Population Studies, **46** (1992), 53–64
Printed in Great Britain

Polygyny and Fertility among the Shipibo of the Peruvian Amazon*

WARREN M. HERN†

INTRODUCTION

In this report we describe the fertility of an Amazon Indian tribe with one of the highest documented fertilities of any human group, a gross reproduction of 4.933 in 1964–69.[1] This tribe, the Shipibo, is experiencing rapid cultural change which includes a decline in the prevalence of polygyny. We shall test the specific hypothesis that polygyny limits the fertility, both of individual women and of the community, through post partum sexual abstinence and longer birth intervals. The birth intervals of polygynously married women are longer, and their fertility is lower. The community's fertility rate is negatively associated with the proportion of polygynous birth intervals.

Disruption of traditional cultural controls on fertility may provide an important explanation of increased fertility in some ethnic groups which are experiencing rapid cultural change.[2] This may be caused by a reduction in the length of the period of breastfeeding and by shorter post partum sexual abstinence on the part of women. This is generally true in Africa, although contrary results have been published.[3] Polygyny has commonly been associated with longer post partum sexual abstinence on the part of women, and this should logically have led to longer birth intervals.[4] A common flaw in

* This research was supported in part by the Wenner–Gren Foundation for Anthropological Research. I wish to acknowledge the assistance of Linda Hodge in collecting these data and the indispensable help of Connor and Mary Nixon. I also wish to acknowledge the dedicated help of my Shipibo assistants and the warm hospitality of the Shipibo people. I thank J. C. Caldwell, A. R. Omran, E. A. Hammel, M. Nag, P. Reining, N. A. Chagnon, M. Borgerhoff-Mulder, and J. B. Lancaster for their helpful comments and encouragement. I especially appreciate the suggestions of the *Population Studies* editorial staff and reviewers. A longer version of this paper was presented at the annual meeting of the Population Association of America, Toronto, Canada, 5 May 1990.

† Warren M. Hern, M.D., M.P.H., Ph.D., Associate Professor Adjunct, Department of Anthropology, Campus Box 233, University of Colorado, Boulder, Colorado, 80309-0233.

[1] W. M. Hern, 'High fertility in a Peruvian Amazon Indian village,' *Human Ecology*, **5** (1977), pp. 355–368.

[2] M. Nag, 'How modernization can also increase fertility', *Current Anthropology*, **21** (1980), pp. 571–587.

[3] V. R. Dorjahn, 'Fertility, polygyny, and their interrelations in Temne society', *American Anthropologist*, **60** (1958), pp. 838–860; J. C. Caldwell and P. Caldwell, 'The role of marital sexual abstinence in determining fertility: a study of the Yoruba in Nigeria', *Population Studies*, **31** (1977), pp. 193–217; O. Aborampah, 'Plural marriage and fertility differentials: a study of the Yoruba of Western Nigeria', *Human Organization*, **46** (1987), pp. 29–38; H. Chojnacka, 'Polygyny and the rate of population growth', *Population Studies*, **34** (1980), pp. 91–107; D. A. Cleveland, 'The political economy of fertility regulation: the Kusasi of Savanna West Africa (Ghana)', in *Culture and Reproduction: An Anthropological Critique of Demographic Transition Theory*, W. P. Handwerker (ed.) (Boulder, 1987), pp. 283–284; B. L. Isaac, 'Female fertility and marital form among the Mende of rural Upper Bambara Chiefdom, Sierra Leone', *Ethnology*, **19** (1980), pp. 297–313; W. P. Handwerker, '"Natural fertility" as a balance of choice and behavioral effect: policy implications for Liberian farm households', in Handwerker, *op. cit.*, pp. 107–108; H. J. Page and R. Lesthaeghe, (eds.), *Child-Spacing in Tropical Africa* (London, 1981); I. Sembajwe, 'Effect of age at first marriage, number of wives, and type of marital union on fertility', *Journal of Biosocial Science*, **11** (1979), pp. 341–351; P. O. Olusanya, 'The problem of multiple causation in population analysis, with particular reference to the polygamy-fertility hypothesis', *Sociological Review*, **19** (1971), pp. 165–178.

[4] J. M. Whiting, 'The effects of climate on certain cultural practices', in *Explorations In Cultural Anthropology*, W. H. Goodenough (ed.) (New York, 1964), p. 511; R. Schoenmaeckers, I. H. Shah, *et al.*, 'The child-spacing tradition and the post partum taboo in tropical Africa: anthropological evidence', in Page and Lesthaege, *op. cit.* in fn. 3, p. 25.

most published studies is the lack of information on individual fertility that relates polygynous status to birth interval. In only a few studies has the fertility experience of polygynously and monogamously married women been compared within the same society. This is because cultural changes which 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.[5] An important exception is the work of Borgerhoff Mulder, whose study of the Kipsigis showed no important differences between the fertility of polygynous and monogamous women. Garenne and van de Walle, in their study of the Sereer, however, found lower fertility among polygynous women.[6] Outside Africa, studies of groups as disparate as Mormons, residents of Bangladesh, and New Guinea tribes have shown that polygyny reduces women's fertility.[7]

Polygyny is common in lowland South American societies,[8] but its prevalence and impact on fertility have 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 per cent has been found in Cashinahua families, together with a tribal 'population policy' which encourages fertility.[9] Chagnon has noted polygyny rates as high as 50 per cent among the Yanomama, who observe strict post partum sexual abstinence and among whom birth intervals are consequently longer (average: 3.4 years).[10] Birth intervals among the Xavante, who also favour sororal polygyny, are similarly long, and fertility is low, but this may be due to infanticide in both tribes.[11] Early and Peters have ascribed long birth intervals among the Mucajai Yanomama to prolonged lactation and induced abortion.[12]

In my own early studies of the Shipibo, I noted a household polygyny rate of 7.1 per cent, with 9.8 per cent of all women of reproductive age (aged 15+ years) in polygynous unions. According to local accounts, the prevalence of polygyny was declining. Herbal

[5] W. Petersen, 'A demographer's view of prehistoric demography', *Current Anthropology*, **16** (1975), pp. 227–245; J. Caldwell, P. Caldwell, and B. Caldwell, 'The function of child-spacing in traditional societies and the direction of change', *Current Anthropology*, **28** (1987), pp. 25–43.

[6] M. Borgerhoff Mulder, 'Marital status and reproductive performance in Kipsigis women: re-evaluating the polygyny–fertility hypothesis', *Population Studies*, **43** (1989), pp. 285–304; M. Garenne and E. van de Walle, 'Polygyny and fertility among the Sereer of Senegal', *Population Studies*, **43** (1989), pp. 267–283.

[7] J. E. Smith and P. R. Kunz, 'Polygyny and fertility in nineteenth-century America', *Population Studies*, **30** (1976), pp. 465–480; D. L. Anderton and R. J. Emigh, 'Polygynous fertility: sexual competition versus progeny', *American Journal of Sociology*, **94** (1989), pp. 832–855; N. Bowers, 'Demographic problems in montane New Guinea', in *Culture and Population: A Collection of Current Studies*, S. Polgar (ed.) (Chapel Hill, NC, 1971), pp. 11–31; P. W. van Arsdale, 'Population dynamics among Asmat hunter-gatherers of New Guinea: data, methods, comparisons', *Human Ecology*, **6** (1978), pp. 435–467; J. W. Wood, P. L. Johnson, and L. L. Campbell, 'Demographic and endocrinological aspects of low natural fertility in highland New Guinea', *Journal of Biosocial Science*, **17** (1985), pp. 57–79; K. Shaikh, K. M. A. Aziz, and A. I. Chowdhury, 'Differentials of fertility between polygynous and monogamous marriages in rural Bangladesh', *Journal of Biosocial Science*, **19** (1987), pp. 49–56.

[8] J. Siskind, 'Tropical forest hunters and the economy of sex', in *Peoples and Cultures of Native South America*, D. R. Gross (ed.) (Garden City, 1973); J. Jackson, *The Fish People: Linguistic Exogamy and Tukanoan Identity in Northwest Amazonia* (Cambridge, Mass., 1983).

[9] F. E. Johnston, K. M. Kensinger, R. Jantz, *et al.*, 'The population structure of the Peruvian Cashinahua: demographic, genetic, and cultural interrelationships', *Human Biology*, **41** (1969), pp. 29–41; F. E. Johnston and K. M. Kensinger, 'Fertility and mortality differentials and their implications for microevolutionary change among the Cashinahua', *Human Biology*, **43** (1971), pp. 356–364.

[10] N. A. Chagnon, *Yanomamo: The Fierce People*, 2nd edn (New York, 1977); N. A. Chagnon, 'Is reproductive success equal in egalitarian societies?', in *Evolutionary Biology and Human Social Behavior: An Anthropological Perspective*, N. A. Chagnon and W. Irons (eds.) (North Scituate, Mass., 1979), p. 105.

[11] J. V. Neel and N. A. Chagnon, 'The demography of two tribes of primitive, relatively unacculturated American Indians', *Proceedings of the National Academy of Sciences*, **59** (1968), pp. 680–689; J. V. Neel and F. M. Salzano, 'Further studies on the Xavante Indians. X. Some hypotheses-generalizations resulting from these studies', *American Journal of Human Genetics*, **19** (1970), pp. 554–574.

[12] J. D. Early and J. F. Peters, *The Population Dynamics of the Mucajai Yanomama* (San Diego, Cal., 1990).

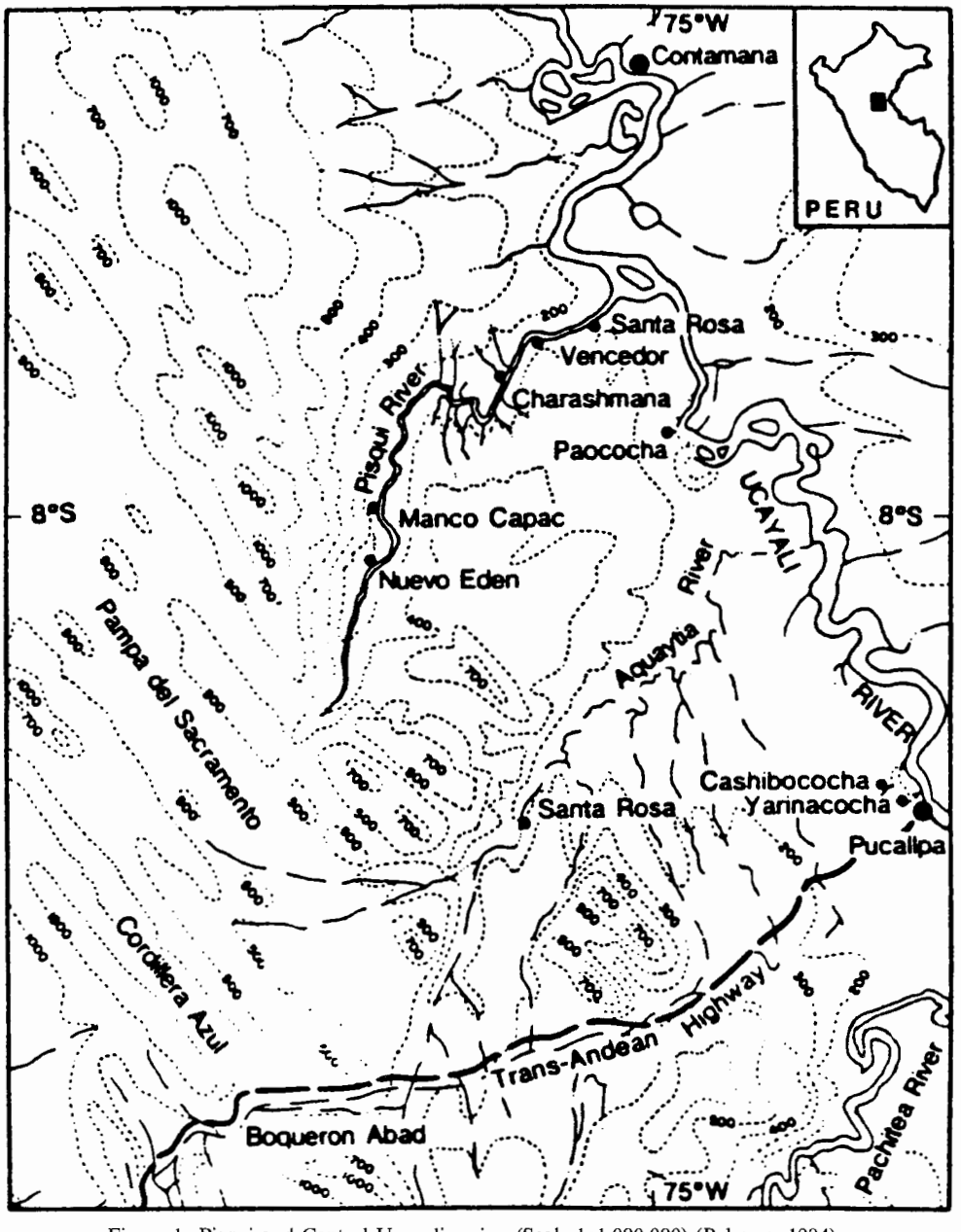

Figure 1. Pisqui and Central Ucayali region (Scale 1:1,000,000) (Behrens, 1984).

contraceptives, which were widely used by Shipibo women, accomplished their putative effectiveness by being associated with sexual abstinence.[13]

Polygyny does not necessarily affect women's fertility in itself, but is an intermediate variable which may affect it through post partum sexual abstinence and frequency of coitus.[14] Among other proximate factors that affect fertility are post-natal infecund-

[13] W. M. Hern, 'Knowledge and use of herbal contraceptives in a Peruvian Amazon village', *Human Organization*, **35** (1976), pp. 9–19.

[14] J. Bongaarts, 'A framework for analyzing the proximate determinants of fertility', *Population and Development Review*, **4** (1978), pp. 105–132; J. Bongaarts and R. G. Potter, *Fertility, Biology, and Behavior: An Analysis of the Proximate Determinants* (New York, 1983); Nag, *loc. cit.* in fn. 2.

ability caused by lactation-suppressed anovulatory amenorrhoea, which appears to have been important among the !Kung.[15]

Lactation is an uncertain method of suppressing ovulation, but it is probably more effective in tribal societies in which the infant can suckle intermittently at frequent intervals, as is the case with the Shipibo.

In this study, polygynous status is regarded as a proxy control variable[16] for post partum sexual abstinence, which is assumed to be one of the most important independent behavioural variables that affect fertility.

BACKGROUND

About 25,000 members of the Shipibo–Conibo tribe live in the Ucayali River Basin in the eastern Peruvian Amazon near the town of Pucallpa. They have maintained their cultural identity in spite of more than 300 years of western contact. They 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.[17]

The Shipibo are matrilocal and are probably matrilineal.[18] 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 also come into increasing contact with Western culture through the economic system and the establishment of a private health facility, the Hospital Amazonico 'Albert Schweitzer', in 1962. 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 in 1964, 1969, 1974, and 1979, as well as the current field study for a total of about 20 months.

One of the most striking observations is the apparent decline in the prevalence of sororal polygyny.[19] 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.

METHODS

Information was collected by universal household interview in eight Shipibo communities on the Ucayali and Pisqui rivers over a 14-month period in 1983 and 1984.

[15] M. Konner and C. Worthman, 'Nursing frequency, gonadal function, and birth spacing among !Kung hunter-gatherers', *Science*, **207** (1980), pp. 788–791; R. B. Lee, 'Lactation, ovulation, infanticide, and women's work: a study of hunter-gatherer population regulation', in *Biosocial Mechanisms of Population Regulation*, M. N. Cohen, R. S. Malpass, and H. G. Klein (eds.) (New Haven, 1980), pp. 321–348.

[16] S. Greenland and R. Neutra, 'Control of confounding in the assessment of medical technology', *International Journal of Epidemiology*, **9** (1980), pp. 361–367.

[17] C. A. Behrens, *Shipibo Ecology and Economy*, (Doctoral dissertation, UCLA, 1984); C. A. Behrens, 'Scientific basis for Shipibo soil classifications and land use: changes in soil–plant associations with cash cropping', *American Anthropologist*, **91** (1989), pp. 83–100; R. W. Bergman, *Amazon Economics: The Simplicity of Shipibo Indian Wealth* (University Microfilms International, Ann Arbor, 1980); D. W. Lathrap, *The Upper Amazon* (New York, 1970).

[18] J. M. Abelove, Pre-Verbal Learning of Kinship Behavior Among Shipibo Infants of Eastern Peru, Doctoral dissertation, City University of New York.

[19] W. M. Hern, Polygyny and fertility among the Shipibo: an epidemiologic test of an ethnographic hypothesis. Unpublished Ph.D. dissertation, University of North Carolina School of Public Health, 1988.

A complete reproductive history was obtained from each woman aged 13 years or older ($N = 386$). Care was taken to identify each birth event and define birth interval lengths to the extent possible. Ages, durations of marriages, timing, and sequence of birth events, and independent checks for accuracy were obtained by 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 proportion of each woman's closed birth intervals that were polygynous was calculated.

In addition, the mean length of closed birth intervals was calculated for each woman.

RESULTS

Of a total of 1,445 individuals enumerated in *de jure* censuses of eight villages, more than one-third (585) were located in Paoyhan (Table 1). The total population sex ratio was 104 men per 100 women, with considerable variation among villages. Table 2 shows an

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

Table 2. *Age structure of population by sex*

	Males		Females		Total	
Age	Number	Per cent	Number	Per cent	Number	Per cent
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

extremely young population with nearly half (49.3 per cent) being less than 15, and 60.3 per cent less than 20 years of age.

Crude birth rates for the census year ranged from a low of 42.6 to 89.6 per 1,000 (Table 3), and crude death rates from a low of 14 to a high of 63.8 per 1,000. The overall infant mortality rate was 138 per 1,000. General fertility rates, total fertility, and gross reproduction indices 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 it was highest in Irazola, where the polygyny rate was one of the lowest.

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).

Table 3. *Vital rates by village*

Village	Mid-year 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	1,419	62.7	26.1	36.6

Table 4. *Fertility rates by village*

Village	General fertility rate	Child–woman ratio*	Total fertility†	Gross reproduction index	Mean completed 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.

Table 5. *Frequency distribution of ages at menarche, by polygynous status*

	Monogamous		Polygynous		Total	
Age	Number	Per cent	Number	Per cent	Number	Per cent
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 of ages at first marriage, by polygynous status*

	Monogamous		Polygynous		Total	
Age	Number	Per cent	Number	Per cent	Number	Per cent
8	0	0.0	1	1.6	1	0.4
9	2	1.0	0	0.0	2	0.7
10	1	0.5	3	4.9	4	1.5
11	6	2.9	2	3.3	8	3.0
12	24	11.4	11	18.0	35	12.9
13	61	29.0	21	34.4	82	30.3
14	42	20.0	12	19.7	54	19.9
15	32	15.2	7	11.5	39	14.4
16	23	11.0	4	6.6	27	10.0
17	7	3.3	0	0.0	7	2.6
18	8	3.8	0	0.0	8	3.0
19	1	0.5	0	0.0	1	0.4
20	2	1.0	0	0.0	2	0.7
23	1	0.5	0	0.0	1	0.4
Total	210	100.0	61	100.0	271	100.0

There was no difference in the mean age at menarche by polygynous status (13.2 monogamous compared with 13.1 polygynous; $P = 0.144$), but polygynous women tended to marry a year earlier (14.1 compared with 13.2) than monogamous women ($P = 0.001$). 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; $P < 0.01$).

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 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.

Of all women aged 15 or older, 84.5 per cent had experienced at least one pregnancy, 85.6 per cent had been married, and 82.5 per cent had experienced at least one term birth (Table 7). The mean and median ages at last delivery were 28.8 and 28.5, respectively,

Table 7. *Frequency distribution of number of births, all females aged 15+*

	Number	Per cent
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

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 ($N = 42$) or over 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 with a median of 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 $r^2 = 0.0012$; $F = 2.49$; $P = 0.115$). A similar study of age at the beginning of each birth interval with the length of birth intervals shows little correlation ($\beta = 0.032$; $r^2 = 0.001$). Birth intervals do not lengthen appreciably as women age.

Table 8. *Birth interval length by interval number*

Birth-interval number	Mean	Median	Standard deviation	*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

An individual fertility rate (IFR) was calculated for each woman by dividing her parity by her reproductive span in years and multiplying by 100.[20] *Reproductive span* is defined as the interval between the first term or premature birth and the last, measured in months and divided by 12. The mean IFR was 56.8 with a median of 49.1.

Of the 386 women aged 13 or over, 75 (19.4 per cent) had ever participated in a polygynous union. Fifty of them, including some who were less than 15 or over 45 years old (13.0 per cent of the total) were in polygynous unions at the time of the interview. Forty-five of the women of reproductive age (15–44) (or 15.7 per cent) were currently in polygynous unions; the highest proportions were found in the Pisqui villages of 9 de Octubre (45.5 per cent), Vencedor, Tupac Amaru, and Charashmanan. The highest prevalence of polygynous birth intervals was 56.6 per cent and the lowest was 5.3 per cent.

The overall proportion of men aged 15 or more years in polygynous unions was 9.3 per cent (16.6 per cent of all households) with ranges from 3.4 per cent (Paoyhan) to 21.9 per cent (Vencedor) (Table 9).

Effect of polygyny on birth-interval lengths and individual fertility

An important finding is that mean birth interval lengths were four months longer for polygynous than for monogamous women ($P < 0.02$; Table 10). Mean IFRs were significantly lower for polygynous women, who had 1.3 fewer children per reproductive span than monogamous women ($P < 0.001$, 2-tailed probability; Table 11). The

[20] W. M. Hern, 'Individual fertility rate: a new individual fertility measure for small populations', *Social Biology*, 37 (1990), pp. 102–109.

Table 9. *Proportion of men 15+ years of age in polygynous marriages, by village*

Village	No. of households	Monogamous or unmarried	Polygynous		Total
			Number	Per cent	
Charashmanan	25	47	9	16.7	56
Vencedor	14	25	7	21.9	32
Tupac Amaru	18	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

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

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 relative older ages of the polygynous women, which averaged 40.4, compared with 29.8 for monogamous women.

Regression of the proportion of polygynous birth intervals on IFR 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). 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 shown in a regression of the general fertility rate on the cumulative proportion of polygynous birth intervals for Pisqui villages only in which a nearly straight line negative correlation is plotted ($\beta = -0.96058$) and R^2 is 0.92271 ($P < 0.01$). The same analysis with all villages except Paoyhan yields a similarly strong result ($\beta = -0.94786$).

The results of this section demonstrate that:

- there are significant differences in birth-interval lengths between monogamous and polygynous women, with birth intervals for polygynous women being a little more than four months longer;

Table 12. *General fertility rates and proportion of polygynous birth intervals by village*

Village	General fertility rate	Proportion of polygnous 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

Table 13. *Regression of proportion of polygynous birth intervals on general fertility rate*

Multiple R	0.84515				
R^2	0.71428				
Adjusted R^2	0.66666				
Standard error	0.05384				
Analysis of variance					
	DF	Sum of squares		Mean square	
Regression	1	0.04348		0.04348	
Residual	6	0.01739		0.00290	
$F = 14.99944$	Signif. $F = 0.0082$				
Equation number (1)	Dependent variable			General Fertility Rate	
Variable	B	S.E. B	β	T	Sig. T
proportion polygynous	−0.38314	0.09893	−0.84515	−3.873	0.0082
(constant)	0.38704	0.03452		11.211	0.0000

- individual fertility is lower for polygynous women, who have on average 4.7 births per reproductive span by comparison with monogamous women, who have on average 6.0 births per reproductive span;
- regression analysis shows a weak but statistically significant positive relationship between polygyny and individual mean birth-interval lengths;
- regression analysis shows a dampening effect of polygyny on individual fertility;
- there is an unequivocally strong negative relationship between the community prevalence of polygyny and community fertility which is demonstrable in various ways and which constitutes the major finding of this study.

DISCUSSION

Several important facts emerge from this review and study:

- Polygynous family structures of one kind or another have been found among the Shipibo since the earliest recorded contacts with them;
- polygyny is important enough to them to have prompted violent reprisals against those who discouraged this custom;[21]

[21] J. H. Steward and A. Metraux, 'Tribes of the Peruvian and Ecuadorian Montaña', in *Handbook of South American Indians*, J. H. Steward (ed.), vol. 3, The Tropical Forest Tribes, Bulletin 143 (Bureau of Ethnology, Washington, DC, 1948), pp. 51–59, 290–347, 555.

- they share this social-structural feature with a wide variety of lowland South American Indian tribes, some of them, other Panoan groups, with close linguistic ties to the Shipibo;
- polygyny is almost universally linked with post partum sexual abstinence, lactational amenorrhoea, and long birth intervals;
- long birth intervals are closely and causally related to low fertility among pre-industrial groups, better child survival, and lower maternal mortality;[22]
- polygyny as a family structure is not increasing anywhere in the world, including the Shipibo – on the contrary, its gradual diminution and disappearance is evidence of cultural change, or even 'modernization';[23]
- fertility among the Shipibo, both at the community and tribal levels, appears to be exceedingly high.

The difference between the mean birth interval lengths of polygynous and monogamous women is only four months. Potter *et al.*[24] indicated 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 prolonged breastfeeding. This difference of four months may account for the differences between the fertility of polygynous and monogamous women. Bongaarts has shown that even moderate declines in the post partum, non-susceptible period of nine months among the Yoruba would produce increases of over 32 per cent in marital fertility.[25] 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 was unable to observe whether there are or were differences in nursing practices between 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 at first birth, nor are birth interval lengths much affected by age, interval number, or birth order.[26] Mean birth-interval lengths are not affected by village location.

All community and cumulative individual fertility measures are influenced by the prevalence of polygyny in the community, but the general fertility rate is at once the most general measure, and exhibits the most striking and statistically[27] significant negative association with the cumulative community index of the proportion of polygynous birth intervals.[28]

[22] J. Yerushalmy, 'On the interval between successive births and its effect on survival of infant', *Human Biology*, **17** (1945), pp. 65–106; D. Wolfers and S. Scrimshaw, 'Child survival and intervals between pregnancies in Guayaquil, Ecuador. *Population Studies*, **29** (1975), pp. 479–496, 1975; C. De Sweemer, 'The influence of child spacing on child survival', *Population Studies*, **38** (1984), pp. 47–72.

[23] J. C. Caldwell, *Theory of Fertility Decline* (New York, 1982), p. 289.

[24] R. G. Potter, J. B. Wyon, M. Parker, *et al.*, 'A case study of birth interval dynamics', *Population Studies*, **17** (1963), pp. 155–166.

[25] J. Bongaarts, 'The impact on fertility of traditional and changing child-spacing practices', in *Child-Spacing in Tropical Africa*, H. J. Page and R. Lesthaeghe (eds.) (London, 1981), p. 111.

[26] L. L. Bean and G. P. Mineau, 'The polygyny–fertility hypothesis: a re-evaluation', *Population Studies*, **40** (1986), pp. 67–81.

[27] 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).

[28] 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 were found.

If any prediction can be made on the basis of the present study, it would be that the major increases in fertility among most of the Shipibo communities studied may be still ahead.

CONCLUSIONS

It appears that, for the communities investigated:

- polygyny is associated with lower individual fertility;
- modernization results in a declining community prevalence of polygyny;
- modernization appears to be associated with higher, not lower, fertility among the Shipibo.

These results support the general hypothesis that 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. To the extent that they are, however, they support an important conclusion: fertility can be expected to increase in societies that experience rapid cultural change from traditional to peasant to urban societies.