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Population Dynamics Among Asmat Hunter-Gatherers of New Guinea: Data, Methods, Comparisons

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Asmat hunter-gatherers of Irian Jaya have been experiencing rapid culture change since 1953, yet demographically still can be classified as "living primitives." Methods of nonstandard data analysis are utilized in an attempt to provide specific information on age-sex structure, fertility, birth rates, death rates, population growth, internal migration, and life expectancy in the contact era, and to aid in the development of a two-part model of population growth encompassing the immediate precontact and contact eras. Special attention is paid to the continuing albeit reduced impact of infanticide. Brief comparisons with other Melanesian and Third World societies are presented; the Asmat average annual growth rate of 1.5% since first permanent contact in 1953 contrasts with the generally higher rates reported for most of these other groups.

KEY WORDS: New Guinea; Asmat; hunter-gatherers; population dynamics; infanticide.

INTRODUCTION

The Asmat are a scattered, relatively sedentary group of over 40,000 hunting, fishing, and sago-gathering Papuan tribesmen who inhabit a portion of the southwestern lowland swamp and rain forest of Irian Jaya (Indonesian New Guinea). The population data upon which this paper is based were gathered in 1973 and 1974 as part of a broader field study aimed at assessing the impact of externally induced culture change. The intent herein is to provide a descriptive overview and methodological assessment of the population dynamics of a culturally transitional society not yet far removed from the Stone Age technologically, but undergoing rapid change due to the impacts of missionization, enclave

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development of oil, timber, and marine resources, wage labor, and Indonesian state policies. Athough such socioeconomic and political correlates of change are discussed briefly, my primary intent is to present population data (including information on infanticide), to the extent that cross-cultural comparisons of a specific demographic nature can be made. Several summary comparisons are presented, and a two-part model is developed in an attempt to account for population growth in the immediate precontact and contact eras.

More specific information on the population dynamics of tribal populations is needed, as Neel and Weiss (1975: 25,49) have emphasized in their pioneering studies of Yanomama biodemographics: "Our knowledge of the demographic structure of such groups is woefully inadequate .... [We] appeal to anthropologists working with populations such as the Yanomama to produce comparable bodies of data." The present study, if only in part, fulfills this request.

BACKGROUND: RECENT CHANGES

A unique characteristic of the Asmat situation as compared with most other developing peoples worldwide is that the Asmat have been in continuous contact with outside change agents only since 1953, when the first permanent Dutch government post, Catholic mission, and trade operations were established in a settlement called Agats. Prior to that time, contact had been intermittent and often hostile. Headhunting and warfare did not end until the late 1950s in many coastal villages; they may still occur among some isolated Asmat bands in the interior. In view of the brief time span involved, a great deal has happened in terms of externally induced change.

Generally, the kind of change processes that the Asmat are undergoing can be viewed within the framework of a political economy. Stated simply, this means that economic organization in Asmat has come under the control of state-administered political institutions. Although traditional systems of production and exchange have not been eliminated, they have been altered as the people have been increasingly incorporated into the Indonesian political-economic system. Compulsion has been introduced so that Asmat – its people and resources – can contribute to the development of Irian Jaya and, ultimately, Indonesia. These changes have three important correlates, each of which is merely touched upon herein: (1) traditionally a part of the Melanesian culture area, Asmat should now be analyzed from a Southeast Asian sociopolitical perspective as well; (2) the Asmat, and other New Guineans also, are increasingly being brought into the Third World; (3) population processes associated with the changes in Asmat life should be viewed from the perspective of Indonesia as a whole.

SOCIAL AND ENVIRONMENTAL CHARACTERISTICS

Traditionally (i.e., prior to 1953), the Asmat consisted of a large number of semiautonomous, semisedentary bands ranging in size from perhaps 25 to 100 or more individuals. Reconstructions based upon local oral history indicate that at least eight major Asmat subdividions existed, being loosely based upon common ancestry, dialect, and geographic proximity. Although there is no archaeological indication as to how long this area of more than 25,000 square kilometers has been inhabited by humans (alluvial mud makes on-site analysis virtually impossible), it is probable that Papuans reliant upon sago-gathering have occupied the southwest New Guinea region for well over a thousand years.[2] Even though swamp, mud, and rain forest provide barriers to overland travel, a complex pattern of ritualistic revenge warfare evolved using the intricate maze of interconnected rivers and waterways. Headhunting and cannibalism coevolved with warfare as ritual responses to perceived spiritual imbalances and as rites of ancestor propitiation. Despite legends and reports to the contrary, it is unlikely that cannibalism ever served a primary dietary purpose (Van Arsdale, 1975: 49-52; cf. Dornstreich and Morren, 1974). Depending upon the status of shifting alliances within a major geographic subdivision, cannibalistic revenge occasionally was directed at a village's immediate upstream or downstream neighbors.

Asmat social structure was first researched in detail by Father Gerard Zegwaard, a Catholic missionary who was the first outsider to take up permanent residence in the region. His study (Zegwaard and Boelaars, 1972), in conjunction with that of Pouwer (1970) and the later work of Eyde (1967), made it clear that land utilization was a partial determinant of the dualistic, spatially oriented social system. There is a lack of extensive lineal recognition of descent-based, segmentary principles. Rather, dual segmentation reflects both group settlement patterns and men's longhouse (*yew*) divisions.

Each semipermanent settlement comprises one or more *yew* houses surrounded by the huts of their family members. Traditionally, these were always located on large river bends or smaller tributaries. Each *yew,* being the largest stable unit of social organization, is equated conceptually with a men's house group (*yew mopan*) and by extension with its men's wives and children. Thus, in common usage the term *yew* refers to both the longhouse and its associated kin group; in some cases the village name derives from the name of the most prominent *yew*. Every *yew* is divided into named halves or moieties, termed *aypim,* one of which is considered to be the original and the other its dualistic offshoot. When intravillage disputes of a serious nature occur, splits occur along *yew*

[2] Dates are very uncertain, but evidence indicates that humans arrived on the continent of Sahulland (New Guinea-Australia-Tasmania) during the Late Pleistocene, perhaps 30,000 B. P., after migrating from Southeast Asia (Howells, 1973: 125ff.).

lines, to the extent that one or more *yew* may leave to establish a settlement elsewhere. As is noted in a subsequent section, internal migration of this sort, which seems to have served as a primary mechanism for the dispersion and distribution of many Asmat groups, makes the statistical interpretation of population dynamics somewhat more difficult.

Today, as part of the Indonesian state system, Asmat living in the coastal region have modified certain of their settlement patterns. No longer do Big Men have the prerogative of moving the village if need arises, intravillage disputes less frequently result in *yew* dispersal, and government-appointed headmen, who still reside in their home villages, have taken over certain important decision-making processes. In many instances this has resulted in the disruption of traditional men's house group clustering patterns, even to the point of eliminating longhouses entirely. Yet dualism and reciprocity persist in the patterning of social interactions, and the adaptive flexibility which evolved as a correlate of spatial (as opposed to lineal-based descent) reckoning seems to be standing the Asmat well as externally induced change continues (q.v., Van Arsdale, 1975: 255-260, 311). In the assessment of population dynamics which follows, two at times countervailing themes must be borne in mind: First, today's Asmat population and (to some extent) culture have succeeded in maintaining a large degree of continuity with the past. Thus certain processes and causal factors "operating upon" the population of the past must be presumed to be operating upon the population of the present and immediate future. Second, this is nevertheless occurring within a broad context of externally imposed, and increasingly village-sedentary, conditions. What were once groups of semisedentary bandsmen, only loosely aligned, are now a single *tribal* group more clearly defined by virtue of outside causal factors (cf. Fried, 1975). The relative statistical importance of these two themes upon population dynamics cannot as yet be accurately ascertained.

RESEARCH METHODS

Just as externally induced changes and development programs in most cases have not been as intensive in Irian Jaya as in Papua New Guinea, the comprehensive application of accurate census techniques and demographic methods lags behind in the western portion of the island as compared with the eastern. In part, this difference is attributable to the less comprehensive census program currently in operation in some of Indonesia's Outer Islands and remote eastern provinces. Van de Kaa, considered by some the leading expert in New Guinea demographic analysis (q.v., Caldwell, 1971), conducted the last detailed survey of Irian Jaya, in conjunction with Groenewegen. Their six-volume product, *Results of the Demographic Research Project, Western New Guinea* (in Dutch, 1964-1967), has yet to be fully updated. The greater progress made in asses-

sing Papua New Guinea's population dynamics is best exemplified in the papers presented at a demography seminar in Port Moresby in 1970, subsequently published in the *New Guinea Research Bulletin* under the joint title "Population Growth and Socio-Economic Change" (1971). Here too, van de Kaa assumes a prominent position with his complex analysis of past trends and projections of future growth. For example, he foresees a remarkable increase in Papua New Guinean life expectancy at birth by 1991 – up to 60 years from the figure of approximately 43 years for 1966 (1971: 19).

Demographic and other aspects of the present Asmat study were conducted within the framework of an intraregional controlled comparison. In order to assess the total impact of externally induced change, and to better predict future change processes, research villages were selected from among those on the coast that previous mission data indicated were uniformly the most changed. These methodological considerations dictated that these villages and their environs be as culturally and ecologically homogeneous as possible, near the postulated local source of externally induced change (the town of Agats), and possessing a common ancestry and dialect. The Bismam group of Asmat villages, one of the eight major subdivisions, was found to fit these criteria. All are located within a 17 kilometer (km) radius of Agats, the village names being Beriten, Per, Ewer, Syuru, Owus, and Yepem. Eyde (1967) and Lang (1973) had demonstrated the common ecological zone exploited by these people. This combination of factors enabled me to select Ewer, Syuru, Owus, Yepem, and Agats as the places where virtually all of the research material would be collected (see Fig. 1).[3]

By controlling for the above variables, it was then possible to gather more meaningful population data at both the macro (village) and micro (individual) levels. Although scattered mission census data existed for some previous years at the village level, virtually none were available concerning age distribution, specific individuals, and household composition. Harpending (1973) and Feeney (1975) refer to this as the problem of nonstandard data collection and analysis. Where comprehensive written records are nonexistent, some traditional demographic techniques are inadequate or inappropriate, or the data gathered are not sufficiently rigorous to be analyzed and compared with that of other subnational populations. Therefore, part of the purpose of this paper is to indicate how limitations of this sort were in part overcome, as well as to indicate the extent to which recently devised demographic procedures of special interest to anthropologists are applicable to the Asmat data.

[3] All research villages were located near the mouths of small- to medium-sized rivers, each of which flows into the Arafura Sea. Low physiographic relief results in seasonal tidal inundation of the coastal strand, mangrove, and rain forest biomes; thus huts are built on stilts. Mud and swamp make travel by foot for distances of over half a kilometer highly impractical.

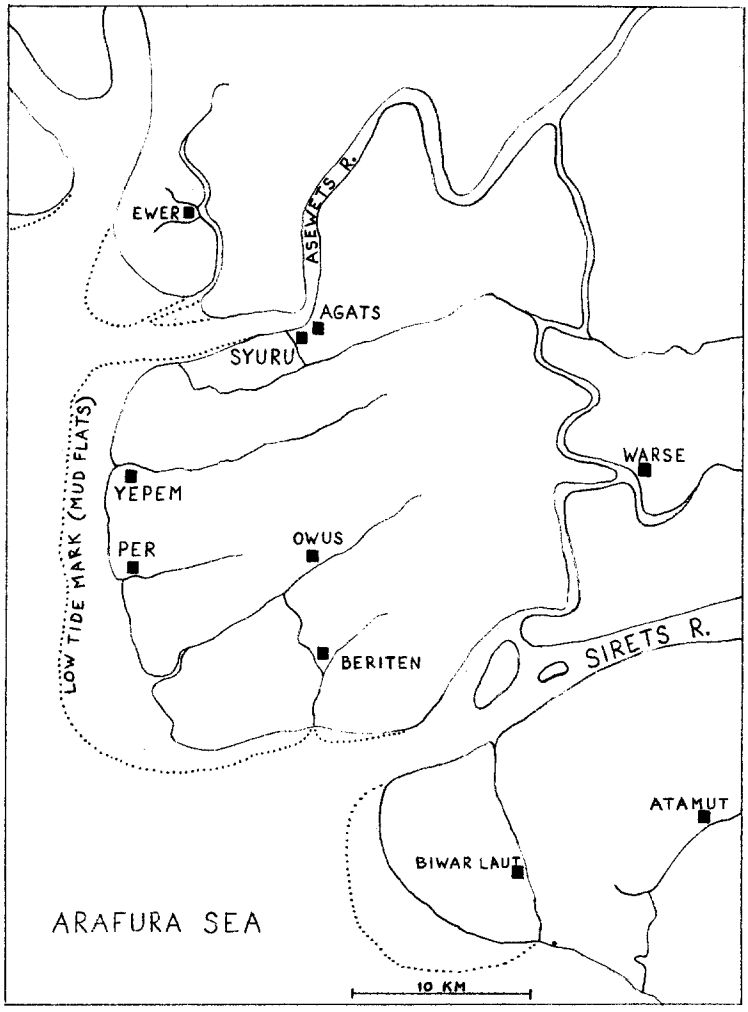

Fig. 1. The Bismam Region of Asmat, and immediately adjacent villages to the east and southeast.

The problem of nonstandard data was partially solved by employing a sample survey, whereby a limited yet representative number of people were chosen from among the total population of each village, using procedures designed to minimize interviewer bias. For the collection of all Bismam Asmat demographic data apart from village censuses (which by definition enumerate every person), sampling was accomplished by interviewing only those persons residing in the households of men who had been selected randomly (using a random number table) for inclusion in a related culture-change survey. Detailed

pregnancy histories were obtained only from the wives of these men. Demeny (1971: 811, 823) points out that sample surveys such as this are common in statistically underdeveloped regions and that meaningful statistics can be derived from them, but that in then evaluating them the investigator must be sensitive to the assumptions incorporated in the estimating procedures and to possible errors in the data themselves.

Based upon their research among the Chimbu of New Guinea, Brown and Winefield (1965) found that such errors are most prevalent with age estimates and mortality data. Other researchers agree (Feeney, 1975; Carrier and Hobcraft, 1971: 2; Weiss, 1973: 12). Deficiencies in birth and infant mortality data are reflected even in the most general ("crude") fertility and mortality statistics. My own estimation procedures were based on birth order among siblings, marital and parenthood history, event calendars, and appearance. Practice enabled me to refine this procedure to a point where my "blind estimate" of an older Asmat's age (i.e., 40 to 50 years) came within 3 to 5 years for those few persons whose exact year of birth had been recorded by nonresident missionaries of the pre-World War II era. These techniques, in combination with random sampling within the overarching framework of an intraregional controlled comparison, provided me with population data I believe to be fairly accurate.

THE ASMAT CENSUS

During 1970-1971, Indonesian government officials (with the aid of missionaries and selected Asmat) conducted a thorough census of the Asmat region. A total of 119 known villages or settlements were enumerated, having a total population of 40,058. Estimates made by the author based on an expedition to the remote interior in 1974 indicate that there may have been another 1,000 to 2,000 semisedentary people living within 10 to 50 km of the Central Highlands. Unfortunately, although age–sex distributions are available for many of the villages surveyed by the government, the age data are of little statistical value. Not only were most of the enumerators entirely untrained, but there is no consistency in estimates made from one village to the next. What is clear is that, beyond the age of about 20, there is a trend toward more women than men per cohort. For the oldest individuals in each village, it also seems reasonably certain from the government data that a large majority are women.

Because of this inconsistency in census reporting, it is imperative that the bulk of statistical calculations for the Asmat be confined to the Bismam. Figure 2 presents the age-sex distribution for all individuals (658) included in the random sample households (n = 72) in Ewer, Syuru, Owus, and Yepem.[4]

[4] Although age-sex data were collected in the town of Agats as well, they are not included here for obvious reasons: 19 ethnic or tribal groups are represented in the population of 662, as well as missionaries from the United States.

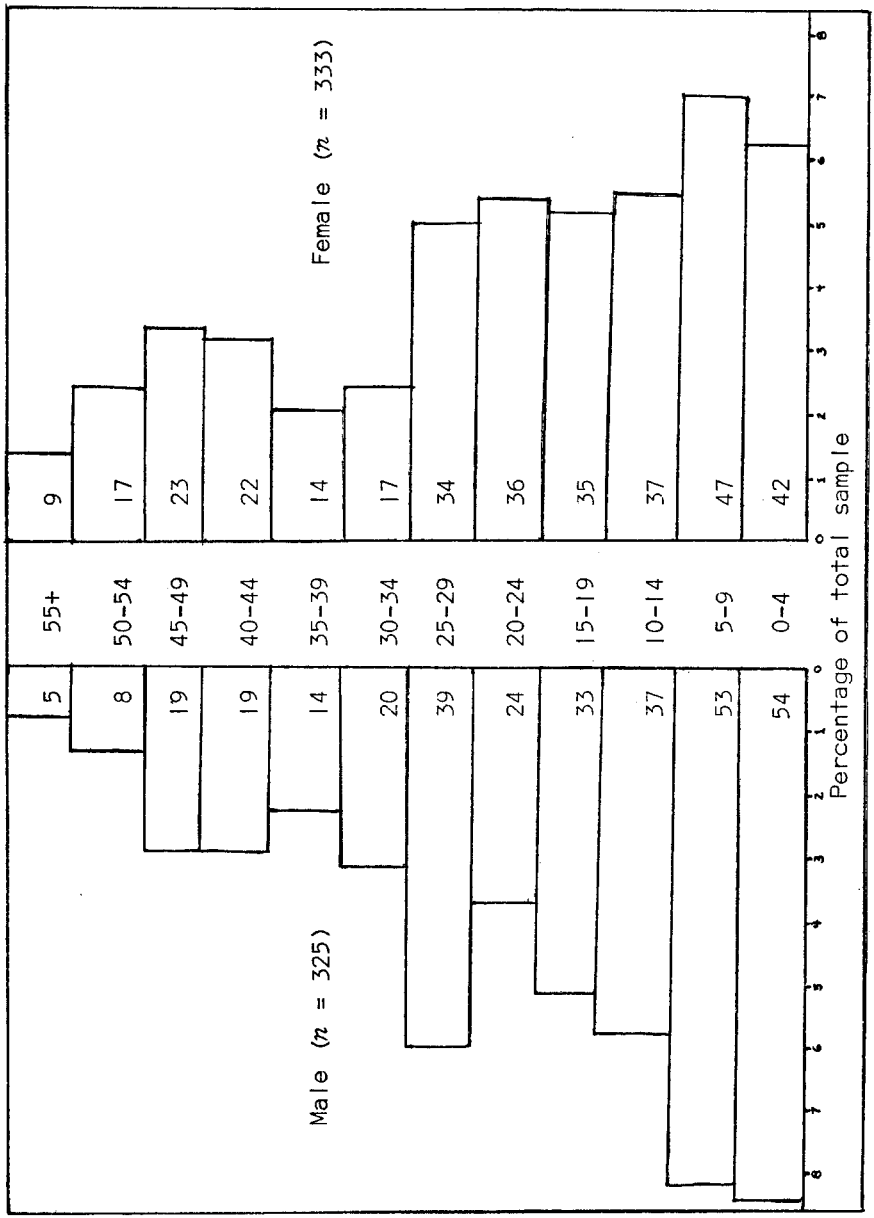

Fig. 2. Age-sex structure for all Bismam sample households ($n = 72$).

Having a total population of 2,568 as of December 1973, these four Bismam villages are thus represented by a sample of slightly over 25% of their total population. (As of the same date, the total population for all six Bismam villages was 3,167.) Despite the fact that my age estimates may be subject to slight error, especially among older persons, several important characteristics emerge. First, there is a substantial excess of males over females among children. Second, there is an excess of females over males among adults. Third, there is greater "age" in the female population as a whole, as indicated by a somewhat more column-like population profile compared with that of Bismam males. Finally, there are variations of a significant nature in the size of many chronologically adjacent cohorts, male and female. While some of the variations probably can be attributed to incorrect estimations (q.v., Neel and Weiss, 1975: 28-29), specific population variables must also be considered, including sporadic events associated with the presence of change agents, such as epidemics.

Figure 3 presents the age-sex distribution for the total population of the four villages in question, as well as an overlay comparison with two other Papuan societies (q.v., Rappaport, 1968: 16; Bowers, 1971: 15). First, statistical comparison of the Bismam profile in Fig. 3 with that presented in Fig. 2 shows that they correspond quite closely. There are 24 age–sex cohorts represented (0-4 male, 0-4 female, etc.); based upon Fig. 3, 12 of the sample cohorts in Fig. 2 were found to be slightly underrepresented and 12 slightly overrepresented. The average population percentage discrepancy for all male cohorts was only 0.67%; that for female cohorts also was well under one percent, at 0.69%. This would seem to support the contention that nonstandard data limitations are not appreciably increased if a properly executed sample survey is employed. A random household survey therefore can be used to provide a valid age-sex distribution, if not for the entire society, then at least for the specific villages involved.[5] Second, a comparison of the Fig. 3 Bismam pyramid with the overlays of the Tsembaga Maring and Kepaka also shows a high degree of correspondence in certain respects. In all cases there is a more column-like profile for females than males. Furthermore, whereas for the Asmat 42.3% of the population are in the 0-14.9 age range, approximately 39.9% are in this range for the Kepaka and 37.7% for the Tsembaga Maring. For the Tsembaga 14.2% of the population are in the 0-4.9 cohort, for the Asmat 13.3%, and for the Kepaka 10.9%. The Tsembaga show the highest percentage (13.2) in the 45+ range, with the Bismam

[5] The close correspondence between the Bismam sample age-sex distribution and that for the four villages as a whole is further illustrated by comparing age-specific percentages: from the sample of 72 households 41.0% of the population are found to be under 15, and in the total four-village census 42.3%; proportions aged 15 to 50 are 53.0 and 51.9%, respectively; proportions aged 50+ are 5.9 and 5.7%, respectively. However, in those instances herein where analysis requires age-sex distribution data only, the census material rather than sample data has been utilized to further minimize error. All 1973 CBR, CDR, and infant mortality rate calculations are based upon village-wide data as well.

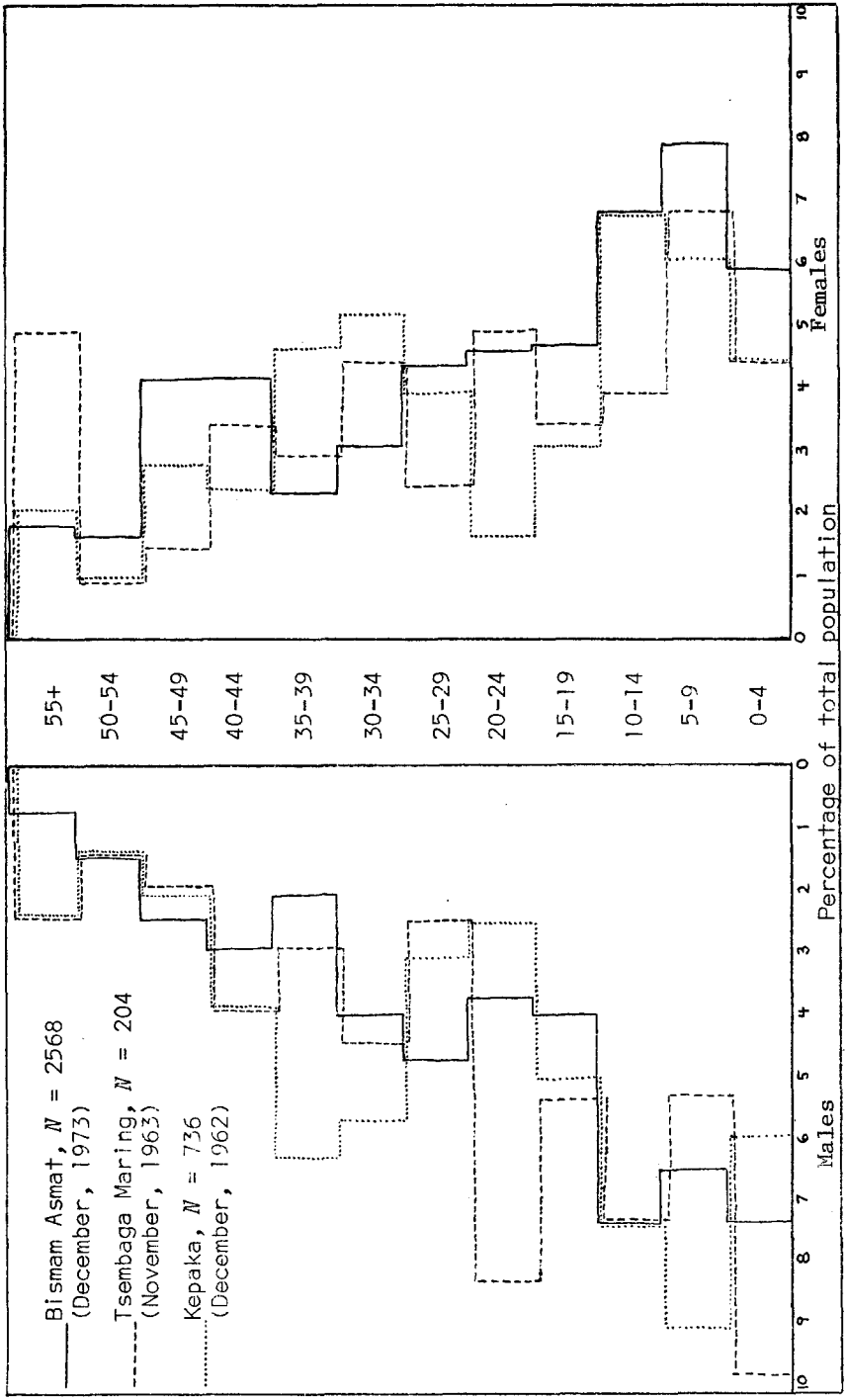

Fig. 3. Comparison of age-sex structures for selected New Guinea populations.

at 12.5% and the Kepaka at 12.0%. The implication of these figures is that the Bismam profile represents a similar relatively "young" population, with some cohort-specific variations.

The average age for the Bismam, as calculated from the random household census, is about 22.1 years; average male age is 20.9 and that for females is 23.4. It is worth comparing these figures with those for the Yanomama, as reported by Salzano (1972: 240). There the average male age is 20.8 years, while that for females is 23.4. For the Asmat these averages reflect the overrepresentation in older-age cohorts of females compared with males, and the fact that female life expectancy exceeds that of males by several years. It is unusual for a man to live as long as 60 years, although a report substantiated by missionary cross-checking indicates that an old warrior by the name of Saati was approximately 90 years old when he died in November 1970.

INFANTICIDE

Assuming the standard worldwide male–female ratio of 105:100, it is important to consider the observed Asmat ratio. Whereas that for the entire population of the four villages is 92:100 in favor of females, the ratio for infants surviving (age 0-0.9) in 1973 is 158:100 in favor of males. This of course raises the question of female infanticide and whether it is still being practiced. Following upon the ideas of Birdsell and Lorimer, Divale and Harris (1976: 525) assert: "The only way in which sex ratios as high as 128:100 (based upon cross-cultural statistical analyses) can be achieved, is through postpartum selection (e.g., preferential overt female infanticide)." Catholic missionary records and informant interviews make it clear that infanticide in Asmat was commonly practiced against females, twins, and deformed infants prior to 1953 (cf. Bulmer, 1971: 153). Although the practice has clearly been suppressed in part (as evidenced by the fact that twins now are found in many villages), my evidence indicates that not all types of infanticide have been eliminated in the Bismam area. Informants are exceedingly reluctant to discuss present-day practice, referring instead to past practices when questioned. The implication of a ratio of the magnitude of 158:100 therefore needs to be assessed inferentially and statistically, after first summarizing current research on the subject.

Infanticide is now recognized as having been a common form of population control in preindustrial populations, including contemporary "living primitives" (see, e.g., Divale and Harris, 1976). As Hawthorn (1970: 46) implies, it is relatively easy to carry out in practice, and can be effectively controlled. Infanticide allows, at the micro-level, for the selection of characteristics in offspring (e.g., sex and physical condition) and at the macro-level for the regulation of population size (q.v., Benedict, 1972: 80-81). Both levels relate to recognition by hunter-gatherers of the need to effectively space and nurture children (Birdsell, 1968: 239). Lee and DeVore, in their classic book *Man the*

Hunter (1968), summarize discussions held among a number of researchers who generally agree that infanticide is part of a conscious, explicit, decision-making process. Writing elsewhere, McArthur (1975: 93) does not rule out the possibility that infanticide might, in some instances, be practiced randomly; but it is unlikely even among Pleistocene hunter-gatherers that randomness was the norm (q.v., Birdsell, 1968: 239). Based upon studies of contemporary populations, it is evident that hunter-gatherers are well aware of resource-population correlative interactions, as Ackerman (1959: 621) and Harris (1977: 17) so succinctly state, and thus plan many of their economic activities accordingly. As appears to be the case for the Asmat, part of this planning leads to the implementation of some infanticide.

Of the four villages surveyed, the three smaller (Ewer, Owus, Yepem) each have infant ratios very near 105:100. Inferentially, based upon the evidence on hand, it might thus be assumed that infanticide is not being practiced here. On the other hand, in 1973 Syuru (population 942) had 29 surviving infant males and nine surviving infant females, an excess of 20. Thus for this one village alone the ratio is 322:100, bringing the four-village figure up to the 158:100 ratio. Although I was unable to obtain direct evidence of resurgent female infanticide, indirect evidence indicates such might be the case. Despite Syuru's proximity to Agats (1 km) and its 20-year record of having received intermittent Western health care, during 1973 a rumor spread through the village that children were dying as a result of clinic immunizations. Clinic attendance ground almost to a halt, and the number of practicing *namer-o* (traditional curers) doubled. This resurgence in curing, combined with a stated belief that village population growth had been increasing somewhat too rapidly (this statement further reinforced by contacts made by certain *namer-o* with spirits of *safan,* the "other side"), might have resulted in a temporary but statistically significant impetus for reintroducing (or increasing) female infanticide. An alternative explanation, also viable, is that an unusual natural fluctuation occurred in male-female birth rates in Syuru in 1973. In the final section of this paper, possible interrelationships between infanticide and the cessation of warfare are discussed briefly.

INTERNAL MIGRATION

Before presenting detailed information on Asmat birth, death, and population growth rates, brief mention should be made of the relative importance of internal migration as a determinant of demographic change. This must be assessed at two levels, the micro (individual) and macro (village). The former was found to be of relatively little importance, the latter of relatively great importance.

Respondents in the villages of Ewer, Owus, and Syuru (no other villages were sampled on this topic) were found to have lived in the same village for their

entire lives in 85.9% of the cases. The remainder had lived in the same village most of their lives; two-thirds had resided in two villages and one-third in three. Genealogies revealed that in almost all cases parents and grandparents had also come from the respondent's village, and data presented in Table I indicate that even in the grandparental generation, very few persons migrated in from other villages. Most of the women who did seem to have come at marriage, either by capture or arrangement. Despite the value of such specialized marriage arrangements in terms of solidifying intervillage bonds and reducing hostilities, the practice seems to have been infrequent during both pre- and post-contact periods. The high level of village endogamy indicated by these data compares closely with that obtained for other New Guinea sago-gatherers (Serjeantson, 1975: 402).

Over the past several decades individuals from Owus seem to have migrated internally within the Bismam area slightly more than have the inhabitants of other villages. It is possible that this is related to the pattern of traditional bond friendships and resultant wife exchanges (*papis*), which have been maintained more strongly here. Although specific explanations are lacking, *papis* also may be related to the relatively high population growth experienced by Owus since the 1950s.

Only 11 of the 658 persons residing in the 72 Bismam Asmat sample households were found to have been born outside the Bismam area, i.e., 1.6%. Such a low proportion may be related to restrictions brought about by patterns of revenge warfare. Nonetheless, this figure seems to be relatively low even in comparison with other New Guinea populations (cf. Bowers, 1971: 23).

At the macro-level, intravillage disputes resulting in *yew* migrations were traditionally a primary mechanism for the dispersion of Asmat groups and the formation of new settlements. With the advent of Indonesian government intervention such migrations have been strongly discouraged. As recently as about 1850, based upon a compilation of oral history (Van Arsdale, 1975: 54-55), it appears that the primary concentration of today's Bismam progenitors resided in a single settlement some 12 km south of present-day Agats. At that

Table I. Village Affiliations of Respondents' Parents and Grandparents

Relationship to ego	Village of birth	
	Same as ego (%)	Different than ego (%)
Fa	96.5	3.5
Mo	94.1	5.9
Fa Fa	94.1	5.9
Fa Mo	94.1	5.9
Mo Fa	85.9	14.1
Mo Mo	91.8	8.2

time there also were two secondary (smaller) Bismam settlements. Subsequent fissioning and refissioning along *yew* lines resulted in an increasingly broad distribution of settlements within the some 1000 km^2 of present-day Bismam territory. In addition to the ongoing yet relatively infrequent influx of individuals already mentioned (a process undoubtedly balanced by similar outmigration), since 1850 there have been only three known migrations and subsequent amalgamations of external *yew* into the relatively closed Bismam population. There is no way of knowing the exact numbers of people involved, but the detailed research of Eyde (1967) on Asmat social organization and fissioning processes leads me to estimate that perhaps 100 to 150 individuals were incorporated by each such *yew* amalgamation. No known permanent migrations of entire *yew* out of the Bismam area have occurred since 1850, although there have been several partial dispersals involving small numbers of people.

In summary, it is practical to treat the Bismam population as a closed unit for purposes of general statistical and demographic analysis, with the exception of three *yew* amalgamations. The impact of these macro-level variables on population growth rates is discussed in the last section.

BIRTH AND DEATH RATES

As mentioned earlier, detailed pregnancy histories were obtained only from the wives of men who had been interviewed in a related culture-change survey. When these data are combined with the general information on all births in the four Bismam Asmat villages during 1973, they provide a fairly complete picture of local fertility trends.

The Bismam crude birth rate (CBR) for 1973 was 56 – that is, there were 56 live (reported) births for every 1000 persons. Longitudinal comparisons are difficult, because mine are the first accurate data obtained for the Bismam since 1961 concerning this rate. As reported in Table II, Van Amelsvoort (1964: 196) calculated the 1961 CBR for Syuru at 69 and that for Ewer at 73; unfortunately, no data are available on birth or death rates for the Bismam population as a whole for any year other than 1973. Furthermore, extreme care must be taken in extrapolating from single-year data alone, e.g., in 1956 the CBR for Syuru was only 28. It is clear that the Asmat birth rate has been high during the post-contact era (a rough estimate based upon Table II indicates that 55 would be a conservative figure), and the crucial problem which remains is to approximate the rate for the pre-contact period. According to the theory of demographic transition (q.v., Davis, 1945), there is a widespread trend toward constancy in the birth rate from primitive to culturally transitional situations. It is recognized herein that the Bismam Asmat can be classified culturally as "early transitional."

Table II. Bismam Fertility, Mortality, and Growth Rates[a]

	Syuru				Ewer					Yepem		Owus
	1955	1956	1961	1973	1955	1956	1960	1961	1973	1960	1973	1973
Population	641	642	697	942	664	663	665	696	829	383	378	419
No. of live births	41	9	48	49	50	10	55	51	44	33	27	23
Crude live birth rate	64	28	69	52	75	30	84	73	53	86	71	54
No. of deaths	18	8	?	36	29	10	29	?	36	10	16	9
Crude death rate	28	26	?	38	45	30	44	?	43	26	42	21
Infant mortality rate	146	889	125	240	460	900	364	196	511	182	407	125
Crude rate of natural increase (%)	3.6	0.2	?	1.4	3.0	0.0	4.0	?	1.0	6.0	2.9	3.3

[a]Data for years 1955, 1956, 1960, and 1961 obtained from Van Amelsvoort (1964: 196).

This reasoning (in the absence of any specific data for the pre-contact period) would lead to the assumption of 55 as the approximate rate prior to 1953. However, as Teitelbaum (1975) points out, transition theory is based largely upon changes which occurred in 19th-century Europe, and at a very broad level of generalization. Specific causal factors as they might relate to specific subpopulations are, for the most part, lacking. Davis (1975: 31) and Pirie (1971: 4) note that in some developing countries with traditionally high fertility rates, and in the absence of population control programs as socioeconomic changes (including health care and nutritional innovations) begin to accelerate, birth rates have risen to still higher levels. This alternative reasoning would lead to the assumption of a rate lower than 55 for the pre-contact era. Cross-cultural comparisons must be presented before conclusions, no matter how tentative, can be derived (see also, e.g., Carroll, 1975: 390-395).

Here it should be noted that, despite the small population upon which it is based, the Bismam rate of 56 for 1973 is similar to those observed in a number of developing countries, particularly in Africa. It is slightly higher than those for Central and South America and the countries of Southeast Asia (DeJong, 1972: 35-37). It is lower than that observed in a few other primitive societies (e.g., Hern, 1976: 13; Pryor, 1974: 41-42). During the years 1965 to 1973, the average birth rate for Melanesia as a whole was approximately 42 per 1000 (Reining and Tinker, 1975: 80). As a subpopulation within the Indonesian polity, it is also interesting to contrast the Bismam with Indonesia as a whole. During the decade 1960-1970 the CBR for the entire country averaged approximately 44 per 1000 (McNicoll and Mamas, 1973: 45). From an ecological perspective, of course, it is imperative to compare Asmat with other New Guinea populations owing to presumed similarities in population dynamics variables. For example, early data compiled by van der Hoeven (1956: 303-304) in Irian Jaya, then called Netherlands New Guinea, indicate a north coast CBR of approximately 41 per 1000, averaged for the years 1937 through 1953. For Papua New Guinea's Breri people, Stanhope calculated the average CBR over the years 1953-1960 to be 48 per 1000, followed by what would seem to be a nonsignificant increase to 50 per 1000 based upon a survey conducted in 1968 (1970: 27, 32). Van de Kaa (1971: 17), using a broad baseline of 1961-1966 data from throughout Papua New Guinea, estimated the CBR at almost 44 per 1000. This was a downward revision from his earlier estimate of slightly over 45 per 1000 using the same data (1970: 13). An estimate of 44 per 1000 has been suggested as a reasonable figure for Papua New Guinea as of 1970 (q.v., Caldwell, 1971: 163).

In summary, the stance adopted here is that demographic transition theory cannot accurately be extended to non-European/non-Western contexts in its particulars. This is primarily because processes of culture change in the Third World do not mirror those that have characterized the development of First World countries. Comparisons presented above of the recent Bismam birth

Table III. Average Number of Completed Pregnancies per Cohort (as of December 31, 1973)

P_1	15–19	0.6
P_2	20–24	1.4
P_3	25–29	3.1
P_4	30–34	4.3
P_5	35–39	5.7
P_6	40–44	6.5
P_7	45–49	6.7
	50+	7.6

rate and those of other developing peoples suggest that the Asmat rate is relatively high, and that it is probably higher now than in the immediate pre-contact era. Nonetheless, the Bismam Asmat generally are representative of (but not identical to) "living primitives" demographically, but transitional people culturally. These interpretations are incorporated into the two-part model of population growth presented in the final section.

By relying upon age estimates, event calendars, full pregnancy histories, and resultant statistics it is possible to describe in general terms certain reproductive characteristics for the Bismam. The average number of completed pregnancies per married woman was found to be 3.78. This compares, for example, with 4.44 for the Kepaka (Bowers, 1971: 27). Fertility data presented in Table III indicate that the average number of children ever born to women aged 50+ years is 7.6, but is should be noted that based upon Coale and Demeny's hypothesis (1967: 33-34) that TF/P_3 is closely related to P_3/P_2 and therefore that TF (total fertility) is closely approximated by $(P_3)^2/P_2$, a TF figure of 6.9 is derived for the Bismam. Because the latter estimate, approximating the sum of the age-specific birth rates, is only slightly less than the 50+ figure of 7.6, it can tentatively be concluded that the problem of misreporting children ever born seems to be minimal given Asmat's high mortality rate (cf. Coale and Demeny, 1967: 33; Seltzer, 1973: 21-22). Since a majority (65.9%) of the women in the sample had been at pregnancy risk only during the post-contact period (1953-1973, cohorts P_1 through P_4), and since even those aged 50 in 1973 had been at risk during this period for 57.1% or well over half of their probable reproductive years (ages 15 through 49),[6] it can be assumed that

[6] Several women whose ages I estimated to be between 45 and 50 had given birth within the year. However, as Neel and Weiss (1975: 31-32) indicate, even with the aid of biomedical data it is difficult to determine the reproductive span in specific primitive populations with any degree of accuracy. There is evidence that menopause occurs as early as 40 in some New Guinea populations (Scragg, quoted by Serjeantson, 1975: 409).

children born but possibly killed during the post-contact era have been reported as completed pregnancies. If some female infanticide still takes place, as suggested earlier, it will have little statistical bearing on demographic calculations dealing with mortality: infants dying from this cause can be grouped with those dying from all other causes (Feeney, 1975: 24). Ethnographically, it is probable that the response *"sakit"* (sick), given by over 90% of the parents queried as to causes of their infants' deaths, is a standard nondescript answer intended to cover virtually all forms of illness, accident, and infanticide.

Although several Bismam women were found to have borne more than 10 children, a total fertility rate of 6.9 for the population as a whole falls within the upper range for human societies. However, it is about average for New Guinea as a whole (Caldwell, 1971: 163). Coale (1974: 44-45) notes that no sizable populations have been observed with total fertility much greater than 8 births per woman. For example, Layrisse *et al.* (1976: 1135) report 8.5 as the TF for Venezuela's Warao Indians. The "world record" apparently is 10.4, for the Hutterites of western Canada (Howell, 1976: 29). Nag (1962: 170) summarizes data for nine Pacific populations, indicating that, while most fall in the relatively low-to-medium range of 2.6 to 5.0, Alorese and Tikopians have in the past exhibited rates similar to that for the Bismam. At the other extreme is West Germany, with a recent rate of only 1.5 (Westoff, 1974: 112). It should be noted that the rate of childbearing among the Bismam, as indicated by the average number of live-born children per cohort, increases steadily until the age of 40+ years. These data, as summarized in Table III and displayed graphically for comparative purposes in Fig. 4, accord closely with those presented by Stanhope and Hornabrook (1974: 447) for three other lowland New Guinea populations.

A majority of women in the small Bismam sample ($n = 85$) were found to have first given birth at the age of about 18 or 19. However, because a number of additional variables (to be discussed) complicate the interpretation and explanation of Bismam population growth, a current cohort-by-cohort comparison such as that presented here is of little analytic value over the long run, unless population growth has occurred without appreciable changes in cohort-specific fertility.

Boys ever born to married women of all ages were found to average 2.1, girls 1.7. Twin births were reported by 2.4% of those interviewed, with a dizygotic twinning rate of 11.9 per 1000 births. This latter figure falls squarely within the expected range derived from the general cross-cultural comparisons of Bulmer (1970: 84-91); in view of the fact that in Asmat twins were traditionally subject to infanticide, thus making such births likely candidates for underreporting, further support is lent to the assumption that most completed pregnancies have been reported accurately.

Mortality can be defined as the number of deaths occurring in a population during a given period of time. Certain statistics require that the rate be

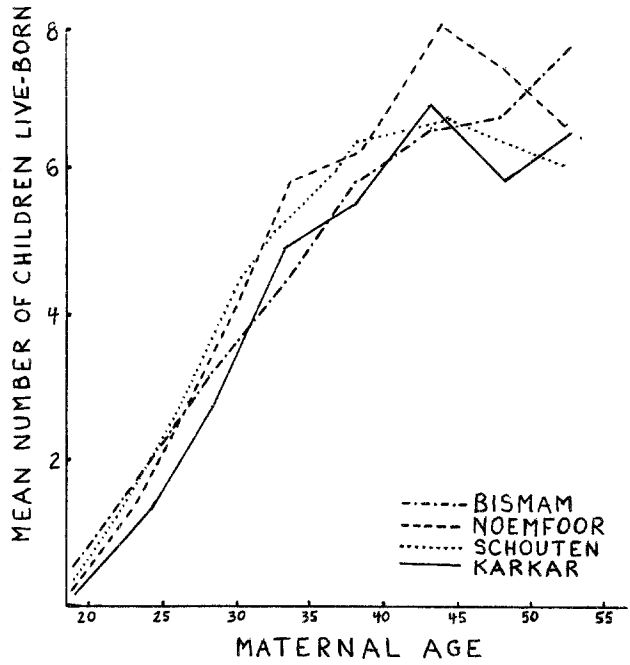

Fig. 4. Comparison of total fertility curves for selected lowland New Guinea populations.

broken down, e.g., the infant mortality rate refers to the number of deaths among children aged less than 1 year per 1000 live births per year. Although fertility is the initial determinant of age distribution, in a population such as Asmat where people of all age groups are exposed to a greater statistical death risk than those in developed countries, the role that mortality plays can be extremely complex.

The Bismam crude death rate (CDR) for 1973 was 37 per 1000 persons (see Table II for village-specific rates). Data for past years make it clear that the CDR has fluctuated widely, but seems to have averaged about 35 to 40 per 1000 over the last 2 decades. By comparison, recent rates in developed countries have averaged about 10 per 1000 (Reining and Tinker, 1975: 80). Recent rates for Indonesia as a whole are not known with certainty, but are estimated to be about 25 to 30 per 1000 (McNicoll and Mamas, 1973: 11-15). In New Guinea, Stanhope estimated the CDR for the Breri during the years 1953-1960 to be about 25 per 1000, with the updated figure for 1968 being about 23 per 1000 (1970: 27, 32). Five other New Guinea societies with which Stanhope compares the later Breri rate exhibit even fewer deaths per year, ranging from 8 to 23 per 1000 (1970: 37); however, it should be noted that the CBRs of these other

societies are lower as well. Van de Kaa (1971: 17), making a revision of an earlier estimate (1970: 13), calculated a CDR for Papua New Guinea of about 21 per 1000 during the years 1961-1966. As with the birth rate, the Asmat death rate is significantly higher.

Infant mortality figures presented in Table II indicate that these rates have varied greatly from year to year within and among Bismam villages. For example, in Ewer and Syuru during 1956 almost all of the infants died; although the infant mortality figures of 900 and 889 per 1000 are accurate, they are exceedingly misleading and of no predictive value because in Ewer only 10 live births were reported, and in Syuru only nine. In contrast, in 1961 the rate in Ewer was 196 per 1000 and that in Syuru only 125 per 1000, with the numbers of live births being far greater than in 1956. Although no stable trend emerges owing to the small populations involved, it appears that a rate of approximately 300 per 1000 can be applied as a yearly average over the last 2 decades. This exceeds that for many other regions of Irian Jaya and Indonesia's Outer Islands, where McNicoll and Mamas report an implied rate of 157 for the decade 1960-1970 (1973: 13). Van der Hoeven found the rate to be about 230 along Irian Jaya's north coast, with a range of 100 to 300 (1956: 306-308). Stanhope's data for the Breri suggest an infant mortality rate of at least 125 per 1000 as of 1968; this compares with data from five other New Guinea societies which range from 47 to 234 (1970: 32, 37).

The average number of children surviving to the age of 15 per woman aged 50 or more is 3.5. Unlike developed countries, where very few deaths occur among persons aged 0 to 15, and where the number of children ever born can be used to obtain an estimate of population replacement rates as succeeding cohorts reach the start of their reproductive years,[7] recently contacted regions such as Asmat experience so many deaths of persons aged 14 or less that number of children ever born yields little direct evidence as to future growth trends. An average of only 1.2 female children per woman survive to 15, and since an average of about 3 females have been born to women whose reproductive years are complete, it can be concluded that childhood mortality factors (including infanticide) take a relatively heavy toll on the reproductive potential of the population. At the start of the childbearing years, there is only a slight excess in the female replacement rate.

Some data are available as to causes of mortality among the Bismam Asmat during the contact era. Unfortunately, a great deal of interpolation must be used in order to ascertain prominent long-term trends in mortality-related variables during this time. Health-care records and mortality statistics were more complete under the Dutch regime than under the current Indonesian state. Indeed, health

[7] Under conditions of extremely low mortality among the pre-reproductive population, only 2.1 births per woman are required to replace a given generation with another of the same size (q.v., Westoff, 1974: 110).

care itself was far more comprehensive and systematic under the Dutch. Despite the belief of certain Catholic missionaries working in Asmat that health care should not be one of their primary concerns, a major mission hospital-clinic station has recently been opened in the southern part of the region. No other Western-oriented medical care was available there. The author also initiated small-scale clinics in two Bismam villages, in one instance using a vacant structure that the government had built for medical purposes but never used.

In death, the Asmat attribute the permanent loss of the adult soul to its journey to the spirit world of *safan* (the "other side"). Mortality is perceived as of much less sociocultural significance for young children or infants, however, because they are not yet thought to be true persons. It is believed to take a period of maturation, often as long as 3 or 4 years (as well as a name change) for a child to become recognized as a person. Given the exceptionally high rate of infant mortality, such "delayed recognition" has obvious adaptive features in terms of social bonding. Whereas the primary causes of death among adults during the contact era seem to have been malaria, complications surrounding yaws, filariasis and its sister disease elephantiasis, pneumonia, intestinal disorders, and diseases not indigenous to the area such as smallpox, cholera, whooping cough, and influenza, the main factors associated with infant mortality seem to have been pneumonia, malaria, diarrhea, post-delivery complications, and occasional epidemics of nonindigenous diseases.

Intricacies in the interaction of traditional belief patterns and Western health practices were recognized early on by Dutch medical personnel and their Papuan assistants, who during the earliest health campaigns in the 1950s attempted to preserve certain traditional cultural norms when they instituted immunization programs, in-patient clinics, and maternal and child health-care out-patient programs. Immunizations and other forms of preventative treatment (especially for yaws) met with a great deal of success in some areas of Asmat, but infant mortality rates in Bismam villages participating in maternal and child-health programs did not show a significant decline. One reason seems to have been that, even on an out-patient basis, attendance was sporadic. This, combined with the finding in Asmat and elsewhere in Dutch New Guinea that in-hospital delivery was not highly correlated with infant survival, led authorities to cut back on programs of this nature (Van Amelsvoort, 1964: 113-115).

These trends continue to the present day, and in some ways are magnified in that health care provided by the Indonesian government is sporadic at best. My data indicate that, of the wives sampled, 20.9% had given birth to their children in hospital-clinics only, and another 25.4% had given birth to at least one "hospital baby." Over half the married women had given birth to all their children in the traditional manner, which in many cases means there was no midwife or assistant present. The inference is that in-hospital delivery is not highly correlated with infant survival because Bismam women (under the short-lived but efficient Dutch regime) did not have a long enough opportunity to

witness the increased infant survival benefits, and that (under the present-day but inefficient Indonesian regime) little consistency has been demonstrated in post-delivery care by clinic personnel. This situation is one of mutual negative reinforcement in that most women show little consistency in their contacts with clinic personnel.

The impact of certain nonindigenous disease epidemics on the overall Bismam mortality rate can in some cases be estimated, but this in no way means that a long-term trend can be projected with any accuracy. For example, in 1961-1962 a severe cholera epidemic reached most of the coastal and central Asmat villages. It began in Owus and Syuru. A majority of the victims were young adults, and it is likely that as many as 3% of the Bismam villagers died, with over 600 people dying in all of Asmat. It is possible that deaths resulting from this epidemic account for some of the underrepresentation in both male and female cohorts now aged 35 to 39 (see Fig. 3). Another example is the influenza epidemic of 1970. Again, Owus was apparently struck first. Throughout Asmat another 600 people died, a majority being young children (Trenkenschuh 1972: 67). These deaths may account for some of the underrepresentation in male and female cohorts now aged 15 to 19 (see Fig. 3). Other examples could be cited where epidemics resulted in fewer deaths, e.g., 0.5% of the Bismam (primarily old people) died from the influenza epidemic of 1973-1974 (see Van Arsdale, 1975: 270-273).

Dutch health survey teams in the mid-1950s gained a "favourable impression . . . concerning the nutritional state of the population" (Van Amelsvoort, 1964: 77). This situation still holds: malnutrition *per se* cannot be introduced as an important cause of death. However, it should be noted that a protein-deficiency disease (which may be akin to kwashiorkor) is quite common, and is found among young children who, upon weaning between the ages of 2 and 4, are suddenly put on diets consisting largely of sago. For the villages of Ewer, Syuru, Owus, and Yepem, it was found that only a small proportion (9.2%) of the children who died aged 9.9 years or less died when in the 2.0 to 3.9 age range. It is not known what proportion of these deaths may have been due to weaning-related activities, but the implication is that nutritional problems are of minimal significance, even among children. Dunn (1968: 223) makes the same statement for hunters and gatherers in general.

Leaving the discussion of warfare-related deaths until the next section, the preceding analysis of mortality-related variables leads to the tentative conclusion that the introduction of modern health care has not made an appreciable impact upon Asmat. The "modern health transition," as described by Lerner (1974) and others, has yet to correlate with a significant drop in mortality. Those inroads that have been made, such as a reduction in deaths due to malaria, have been countered by numerous deaths due to epidemics of nonindigenous diseases and inefficient infant and child health care. Although I observed people

suffering from nonacute fatal diseases, no data are available as to their type, prevalence, or statistical impact upon the overall mortality rate.

POPULATION GROWTH

Subtracting the Bismam CDR for 1973 of 37 per 1000 from the CBR of 56 per 1000 and transforming the result into a percentage, the crude rate of natural population increase is found to be 1.9%. A comparision of this rate with data compiled by Van Amelsvoort (1964: 196) and presented in Table II indicates, for example, that the crude rate of natural increase for Syuru in 1955 was 3.6% but in 1956 only 0.2%. The rate for Ewer in 1955 was 3.0% but in 1956 was 0. Fluctuations at the village level are obviously great from year to year, a circumstance to be expected given the relatively small size of Bismam communities. (Syuru, the largest, has 942 inhabitants; Beriten, the smallest, 225.) However, by using mission censuses for the Bismam, which are available for several of the years from 1956 onward, in combination with my own village censuses for December 1973, an accurate average annual rate of population increase of 1.5% is derived for the six villages together (see Fig. 5).

This compares with a rate of approximately 2.0% for Indonesia (McNicoll and Mamas, 1973: 6-8). Van de Kaa calculated a growth rate of approximately 2.3% for Papua New Guinea during the years 1961-1966 (1971: 17). Only the Sepik District among the seven areas he used as a basis for his calculations had a growth rate less than that observed in Asmat (1970: 10). In certain coastal areas of Papua New Guinea ecologically similar to Asmat the rate has been estimated at 2.8% annually (Stanhope, 1970: 36-37). An average annual growth rate of 2.5% has been suggested as conservative for Melanesia as a whole (Pirie, 1971: 13). Smith (1971: 62) implies that the rate for Papua New Guinea during the late 1970s will exceed 2.9% annually, a rate that has already been sustained in certain local areas for over a decade (see, e.g., Lea and Weinand, 1971: 127-128).

In short, the annual growth rates for Papua New Guinea and many of its local areas during the 1960s and 1970s have been above those for some other developing countries, and well above the average for the world as a whole (slightly more that 2.0% as of the mid-1970s). Furthermore, these rates have been increasing in exponential fashion, i.e., there has been a steady average increase in the growth rate from one year to the next. While in no way overlooking the fact that the Bismam growth rate is significant, it is considerably less than the Melanesian average. In addition, it has not varied appreciably since 1956. Interpolations within the available census data points indicate that, on the average, the yearly rate of 1.5% has remained relatively constant, with no exponential increase.

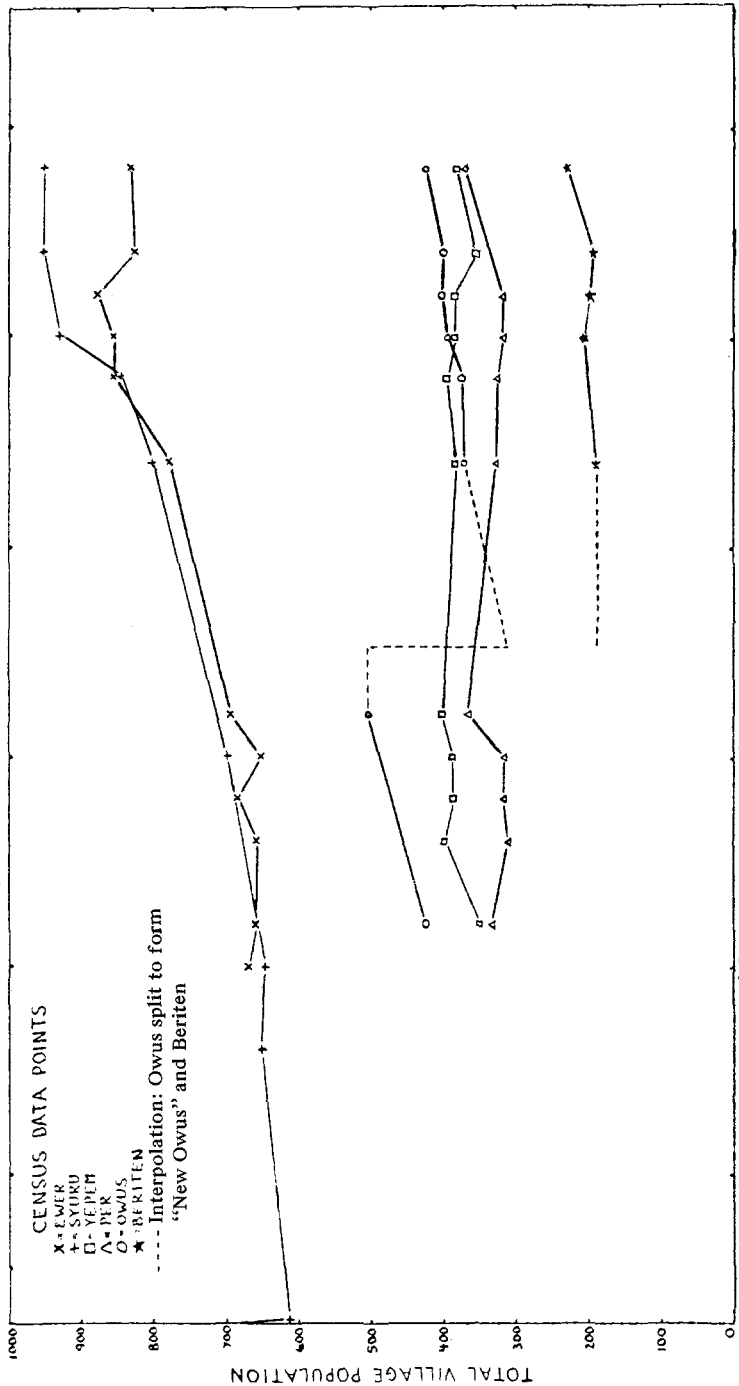

Fig. 5. Population growth trends for each of the six Bismarn villages.

Based upon the data concerning the recent Bismam growth rate alone, it might be tentatively suggested that the post-contact population has been a demographically stable one. However, further analysis of other factors is needed in an attempt to account for what now in Asmat might best be described as a "culturally transitional" yet "demographically traditional" situation, and this can best be accomplished with the aid of a two-part model – one part for the pre-contact era and the other for the post-contact era. Demographic modeling, combined with a good deal of inference in a statistically underdeveloped area such as this, is needed to complete the interpretation of population dynamics and correlates of internal and external sociocultural changes. In other words, there are two central questions for which a model can hopefully provide answers: in what way is the Bismam growth rate of 1.5% annually during the contact era a correlate or function of externally induced change processes, and what was the pattern and rate of Bismam growth during the latter portion of the precontact era (cf. Swedlund and Armelagos, 1976: 16-17)?

Beginning with the second question, for purposes of the first part of the model it will be shown that the Bismam represented a stable population during the latter portion of the pre-contact era (i.e., 1850 to 1953 A.D.). That is, they presumably were characterized by little in- or out-migration, relatively constant birth and death rates, a relatively constant age-sex structure, and a relatively constant annual rate of growth. Although no direct statistics are available for this period, and the presumption of stability must remain conjectural, it can be supported indirectly. As mentioned in a preceding section, a compilation of oral history of the Bismam area has been completed, and can be used to shed light upon pre-contact population dynamics. [Barth (1971) used a similar method in his investigation of intertribal relations in the Fly River region of New Guinea.] It is this process of reconstruction that leads to my assumption of stability. This is in contrast to the assumption, although over a much longer period of time, of a stationary (no growth) population which Weiss (1973) suggests might be applicable to the construction of models for pre-contact hunter-gatherer societies of this sort.

The primary concentration of Bismam in approximately 1850 lived in a single "medium-sized" settlement about 12 km south of present-day Agats. As mentioned earlier, there also were two "smaller" Bismam settlements. If a population of 450 persons is taken to be "medium-sized" (based on today's Asmat standards),[8] and a population of 150 is taken to be "small," then an 1850 baseline population of 750 can be used to begin construction of the model. The year 1953, at the other end of this part of the model's chronological continuum, can

[8] I have informally surveyed the site where this settlement once stood. Although no direct traces remain as indications of housing patterns, the approximate perimeter of the site can be determined due to differences in primary and secondary rain forest growth. Inferentially, these observations confirm Asmat statements that the settlement had been "medium-sized."

be assigned a Bismam population of approximately 2300+. This figure is derived by using the post-contact growth rate of 1.5% and applying it retrospectively to the earliest known complete Bismam census figure – 2,441 in 1956.

To account for population growth from 750 to 2,300 over the span of approximately 1 century, macro-level (village or *yew*) migration must first be considered. Since 1850 only three known assimilations of previously non-Bismam *yew* have occurred. My estimation, lower than that suggested by Zegwaard (Eyde, 1967: 310), is that 100 to 150 people were involved during each assimilation: two, during the mid-1930s, involved the *yew* Kaimis and Yofor; one, about 1950, involved *yew* Yepet. Between 1850 and 1953 no known outmigrations of Bismam *yew* of a permanent nature took place.

Some of the most important indigenous disease-related causes of death have been discussed. These presumably made a relatively steady impact throughout this period. Traditionally in Asmat, large numbers of deaths occurring in any one battle or raid were relatively unusual, and Bismam oral history reveals no such major events during this period. Smaller numbers of fatalities (i.e., 10 or less) occurring at frequent intervals due to ongoing revenge warfare cannot be overlooked, but for modeling purposes the assumption is made that such deaths did not create significant perturbations in the long-term growth rate. Traditional warfare-related deaths and indigenous diseases alike are treated as having ongoing processual effects rather than episodic (i.e., "battlefield decimation" or "epidemic") effects.

Although the era of permanent contact began in 1953, sporadic encounters with outsiders prior to that data had important effects. Two events of demographically significant, episodic proportions are included in the model. In 1930 approximately 100 Bismam warriors were killed after a raid on a government outpost in the neighboring Mimika region. Near the end of World War II 61 inhabitants of Syuru were killed by Asmat warriors from elsewhere in the region, the decimation made possible by internal disruptions, killings, and village displacement caused by Japanese and Allied occupation, movements, and counterattacks. (A visiting missionary made a lone census in Syuru shortly after the deaths occurred. It is from this that the earliest village census point included in Fig. 5 is derived.) There is no way of knowing the general effect of World War II upon overall Bismam population dynamics. Van de Kaa (1970: 3) suggests that while the war undoubtedly had adverse effects for peoples of New Guinea, demographic researchers should be warned against overestimating its impact. For purposes of the present model it is assumed that, rather than a decline in total population, the Bismam experienced a 4 year period of stasis.

Given the aforementioned events and population parameters, some of which are conjectural, an average annual growth rate of approximately 1.0% accounts for the increase from 750 to 2,300 during the period 1850-1953. In terms of the model, the birth rate and nonepisodic death rate are presumed

to have remained relatively constant in this growing population, with a portion of the differential between the two rates being the primary cause of growth and inmigration being a secondary cause. To be sure, a rate of 1.0% is far greater than that which must have prevailed throughout most of the pre-contact era; Petersen (1975: 232) implies a rate of less than 0.1% for most of humanity's existence. Presumably the Asmat, even during the contact era, have generally existed at well below "carrying capacity," and at least since 1850 (despite droughts that occur roughly once every 7 years) have had generally abundant food resources. Recent demographic studies strongly support the notion of primitive societies existing at well below carrying capacity (Petersen, 1975; Harpending and Bertram, 1975), with Hayden (1975) even suggesting that the very concept is theoretically inadequate, in part because resource availability is not a constant. In any event, the Bismam evidently were experiencing atypical growth during the time covered by the first part of the model. Similar demographic situations and relatively short-term rates of high growth have been postulated for other prehistoric populations (see, e.g., Longacre, 1975: 73). That local concentrations of traditional hunter-gatherer populations can be sustained over decades is supported by the work of Williams (1974).

No single culture change correlate takes on primary importance during the development of the second part of the model, covering the years 1953–1973. As stated, the average annual growth rate has been 1.5%, with no indication of exponential increase. With this overall indicator determined, the issue ideally becomes one of determining causal or correlative interrelationships among cultural factors and vital rates. Unfortunately, total population census counts are the only demographic data available throughout most of the period. The vital rates discussed in detail in the previous section are based upon a scattering of measurements, most of them made by the author during 1 year only. Given these limitations, it has been noted that the Bismam CBR and CDR are relatively high when compared with those of other New Guinea societies, and that the infant mortality rate is exceptionally high. Total fertility is high, but about the same as that recorded for other ecologically similar Papuan peoples.

Applying equations presented by Weiss (1973), Bismam life expectancy at birth, termed E(0), is calculated at approximately 24.8 years. For those surviving the pre-adult years (0–14.9), life expectancy at age 15 [E(15)] is 27.0 years. As discussed in detail elsewhere (Van Arsdale, in press-a), today's average 15-year-old therefore can be expected to nearly reach "old age," which is thought to begin at about 45. These figures, especially that for E(15), accord very closely with averages derived for other "living primitives" (q.v., Weiss, 1973: 49-50). An E(0) lower than that for numerous contemporary societies in Papua New Guinea (van de Kaa, 1970, 1971) is attributable, in large part, to the infant mortality rate. Van Amelsvoort's data (Table II), in conjunction with my own, result in the modeling assumption that this rate has maintained a relatively

constant average during the contact era despite local fluctuations, and that the "modern health transition" seen as a correlate of externally induced culture change in developing societies is not yet of appreciable significance in terms of infant survival. This assumption is further supported by evidence already presented as to the erratic nature of Indonesian health care in Asmat: modern medicine has yet to make a long-term demographic impact.

The second part of the model takes into account what appears to be the "disease-mortality cancelling effect." For both infants and the populace at large, during the contact era there have been about as many negative as positive effects on acute disease-related mortalities. While on the one hand deaths due to indigenous diseases have been reduced, they have been increased (and frequently in epidemic proportions) due to the introduction of nonindigenous diseases. About as many people now die of acute disease-related deaths as in the pre-contact era.

How then does one account for an annual population growth rate of 1.5%? The high birth rate of approximately 55 per 1000 would appear to be a key, tied to my previously stated assumption that the CBR was lower prior to 1953. In Asmat it may be the case that, while disease-related care has not improved, nutrition-related health has (Van Arsdale, 1975: 214-245). Possible slight reductions in the Bismam birth interval (Van Arsdale, 1975: 297-298) indicate that a few young women may be experiencing physiological changes which are contributing to increased fecundity (q.v., Frisch and McArthur, 1974). These may be due to newly introduced foods (q.v., Katz, 1972: 357-358), such as garden crops and rice, which might contribute to future increases in infant survival rates as well. It is also possible, although highly speculative, that decreased birth intervals are related to physiological changes accompanying the Bismam transition to a somewhat more sedentary lifestyle (q.v., Kolata, 1974: 934). Furthermore, the Bismam woman's workload has been demonstrated elsewhere not to be excessive (Van Arsdale, in press-b), a factor which may also contribute to increased fertility (see, e.g., Dahlberg, 1974).

A nonphysiological cause needs to be mentioned as a strong possibility. In areas such as Asmat where infant mortality is high, it is likely that the next infant is perceived as a desirable hedge against continuing high rates (Freedman and Berelson, 1974: 36; Kunstadter, 1972: 317, 321). I suggest that mortality compensation of this sort over the last two decades, probably falling on the heels of externally introduced epidemics, is partially responsible for the postulated slight increase in fertility among some younger women.

Fertility (i.e., its regulation) can serve as more of a population growth "dampener" in transitional and modernizing societies, whereas mortality serves as more of a dampener in primitive societies (Weiss, 1973: 55). For the Bismam who are culturally "early transitional," it is possible that certain cultural and physiological changes suggested above are contributing to a relatively short-

term "deregulation" of fertility's dampening effect, in fact contributing to a slight increase which is being reflected in a higher birth rate.

Mortality is viewed in the second part of the model as continuing the overall dampening effect it traditionally exerted. It is probable that the crude death rate has only decreased slightly from that of the late pre-contact era. Certain of the specific factors involved, especially diseases, have shifted in the pattern but not lost their causative importance. It is likely that infanticide still continues but with less frequency, and some of the population growth is probably attributable to its reduced significance. There is no way of calculating directly Bismam life expectancy for the period covered by the first part of the model, but the recent E(0) of only 24.8 years suggests that (in contrast to Papua New Guinea) this expectancy has changed relatively little from the precontact period. For these reasons there has only been an average increase of 0.5% in the annual growth rate from the pre-contact to the contact era.

Traditional warfare-related mortality does not occupy a primary position in the model. This is in contrast to the role assigned it in studies of the Yanomama (Chagnon, 1968) and other primitive New Guineans (e.g., Vayda, 1976). At least among the Bismam Asmat during the past century, traditional warfare-related deaths were relatively frequent but few in number at any one time. The ritual cycle of revenge warfare was, with the possible exception of male initiation rites requiring several enemy heads, geared toward long-term minimal loss of life. The model assumes that the external suppression of warfare and cannibalism, with resultant slight decreases in the yearly mortality rate, plays but a secondary role in the growth pattern. It is recognized that when a premium is no longer being placed upon warriors some female infants will be permitted to survive who might otherwise have been killed (q.v., Divale and Harris, 1976; Harris, 1977: 17ff). This probably lends partial explanation to the reduction in Bismam infanticide.

Neither in-migration nor out-migration has been of importance at the macro-level during the contact era, and neither is included in the second part of the Bismam model.

In conclusion, several factors associated with changes in fertility and birth rates assume primacy in my explanation of an increase in the rate of population growth from 1.0 to 1.5% annually within the last few decades. Changes in overall mortality rates, including those associated with the cessation of warfare, have been minimal and assume secondary importance. Further demographic refinements and analyses will shed additional light on the Asmat as they move more fully into the transitional phase. Techniques of nonstandard data collection and analysis having special significance for anthropologists are rapidly being improved by biodemographers, cultural anthropologists, archaeologists, and others. Some have been used here. However, a great many of my interpretations and modeling procedures have been conjectural. Detailed longitudinal data are still minimal, and this ideally is what is needed. What is clear is that

demographically the Asmat are still representative of "living primitives," while at the same time being representative culturally of transitional peoples. It must be recognized that, even demographically, "living primitives" cannot be assessed as if they existed in total isolation from First and Third World countries. Certain linkages have existed ever since first contact was established. However, in part because of the relatively short time that permanent outside contacts have been in effect and in part because health care has been more erratic than elsewhere in Melanesia, under the Indonesian political economy these people are yet to be fully integrated into Third World change processes.

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