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Population Studies and Historical Demography: Context of Microevolution in Micronesia

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Abstract—Demographic models derived for Micronesian islands form the basis for developing hypothetical reconstructions of Micronesian population histories. Population data and estimates from archaeological reports, historical sources and censuses are then compared to these simulated outcomes. The results are used to evaluate extant materials and reconstructions of population histories and current processes responsible for the observed biological variability of Micronesian island populations. The study provides a broad demographic framework essential to better understanding of, and more productive research into, the adaptive processes which led to the ecological successes of proto-Micronesian settlers and their descendants.

Introduction

In the near-absence of extensive and well-preserved skeletal series or inscribed tombstones, or of lengthy series of parish registers, reliable and internally consistent census materials or other nominative materials with considerable time depth, most population histories for Micronesian islands have relied on other unwritten sources, including genealogical materials, checked where possible against historical accounts and written materials of limited extent and varied quality (e.g., Carroll 1975, Marshall 1972, Ritter 1978). Rare indeed are historical demographic reports based on evaluated census reports and vital records, even for single villages (but see del Valle 1979, Rossman 1978), and I am unaware of any overview of the population history of the region comparable to McArthur's (1968) summaries for selected Polynesian and Melanesian island groups or of the demographic history of any major Micronesian island group comparable to Schmitt's classic treatise for Hawaii.

Several of the relatively few students of human biology and genetics who have carried out studies in Micronesia have developed population registers, primarily from genealogical materials, reproductive histories, even on-site census collections (e.g., Morton *et al.* 1973, Morton 1980, Hunt *et al.* 1954, Hunt 1950, Levin 1976, Murrill 1950, Underwood 1966, 1973a, b). With the notable exception of Morton's use of population registers based on genealogical materials for Mokil and Pingelap, I do not know of any research comparable to Cavalli-Sforza's (1958) work in Italy or Jacquard's (1978) use of linked family records for the Genevan bourgeoisie based on a linked nominative family register with historical time depth for an entire Micronesian island population. Consequently, relatively little is known or has been reliably reconstructed from existing sources relating to the demographic dynamics underlying present variation and genetic structure in or among Micronesian populations.

For the past ten years, I have been developing a linked family register from nomi-

native data and ethnographic sources for the population of Guam, and the results of some preliminary analyses of these materials are now available. At this stage, the results can only suggest the contributions which a study in the historical demography of Guam can make to our understanding of microevolutionary processes and outcomes in one Micronesian population. Some of the results may be directly applicable to population research among other Micronesian populations but, more important, they may stimulate others to carry out such studies in the near future. For, as Alkire (1965) has drawn our attention to the interdependency of Micronesian island peoples, future efforts in genetical demography will be incomplete until a truly comprehensive study of Micronesian population histories is carried out.

Materials

I obtained in 1969 a photocopy of the household census of Guam dated December 31, 1897; later I was able to compare this copy with the source document now held in the Library of Congress. This census has now appeared in edited form (Mallada 1984), and the introductory portion of the latter publication lists some of the problems which had to be addressed in compiling the individual census cards which I then prepared for each

Table 1. Age-sex distribution of native population, Guam, 1897 (Spanish Census).

Age Group (in years)[1]	Males		Females		Total	
	Number	Percent	Number	Percent	Number	Percent[2]
0	134	1.5	116	1.3	250	2.9
0–4	645	7.4	640	7.4	1,285	14.8
5–9	586	6.7	525	6.0	1,111	12.8
10–14	439	5.0	458	5.3	897	10.3
15–19	405	4.7	461	5.3	866	10.0
20–24	426	4.9	512	5.9	938	10.8
25–29	382	4.4	455	5.2	837	9.6
30–34	307	3.5	355	4.1	662	7.6
35–39	214	2.5	212	2.4	426	4.9
40–44	134	1.5	159	1.8	293	3.4
45–49	126	1.4	183	2.1	309	3.6
50–54	119	1.4	198	2.3	317	3.6
55–59	105	1.2	155	1.8	260	3.0
60–64	117	1.3	124	1.4	241	2.8
65–69	69	0.8	66	0.8	135	1.6
70–74	38	0.4	35	0.4	73	0.8
75+	21	0.2	18	0.2	39	0.4
Unknown	4	—	5	—	9	—
Totals	4,137	47.4	4,561	52.4	8,698	100.0

[1] Ages are those reported by compilers of the Spanish Census for December 1897.

[2] Due to rounding to nearest tenth, column percent totals for males plus females do not equal 100 percent.

Table 2. Reconstructed age-sex distribution of native population, Guam, 1897 (from vital records and Spanish Census).

	Males		Females		Total	
Age Group	Number	Percent	Number	Percent	Number	Percent
0	145	1.6	133	1.4	278	3.0
0–4	703	7.5	715	7.6	1,418	15.2
5–9	622	6.7	572	6.1	1,194	12.8
10–14	468	5.0	498	5.3	966	10.3
15–19	422	4.5	498	5.3	920	9.8
20–24	461	4.9	546	5.8	1,007	10.8
25–29	408	4.4	488	5.2	896	9.6
30–34	321	3.4	376	4.0	697	7.5
35–39	216	2.3	247	2.6	463	5.0
40–44	142	1.5	172	1.8	314	3.4
45–49	137	1.5	205	2.2	342	3.7
50–54	135	1.4	202	2.2	337	3.6
55–59	119	1.3	164	1.8	283	3.0
60–64	116	1.2	133	1.4	249	2.7
65–69	79	0.8	71	0.8	150	1.6
70–74	43	0.5	38	0.4	81	0.9
75+	17	0.2	19	0.2	36	0.4
Totals	4,409	47.1	4,944	52.7	9,353	100.0

Guamanian listed in the original census. Data from these cards were entered into suitable format for computerized sorting, resulting in a summary of the age-sex distribution of the population included in the census return for 1897 and now corrected for identified copying errors (Table 1).

Soon after the U.S. Navy assumed administrative control of Guam, a mandatory system of vital event registration was instituted. The resulting records, at first written in Spanish, commence with entries for October 1901, and I was permitted to copy all records for the period 1901–41 at the Government of Guam Vital Records Office during several research trips to the island between 1969 and 1985. I also obtained from the Micronesian Area Research Center photocopies of summaries of vital record reports appearing in the *Guam Newsletter* (1914–1922) and the *Guam Recorder* (1924–1941). Following the methods described by Wrightson & Levine (1979), a linked family register was compiled by hand, connecting vital records and ethnographic information for the 1901–1941 period to the 1897 census data.

I will not present here the many difficulties encountered in connecting these materials, some surely common to any endeavor of this kind, but others specific to the nature of the particular data and population. However, it is important to note that the Spanish 1897 census was clearly incomplete and supplementary census cards had to be created from the evidence contained in vital records materials of individuals born before 1898 and appearing in later vital records (Table 2). These basic data have been supplemented by delayed

registrations added to vital records in ensuing years and by interpolations of unrecorded births derived from actual death and marriage records. The final register necessarily omits all individuals who were born and also died between 1898 and October 1901. Aside from this latter exception, I believe that the register covers 90 percent or more of an identified population subject to very low rates of migration. The information in the completed register has been entered into a computerized relational data base system for facility in handling.

Results

STRUCTURAL CHARACTERISTICS

A comparison of the age-sex structure of the native population of Guam in 1897 as reported in the Spanish census of that date and as reconstructed is revealing about the extent (overall 7.5 percent) and probable causes of under-reporting in the former (Table 3). According to Mallada (1984), the census for each administrative unit (*cabeceria, barrio, vista*) was often prepared by a scribe working for a district head (*cabeza*) and was signed by the latter before submitting the report for additional signature by the parish priest or commissioner (*gobernadorcillo*). Considerable variation in style, use of dual sur-

Table 3. Summary comparisons: age-sex distribution of the native population, Guam, 1897—from Spanish Census (a) and from Reconstructed Census (b).

	Males			Females			Totals[1]		
Age Group	Percent (a)	Percent (b)	Change	Percent (a)	Percent (b)	Change	Percent (a)	Percent (b)	Change
0	1.5	1.6	+0.1	1.3	1.4	+0.1	2.9	3.0	+1.0
0–4	7.4	7.5	+0.1	7.4	7.6	+0.2	14.8	15.2	+0.4
5–9	6.7	6.7	—	6.0	6.1	+0.1	12.8	12.8	—
10–14	5.0	5.0	—	5.3	5.3	—	10.3	10.3	—
15–19	4.7	4.5	−0.2	5.3	5.3	—	10.0	9.8	−0.2
20–24	4.9	4.9	—	5.9	5.8	−0.1	10.8	10.8	—
25–29	4.4	4.4	—	5.2	5.2	—	9.6	9.6	—
30–34	3.5	3.4	+0.1	4.1	4.0	−0.1	7.6	7.5	−0.1
35–39	2.5	2.3	+0.2	2.4	2.6	+0.2	4.9	5.0	+0.1
40–44	1.5	1.5	—	1.8	1.8	—	3.4	3.4	—
45–49	1.4	2.5	+0.1	2.1	2.2	+0.1	3.6	3.7	+0.1
50–54	1.4	1.4	—	2.3	2.2	−0.1	3.6	3.6	—
55–59	1.2	1.3	+0.1	1.8	1.8	—	3.8	3.8	—
60–64	1.3	1.2	−0.1	1.4	1.4	—	2.8	2.7	−0.1
65–69	0.8	0.8	—	0.8	0.8	—	1.6	1.6	−0.1
70–74	0.4	0.5	+0.1	0.4	0.4	—	0.8	0.9	+0.1
75+	0.2	0.2	—	0.2	0.2	—	0.4	0.4	—
Total	47.4	47.1	−0.3	52.4	52.7	+0.3	100.	100.	—

[1]Due to rounding to nearest tenth, column percent totals for males plus females may not equal 100 percent.

names and other features among district reports, suggests a lack of central coordination in the collection of information, and I would suspect that no strenuous effort was made to identify households in more remote or inaccessible locations or whose members interacted infrequently with church or civil authorities. Since the relative proportions of each age-sex cohort in the reconstructed census are essentially unchanged from those in the Spanish document, there appears to be no other detectible systematic bias in underreporting, again suggesting that omissions represented members of entire households. Accordingly, further discussion of age-sex structure will be based on data contained in the reconstructed census unless specifically noted otherwise.

Perhaps the most striking feature revealed in Table 2 about the structure of the native population of Guam in 1897 is its relative juvenility, with median age of 20 years, and over 38 percent of the total population then less than 15 years of age. Females outnumber males in every age group except among the very young and in the older segment of the population. The overall sex ration, 89.2, is scarcely changed from that (89.6) derived from the Spanish census of eleven years earlier which listed 4,081 Chamorro males and 4,550 Chamorro females, as reported by Governor Olive García (Driver 1984: 90). Finally, an apparent structural anomaly, the relatively large size of the group 20–24 years in comparison to younger cohorts, is not likely due to minor adjacent age-heaping around the age of majority, 21 years, or even toward a round figure of 20 years at the census date of 1897, since the total number reported for those in this age group exceeds the numbers reported for each of two succeeding younger cohorts.

These characteristics are partially explicable in the light of certain internal structural features and relevant historical evidence. We know, for example, that total population size had doubled in the forty years since the devastating smallpox epidemic of 1856, an average annual growth rate of 2.5 percent. Even so crude an index as the child-woman ratio, 609, affirms this continuing growth trend. I suspect that mortality effects of that epidemic on the potential parental pool for births some twenty to forty years later, i.e., those to be born between 1876 and 1896, inhibited the population from attaining an even higher growth rate and larger numbers. It may also provide a plausible explanation of the larger size of the age group 20–24 years in 1897, or, put differently, of the relatively diminished numbers of cohorts in younger age groups. The masculinity of the sex ratio, 109, for those listed as born in 1897 is close to that (108.4) reported at birth from modern Papua New Guinea (cited in Skeldon 1979: 5), or, more generally, world value of around 106, and strongly suggests differential mortality and greater likelihood of migration among males, although historical materials provide scant evidence of significant rates of emigration (see below).

It is possible in this manner to draw some inferences about demographic processes operating in the past to produce population characteristics recorded in a census of a given date, even to estimate for some populations the general range of their operations and effects from comparisons to model life tables. However, such methods at best produce approximations and can never provide a wholly satisfactory substitute for more direct sources of demographic information. Fortunately, analyses of the Guam family register, based as it is on vital events experienced by those recorded in the 1897 census and their descendants, provide more direct and far more detailed evidence of the demographic his-

tory of that population between 1897 and 1941. Further, by assuming that underlying behavioral patterns changed only gradually, if at all, from those prevailing in preceding decades, the results can offer a plausible framework on which to reconstruct demographic patterns prevailing in the pre-1897 period.

DEMOGRAPHIC PATTERNS: MIGRATION

It is axiomatic that growth in a closed population results from an excess in the numbers of births over the numbers of deaths ("natural increase"). Judging from the available evidence, any contribution to overall growth from migration was negligible. Throughout the entire period a sizeable non-native community, exclusive of U.S. Navy personnel, resided on the island but their numbers and vital events have been excluded from the family register, except that all births involving at least one native parent are included. Little information is recorded regarding emigration of native residents, although official sources record the deportation of 22 lepers to the Philippine Islands in 1913, where, by 1932, 7 insane patients had also been sent, and by 1920, 20 native men are listed as having been accepted into military service. In the latter years of the period, a small number of native women married foreigners and left the island but throughout this period more frequent opportunities were available to males for off-island employment, usually of a temporary nature. From such spotty evidence, it appears that migration played a negligible role in total population growth but may have contributed in a very minor way to the observed preponderance of adult females.

DEMOGRAPHIC PATTERNS: FOUNDATIONS OF NATURAL INCREASE

Some general view of the levels of fertility and mortality which sustained population growth during this period can be obtained merely from examining summary data, mostly published in various governmental sources (Table 4). However, crude vital rates based on these figures undervalue actual fertility levels of later periods when total population number included increasingly larger proportions of cohorts then less than 15 years of age (38 percent in 1902, 43 percent in 1930, and 45 percent in 1940). Although the necessary conditions for reliable use of life table methods are not present, life-expectancy values were calculated for comparative purposes only (Table 5). Insofar as any reliability can be placed on these results, it appears that improvement in mortality conditions over this period primarily affected younger cohorts of both sexes (future parental cohorts) and females of all ages.

What such overviews fail to reveal is the necessary detailed information about underlying demographic mechanisms through which microevolutionary processes operate and from which population growth resulted. How much variance was there in completed reproductive performance of fertile women? To what extent did differential male mortality suppress the expression of female fertility? What changes occurred in the relative values of the fertility and mortality components which provide the context for the operation of selective pressures? In the remainder of this section, I will try to summarize briefly some results of selected analyses of individual and family register data which suggest the nature and operations of these mechanisms.

Table 4. Number and crude vital rates for selected years. Guam, 1901–1941 (data from government sources)[1].

	1902[2]	1910	1920	1930	1940
Total Native Population	9,630	11,624	12,216	16,402	20,164
Number of births	428	538	661	802	839
Crude birth rate	44.4	47.9	54.1	48.9	41.6
Number of deaths	237	309	216	383	301
Crude death rate	24.6	26.6	17.7	23.4	14.9
Increment (births-deaths)	191	229	445	419	538
Percent Increment to total population	2.0	2.0	3.6	2.5	2.7

$$\text{Crude vital rate} = 1000\left(\frac{\text{Number of vital events}}{\text{Total population number}}\right)$$

$$\text{e.g.: } 1000\left(\frac{\text{428 births}}{\text{9,630 population}}\right) = 44.4$$

[1]In the absence of appropriate data, rates are calculated on reported population totals rather than on calculated mid-year total population figures.

[2]Reconstructed values for population at the beginning of 1902 by extrapolation from 1897 Spanish census to total population reported at December 31, 1901.

Table 5. Summary of life-expectancy values for three time periods, Guam[1].

Age Group	[c]values					
	Males			Females		
	1902	1930	1940	1902	1930	1940
0–4	34.41	39.01	47.56	34.94	39.40	50.96
5–9	50.94	54.38	53.39	48.52	52.48	56.24
10–14	47.45	51.24	49.19	45.76	49.53	51.44
15–19	43.39	46.73	44.37	42.20	44.77	46.44
20–24	39.31	41.99	39.58	38.96	40.56	42.06
25–29	35.90	38.13	35.42	35.04	36.93	38.16
30–34	32.52	34.34	30.87	31.14	33.34	34.13
35–39	28.41	29.34	27.27	26.95	28.34	31.45
40–44	26.92		23.97	23.14		28.42
45–49	24.52	24.42	21.01	20.91	21.85	25.00
50–54	23.81		18.15	19.83		21.19
55–59	18.84	10.81	15.33	14.83	15.70	17.19
60–64	13.84		11.68	12.47		13.98
65–69	8.84	11.32	9.08	9.71	9.50	10.88
70–74	4.27		5.88	5.28		6.41
75+	2.50	2.50	2.50	2.50	2.50	2.50

[1]Note: Life table values calculated by the Reed-Merrill method, after Barclay (1958).

Table 6. Summary information from Family Register for native Guamanians alive in 1897.

Birth Years	Male	Female	Total	Number dead by Sept. 1941	Number ever fertile	Number of offspring	Percent recorded dying before October 1941	Percent fertile	Mean Number of offspring
1893–97	703	715	1418	387	663	4522	27.3	46.8	6.8
1888–92	622	572	1194	372	715	5288	31.2	59.9	7.4
1883–87	468	498	966	334	592	4237	34.6	61.3	7.2
1878–82	422	498	920	341	520	3592	37.1	56.5	6.5
1873–77	461	546	1007	446	653	3797	44.3	64.8	5.8
1868–72	408	488	896	491	655	3642	54.8	73.1	5.6
1863–67	321	376	697	393	503	2671	56.4	72.2	5.3
1858–62	216	247	463	271	323	1622	58.5	69.8	5.0
1853–57	142	172	314	176	219	1070	62.4	69.7	4.9
1848–52	137	205	342	203	230	987	59.4	67.3	4.3
1843–47	135	232	337	199	215	854	59.1	63.8	4.0
1838–42	119	164	283	176	194	758	62.2	68.6	3.9
1833–37	116	133	249	157	157	491	63.1	63.1	3.1
1828–32	79	71	150	102	82	221	68.0	54.7	2.7
1823–27	43	38	81	39	33	92	48.1	40.7	2.8
1818–22	10	10	20	7	3	3	35.0	15.0	1.0
1813–17	7	8	15	8	3	6	53.3	20.0	2.0
1808–12	—	1	1	—	—	—	—	—	—
Totals	4,409	4,044	9,353	4,122	5,760	33,653	44.1	61.6	5.8

DEMOGRAPHIC HISTORY

Selected features of individual demographic histories through September 1941 for all individuals alive in 1897 are presented in summary form in Table 6. These data include those births and deaths occurring between 1898 and October 1901 which could be ascertained by extrapolation from records of later dates. An even more revealing view of fertility patterns is provided by examining female cohort fertility and mortality (Table 7). Finally, individual records listed in the Spanish census for 116 females born in 1897 were analyzed and the results checked against similar analyses of individual records for 89 females listed as born in 1887 and of 109 females reported born in 1892 (Table 8).

Death records for the period 1902–1904 reveal that an average of 26 deaths per year involved females between the age of 1 and 4 years, and this value was used to estimate conservatively the probable number of females born in 1897 who could be expected to have survived until 1902, i.e., 90. An additional nine females born in 1897 were recorded as dying between 1905 and 1924 without ever having given birth, while 56 of the remaining 81 females (60 percent) produced at least one child each. Among these 56 women, 16 died before age 41 while another 6 of 40 fertile marital unions were dissolved by the death of husband before the wife reached age 41. A similar pattern was identified from the individual records for both other birth cohorts.

That population growth took place at all in view of these high mortality and infertility

Table 7. Summary information from Family Register for native Guamanian females alive in 1897.

Birth years	Number of females	Number dead by Sep 1941	Number ever fertile	Number of offspring	Mean N to fertile females
1897	133	35	64	430	6.7
1893–97	715	189	344	2348	6.8
1888–92	572	181	357	2411	6.8
1883–87	498	169	319	2263	7.1
1878–82	546	186	304	1873	6.2
1873–77	546	218	366	1984	5.4
1868–72	488	246	351	1767	5.0
1863–67	376	212	271	1234	4.6
1858–62	247	141	157	713	4.5
1853–47	172	95	121	505	4.2
1848–52	205	115	139	587	4.2
1843–47	202	120	137	492	3.6
1838–42	164	101	108	386	3.6
1833–37	133	85	71	178	2.5
1828–32	71	52	36	84	2.3
1823–27	38	16	10	14	1.4
1818–22	10	1	1	1	1.0
1813–17	8	4	3	2	1.5
1808–12	1	—	1	1	1.0
Totals	4,944	2,131	3,096	16,843	5.4

Table 8. Summary of reproductive histories for three female Guamanian birth cohorts (1887, 1892, 1897) listed in Spanish Census dated 31 December 1897.

Category	BIRTH COHORTS		
	1887	1892	1897
Total number of females	89	109	116
Number fertile females	64	63	56
Number of fertile women surviving to age 41+ years	46	45	40
Number of fertile women dying before age 41 years	13	11	10
Number of fertile marital unions ended by death of husband before wife attained age 41 years	7	7	6
Number of offspring of fertile surviving women	374	383	317
Mean number of offspring of fertile surviving women	8.1	8.5	7.8
Mean age of all mothers (all births)	31.1	30.2	30.2
Age range of mothers at birth	15–49	15–47	16–44
Number of mothers in surviving unions	39	39	34
Mean number of offspring of mothers in surviving unions	8.5	9.3	8.4
Mean number of children of mothers age 31+ years and in surviving unions	4.9	4.9	4.5

levels is a tribute to the impressive levels of (nearly completed) reproductive performance of surviving women of the 1897 birth cohort, particularly those in continuing marital unions. Among the latter 34 women, over half of all births involved deliveries to mothers then aged 30 to 40 years, with a mean birth interval for all births of 28 months (range 16–52 months). Mean age of these mothers at first birth was 22.5 years (range 16–30 years). Only four of these women produced less than five offspring, another fifteen produced between five and nine children each, while fifteen others each bore ten or more children, among whom were two women who each gave birth to one set of twins. Not unexpectably, 42 of the 286 children born to these 34 women, or nearly 15 percent, died before the first birthday, and a total of 92 children (32 percent) died before attaining the age of 15 years or, if younger, before the end of 1941.

The effects of excessive mortality among males of all but the most advanced age groups on total fertility was not confined to premature disruption of marital unions (15 percent). Analyses of death records for the period 1902–1914 reveal a sex ratio at death for infants ages 0–7 days of 114.1, but, for those aged 8–28 days, this value reached an astonishing 198.7. Consequently, a relative shortage of males of marriageable age ensured in this Catholic society that a sizeable portion of females would never have opportunity to marry. Some compensation, and greater opportunities for expression of fecundity of unmarried females, were possible through extramarital relationships, with observers of this period (Cox, 1904) reporting relatively high levels (11 percent) of illegitimate births, and analysis of actual birth records for 1902–1914 found 14 percent of all births listing no identified father.

For the 1897 birth cohort, the completed sibship size (mean = 2.4, range 1 to 6) of

six never-married mothers was well below that for married women in surviving unions (8.4). Given the greater life expectancy of adult women, opportunities to marry widowers were rare, and, given prevailing religious practices and beliefs, no divorced males were ever available. As a result, a significant proportion of 28 never-fertile women may never have been at risk as a result of demographic and social conditions.

Summary and Conclusions

Some preliminary analyses of selected data from the linked family register for Guam for the period of 1897–1941 have already provided some significant insights into the genetic structure and composition of this Micronesian island population. A reconstructed census for 1897 identified a native population of 9,353 individuals, of whom over 38 percent were then less than 15 years of age, and with females outnumbering males in every age group except among the very young and among very elderly cohorts. Although 395 different surnames are recorded in the register, eleven of these account for 40 percent of all listed individuals and a total of twenty-nine surnames represent 66 percent of the total. The results of an analysis of the reproductive performance (or, more importantly, lack thereof) for 116 females listed in the Spanish census of 1897 also confirm the small size of the effective breeding population, with 52 percent of these 116 females producing no offspring, while a mere 29 percent of their number produced almost 80 percent of the total number of children born. Effective population size was even further reduced by preferential village/town endogamy, between and among which gene flow was severely limited.

Excessive male mortality, the primary cause of the observed sex ratio imbalance among adults, undoubtedly contributed to a major degree to female infertility and the variance in fertility (see Table 9) in this overwhelmingly Catholic population and was only

Table 9. Summary fertility measures for Guamanian females of two birth cohorts, and values for components of Crow's Index.

	All Offspring			Offspring Surviving to Age 15				
	Mean Number	Variance	I_f	Mean Number	Variance	I_f	I_m	I_i
Guamanian women born in 1897 and surviving to age 15 years+ (N = 84)	4.3	17.9	0.97	2.8	8.6	1.10	0.75	2.68
Guamanian women born in 1887 and surviving to age 15 years+ (N = 81)	5.3	21.5	0.77	4.0	13.4	0.84	0.33	1.45
Guamanian women born in 1897 and in surviving unions at age 41+ (N = 34)	8.4	9.6	0.14	5.4	5.6	0.19	0.56	0.80
Guamanian women born in 1887 and in surviving unions at age 41 (N = 39)	8.5	15.8	0.22	6.4	10.3	0.25	0.33	0.66

partially compensated by extramarital unions producing somewhat in excess of 10 percent of all births during the entire period. Remarriage of widowers was far more infrequent, although 8 percent of all such recorded unions through the entire period involved second marriages to deceased wife's sister. Unfortunately, these indirect effects of mortality which contribute so importantly to variance in fertility (I_f) are not adequately integrated into standard calculations of such measures of evolutionary opportunity as Crow's Index of the opportunity for selection, which distinguishes the contributions of fertility (I_f) from those of mortality (I_m).

Female mortality, operating mainly in the prereproductive years, removed at least 25 percent of all pre-adult females. Among 56 fertile women born in 1897 who survived to produce at least one child, 29 percent died before reaching the age of 41 years, while 15 percent of 40 fertile marital unions were prematurely dissolved by the husband's death prior to the wife's attaining her 41st birthday. These mortality effects are particularly significant in view of the prevailing maternal age pattern, with half of all births among 34 surviving married women in continuing unions occurring to mothers then in their fourth decade of life.

The results of these preliminary studies are being verified through similar analyses of register data for each represented birth cohort and, in future, for the extended series for which parish register information exists. The relative contributions, as directly ascertained from complete historical information, of founder and kinship effects and of direct inbreeding effects on this group of semi-isolated breeding groups which together comprised the native population of Guam is only briefly glimpsed from the limited time series now available. What is already clear (Underwood unpub., in prep.) is that the relatively numerous populations of larger Micronesian islands were not inherently dissimilar in structure and composition from their neighbors on smaller islands and atolls. Rather, intra-island geographic barriers and more complex systems of socio-structural organization found on larger islands were capable of producing semipermeable breeding isolates of similar size, structure and constitution to those described for Pingelap and Mokil (Morton, *et al.* 1973) Nukuoro (Carroll 1975), Eauripik (Levin 1976) or any number of other Micronesian atolls and smaller islands.

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