EVALUATING HISTORIC FERTILITY CHANGE IN SMALL RESERVE POPULATIONS

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THE INVESTIGATION OF HISTORICAL FERTILITY change among indigenous peoples of British Columbia living on reserves has been hampered by the quality and completeness of census and vital event data. Band censuses taken by the Department of Indian Affairs prior to the 1960s were often unreliable (Romaniuk and Piché 1972). Before 1920, yearly band population figures were based on periodic censuses and the subsequent yearly additions or subtractions of known births and deaths. Quinquennial censuses were established in 1924 and continued until the creation of the Central Indian Registry in 1951, which was created to formally record the vital events of all Registered Indians. There was also no provision for the legal registration of births and deaths in the province prior to 1917 (Province of British Columbia 1949). In that year a voluntary system, which led to considerable inaccuracies and incompleteness in recording, was implemented. This system continued until 1943, when registration became mandatory by an amendment to the Vital Statistics Act.

Although several prehistoric and historic demographic studies on British Columbian indigenous peoples have been conducted (Boas 1887; Cybulski 1978; Duff 1965; Fisher 1977; Keddie 1982; Kroeber 1939), only Duff (1965) has examined the area of fertility change in any detail. This paucity of data and research is addressed here by outlining a multi-step demographic approach to assess the feasibility of using genealogical data to evaluate fertility change in small reserve populations. This assessment was made by relying on genealogical data from the Ahousaht and Anaham, two British Columbian reserve populations, to assess fertility change over a recent retrospective period spanning three generations. Results from this case study show that genealogical data can provide valuable demographic insights into fertility change in small reserve populations.

THE POPULATIONS

The Ahousaht are one of the numerous Nuu-chah-nulth bands that presently live and traditionally occupied the West Coast of Vancouver Island from Cape Cook to Jordan River and Cape Flattery as far south as Ozette across the Strait of Juan de Fuca in Washington State. In the early historic period the Ahousaht were a small local group, confined to the foreshore of Vargas Island and to a small area across Calmus Pass below Guemes Mountain. By the mid-nineteenth century the Ahousaht had arrived at their present location, on Flores Island northwest of Tofino, at the expense of other Nuu-chah-nulth groups, especially the Otsosat.

Archaeological work on the Northwest Coast of Vancouver Island (Dewhirst 1980; Haggarty 1982; McMillan and St. Claire 1982) seems to demonstrate a single indigenous culture in the process of gradual adaptation to the rugged coastal environment. As most subsistence resources were seasonal, Nuu-chah-nulth occupied most sites on a semi-permanent seasonal basis and rarely travelled any considerable distance. Winter villages were situated on the upper reaches of coastal inlets in coves sheltered from winter storms, and summer villages, often fishing stations, were located on the lower parts of coastal inlets and on the coast. During the early historic period summer villages, being nearer to schooner routes and later those of steamships, increasingly became more economically important.

In the 1880s several reserves — former summer and winter villages and fishing stations from Meares and Vargas Islands to the entrance of Hesquiat Harbour — were set aside for the Ahousaht by the Dominion of Canada. Marktosis became the permanent Ahousaht reserve community. During this period the pace of culture change was greatly accelerated. When commercial fur seal hunting began to flourish, recruited Ahousaht and other Nuu-chah-nulth hunters boarded schooners bound for the Bering Strait, Japan, China, and San Francisco. Ahousaht natives also resided temporarily in Victoria, among the Fraser River canneries, and in the Puget Sound hopfields (Drucker 1951). Further Ahousaht acculturation was influenced by: the establishment of a Presbyterian elementary school at Ahousaht in 1897 (McFadden 1971); the establishment of Tofino and various other white settlements and enterprises along the West Coast; the start of regular steamship service up and down the coast; and the prohibition of the potlatch in 1884 (Drucker 1951). Traditional native life of the Ahousaht, like other Nuu-chah-nulth groups, was suppressed on all fronts by missionaries, Indian agents, and others who believed Native culture was an obstacle to the introduction of Christianity and Euro-Canadian values (Arima 1983).

The Anaham are one of the six Chilcotin bands that traditionally occupied the Chilcotin River watershed and the upper reaches of the Homalco, Klinaklini, and Dean rivers, which lie between the Chilcotin River drainage system and the Coast Mountain Range. Prior to contact, the Chilcotin territory did not extend as far eastward (Lane 1981). Their gradual movement eastward after European arrival was influenced by several factors: the discovery of gold on the Fraser River and subsequent Euro-Canadian settlement of the surrounding countryside; the extensive abandonment by Shuswap of territory west of the Fraser River; and the coercion of natives by the British Columbian government to settle in areas where they could be more easily observed and controlled (Teit 1909).

The Chilcotin are believed to be a recent derivative of a northern Athapaskan antecedent which migrated into the Chilcotin Plateau approximately 500 to 600 years ago (Helmer 1977; Wilmeth 1977, 1978). Aboriginally, the Chilcotin were a nomadic people. Their subsistence economy was based on fishing, hunting, and gathering. The nuclear family was the basic unit of social organization. This minimal social unit could operate independently; however, most often a small collection of families, usually brothers or other forms of associated kin, organized themselves into camps. Such camps cooperated closely in daily activities, but usually were informal and of indefinite duration. A number of interrelated camps formed bands which had informal leadership and which occupied but did not control territory (Lane 1981; Wilmeth 1978).

In the late 1870s a substantial number of Chilcotin established themselves in the present Anaham village at Anahim's Flat. By the 1890s Anaham was an established village, reserve centre, and Catholic mission centre regularly visited by Oblate Missionaries. But the natives were still nomadic. They roamed the country, living in tents and hunting, fishing, and trapping much as before. Most families owned small cattle herds; the sale of cattle and furs provided them with extra income. Others laboured on local ranches for extra income during parts of the year. The established village remained unoccupied most of the time and the nomadic lifestyle of the Anaham was largely unchanged until after the Second World War.

In the late 1940s this traditional way of life slowly began to erode. The Sisters of Christ the King, who had just recently established themselves on the reserve, were influential in initiating a sedentary lifestyle among the Anaham (Whitehead 1981, 1984). Thus the pace of cultural change from the 1950s onwards quickened. Modern forms of communication and transportation seem to have influenced the Anaham's increased contact with Canadian society and their rapid acculturation (Hosgood 1982). Subsistence resources and economic opportunities available declined; activities that were once carried out on public land — fishing, grazing, haying, hunting, and trapping — were now mainly confined to reserve land because of non-Chilcotin interests and developments (Lane 1981).

MATERIALS AND METHODS

This study was an outgrowth of a 1968 multidisciplinary investigation conducted under the auspices of Dr. Melvin Lee of the School of Home Economics at the University of British Columbia (Alfred et al. 1969, 1970, 1972; Birkbeck et al. 1971; Desai and Lee 1971, 1974; Lee and Birkbeck 1977; Lee, Reyburn, and Carrow 1971; Lee et al. 1971). The primary objective of Lee's research was to assess the effect of changing Native British Columbia Indian lifestyle and the diminishing isolation of reserve communities on their nutritional status. In particular, his research assessed and compared the nutritional status of the Ahousaht and Anaham using dietary, biochemical, anthropometric, and cultural data.

Cultural data, specifically genealogies, obtained from Lee's nutritional study were the primary focus of this paper. At both reserves, subjects were drawn exclusively from a non-random sample of persons who chose to have blood taken as part of a biochemical assessment of their dietary habits. Starting in 1968, these genealogies possess a time depth of three generations (about seventy-five years) and record the year of birth, and familial and kinship relationships between Ahousaht and Anaham men and women. However, they contain little or no information on the nature or duration of marital or *de facto* relationships.

Direct and indirect fertility measures were applied to analyse fertility change among women born during two periods: 1894-1923 and 1924-1938. The majority of these women have finished childbearing, commonly defined as between fifteen and forty-nine years of age, and have passed through the reproductive period without recourse to contraceptive techniques. Only in the last period are there any women who are between the ages of forty and forty-nine years and who may have consciously practised contraception (see Romaniuk 1981). Thus, these groupings are relatively homogeneous in terms of representing women who have completed child-bearing and natural fertility regimes — defined here as a population of women who do not consciously practise any type of conception, but may restrain fertility through such practices as extended breast-feeding (Henry 1961). Fertility change over these periods was evaluated directly by calculating age-specific and total fertility rates, and parity progression ratios.

The Brass relational Gompertz fertility model (United Nations 1983) was used to adjust observed Ahousaht and Anaham age-specific fertility schedules indirectly for the underreporting of births. The shape of Ahousaht and Anaham age-specific fertility curves was adjusted by relating Ahousaht and Anaham observed fertility rates to a standard natural fertility model schedule. The basis of this model is the premise that any observed fertility schedule can be transformed into a linear function by a complementary log-log (Gompertz) transformation of cumulated age-specific fertility rates. Also, unlike the commonly used Coale and Trussell (1974) model fertility schedules, the Brass relational Gompertz fertility model does not require marital fertility data to determine the pattern of age-specific fertility. As noted above, data on marital fertility were not available from the Ahousaht and Anaham genealogies.

Computer-simulation methodology (Dyke and MacCluer 1973) was also employed to deal with the variability characteristically found in small populations. AMBUSH (Howell 1979; Howell and Lehotay 1977, 1978), a stochastic microsimulation, was repeatedly run to simulate and assess the range of variability expected between Ahousaht and Anaham demographic parameters. The outcome measures of AMBUSH simulations were subject to the cumulative effects of random variation over time and were not based upon the input schedules alone. The results of several AMBUSH simulation runs provided a measure of the variability that can be expected in the features of small populations.

Twenty simulation runs of Ahousaht and Anaham start populations, each running for a period of approximately sixty years, were completed. AMBUSH operated by retaining the individuality of Ahousaht and Anaham persons and by generating future events for each of these individuals through a Monte-Carlo process. The input specifications which characterize each AMBUSH simulation run are as follows. First, Ahousaht and Anaham base populations were directly drawn from the genealogies. Second, the sex ratio at birth, in all simulations, was designated as 105 men per 100 women. Third, fertility schedules were drawn from the cumulative fertility experience of reproductive Ahousaht and Anaham women. Finally, Ahousaht and Anaham sex-specific mortality schedules were directly drawn from the Wakashan and Athapaskan life tables compiled by Alfred (1976). Output measures, crude birth and total fertility rates, were tabulated after fifty years of simulation in order to avoid tabulating features that were directly derived from the peculiarities of the start population. Confidence intervals were calculated at a 95 per cent level of confidence to give a range of values most likely to include the true value of crude birth and total fertility rates.

RESULTS

Genealogical data were collected from a sample of 198 Ahousaht (54 per cent of the *de facto* population) and 195 Anaham (37 per cent of the de facto population). Starting in 1968, these genealogies possess a time depth of three generations (approximately seventy-five years) and record the familial and kinship relations between the year of birth and sometimes death of 302 Ahousaht and 517 Anaham men and women. The following analysis delineates the fertility patterns of a subset of forty-eight Ahousaht and eighty-four Anaham women who were born between the years of 1894 and 1938 and who had a total of 245 and 424 births respectively.

Historical demographic trends

As shown in table 1, population census figures and crude birth rates for these two bands have not always been obtainable at regular intervals in the past. Available Ahousaht and Anaham census figures indicate that the growth rates of both populations have varied considerably. Between 1881 and 1929, the Ahousaht population declined from 300 to 178, with the largest decline being 0.9 per cent per year from 1900 to 1929. Since 1930, the population has increased by over five-fold. The population grew slowly, about an average of 0.5 per cent per year, from 1930 to 1949; while during the 1950-1965 period, the Ahousaht band grew very rapidly, the average annual growth rate being about 3 per cent per year. Finally, between 1966 and 1984 the average annual growth rate dropped to about 1.4 per cent per year.

The Anaham have also experienced varying periods of population decline and growth, the most severe decline being between 1914 and 1924, when the population decreased by 83 and the average annual growth rate dropped by nearly 1 per cent per year. Since 1939, the Anaham population has grown rapidly. During the period from 1939 to 1965, the population increased on average by 1.3 per cent per year; however, this rate declined somewhat to 1 per cent per year from 1965 to 1984.

For both populations crude birth rates, the number of live births per 1,000 population, can only be calculated for two short and select intervals of time. From 1889 to 1914, band-specific rates drop and recover; while between 1969 and 1984, rates in both populations decline dramatically. Inferences about the period in between are impossible due to the lack of available birth registration data.

TABLE I

Ahousaht and Anaham Reserve Populations Estimates and Crude Birth Rates (CBR)[a], 1884 to 1984

	AHOUSAHT		ANAHAM	
YEAR	POPULATION	CBR	POPULATION	CBR
1884	296	—	196	—
1889	282	—	186	74[b]
1894	261	—	198	—
1899	266	65[c]	207	—
1904	262	—	223	45
1909	224	45[d]	224	36[d]
1914	195	62	280	89
1924	—	—	197	—
1929	178	—	228	—
1934	183	—	277	—
1939	187	—	269	—
1944	217	—	324	—
1949	222	—	336	—
1954	392	—	373	—
1959	482	—	443	—
1965	625	—	556	—
1969	709	46	607	38
1974	838	35	675	43
1979	971	34	741	35
1984	1,083	28	810	10

Sources: Government of Canada (1884-1916, 1924-1959, 1965-1984a,b).

[a] Crude birth rate is the number of live births per thousand population.

[b] Based on births for the year 1890.

[c] Based on births for the year 1901.

[d] Based on births for the year 1910.

Direct and indirect estimation

Tables 2 and 3 compare unadjusted and adjusted age-specific and total fertility rates for two Ahousaht and Anaham birth cohorts. Age-specific rates are measure of the number of live births per thousand women in an age group per year; while the total fertility rate is the sum of age-specific fertility rates multiplied by five and divided by

TABLE 2

Unadjusted Cumulative Age-Specific Fertility and Total Fertility[a] (TFR) for Ahousaht and Anaham Women, by Year of Birth of Mother

BIRTH YEAR	WOMEN	AGE-SPECIFIC FERTILITY RATES 15-19	20-24	25-29	30-34	35-39	40-44	45-49	TFR
Ahousaht									
1894-1923	15	0	67	147	173	240	160	13	4.0
1924-1938	22	127	373	464	300	127	18	0	7.0
Anaham									
1894-1923	25	88	192	192	296	296	160	32	6.3
1924-1938	35	86	303	440	291	143	0	0	6.3

[a] Age specific rates are recorded as the number of live births per thousand women in an age group per year. The total fertility rate is the sum of age-specific fertility rates multiplied by five and divided by one thousand.

TABLE 3

Adjusted Cumulative Age-Specific Fertility and Total Fertility[a] (TFR) for Ahousaht and Anaham Women, by Year of Birth of Mother

BIRTH YEAR	WOMEN	AGE-SPECIFIC FERTILITY RATES 15-19	20-24	25-29	30-34	35-39	40-44	45-49	TFR
Ahousaht									
1894-1923	15	3	51	150	225	229	126	13	4.0
1924-1938	22	85	472	459	262	109	23	1	7.1
Anaham									
1894-1923	25	76	197	258	274	257	162	32	6.3
1924-1938	35	30	421	480	242	80	12	1	6.3

[a] Age specific rates are recorded as the number of live births per thousand women in an age group per year. The total fertility rate is the sum of age-specific fertility rates multiplied by five and divided by one thousand. Age-specific rates have been adjusted using Brass relational Gompertz fertility model (United Nations, 1983).

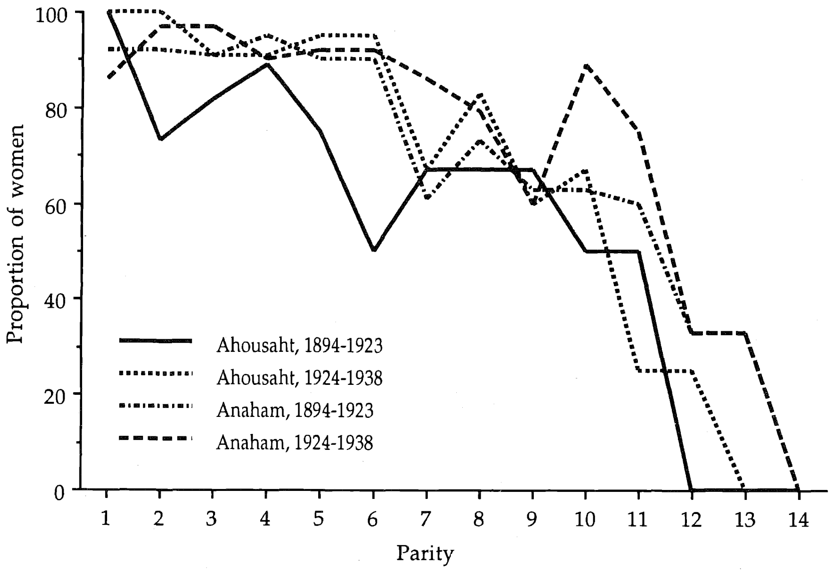

FIGURE 1 Parity progression ratios for Ahousaht and Anaham women, by year of birth of mother

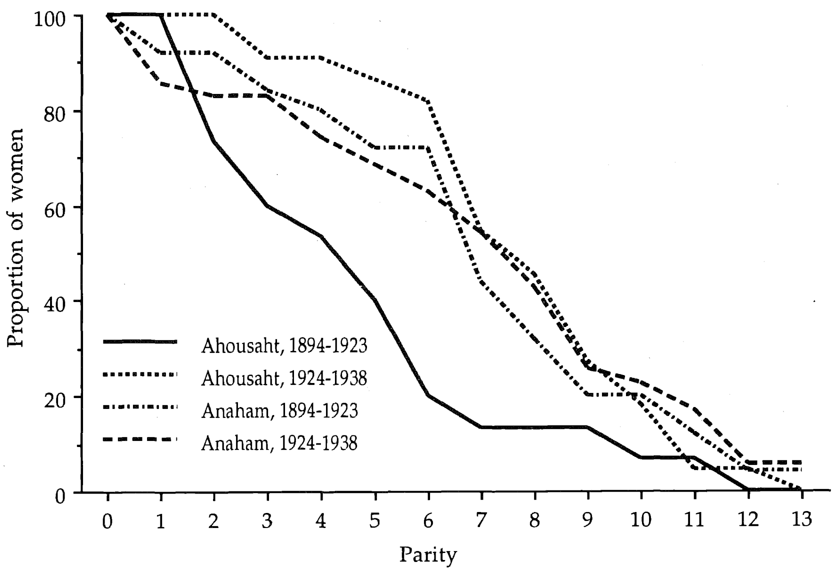

FIGURE 2 Cumulative proportion of Ahousaht and Anaham women progressing to the next parity, by year of birth of mother

one thousand. An inspection of Ahousaht and Anaham age-specific fertility over the two time periods reveals a notable increase in rates between the ages of fifteen and twenty-nine and decrease in rates from the age of thirty-five and over. This decline in fertility rates is especially evident in table 3, where Ahousaht and Anaham age-specific rates have been adjusted for the underreporting of births using the Brass relational Gompertz fertility model.

Parity distributions

Figures 1 and 2 compare the parity distributions of the two cohorts of Ahousaht and Anaham women. As noted in figure 1, the proportion of women who progress from one parity to the next remains high from parities one through six. The only large loss of women is experienced by the Ahousaht 1896-1914 cohort, with these women possessing notably lower ratios than the other three groups. After parity six, only the ratios for the Anaham 1924-1938 cohort remain high for an extended interval. As shown in figure 2, the cumulative proportion of women progressing from one parity to the next is quite low for the Ahousaht 1896-1914 cohort, high for the Ahousaht 1924-1938 cohort, and similar for the two Anaham cohorts. Differences between the Ahousaht cohorts are especially noticeable between parities one and nine.

TABLE 4

Simulated AMBUSH Crude Birth and Total Fertility Rates[a,b] *for Ahousaht and Anaham Women aged 15 to 49, 1968*

	MEAN	CONFIDENCE INTERVALS[c]
Ahousaht		
Crude birth rate	56	(49-63)
Total fertility rate	8.8	(7.7-10.1)
Anaham		
Crude birth rate	48	(38-61)
Total fertility rate	6.9	(5.3-8.8)

[a] Rates were determined from 20 AMBUSH simulation runs of 60 years each.

[b] Crude birth rates are recorded as the number of live births per thousand population. The total fertility rate is the sum of age-specific fertility rates multiplied by five and divided by one thousand.

[c] Confidence intervals around the mean were determined at a 95 per cent level of probability.

Computer simulation

Table 4 compares simulated AMBUSH crude birth and total fertility rates for Ahousaht and Anaham women aged fifteen to forty-nine years in 1968. As the confidence intervals demonstrate, differences in simulated Ahousaht and Anaham crude birth and total fertility rates are not statistically different at a 95 per cent level of confidence.

DISCUSSION

The genealogical method of inquiry (Rivers 1900) allows social scientists to vigorously apply demographic measures to genealogies collected during community field studies. These measures allow the reconstruction of the fertility records of reproductive and post-reproductive women without dealing with incomplete vital event registries. The influence of Rivers' work can be seen in more recent demographic inquiries of people like Howell (1979) and Roth (1981a).

Results from this study demonstrate that genealogical data can offer valuable insights into fertility change and help gauge some of the information gaps left by incomplete band-specific censuses and vital event data. There are several reasons why censuses and vital statistics were less effective than genealogical data in describing fertility change in the Ahousaht and Anaham populations. Most importantly, as shown in table 1, band-specific vital event records are often incomplete and hampered by the growing problem of late registration of births and deaths (Piché and George 1973; Romaniuk and Piché 1972). Furthermore, these sources of data do not generally recognize those of mixed origin or those who were not registered under the Indian Act (Romaniuk and Piché 1972). Demographic comparisons between time periods and age groups are also difficult, because of lack of data and non-standardized age and sex categorizations.

Genealogical data were also better at highlighting the fact that both bands had experienced dramatic and similar shifts in age-specific and total fertility rates over time. In both communities, the fertility regime exhibited by women born between 1894 and 1923 conforms to a pattern of natural fertility; while for those born between 1924 and 1938 the pattern more closely resembles that found in other indigenous populations undergoing fertility change (see Roth 1981b), where there are a substantial number of women having children at earlier ages and making greater use of the total potential reproductive period. The comparison of Ahousaht and Anaham simulated crude birth and total fertility rates also indicates that recent historic fertility rates for the two bands are very similar and that differences in these rates can be accounted for by the process of random fluctuation.

This period of fertility transition, which is characteristically found in Canadian indigenous populations (Romaniuk 1981; Roth 1981b), has been ascribed to a host of factors associated with declining mortality due to improved infant and maternal health status, and increased sedentism (Johansson 1982). Although the reasons behind the decline of mortality in British Columbia reserve populations are poorly understood, especially at the band level, available vital registration data suggest that infant mortality rates for many causes of death began to decline in the early 1940s (Baker-Anderson 1981). During the period 1942-1947, infant cause-specific death rates for measles, whooping cough, influenza, tuberculosis and bronchitis all dropped. Since 1948, the infant mortality rate has declined from 133 per 1,000 live births to 21 per 1,000 live births in 1989. Even though this decline in infant mortality cannot be directly linked to fertility, the initial decline in mortality rates did occur at the same time as the Ahousaht and Anaham bands were undergoing a fertility transition.

Among nomadic populations, fertility has also been shown to increase concomitant with settlement. Roth (1981b, 1985) has demonstrated that among the Kutchin increased sedentism is associated with women beginning child-bearing at an earlier age and using more of the total potential reproductive period with no significant shortening of birth intervals. Although birth spacing data are unavailable in this study, age-specific fertility and parity data suggest that the Ahousaht and Anaham have undergone a similar pattern of fertility change. Among the Anaham, who were nomadic hunters and gatherers, this change was even associated with increased sedentism after 1945.

Fertility rates may have also been influenced by diseases like tuberculosis, a chronic infectious disease which was the leading cause of death in the native population until the 1950s (Graham-Cummings 1967). Genital tuberculosis, one of the many extrapulmonary forms, is known to cause subfecundability, by increasing rates of coital inability, contraceptive failure, and pregnancy loss (McFalls and McFalls 1984). While the link is tenuous, the incidence of tuberculosis in the native population did decline at a time when fertility rates were on the increase.

The main disadvantage with genealogical data is the common finding that older women frequently omit earlier births, particularly if these offspring die (Brass 1975; Howell 1979). This type of underreporting of births is probably especially prevalent for Ahousaht and

Anaham women born between 1894 and 1923 and who gave birth during a period of very high infant mortality. However, in this study the overall effect of this underreporting was reduced by using the Brass relational Gompertz fertility model to adjust Ahousaht and Anaham fertility schedules.

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