | 14.4 |
| 16 | 23 | 8.5 | 4 | 1.5 | 27 | 10.0 |
| 17 | 7 | 2.6 | 0 | 0.0 | 7 | 2.6 |
| 18 | 8 | 3.0 | 0 | 0.0 | 8 | 3.0 |
| 19 | 1 | .4 | 0 | 0.0 | 1 | .4 |
| 20 | 2 | .7 | 0 | 0.0 | 2 | .7 |
| 23 | 1 | .4 | 0 | 0.0 | 1 | .4 |
| Total | 210 | 77.5 | 61 | 22.5 | 271 | 100.0 |

Mean age of the 386 females aged 13 or older who had passed menarche and from whom reproductive histories were obtained was 30; median age was 27, and modal age 18. Both the mean and median parities in this group were four. Fifty-two women were pregnant at the time of the interview. Only one of the 56 women past the age of menopause had never been pregnant.

Table 7.
Frequency Distribution, Number of Births, All Females Aged 15+

| | Number | Percent |
|---|---|---|
| 0 | 62 | 17.5 |
| 1 | 31 | 8.8 |
| 2 | 26 | 7.3 |
| 3 | 37 | 10.5 |
| 4 | 30 | 8.5 |
| 5 | 32 | 9.0 |
| 6 | 18 | 5.1 |
| 7 | 37 | 10.5 |
| 8 | 19 | 5.4 |
| 9 | 20 | 5.6 |
| 10 | 20 | 5.6 |
| 11 | 17 | 4.8 |
| 12 | 3 | 0.8 |
| 13 | 2 | 0.6 |
| Total | 354 | 100.0 |

Table 8.
Birth Interval Length by Interval Number

| Birth Interval Number | Mean | Median | Std. Dev. | N |
|---|---|---|---|---|
| 1 | 31 | 24 | 24 | 248 |
| 2 | 31 | 25 | 16 | 225 |
| 3 | 30 | 27 | 15 | 187 |
| 4 | 32 | 28 | 21 | 158 |
| 5 | 28 | 26 | 13 | 132 |
| 6 | 33 | 29 | 19 | 111 |
| 7 | 34 | 30 | 18 | 81 |
| 8 | 30 | 27 | 13 | 60 |
| 9 | 35 | 29 | 19 | 42 |
| 10 | 36 | 32 | 19 | 21 |
| 11 | 30 | 26 | 12 | 6 |
| 12 | 26 | 26 | — | 2 |

Of all women aged 15 or older, 84.5 percent had experienced at least one pregnancy, 85.6 percent had been married, and 82.5 percent had experienced at least one term birth (Table 7). The mean and median ages at last delivery were 28.8 and 28.5, respectively, and the mean reproductive span for all parous women was 13 years. The mean birth interval for all women was 31.5 months with a median of 28.5. Mean and median birth intervals for women aged 45 or over (N=42) were 36.2 and 31.6 months, respectively. Among 1,274 birth intervals reported for all women of parity 2 or higher, mean birth interval was 31.0 months, and the median was 26.0.

Regression analysis of birth-interval number on birth-interval length shows no increase of length with interval number (Table 8; $\beta = 0.0442$, adjusted $r^2 = .0012$; $F = 2.49$; $p = 0.115$). A similar comparison of mother's age at the beginning of each birth interval with the length of the birth interval shows little correlation ($\beta = 0.032$; $r^2 = 0.001$). Birth intervals do not lengthen appreciably as women age.

An Individual Fertility Rate (IFR) was calculated for each woman by dividing her parity by her reproductive span in years and multiplying by 100 (Hern 1990). *Reproductive span* is defined as the interval between the first birth and the last (whether term or premature) in months divided by 12. The mean Individual Fertility Rate was 56.8 with a median of 49.1.

Of the 386 women aged 13 or over, 75 (19.4%) had at some time participated in a polygynous union. Among these women, including some who were under 15 or over 45 years old (13.0 percent of the total), 50 were in polygynous unions at the time of the study. The 45 who were of reproductive age (15-44) constituted 15.7 percent of all women in this category, with the highest proportions in the Pisqui villages of 9 de Octubre (45.5 per cent), Vencedor, Tupac Amaru, and Charashmanan. The highest community prevalence of polygynous birth-interval lengths in the various villages was 56.6 percent and the lowest was 5.3 per cent.

Table 9.
Proportion of Men 15+ Years of Age in Polygynous Marriages, by Village

| Village | Number of Households | Monog. or Unmarried | Polygynous | Total |
|---|---|---|---|---|
| Charashmanan | 25 | 47 | 9 (16.7%) | 56 |
| Vencedor | 14 | 25 | 7 (21.9%) | 32 |
| Tupac Amaru | 8 | 28 | 4 (12.5%) | 32 |
| Irazola | 13 | 23 | 1 ( 4.2%) | 24 |
| Santa Rosa | 16 | 33 | 2 ( 5.7%) | 35 |
| 9 de Octubre | 8 | 12 | 2 (14.3%) | 14 |
| Paococha | 25 | 29 | 5 (14.7%) | 34 |
| Paoyhan | 92 | 143 | 5 ( 3.4%) | 148 |
| Total | 211 | 340 | 35 ( 9.3%) | 375 |

The overall proportion of men over the age of 14 in polyynous unions at the time of the interview was 9.3 percent (16.6 percent of all households) with ranges from 3.4 percent (Paoyhän) to 21.9 percent (Vencedor) (Table 9).

**Effect of Polygyny on Birth Interval and Individual Fertility**

An important finding is that mean birth intervals were four months longer for polygynous than for monogamous women ($p < 0.02$; Table 10). Mean Individual Fertility Rates were significantly lower for polygynous women, who had

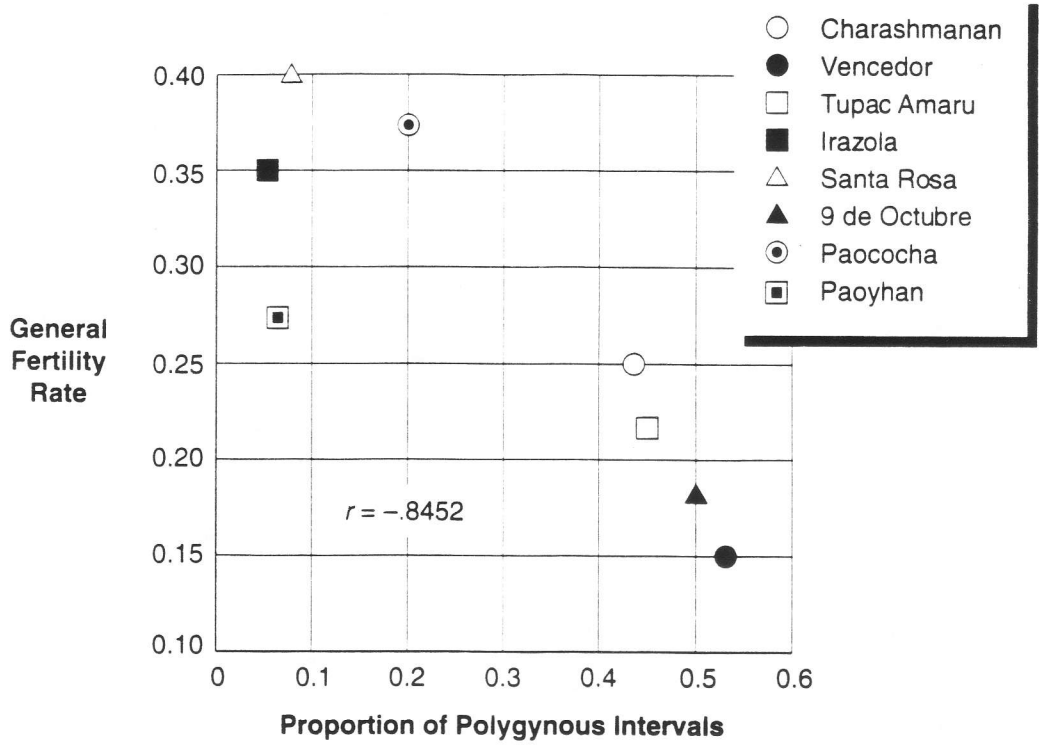
Table 10.
Mean Birth Interval Lengths by Polygynous Status

| Status | Mean | Median | N |
|---|---|---|---|
| Polygynous | 34.5 | 31.4 | 68 |
| Monogamous | 30.3 | 27.7 | 167 |
| Total | 31.5 | 28.5 | 235 |

Table 11.
Individual Fertility Rate by Polygynous Status

| Status | Mean | Median | N |
|---|---|---|---|
| Polygynous | 47.09 | 44.44 | 68 |
| Monogamous | 60.64 | 51.53 | 167 |
| Total | 56.75 | 49.12 | 235 |

Figure 2.
Relationship of Polygyny and Fertility in Eight Shipibo Villages




1.3 fewer children per reproductive span than monogamous women ($p < 0.001$, 2-tailed probability; Table 11). The percentage of living children was higher among monogamous than among polygynous women (70.9 compared with 63.2), although this may be accounted for by the relatively greater age of the polygynous women, whose mean age was 40.4 compared with 29.8 for monogamous women.

Table 12.
General Fertility Rates
and Proportion of Polygynous Birth Intervals by Village

| Village | General Fertility Rate | Proportion of Polygynous Birth Intervals |
|---|---|---|
| Charashmanan | 0.255 | 0.433 |
| Vencedor | 0.148 | 0.523 |
| Tupac Amaru | 0.217 | 0.455 |
| Irazola | 0.353 | 0.067 |
| Santa Rosa | 0.400 | 0.080 |
| 9 de Octubre | 0.182 | 0.500 |
| Paococha | 0.378 | 0.201 |
| Paoyhan | 0.271 | 0.070 |
| All villages | 0.278 | 0.224 |

Regression of the proportion of polygynous birth intervals on Individual Fertility Rate yields $\beta = -0.25067$ and adjusted $R^2 = 0.05885$, $F = 15.8$ ($p = 0.0001$). This slight negative correlation confirms the dampening effect of polygyny on fertility.

At the community level, the strongest negative correlation between the cumulative proportion of polygynous birth intervals and a fertility variable is with the General Fertility Rate (Table 12; Figure 2). There is a strong negative correlation between polygyny and fertility ($\beta = -0.84515$), with an adjusted $R^2$ of 0.6667 ($F = 15$; $p < 0.01$; Table 13).

The clearest and strongest demonstration of the relationship between polygyny and fertility is a regression, for Pisqui villages, of the general fertility rate on the cumulative proportion of polygynous birth intervals, which yields a nearly straight-line negative correlation ($\beta = -0.96058$ and $R^2$ is 0.92271, with $p < 0.01$). The same analysis carried out for all villages except Paoyhän yields a similarly strong relationship ($\beta = -0.94786$).

In sum, the evidence shows that:

- birth intervals for polygynous women are a little more than four months longer than for nonpolygynous women;
- individual fertility is lower for polygynous women, who have an average of 4.7 births during their reproductive span, than for monogamous women, who have on average 6.0 births;

Table 13.
Regression of Proportion of Polygynous Birth Intervals
on the General Fertility Rate, for Eight Shipibo Villages

| | | | | | |
|---|---|---|---|---|---|
| Multiple R | .84515 | | | | |
| R Square | .71428 | | | | |
| Adjusted R Square | .66666 | | | | |
| Standard Error | .05384 | | | | |
| Analysis of Variance | | | | | |
| | DF | Sum of Squares | | Mean Square | |
| Regression | 1 | .04348 | | .04348 | |
| Residual | 6 | .01739 | | .00290 | |
| F = 14.99944 | Signif F = .0082 | | | | |
| Equation Number 1 | Dependent Variable | | GFR | | |
| Variable | B | SE B | Beta | T | Sig T |
| PROPOLY | –.38314 | .09893 | –.84515 | –3.873 | .0082 |
| (constant) | .38704 | .03452 | | 11.211 | .0000 |

• there is a weak but statistically significant positive relationship between polygyny and individual mean birth interval;

• polygyny has a dampening effect on individual fertility; and

• all of these findings demonstrate an unequivocably negative relationship between the prevalence of polygyny in a community and its rate of fertility.

**Discussion**

Other studies show that polygyny is almost universally linked with post-partum sexual abstinence, lactational amenorrhoea, and long birth intervals, and relate these factors to low fertility, better child survival, and lower maternal mortality among preindustrial groups (Yerushalmy 1945; Wolfers and Scrimshaw 1975; De Sweener 1984). The Shipibo have had polygynous family structures since the earliest recorded contacts, and polygyny is important enough for them to have taken violent reprisals against those who discouraged this custom (Steward and Metraux 1948). They share this social-structural feature with a wide variety of lowland South American Indian tribes, some of them, including other Panoan groups, with close linguistic ties to the Shipibo.

What does a difference of four months between the mean birth intervals of polygynous and monogamous women really mean? Potter, et al. (1963) suggest that mean birth intervals in excess of 30 months reflect a mean length of post-partum amenorrhoea of nearly a year and are presumably evidence of lengthy breast-feeding. A difference of four months may account for the observed differences between the fertility of polygynous and monogamous women. Bongaarts (1981) has shown that even moderate declines in the post-partum nonsusceptible period, which lasted nine months among the Yoruba, would produce increases of over 32 percent in marital fertility. Shipibo women nurse their children for between one and three years, but with variable intensity. Shipibo infants are slung on the hip and kept there virtually until they can walk, and during that time they nurse on demand. I did not notice any differences between the nursing practices of monogamous and polygynous women.

Among the Shipibo, however, polygyny is positively correlated with long birth intervals and negatively correlated with fertility in every respect. Fertility is not particularly related to age of first birth, nor are birth intervals much affected by age, interval number, or birth order (Bean and Mineau 1986). The mean length of birth intervals is not affected by village location.

All measures of community and cumulative individual fertility are influenced by the prevalence of polygyny in the community, but the General Fertility Rate is the most general measure and has the most striking and statistically significant negative association with the cumulative community index of the proportion of polygynous birth intervals.[2,3] If any prediction can be made on the basis of the present study, it would be that the major increases in fertility among the Shipibo studied may be still ahead.

## Conclusions

For the Shipibo communities investigated, it appears that:

- Polygyny is associated with lower individual fertility;
- Modernization results in a decline in the prevalence of polygyny;
- Modernization is associated with higher, not lower, fertility.

These results support the general hypothesis that the disruption of traditional cultural patterns that maintain fertility at low levels contributes to higher and even uncontrolled fertility. The results must be interpreted with caution since it is not possible to determine the extent to which they are representative of all Shipibo or other indigenous populations in general. But to the extent that they are, they support an important conclusion: fertility can be expected to increase as tribal peoples experience rapid cultural change from traditional to peasant to urban societies.

## Notes

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2. Demographic measures used here were taken from a variety of texts, but principally H. S. Shryock, J. S. Siegel, *et al.*, *The Materials and Methods of Demography*, Condensed Edition (New York 1976), M. Spiegelman, *Introduction to Demography*, Revised Edition (Cambridge, Massachusetts, 1968, and G. Barclay, *Techniques of Population Analysis* (New York 1958).

3. An important potential source of bias could be selective survival or selective migration. Another possible source of bias includes a differential exposure to venereal disease and to modern contraceptives according to location by village or by other sources of cultural change. No evidence of these sources of bias was found.

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