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The Demography of the Hadza - in Historical Perspective

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The main purpose of this paper is to present a demographic analysis of a surviving 'hunter-gatherer' population - the Hadza of Tanzania. The results are compared with what little demographic information exists regarding other African hunting and gathering societies. Finally, an attempt is made to put the results into some kind of historical perspective.

Introduction

In the past a 'hunting and gathering' way of life was characteristic of a substantial proportion of African communities. Prior to the introduction of agriculture, hunter-gatherers occupied most if not all of the continent, and it has been estimated that even as late as 1500 AD hunter-gatherer bands peopled most of southern Africa, and large tracts of the west, centre, and east of the continent.[1] Today, however, only a few isolated groups of hunter-gatherers survive. The main concentrations are listed below:

i) The Bushmen of Botswana and South West Africa. There is considerable evidence that these people once inhabited most of southern Africa, and possibly parts of east Africa. However today, out of a total population of possibly 60,000 probably less than 5,000 still pursue a wholly hunting and gathering existence, mostly in the desert and steppe areas of Botswana.

ii) The Pygmies of the central African rainforest. Nearly all of these are in close dependent relationships with neighbouring tribes who practise sedentary agriculture.

iii) Small groups of East African hunters and gatherers such as the Hadza.[2]

As an important preliminary to the account of Hadza demography, several limitations that inevitably accompany any such attempt at historical perspective will be briefly reviewed. To begin with, the very rarity of contemporary African hunter-gatherer populations, and still more, the almost complete absence of good data on which to base analysis, are major obstacles to a historical assessment of the demographic characteristics of hunter-gatherers. The problem is compounded when one considers that the present small sample of hunter-gatherers generally inhabit more isolated and inhospitable regions than was previously the case: they have frequently been 'pushed back' into less favourable areas by other, more aggressive societies. For example, it is certain that the majority of pre-contact Bushmen lived in more favourable environments than those that still hunt and gather in the Kalahari desert today.[3]

populated exclusively by other hunter-gatherers, but in the past this must frequently have been the case. Lastly, one must note that there can be few if any remaining communities that have not, to some extent, been affected by the widespread social and technical changes of the outside world. Indeed the very fact that we have demographic or other information about a society implies contact with other cultures - with the attendant possibility that this contact itself may have influenced the phenomenon under study. For all these reasons there is need to be cautious in attributing historical representativeness to any of the surviving sample of African hunter-gatherer societies.

At the same time, contemporary groups probably remain our best link with past hunting and gathering societies. This is especially so if, as is the case with the Hadza, they live in a rich environment (as opposed to the relatively marginal areas inhabited by the Bushmen), while at the same time remaining comparatively isolated from surrounding peoples, unlike, for example, some pygmy groups which, as we have noted, usually live in close association with neighbouring agriculturists.[4]

The Hadza

The demographic information on which the present analysis is based was mostly collected in 1966-67 as part of the Hadza Biomedical Survey. The social organization and ecology of the Hadza have been analysed in the writings of the anthropologist James Woodburn,[5] and some of the principal findings of the Biomedical Survey have been described in a series of articles.[6] It is appropriate to summarize some of these and other writings insofar as they have relevance, both for questions regarding the demography of the Hadza, and also for questions as to how representative it is of the past demography of both this and other hunter-gatherer groups.

The Hadza are a group of about 800 hunters and gatherers living in the Lake Eyasi region of North central Tanzania. The history and origins of the group are obscure: there are rock paintings in the area which almost certainly pre-date Hadza occupation. Their 'click language' is very different from that of neighbouring tribes, and its relationship to that of other click speakers, such as the Bushmen, is uncertain. It has been suggested that the Hadza constitute a link with a way of life existing in East Africa prior to the Bantu invasions.[7] They live in difficult terrain well off the main historical slave and trading routes, and this, along with their nomadic

existence and distinct language, probably accounts both for their relative isolation, and their survival as a viable hunter-gatherer society. The Hadza have certainly occupied their territory for about a century at a minimum; they were one of the last East African groups to be contacted by Europeans when first encountered by the Germans in the 1890s. Over the last two decades the tribe have experienced a certain amount of territorial encroachment, some of it consequent on the tsetse clearance schemes in the area in the late 1950s. However, despite these disturbances, in the early 1960s, the Hadza could hunt and gather over most of their traditional range. Moreover they remained largely independent of neighbouring tribes. Men of other tribes would rarely visit Hadza territory, and Hadza men would only visit neighbouring groups for such purposes as bartering or begging.

In their traditional (pre-1965) lifestyle, the Hadza occupied a territory of approximately 1,000 square miles. Their population density in the early 1960s of just under one per square mile, is comparatively high by hunter-gatherer standards. For most of the time, the people live in bands containing on average about 18 adults. These bands move camp (usually by only a few miles) every few weeks. There is frequent interchange of people between bands. Group movements are rarely prompted by food shortage, but often reflect a desire to avoid social conflict. Additionally, the Hadza believe that to live for a long time in one spot can be hazardous to health. Camps frequently move subsequent to an outbreak of illness, and the seriously ill may be left behind.[8]

In the bush, the Hadza live in huts made of grass and wood. They keep no domestic animals except for a few chickens and dogs, but live entirely from hunting and gathering. They live in an area where game is very plentiful.[9] But when hunting is unsuccessful there are always good supplies of fruit and vegetables. In sum it can be said that there is never any food shortage or drought.

Almost every observer has remarked with surprise on the Hadza's favourable health and nutritional status relative to that of neighbouring settled tribes.[10] For example, in 1960 Jelliffe et al. conducted a survey of 62 nomadic Hadza children, and concluded that "the nutritional status of Hadza children was good by tropical standards...in particular the syndromes of kwashiorkor and nutritional marasmus were not seen".[11] They also noted the comparatively low degree of malarial infection as compared with many other tropical African communities, and commented on the "excellent infant feeding pattern".[12]

The ethnographic accounts suggest that while most girls marry young, usually after the first menstruation, a few may marry before they menstruate. Almost all women, except for a few who are physically or mentally handicapped, will be married by their early twenties. Men usually marry at a slightly older age than women. Hadza tend to settle down and live for several years with a single spouse, and after death or separation the remaining spouse will soon remarry.

As has been mentioned, the Biomedical Survey from which our data are drawn was conducted in 1966-67. At that time a majority of the Hadza had been settled, although they had been persuaded to do so only very recently.[13] As a result, several important changes in their lifestyle had recently come about, and these might well affect the tribe's levels of fertility and mortality subsequent to their settlement.[14] Even before they were settled it would be wrong to assume that the Hadza were entirely free from all external factors that might be expected to affect their demography; a few Hadza had found their way to dispensaries and hospitals, a few had been vaccinated, there were tsetse clearance camps in their general vicinity, and of course, the tribe was occasionally visited by travellers, administrators and ethnographers. But with these qualifications, there is much support for the view that, over the time period to which the demographic analysis presented below pertains,[15] the isolated hunting and gathering way of life of the majority of the people had been subjected to minimal disturbance only.

Survey and Analysis

In all we have age and sex data for 473 Hadza (see Table 1). In 1966-67 about 130 of these were nomadic hunter-gatherers living in several locations in the bush. The remainder were people enumerated in the various government settlement camps - but many of these would, from time to time, revert to their traditional nomadic way of life. It is worth emphasising that the sample of locations that contained these 473 Hadza were whole communities: that is there is no reason to suppose that the age/sex structure given in Table 1 is unrepresentative of that of the tribe as a whole. Moreover, owing to the general geographic and social isolation of the Hadza from neighbouring peoples, one can be confident that the age distribution is substantially unaffected by migration. Thus, for purposes of analysis, the population can be considered closed.

Hadza do not specify their ages on a calendar basis, and the dates of birth of only a very few children were known. Therefore, most ages were

estimated independently by two observers, and where possible, were roughly checked against such things as dental eruption and puberty. Use was also made of older-younger age rankings. Where necessary, a compromise age estimate was assumed. Although the attribution of individual ages is undoubtedly inaccurate, the broad age-categories used in the analysis are probably satisfactory.

The point of departure for the present analysis stems from 75 child-bearing histories collected from three-quarters of the women aged 20-49. The histories were collected in the Hadza language by the survey's anthropologist, with the help of a Hadza assistant. The women were asked for the number of live births they had ever borne, and the number that were still alive. In addition, mothers were asked for the approximate age at death of any dead offspring. A total of 301 live births was reported as ever borne to women aged 20-49. Of these, 64 were thought to have died in the first year of life (e.g. 'died as small babies', or 'died not yet able to crawl'). But at the time of interview about 20 children were estimated to be both alive and under age one, and making some rough allowance for this, we get an estimate of the risk of dying in infancy of approximately 64/294 or 21.8%.[16] A search was then conducted for a life table that satisfactorily encompassed both this level of infant mortality, and the proportions of children reported as dead by age of mother.[17] A Coale-Demeny North model life table, level 6, was judged appropriate. As Table 2 shows, there is general agreement between the level of mortality implied by such a life table, and the relevant information (both sexes combined) reported by the Hadza. The number of deaths observed are, of course, extremely small, and the fluctuations in the proportions dead by age group cannot be regarded as of any significance.

A North model life table, level 6, implies an overall life expectation at birth of just over thirty years (31.0). But to attribute such a life expectancy to the Hadza population necessarily involves an extrapolation from childhood mortality to mortality in adulthood. This is a somewhat precarious assumption - required in the stable population analysis presented below. However, it is the only option open for we have no direct data on adult Hadza mortality. At least the stable population model fit, presented below, is good at later ages. This supports the assumption that adult mortality is related to child mortality in an average way. The fact that there is little difference between the numbers of males and females in the population (see Table 1) gives a rough measure of support to the idea that the overall level of mortality is about the same for both sexes.

Given that the Hadza population can effectively be assumed closed, and that we have no reason to suppose that the underlying levels of fertility and mortality have changed (at least until recently, if at all), stable population analysis constitutes a further possible line of enquiry. Assuming that a North life table, level 6, represents a satisfactory approximation of mortality at ages beyond childhood, Table 3 compares the best fitting stable population with the observed cumulative age distribution. Given the small size of the population, the agreement is reasonably satisfactory. From the stable model rates of birth, death and natural increase can be calculated. The estimate of the birth rate depends heavily on the level of child mortality (for which there is acceptable data), but the division between the death rate and the rate of natural increase is affected by the level of adult mortality. We have seen that the level of the latter is speculative (there is no direct information), therefore the death and growth rates are also speculative:

Estimates of Vital Rates per Thousand

Birth	Death	Natural Increase
46.7	32.8	13.9

Of course, these figures must be taken to represent the vital rates characterising the Hadza population over the long run. For in such a small population both birth and death rates are certain to fluctuate wildly from year to year purely by chance.[18]

From the stable population model we can also estimate total fertility given some indication of the mean age of the specific fertility distribution. An examination of the total children born per woman by age shows an average fertility location with a mean of about 29 years. Referring back to the model population, the corresponding level of total fertility is 6.15 live births, and the gross reproduction rate 3.0. This level of total fertility can be cross-checked with the independent direct evidence of the reported mean parities by age of Hadza women. On the assumption that fertility has remained reasonably constant,[19] we can calculate the implied mean number of children born per woman by age, and make comparisons with the observations. As Table 2 shows, the agreement between estimated and observed parities is good.

Of course, these results are subject to the usual reservations about precision when undertaking such an analysis. This said, the present application of demographic model distributions gives a very consistent and satisfactory picture of Hadza demography, especially given the small numbers involved. In sum we can say that the level of total fertility seems to be around six

live births per woman, and that the reported levels of infant and child mortality correspond to those in a North life table with a life expectation of just over 30 years. With these levels of fertility and mortality the population would be growing quite fast (possibly at around 1.4% per annum) although given a lack of acceptable data on adult mortality, it is hard to be more definite.

Other Studies of African Hunter-Gatherers

With one exception, there are no comparable demographic data or analysis for other African hunter-gatherer populations. Two studies of small bushmen bands give crude age/sex distributions.[20] Without additional information, little can be derived from these studies, short of the fact that both depict quite young populations, which therefore probably have at least moderate levels of fertility. Additionally, the 1965 Bechuanaland Bushmen Survey Report makes several statements about the demography of Bushmen hunter-gatherers. The author of the report, G.B. Silberbauer, writes that: "the average number of children born alive to a woman is three". Again, he estimates the infant mortality rate at the time of the survey to be 10%.[21] Without additional information it is hard to assess Silberbauer's comments. But it can be noted that the rough age distribution presented in the Report (with 41% of the population aged 15 and under) is, over the long run, incompatible with a total fertility rate of only three.

The most thorough demographic study of an African hunter-gatherer population is that carried out by Nancy Howell on the Dobe area !Kung Bushmen of Botswana.[22] The total population of this group is about 600, and both in terms of their general degree of isolation from the outside world, and in their almost total reliance on a hunter-gatherer lifestyle, they are comparable to the Hadza.[23] The data base for Howell's analysis also consists of an age/sex distribution and reproductive histories. However, in addition she had information on parent-survivorship, and, in effect, a virtual !Kung population register maintained over the period 1963-69.

The analysis of retrospective data on child survivorship collected from 165 !Kung women, indicated a level of child mortality comparable to that of a model life table with a life expectation of 32 years. The data on parent-survivorship were also consistent with this life table. Turning to the retrospective fertility data, the responses of women at all ages consistently implied fertility levels which must be considered low for a population practising natural fertility. For example, the mean parity of women aged 45-49 was 4.7 live births, while that of women aged 50 years and

over was only 5.2. A total fertility rate of about five live births, combined with a life expectation at birth of 32.5 years, produces a population with a growth rate of under 0.5 per cent per year.

Discussion

The findings from the study of the !Kung have been cited by many scholars interested in the demography of historic and pre-historic hunter-gatherer populations.[24] And it is against this backcloth that this analysis of Hadza demography must be interpreted. The !Kung study has been used to support the argument that prior to the transition from hunting and gathering to agriculturally-based economies, human populations were generally characterized by relatively low levels of fertility and mortality.[25] Again, it has been frequently supposed that the mortality of hunting and gathering groups was heavier than that of more complex settled agricultural societies; and even though the !Kung inhabit a marginal desert area, Howell's analysis suggested that this was not necessarily so. The comparatively low !Kung fertility levels, with birth intervals of rarely less than three years, have been cited to support arguments that hunter-gatherer populations practised conscious birth spacing and infanticide.[26] In fact Howell gives no evidence to support arguments that such mechanisms are responsible for the relatively low levels of !Kung fertility, (it is worth noting that in general, infanticide is not well documented for African hunter-gatherer societies). While prolonged lactation may play some part, Howell thinks that it has not been known to produce birth intervals of the order of three years.[27] One possible explanation, entertained by both Coale and Howell, is that !Kung diet and activity rates, consequent on inhabiting a marginal desert area, lead to a body composition low enough in fat to cause irregular ovulation.[28] It is admitted that this explanation must be regarded as speculative given that any 'critical fatness' level for the !Kung is unknown. Lastly, the relatively low levels of !Kung fertility, and the population's 'slow' growth rate, are sometimes cited in the context of the near zero rate of growth in world population prior to the agricultural revolution; it is tacitly assumed that the !Kung data support a model of hunter-gatherer populations constantly on the verge of extinction.

In one important respect this analysis of Hadza data produces a finding similar to that for the !Kung: the levels of infant and child mortality in both studies are comparable. They are both consistent with mortality levels in model life tables with life expectations of just over 30 years.

It is also worth noting that studies of the health of Bushmen paint a picture quite similar to that of the Hadza.[29]

However, the levels of fertility indicated for the Hadza are above those of the !Kung. The Hadza completed fertility of about six live births per woman, is in no way unusual, and similar levels characterize many settled agricultural populations. In the Hadza case there seems to be no special case to entertain the critical fatness hypothesis. This might be because unlike the !Kung - but probably in common with many historical hunter-gatherer groups - the Hadza live in a rich environment.

The resulting approximate rate of growth of the Hadza population (1.4% per annum) is also well above that indicated for the !Kung (0.5%). It is difficult to confirm directly that the Hadza population is growing, but the few statements that have been made about total population size, do seem to imply that the population is increasing.[30] If such a rate of growth (or that of the !Kung) had characterized the Hadza for long stretches of history, the population would certainly be much larger than it is today. But the demographic rates of the present analysis represent long-term averages; they give no clue to distant events, such as epidemics or natural disasters, that may have cut back the population from time to time in the past. Thus while it may be true that prior to the advent of agriculture, hunting and gathering societies on average grew only slowly, it may be misleading to ascribe such averages to all such groups all of the time. Some hunter-gatherer groups may at times have grown quite rapidly; expansion to new lands may have been a possibility.[31] Other groups may have suffered severe depletion or extinction: there are reports of whole Bushmen bands being wiped out in epidemics.[32]

In conclusion, the tentative nature of any results and comparisons based on studies of such small hunter-gatherer groups must again be stressed. This analysis of Hadza demography underlines the degree of caution that is required in attempting to 'reconstruct' the past on the basis of contemporary evidence. In particular it shows that there may be no single valid model of the past demography of African hunter-gatherers. The situation may have been much more variable than is frequently supposed.

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Biomedical Survey. The demographic analysis is based on Professor W. Brass's 'Notes on Hadza Population Data'.

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During the discussion Roy Willis mentioned that he had heard from James Woodburn at the Association of Social Anthropologists' recent conference in Swansea, that a team of Japanese demographers had completed a survey of the Mbuti Pygmies of Zaire - a survey that should make them the best documented of all hunter-gatherer groups in Africa from a demographic perspective.

Table 1.

The Hodza Age/Sex Distribution

Age Group	Males	%	♂+♀ cumulative	Females	%	
0 - 4	27		15·8%	48		75
5 - 9	52	43.2	33%	30	40.9	82
10 - 14	26		42%	16		42
15 - 19	13		47·6%	13		26
20 - 24	10		51·8%	17		27
25 - 29	19	41.6		18	43.9	37
30 - 34	21			18		
35 - 39	18			28		
40 - 44	20			7		
45 - 49	22			12		
50 - 54	7	15.2		7	15.2	
55 - 59	3			6		
60+	5			10		
Total	243	100		230	100	

473
- 130
343

235/473 = 49.7%

Table 2

Comparison of Observed Fertility and Mortality with that Implied by Model Distributions

Age	Observed Data					Model*	
	No. of Women	No. of Births	No. now Dead	Mean Parity per Woman	Proportions Dead	Mean Parity per Woman	Proportions Dead
Infant Mortality	-	-	-	-	21.8	-	22.2
20 - 29	31	66	25	2.13	37.9	2.20	34.1
30 - 39	32	164	61	5.13	37.2	5.51	42.6
40 - 49	12	71	29	5.92	40.8	6.15	46.1

* The mean parity values are derived from the stable population fit, and the 'proportions dead' are those implied by a Coale-Demeny North model life table, level 6.

Table 3

Comparison of Cumulative Age Distributions,

Model and Observed Populations

Age x	Percentages Under Age x: Model Stable Population	Observed
5	16.3	15.9
10	29.0	33.2
15	40.2	42.1
25	59.0	53.3
35	73.5	69.3
45	84.3	84.8
55	92.0	94.9

1. In terms of contemporary boundaries, the range of hunter-gatherers in 1500 AD included large areas of contemporary Angola, Botswana, Namibia and South Africa as well as parts of Gabon, The Cameroon, Zaire, Kenya, Malawi, Tanzania and the Central African Republic. See R.B. Lee and J. De Vore, Man The Hunter (Aldine Publishing Company, Chicago, 1968), pp.3-20.

2. For a more detailed catalogue of present-day African hunter-gatherers, see G.P. Murdock, 'The Current Status of the World's Hunting and Gathering Peoples', in Lee and De Vore cited in Footnote 1, pp.15-16.

3. See for example, P.V. Tobias, 'Bushman Hunter-Gatherers: A Study in Human Ecology', in D.H.S. Davis (ed.), Ecological Studies in Southern Africa (Dr W. Junk Publishers, The Hague, 1964), pp.71-75.

4. A similar point regarding the Hadza has been made by Hiemaux who is quoted as saying that the Hadza "probably lived a life more akin to that of prehistoric peoples than did the Bushmen, whose culture must have deteriorated after they had been driven into an unnaturally inhospitable habitat". See F.C. Howell and F. Bourliere, African Ecology and Human Evolution (Methuen, London, 1964), p.636.

5. See J.C. Woodburn (1968a), 'An Introduction to Hadza Ecology' and (1968b), 'Stability and Flexibility in Hadza Residential Groupings'. Both articles are in Lee and De Vore cited in Footnote 1. See also 'Ecology, nomadic movement and the composition of the local group among hunters and gatherers and its implications'. In Man, Settlement and Urbanism, P.J. Ucko, R. Tringham and G. Dimbleby (eds.) (Duckworth, London, 1972).

6. Those of particular relevance here are: F.J. Bennett, I.G. Kagan, N.A. Barnicott and J.C. Woodburn, 'Helminth and Protozoal Parasites of the Hadza of Tanzania'. In Transactions of the Royal Society of Tropical Medicine and Hygiene, Volume 64, No.6, 1970, pp.857-860; F.J. Bennett, N.A. Barnicott, J.C. Woodburn, M.S. Pereira, B.E. Henderson. 'Studies on Viral, Bacterial, Rickettsial and Treponemal Diseases in the Hadza of Tanzania and a Note on Injuries' in Human Biology, Volume 2, No.1, 1975, pp.61-68.

7. See B. Cooper, 'The Kindiga', in Tanganyika Notes and Records, Volume 27, 1949, p.9. 'Kindiga' is another name for the Hadza.

8. For a detailed case of abandonment among the Hadza, see J.C. Woodburn, 'Discussions', in Lee and De Vore, cited in Footnote 1, p.91.

9. The Hadza live in an area where "the amount of meat that could be regularly harvested...is probably as great or greater than anywhere else in the world where hunter-gatherers live or have lived in the past", quoted from Woodburn, 1968a, cited in Footnote 5, p.50.

10. See, for example, B. Cooper cited in Footnote 7, p.13; J.C. Woodburn, 1968a, cited in Footnote 5, p.54.

11. See D.B. Jelliffe, J.C. Woodburn, F.J. Bennett and E.F.P. Jelliffe, 'The Children of the Hadza Hunters', Journal of Paediatrics, Volume 60, pp.907-913.

occurs or the child dies. In the second six months of life, children are introduced to animal protein (e.g. bone marrow, pre-chewed meat), and after 18 months the whole range of adult foods will also be eaten.

13. For details of Hadza settlements see F.J. Bennett et al., 1975, cited in Footnote 6.

14. The changes included (i) a significant increase in Hadza interaction with other tribes, probably resulting in the spreading of gonorrhoea and some other diseases, (ii) an increase in medical treatment, (in their previous nomadic way of life some Hadza, particularly those seriously ill, had visited dispensaries and occasionally hospitals, but overall the tribe had received negligible medical treatment), and (iii) a change in diet towards much greater reliance on crops, particularly maize, rice and sorghum.

15. The analysis makes use of responses to retrospective questions, and the Hadza age/sex distribution, and both these sets of data are mainly dependent on the years prior to settlement.

16. To take account of those births alive and under age one, a third (i.e. 7) was subtracted from the total number of live births ever borne.

17. A.J. Coale and P. Demeny, Regional Model Life Tables and Stable Populations (Princeton, N.J., Princeton University Press, 1966):- Model life tables are specifications of the mortality experience of hypothetical populations. They are usually based on some averaging of empirical observations, and are especially useful as analytical tools when mortality data is in some respects incomplete.

18. For a well documented case of extreme annual fluctuations in the death rate, see H. Oluf Hansen, 'Some Age Structural Consequences of Mortality Variations in Pre-Transitional Iceland and Sweden', Universitetets Statistiske Institut, Research Report No.32 (Copenhagen, 1976).

19. As we have noted, this assumption is necessary for the stable population application.

20. See R.A. Dart, 'Measurements of the ?/Auni Khomani Bushmen' in D.F. Bleek et al., Bushmen of the Southern Kalahari (Witwatersrand Press, Johannesburg, 1937), pp.188-190; also L. Marshall, The !Kung of Nyae Nyae (Harvard University Press, Cambridge, 1976), p.162. Marshall writes (p.165) that no demographic study of the Nyae !Kung has been made, but she believes that in this respect they are very similar to the Dobe !Kung studied by Nancy Howell and examined below.

21. G.B. Silberbauer, Report to the Government of Bechuanaland on the Bushmen Survey (Bechuanaland Government, Gaberones, 1965), pp.12-17.

22. N. Howell, 'The Population of the Dobe Area !Kung' in R.B. Lee and J. De Vore (eds.), Kalahari Hunter-Gatherers. Studies of the !Kung San and Their Neighbours (Harvard University Press, Cambridge, 1976), pp.138-151.

23. The population for which Howell has age and formation numbers about 690 persons.

24. See for example, A.J. Coale, 'The History of the Human Population' in Scientific American, September 1974, pp.41-51; D.E. Dumond, 'The Limitation of Human Population: A Natural History', in Science, 1975, pp.713-721.

25. See N. Howell, cited in Footnote 22, p.138; A.J. Coale, cited in Footnote 24, p.48. Recent research findings seem to indicate that under certain conditions prolonged breast feeding may be associated with such birth intervals.

26. See for example, D.E. Dumond cited in Footnote 24.

27. N. Howell, 'Towards a Uniformitarian Theory of Human Paleodemography', in Journal of Human Evolution, 1976, pp.25-40.

28. See A.J. Coale, cited in Footnote 24, p.48, and N. Howell, cited in Footnote 27, pp.30-33.

29. This similarity is noted in Jelliffe et al. cited in Footnote 11.

30. See G.W.B. Huntingford, The Southern Nilo-Hamites (International African Institute, London, 1953), p.132; J.C. Woodburn, 'The Future of the Tindiga', in Tanganyika Notes and Records, 1962, pp.286-273; F.J. Bennett et al., 1975, cited in Footnote 6.

31. That hunter-gatherer groups have sometimes expanded fast is evidenced by the peopling of Australia, see F.A. Hassan, 'On Mechanisms of Population Growth during the Neolithic', Current Anthropology, Volume 14, 1973, p.535.

32. See G.B. Silberbauer, cited in Footnote 21.