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ESTIMATION OF CHILD MORTALITY AND FERTILITY:
The 1991 Namibia Census of Population & Housing

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by

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Preface

This report gives estimates of total fertility and child mortality based on the 1991 Namibia Census of Population. The estimated life expectancies have been obtained by interpolation in the West model life tables. The present report is basically intended as technical documentation of the methods used in obtaining the above mentioned estimates.

1. METHODOLOGY FOR ESTIMATING TOTAL FERTILITY

1.1 Assumptions

In Namibia, birth statistics are too incomplete for realistic estimation of fertility. For this reason, reproductive questions for indirect estimation of fertility were asked of women in the 1991 Namibia Census of Population and Housing. These questions concerned how many children each woman had given birth to at the time of the census (children ever born) and, if she had given birth to a child during the twelve months preceding the census.

Procedures for estimating fertility from such data are based on the assumptions that while the number of children born during the twelve months before the census are age-uniformly underreported, the parities (children ever born) reported by young women are reasonably accurate. In consequence, the observed parities obtained from the number of children ever born are used to upgrade the births during the twelve months before the census to give estimates of fertility rates from which total fertility can be inferred.

1.2 Estimation Procedure

Denoting the age-specific fertility rate for women aged x by f_x, and assuming that the age distribution of women is uniform for ages $15 \leq x \leq 30$, the mean parities for women aged 15-19, 20-24 and 25-29, respectively, are

$$P_1 = 4.5f_{15} + 3.5f_{16} + 2.5f_{17} + 1.5f_{18} + 0.5f_{19}, \quad (1.1)$$

$$P_2 = \sum_{15}^{19} f_x + 4.5f_{20} + 3.5f_{21} + 2.5f_{22} + 1.5f_{23} + 0.5f_{24},$$

and

$$P_3 = \sum_{15}^{24} f_x + 4.5f_{25} + 3.5f_{26} + 2.5f_{27} + 1.5f_{28} + 0.5f_{29}$$

If the age distribution of women is uniform over the age range 15 to 29 years, and if births during the twelve months before the census are completely recorded, then the mean parities reported in the census (average number of children ever born) should be equal to those calculated from the births that took place during the twelve months before the census using (1.1). If, on the other hand, there is age uniform underreporting of births, then the parities calculated from (1.1) should be proportional to the ones obtained from children ever born. Therefore, denoting the mean parities recorded from the number of children ever born by $\hat{P}_1, \hat{P}_2$ and $\hat{P}_3$, it may be assumed that these are proportional to P_1, P_2 and P_3 so that, for i = 1, 2 and 3

$$\hat{P}_i = \kappa P_i \quad (1.2)$$

thus reflecting that births during the twelve months before the census are underreported by a factor of $\rho = \frac{1}{\kappa}$.

As will appear shortly, it is too optimistic to hope for proportionality on the age range $15 \leq x \leq 30$. In reality, the κ that corresponds to ages 15-19 is not the same as that which corresponds to ages 20-24. Likewise, the κ that corresponds to ages 20-24 is not the same as that which applies to ages 25-29. Hence, it would be more realistic to write $\hat{P}_i = \kappa_i P_i$, i = 1, 2 and 3. However, since a compromise has to be stricken with respect to choosing an upgrading factor κ valid for a broad range of ages, ages, 20-29 say, the proportionality requirement is given in terms of (1.2).

Because $\hat{P}_1$ is highly sensitive to the often small number of births involved, it is not ideal for use in the estimation procedure. For this reason the estimation will mainly be based on the mean parities $\hat{P}_2$ and $\hat{P}_3$.

Although, technically speaking, it is possible to estimate single-year age-specific fertility rates from the births that took place during the twelve months before the census, these are often tabulated by five-year age groups of women. In what follows it will be assumed that this is the case. Denoting these raw rates by ${}_5\hat{g}_{15},\ldots,{}_5\hat{g}_{45}$, single-year rates can be obtained by means of several different kinds of graduation. In passing, it will be noted that ${}_5\hat{g}_{15}$ rather than corresponding to women aged 17.5 actually corresponds to women aged 17 since women, on the average, were half a year younger when they gave birth to the reported children. The same applies to the remaining raw rates.

Often

$$f_x = R\frac{c^k(x-14)^{k-1}e^{-c(x-14)}}{\Gamma(k)}, \; x \geq 14 \quad (1.3)$$

with parameters R, c, k where

$$\Gamma(k) = \sqrt{2\pi}\, k^{k-0.5}\, e^{(-k+1/(12\,k))}$$

is a convenient graduating formula. (1.3) which is recognized as a scaled Gamma probability density function often gives a close portrayal of empirical fertility curves (historically it is one of the most commonly used parametric fertility models). Parameter R in (1.3) measures the level of fertility; it serves the role of a total fertility rate. Parameters c and k in (1.3) are shape parameters. Another convenient graduating formula is the third degree polynomial

$$b_x = C(x-a)(b-x)^2, \; b \geq x \geq a \quad (1.4)$$

often referred to as the Brass fertility polynomial (see e.g., Retherford, 1979). Both (1.3) and (1.4) are used in this report. In (1.4), C determines the level of fertility (C is proportional to the total fertility rate). The reproductive age span is b - a.

The estimation procedure involves that the raw rates ${}_5\hat{g}_{15},\ldots,{}_5\hat{g}_{45}$ are graduated by means of (1.3) and (1.4). Which of the two formulas is preferable is essentially a matter of judging which one gives the best approximation to the ratios of observed mean parities $\hat{P}_1 / \hat{P}_2$ and $\hat{P}_2 / \hat{P}_3$. Each of the graduations gives single-year age-specific fertility rates $\hat{f}_x$. It should be mentioned, of course, that the graduated rates $\hat{f}_x$ could come from any suitably chosen parametric fertility model. Here however only (1.3) and (1.4) will be considered. In the applications given in this report, the fitting has been accomplished using the non-linear module in JMP (SAS for Macintosh), and by taking the above mentioned half year displacement into account.

The total fertility rate, mean age and variance calculated from the graduated rates $\hat{f}_x$ have been calculated using the rates $\hat{f}_{15.5}, \ldots, \hat{f}_{49.5}$ (from a practical point of view this was done using Excel). Using (1.1), the mean parities P_1, P_2 and P_3 corresponding to the schedule $\{\hat{f}_x\}$ are calculated. The upgrading factor κ is then estimated according to (1.2) as

$$\hat{\kappa} = \hat{P}_i / P_i \quad (1.5)$$

whereby the estimated fertility schedule becomes

$$\hat{h}_x = \hat{\kappa}\, \hat{f}_x \quad (1.6)$$

The current total fertility rate and other gross reproductive measures can be obtained from the schedule $\{\hat{h}_x\}$. The technique is illustrated below.

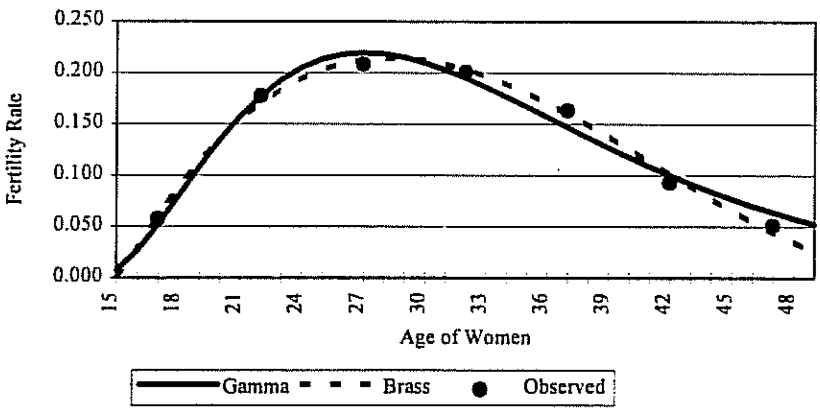
1.3 Illustration of Fertility Estimation Technique

Table 1.1 provides an example of the data used in this report for estimation of fertility at the national as well as regional levels. The table shows that for Namibia the mean parities (average number of children ever born) increase from $\hat{P}_1 = 0.161$ (women aged 15-19) to $\hat{P}_7 = 6.041$ (women aged 45-49). This suggests that if past changes in fertility have been slight, then the current total fertility rate for Namibia must be about 6 children. Looking to the age-specific fertility rates derived from the births during the twelve months before the census, the total fertility rate comes out at 4.8. This suggests that about 4.8/6.0 = 80 percent of the births were reported; amounting to underreporting being about 20 percent.

Table 1.1. Children Ever Born and Births During the Twelve Months Before the Census: 1991 Namibia Census of Population and Housing.

Age (1)	Women (2)	Children Ever Born (3)	Births 12 Months Before the Census (4)	Mean Parity (5) = (3)/(2) $\hat{P}_i$	Fertility Rate (6) = (4)/(2) ${}_5\hat{g}_x$
15-19	84,169	13,521	4,841	0.161	0.0575
20-24	67,264	69,043	11,956	1.026	0.1777
25-29	57,826	123,795	12,062	2.141	0.2086
30-34	45,625	160,341	9,175	3.514	0.2011
35-39	34,488	158,561	5,641	4.598	0.1636
40-44	28,058	155,458	2,615	5.541	0.0932
45-49	22,302	134,725	1,137	6.041	0.0510
TFR					4.8

Fig. 1.1. Gamma and Brass Graduations of Observed Raw Fertility Rates



Fitting (1.3) to the raw rates $_5\hat{g}_x$ in table 1.1 gives $\hat{R}$ = 5.213, $\hat{c}$ = 0.0156, $\hat{k}$ = 5.213 and $\Gamma(\hat{k})$ = 2.1256. Fitting (1.4) gives $\hat{C}$ = 0.00002348, $\hat{a}$ = 15.19 and $\hat{b}$ = 54.7. As already noted, the fitting has been performed using nonlinear minimization of

$$\sum_{17}^{47}({}_5\hat{g}_x - f_x)^2$$

with respect to the relevant parameters, that is, R, c, k or C, a and b. The observed and fitted values are shown in fig. 1.1.

Based on visual inspection of fig. 1.1 there is not much difference between a Gamma and Brass graduation of the observed fertility rates. There are situations however where the Brass fertility polynomial (1.4) is decidedly better than the Gamma model (1.3). This often happens when (i) the level of fertility is high, (ii) the mean age of the fertility schedule is high, and (iii) the variance is large.

The graduated rates $\hat{f}_x$ provide estimates of P_1, P_2 and P_3. The graduated rates corresponding to (1.3) and (1.4) are shown in table 1.2. It will be seen that the total fertility rates corresponding to (1.3) and (1.4) are 4.8 and 4.7, respectively. The corresponding mean values of the graduated schedules are 31.1 and 30.9, respectively. The corresponding (very high) variances are 65.6 and 60.3, respectively (table 1.2). This suggests that for Namibia, the mean age at childbearing is high (around 31 years), and that fertility remains relatively high after age 30. As we shall see, this feature is shared by the regional fertility schedules as well.

The mean parities corresponding to (1.3) and (1.4) as well as the observed parities are also given in table 1.2.

These parities are the mechanisms for the estimation procedure. For the Gamma graduation (1.3) using (1.1), P_1= 0.1141. The observed parity is $\hat{P}_1$= 0.1606 (table 1.2). In consequence, it may be concluded that fertility according to children ever born is $\hat{\kappa}_1$= $\hat{P}_1 / P_1$= 0.1606/0.1141 = 1.41 times higher than suggested by the fertility rates estimated on the basis of children born during the twelve months before the census. Similarly, for ages 20-24, we get $\hat{\kappa}_2$= 1.35, whereas for ages 25-29 we get $\hat{\kappa}_3$= 1.20.

Because P_1 is highly sensitive to variations in fertility, it is, as already noted, not sufficiently stable for inclusion in a method of regularity estimation. For this reason mainly P_2 and P_3 will be used in the present study.

It is important to note that rarely, if ever, are estimates $\hat{\kappa}_1$, $\hat{\kappa}_2$ and $\hat{\kappa}_3$ obtained so that $\hat{\kappa}_1 \approx \hat{\kappa}_2 \approx \hat{\kappa}_3$. Usually, $\hat{\kappa}_1$ is much different from $\hat{\kappa}_2$ and $\hat{\kappa}_3$. But even $\hat{\kappa}_2$ and $\hat{\kappa}_3$ may differ somewhat. A reasonable compromise is to accept the mean value of $\hat{\kappa}_2$ and $\hat{\kappa}_3$ as an upgrading factor.

The adjustment factor for upgrading the fertility rates derived from births during the twelve months before the census been set at $\hat{\kappa} = (\hat{\kappa}_2 + \hat{\kappa}_3)/2$ (see table 1.2).

For the Gamma graduation we get $\hat{\kappa} = (\hat{\kappa}_2 + \hat{\kappa}_3)/2 = 1.27$. For the Brass fertility polynomial we get, in this particular case the same, namely $\hat{\kappa} = 1.27$.

As noted earlier, in choosing which of the two graduations (1.3) or (1.4) should be used, the criterion is the one which reproduces the ratios of observed mean parities $\hat{P}_1 / \hat{P}_2$ and $\hat{P}_2 / \hat{P}_2$ the best (with particular emphasis on $\hat{P}_2 / \hat{P}_2$).

It will be appreciated, of course, that this kind of regularity estimation, that is, using one set of data to correct another, only is an approximate procedure; it cannot claim to be a precise procedure.

Table 1.2 Gamma and Brass Graduations of Fertility Rates Derived From Births 12 Months Before the Census, Estimation of Mean Parities and of Total Fertility Rate

Age	Gamma	Brass	Age	Gamma	Brass
15.5	0.015638	0.011186	33.5	0.181699	0.193246
16.5	0.038344	0.044890	34.5	0.172022	0.185027
17.5	0.065589	0.075067	35.5	0.162061	0.175818
18.5	0.094101	0.101858	36.5	0.151996	0.165759
19.5	0.121602	0.125404	37.5	0.141975	0.154991
20.5	0.146601	0.145847	38.5	0.132119	0.143655
21.5	0.168211	0.163326	39.5	0.122525	0.131893
22.5	0.185988	0.177983	40.5	0.113267	0.119845
23.5	0.199809	0.189959	41.5	0.104401	0.107651
24.5	0.209775	0.199395	42.5	0.095966	0.095453
25.5	0.216133	0.206431	43.5	0.087989	0.083392
26.5	0.219220	0.211208	44.5	0.080483	0.071609
27.5	0.219423	0.213868	45.5	0.073455	0.060244
28.5	0.217144	0.214551	46.5	0.066900	0.049438
29.5	0.212785	0.213398	47.5	0.060812	0.039333
30.5	0.206724	0.210550	48.5	0.055176	0.030068
31.5	0.199316	0.206148	49.5	0.049975	0.021786
32.5	0.190879	0.200333			
TFR	4.8	4.7			
Mean	31.1	30.9			
Variance	65.6	60.3			

Estimated from graduations

	Gamma	Brass	Observed
P_1	0.1141	0.1221	0.1606
P_2	0.7589	0.7699	1.0264
P_3	1.7898	1.7612	2.1408
P_1 / P_2	0.1504	0.1586	0.1565
P_2 / P_3	0.4240	0.4372	0.4795

Adjustment	Gamma		Brass
$\hat{\kappa}_1$	= 0.1606/0.1141	= 1.41	0.1606/0.1221 = 1.32
$\hat{\kappa}_2$	= 1.0264/0.7589	= 1.35	1.0264/0.7699 = 1.33
$\hat{\kappa}_3$	= 2.1408/1.7898	= 1.20	2.1408/1.7612 = 1.22
$\hat{\kappa}$	$= (\hat{\kappa}_2 + \hat{\kappa}_3) / 2$	= 1.27	1.27
TFR	= 1.27 x 4.8	= 6.1	6.1
Estimated TFR		6.1	6.1

2. ESTIMATION OF THE TOTAL FERTILITY RATE FOR NAMIBIA AND ITS REGIONS

2.1 The Total Fertility Rate

The basis for the estimation is table 2.1 which gives the estimated fertility rates calculated from the reports on children born during the twelve months before the census and the census age distribution of women. There are 16 sets of fertility rates: for Namibia, urban and rural parts of Namibia, and for the 13 regions. The estimated parameters for (1.3) and (1.4) are shown in table 2.2.

The estimated fertility rates for Namibia and its regions are given in table 2.3A. More detailed estimates are given in table 2.3B.

Fig. 2.1 Shows the relative fertility levels for the regions.

Table 2.1. Fertility Rates Estimated from Births that took Place During the 12 Months Before the Census

Age	Namibia	Urban	Rural	Caprivi	Erongo	Hardap	Karas	Khomas
17	0.0575	0.0516	0.0596	0.0551	0.0669	0.0590	0.0676	0.0560
22	0.1777	0.1352	0.2008	0.1538	0.1631	0.1945	0.1755	0.1390
27	0.2086	0.1577	0.2406	0.1524	0.1835	0.1924	0.1578	0.1575
32	0.2011	0.1440	0.2352	0.1644	0.1563	0.1390	0.1164	0.1330
37	0.1636	0.1008	0.1968	0.1272	0.1190	0.1055	0.0858	0.0877
42	0.0932	0.0457	0.1129	0.0816	0.0405	0.0364	0.0342	0.0385
47	0.0510	0.0210	0.0615	0.0491	0.0147	0.0266	0.0112	0.0177
TFR	4.8	3.3	5.5	3.9	3.7	3.8	3.2	3.2

Age	Kunene	Ohangwena	Okavango	Omaheke	Omusati	Oshana	Oshikoto	Otjozon-djupa
17	0.0944	0.0489	0.0987	0.0874	0.0324	0.0425	0.0509	0.0872
22	0.2118	0.2209	0.2132	0.2264	0.1646	0.1595	0.1762	0.1897
27	0.2099	0.3044	0.2188	0.2045	0.2494	0.2192	0.2470	0.1714
32	0.2141	0.3130	0.2055	0.1683	0.2732	0.2421	0.2459	0.1594
37	0.1473	0.2820	0.1633	0.1363	0.2378	0.2102	0.2084	0.1133
42	0.0754	0.1789	0.1022	0.0680	0.1373	0.1070	0.1291	0.0637
47	0.0406	0.0990	0.0623	0.0467	0.0695	0.0441	0.0784	0.0254
TFR	5.0	7.2	5.3	4.7	5.8	5.1	5.7	4.1

Table 2.2 Estimated Parameters in Fertility Models

	Gamma			Brass Fertility Polynomial		
Area	R	c	k	C	a	b
Namibia	5.213	0.158	3.065	0.00002348	15.19	54.70
Urban	3.470	0.182	3.167	0.00002249	15.03	51.30
Rural	6.083	0.160	3.156	0.00002685	15.40	55.10
Caprivi	4.409	0.132	2.672	0.00001558	14.45	56.16
Erongo	3.925	0.184	3.089	0.00002851	14.84	50.11
Hardap	3.877	0.204	3.183	0.00003867	15.15	47.66
Karas	3.346	0.193	2.906	0.00003039	14.35	47.72
Khomas	3.298	0.186	3.091	0.00002440	14.82	49.91
Kunene	5.364	0.148	2.675	0.00002633	14.06	52.75
Ohangwena	8.100	0.167	3.533	0.00003059	16.09	57.39
Okavango	5.937	0.125	2.450	0.00002022	13.47	55.66
Omaheke	4.968	0.153	2.618	0.00002530	13.69	52.16
Omusati	6.316	0.204	4.179	0.00002803	16.50	56.50
Oshana	5.503	0.202	4.076	0.00002709	16.17	55.14
Oshikoto	6.297	0.164	3.402	0.00002436	15.76	56.81
Otjozondjupa	4.328	0.147	2.532	0.00002170	13.41	52.02

Table 2.3A. Estimated Total Fertility Rates: 1991 Namibia Census of Population and Housing.

Total Fertility Rates

Namibia	Urban	Rural	Caprivi	Erongo	Hardap	Karas
6.1	4.7	6.8	6.7	5.1	4.9	3.8

Khomas	Kunene	Ohangwena	Okavango	Omaheke	Omusati	Oshana
4.1	6.2	7.7	7.1	6.1	5.7	5.6

Oshikoto	Otjozondjupa
6.7	5.7

Fig. 2.1 Total Fertility Rates: 1991 Namibia Census of Population and Housing
Central Statistics Office/National Planning Commission
Black bars: Northern Regions
Gray bars: Southern Regions

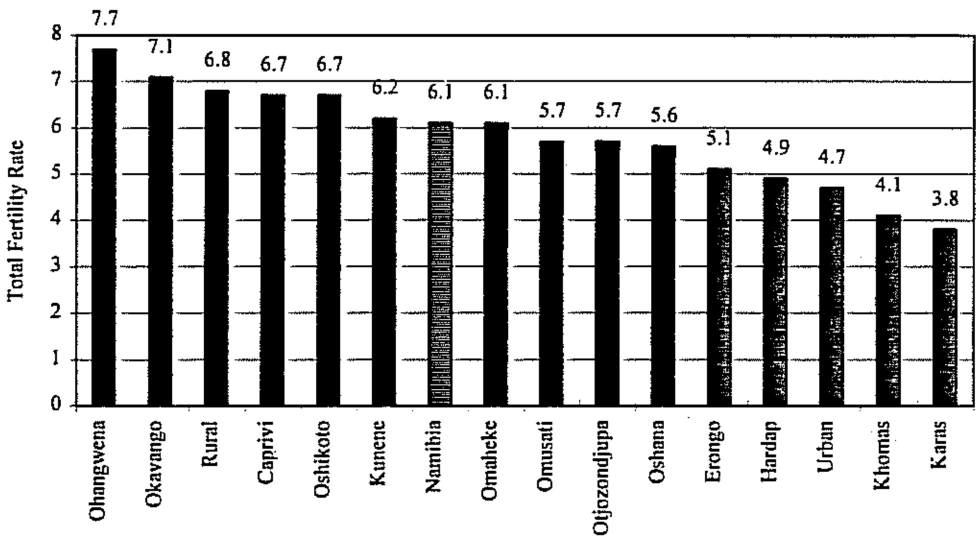


Table 2.3B. Estimated Total Fertility Rates: 1991 Namibia Census of Population and Housing.

Namibia	Gamma	Brass			
TFR	4.8	4.7			
Mean	31.1	30.9			
Variance	65.6	60.3			
Estimated	Gamma	Brass	Obs	$\hat{\kappa}_{Gamma}$	$\hat{\kappa}_{Brass}$
P1	0.114	0.122	0.161	1.41	1.32
P2	0.759	0.770	1.026	1.35	1.33
P3	1.790	1.761	2.141	1.20	1.22
Correction factor $\hat{\kappa}$				1.27	1.27
				% Error Gamma	% Error Brass
P1/P2	0.150	0.159	0.157	-3.93	-1.35
P2/P3	0.424	0.437	0.479	11.57	8.82
Est TFR	6.1	6.1			

Best Estimated TFR = 6.1

Urban	Gamma	Brass			
TFR	3.3	3.2			
Mean	30.1	29.5			
Variance	61.07	52.62			
Estimated	Gamma	Brass	Obs	$\hat{\kappa}_{Gamma}$	$\hat{\kappa}_{Brass}$
P1	0.093	0.107	0.159	1.72	1.48
P2	0.611	0.627	0.920	1.50	1.47
P3	1.399	1.383	1.907	1.36	1.38
Correction factor $\hat{\kappa}$				1.43	1.42
				% Error Gamma	% Error Brass
P1/P2	0.151	0.171	0.173	-12.4	1.1
P2/P3	0.437	0.454	0.482	9.4	5.9
Est TFR	4.7	4.7			

Best Estimated TFR = 4.7

Table 2.3B. Estimated Total Fertility Rates: 1991 Namibia Census of Population and Housing (Continued).

Rural	Gamma	Brass			
TFR	5.6	5.5			
Mean	31.4	31.1			
Variance	65.3	60.3			
Estimated	Gamma	Brass	Obs	$\hat{\kappa}_{Gamma}$	$\hat{\kappa}_{Brass}$
P1	0.119	0.122	0.161	1.36	1.32
P2	0.828	0.844	1.084	1.31	1.28
P3	2.006	1.982	2.288	1.14	1.15
Correction factor $\hat{\kappa}$				1.23	1.22
				% Error Gamma	% Error Brass
P1/P2	0.143	0.144	0.149	3.6	3.0
P2/P3	0.413	0.426	0.474	12.9	10.1
Est TFR	6.8	6.8			
Best Estimated TFR = 6.8					

Caprivi	Gamma	Brass			
TFR	3.9	3.9			
Mean	31.1	30.9			
Variance	70.5	65.3			
Estimated	Gamma	Brass	Obs	$\hat{\kappa}_{Gamma}$	$\hat{\kappa}_{Brass}$
P1	0.120	0.132	0.192	1.59	1.45
P2	0.682	0.676	1.209	1.77	1.79
P3	1.499	1.457	2.491	1.66	1.71
Correction factor $\hat{\kappa}$				1.72	1.75
				% Error Gamma	% Error Brass
P1/P2	0.176	0.196	0.159	-11.2	-23.7
P2/P3	0.455	0.464	0.486	6.3	4.5
Est TFR	6.7	6.9			
Best Estimated TFR = 6.7					

Table 2.3B. Estimated Total Fertility Rates: 1991 Namibia Census of Population and Housing (Continued).

Erongo	Gamma	Brass			
TFR	3.8	3.7			
Mean	29.6	28.9			
Variance	60.3	49.8			
Estimated	Gamma	Brass	Obs	$\hat{\kappa}_{Gamma}$	$\hat{\kappa}_{Brass}$
P1	0.121	0.142	0.198	1.64	1.40
P2	0.759	0.775	1.058	1.39	1.36
P3	1.681	1.664	2.290	1.36	1.38
Correction factor $\hat{\kappa}$				1.38	1.37
				% Error Gamma	% Error Brass
P1/P2	0.159	0.183	0.188	15.1	2.5
P2/P3	0.451	0.466	0.462	2.3	-0.8
Est TFR	5.2	5.1			
Best Estimated TFR = 5.1					

Hardap	Gamma	Brass			
TFR	3.8	3.6			
Mean	28.8	28.2			
Variance	56.0	42.9			
Estimated	Gamma	Brass	Obs	$\hat{\kappa}_{Gamma}$	$\hat{\kappa}_{Brass}$
P1	0.134	0.136	0.146	1.09	1.08
P2	0.844	0.812	1.149	1.36	1.42
P3	1.832	1.761	2.240	1.22	1.27
Correction factor $\hat{\kappa}$				1.29	1.34
				% Error Gamma	% Error Brass
P1/P2	0.159	0.167	0.127	-25.0	-31.2
P2/P3	0.461	0.461	0.513	10.2	10.1
Est TFR	4.9	5.1			
Best Estimated TFR = 4.9					

Table 2.3B. Estimated Total Fertility Rates: 1991 Namibia Census of Population and Housing (Continued).

Karas	Gamma	Brass			
TFR	3.2	3.1			
Mean	28.3	27.7			
Variance	56.9	44.9			
Estimated	Gamma	Brass	Obs	$\hat{\kappa}_{Gamma}$	$\hat{\kappa}_{Brass}$
P1	0.150	0.166	0.173	1.16	1.05
P2	0.827	0.793	0.983	1.19	1.24
P3	1.681	1.606	1.898	1.13	1.18
Correction factor $\hat{\kappa}$				1.16	1.21
				% Error Gamma	% Error Brass
P1/P2	0.181	0.209	0.176	-2.8	-18.5
P2/P3	0.492	0.494	0.518	5.0	4.6
Est TFR	3.8	3.9			
Best Estimated TFR = 3.8					

Khomas	Gamma	Brass			
TFR	3.2	3.1			
Mean	29.5	28.9			
Variance	59.9	49.3			
Estimated	Gamma	Brass	Obs	$\hat{\kappa}_{Gamma}$	$\hat{\kappa}_{Brass}$
P1	0.104	0.121	0.163	1.57	1.35
P2	0.650	0.658	0.877	1.35	1.33
P3	1.433	1.408	1.786	1.25	1.27
Correction factor $\hat{\kappa}$				1.30	1.30
	1.30	1.30		% Error Gamma	% Error Brass
P1/P2	0.160	0.184	0.186	14.1	1.1
P2/P3	0.454	0.467	0.491	7.7	4.8
Est TFR	4.1	4.1			
Best Estimated TFR = 4.1					

Table 2.3B. Estimated Total Fertility Rates: 1991 Namibia Census of Population and Housing (Continued).

Kunene	Gamma	Brass			
TFR	5.0	4.9			
Mean	30.0	29.6			
Variance	67.2	58.8			
Estimated	Gamma	Brass	Obs	$\hat{\kappa}_{Gamma}$	$\hat{\kappa}_{Brass}$
P1	0.188	0.220	0.284	1.51	1.29
P2	1.021	1.025	1.365	1.34	1.33
P3	2.150	2.110	2.445	1.14	1.16
Correction factor $\hat{\kappa}$				1.24	1.25
				% Error Gamma	% Error Brass
P1/P2	0.184	0.214	0.208	11.5	-3.2
P2/P3	0.475	0.486	0.558	15.0	12.9
Est TFR	6.2	6.2			
Best Estimated TFR = 6.2					

Ohangwena	Gamma	Brass			
TFR	7.3	7.3			
Mean	32.5	32.2			
Variance	63.6	61.9			
Estimated	Gamma	Brass	Obs	$\hat{\kappa}_{Gamma}$	$\hat{\kappa}_{Brass}$
P1	0.096	0.097	0.108	1.12	1.11
P2	0.816	0.889	0.973	1.19	1.09
P3	2.224	2.281	2.366	1.06	1.04
Correction factor $\hat{\kappa}$				1.13	1.07
				% Error Gamma	% Error Brass
P1/P2	0.117	0.109	0.111	-6.1	1.0
P2/P3	0.367	0.390	0.411	10.8	5.2
Est TFR	8.2	7.7			
Best Estimated TFR = 7.7					

Table 2.3B. Estimated Total Fertility Rates: 1991 Namibia Census of Population and Housing (Continued).

Okavango	Gamma	Brass			
TFR	5.3	5.2			
Mean	30.6	30.5			
Variance	72.0	64.6			
Estimated	Gamma	Brass	Obs	$\hat{\kappa}_{Gamma}$	$\hat{\kappa}_{Brass}$
P1	0.209	0.183	0.326	1.56	1.78
P2	1.060	0.988	1.528	1.44	1.55
P3	2.189	2.062	2.736	1.25	1.33
Correction factor $\hat{\kappa}$				1.35	1.44
				% Error	% Error
	1.35	1.44		Gamma	Brass
P1/P2	0.197	0.185	0.213	7.7	13.2
P2/P3	0.484	0.479	0.558	13.3	14.2
Est TFR	7.1	7.6			

Best Estimated TFR = 7.1

Omaheke	Gamma	Brass			
TFR	4.7	4.5			
Mean	29.4	29.3			
Variance	65.7	56.2			
Estimated	Gamma	Brass	Obs	$\hat{\kappa}_{Gamma}$	$\hat{\kappa}_{Brass}$
P1	0.204	0.178	0.259	1.27	1.46
P2	1.059	0.965	1.445	1.37	1.50
P3	2.158	1.995	2.686	1.24	1.35
Correction factor $\hat{\kappa}$				1.30	1.42
				% Error	% Error
				Gamma	Brass
P1/P2	0.192	0.184	0.180	-7.2	-2.7
P2/P3	0.491	0.484	0.538	8.8	10.1
Est TFR	6.1	6.6			

Best Estimated TFR = 6.1

Table 2.3B. Estimated Total Fertility Rates: 1991 Namibia Census of Population and Housing (Continued).

Omusati	Gamma	Brass			
TFR	5.8	5.9			
Mean	32.6	32.2			
Variance	58.2	59.1			
Estimated	Gamma	Brass	Obs	$\hat{\kappa}_{Gamma}$	$\hat{\kappa}_{Brass}$
P1	0.049	0.057	0.067	1.37	1.18
P2	0.546	0.674	0.682	1.25	1.01
P3	1.683	1.824	1.704	1.01	0.93
Correction factor $\hat{\kappa}$				1.13	0.97
				% Error Gamma	% Error Brass
P1/P2	0.090	0.085	0.099	9.1	14.2
P2/P3	0.324	0.370	0.400	19.0	7.7
Est TFR	6.6	5.7			
Best Estimated TFR = 5.7					

Oshana	Gamma	Brass			
TFR	5.1	5.2			
Mean	32.4	31.6			
Variance	58.6	58.1			
Estimated	Gamma	Brass	Obs	$\hat{\kappa}_{Gamma}$	$\hat{\kappa}_{Brass}$
P1	0.049	0.072	0.112	2.30	1.56
P2	0.513	0.677	0.831	1.62	1.23
P3	1.535	1.734	1.704	1.11	0.98
Correction factor $\hat{\kappa}$				1.36	1.11
				% Error Gamma	% Error Brass
P1/P2	0.095	0.106	0.135	29.7	21.3
P2/P3	0.334	0.390	0.488	31.4	20.0
EstTFR	7.0	5.6			
Best Estimated TFR = 5.6					

Table 2.3B. Estimated Total Fertility Rates: 1991 Namibia Census of Population and Housing (Continued).

Oshikoto	Gamma	Brass			
TFR	5.7	5.7			
Mean	32.2	31.9			
Variance	64.3	62.2			
Estimated	Gamma	Brass	Obs	$\hat{\kappa}_{Gamma}$	$\hat{\kappa}_{Brass}$
P1	0.088	0.095	0.132	1.50	1.38
P2	0.699	0.760	0.931	1.33	1.22
P3	1.832	1.871	2.131	1.16	1.14
Correction factor $\hat{\kappa}$				1.25	1.18
				% Error Gamma	% Error Brass
P1/P2	0.125	0.125	0.142	11.5	11.6
P2/P3	0.382	0.406	0.437	12.6	7.0
Est TFR	7.1	6.7			
Best Estimated TFR = 6.7					

Otjozondjupa	Gamma	Brass			
TFR	4.0	4.0			
Mean	29.4	29.0			
Variance	66.9	58.0			
Estimated	Gamma	Brass	Obs	$\hat{\kappa}_{Gamma}$	$\hat{\kappa}_{Brass}$
P1	0.186	0.218	0.280	1.50	1.29
P2	0.935	0.925	1.371	1.47	1.48
P3	1.879	1.823	2.435	1.30	1.34
Correction factor $\hat{\kappa}$				1.38	1.41
				% Error Gamma	% Error Brass
P1/P2	0.199	0.236	0.204	2.6	-15.3
P2/P3	0.498	0.507	0.563	11.5	9.9
Est TFR	5.6	5.7			
Best Estimated TFR = 5.7					

2.2 Remarks on Estimated Fertility in the Demographic and Health Survey

The 1992 Demographic and Health Survey (DHS) estimated a total fertility rate of TFR = 5.2 (1992 Demographic and Health Survey Report, p. 20). This report estimates it at TFR = 6.1. This means that the present report estimates total fertility as almost one more child relative to DHS.

Interestingly enough, the Demographic and Health Survey estimated a total fertility rate of 6.3 for the rural parts of Namibia (1992 Demographic and Health Survey Report p. 20). This report estimates rural total fertility at 6.8. There is, then, much less difference between the estimates of total ferility for the rural parts of Namibia; and since the vast majority of areas in Namibia are rural, one may have some confidence in a national total fertility rate in the neighborhood of 6.

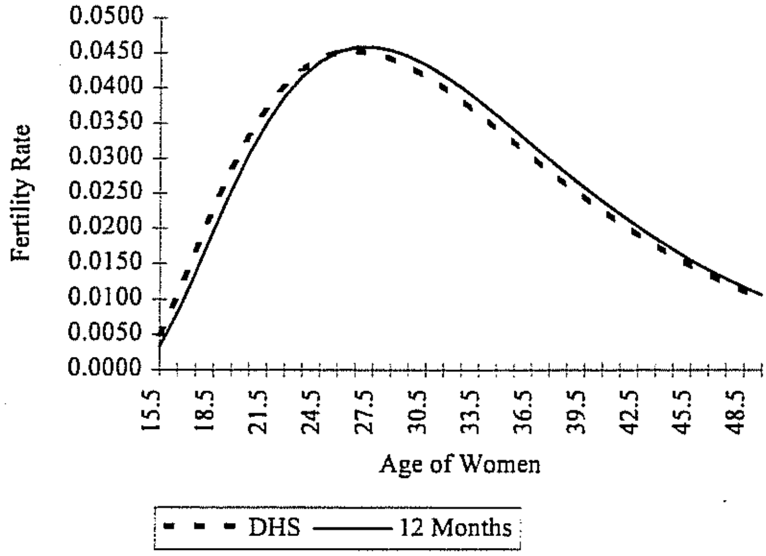
The age-pattern of fertility captured by births during the twelve months before the census (used extensively in this report for estimating the total fertility rate and child mortality) and by DHS are a little different.

Table 2.4 gives the observed and normalized age-specific fertility rates for the census (births during the twelve months before the census) and DHS. Fig. 2.3 shows the result of graduating the normalized rates by means of (1.3). For the census, the estimated parameters are $\hat{R} = 1.096, \hat{c} = 0.157, \hat{k} = 3.059$, and for DHS $\hat{R} = 1.087, \hat{c} = 0.148, \hat{k} = 2.830$. Clearly, fig. 2.3 only suggests a small difference between the captured age patterns of fertility.

Table 2.4. Age Patterns of Fertility Estimated from Births During the 12 Months Before the 1991 Census and the 1992 DHS.

				Normalized		
Age	12 Months	Age	DHS	12 Months	Age	DHS
17	0.058	17.5	0.101	0.012	17.5	0.019
22	0.178	22.5	0.197	0.037	22.5	0.038
27	0.209	27.5	0.236	0.044	27.5	0.045
32	0.201	32.5	0.197	0.042	32.5	0.038
37	0.164	37.5	0.171	0.034	37.5	0.033
42	0.093	42.5	0.099	0.020	42.5	0.019
47	0.051	47.5	0.038	0.011	49.5	0.007
	4.8		5.2	1.0		1.0

Fig. 2.3 Normalized Age-Patterns of Fertility Estimated by the 1992 DHS and the 1991 Census



It will be seen from fig. 2.3 that the DHS age-pattern has an earlier childbearing feature than the one obtained from the census. Actually, if the DHS pattern is used for estimating the total fertility rate for Namibia (using the procedure outlined in this report) then it comes out at 5.6, that is, somewhat lower than 6.1.

It could be argued therefore that possibly this report overestimates total fertility. However, this is a matter of speculation. If one chooses to work with the census data and estimate total fertility from these, then the results are as given in table 2.3B. It should be noted however that both DHS and the census lead to high estimates of the mean age at childbearing. The mean age of the fertility schedule for DHS as well as for the census (total Namibia) is about 31 years. When the mean age of the fertility schedule is that high and when at the same time the variance is about 60, then total fertility is necessarily high. For one thing, it signifies relatively little fertility control among older women.

2.3 Mortpak Estimates of Total Fertility

Using the standard procedures in Mortpak for estimation of total fertility gives, roughly speaking, the same results as obtained in this report. Table 2.5 gives estimates of total fertility obtained by Mortpak.

Table 2.5. Alternative Estimates of Total Fertility by Mortpak

	Report	Mortpak		Report	Mortpak
Namibia	6.1	5.8	Kunene	6.2	5.7
Urban	4.7	4.5	Ohangwena	7.7	7.7
Rural	6.8	6.4	Okavango	7.1	6.5
Caprivi	6.7	6.9	Omaheke	6.1	5.8
Erongo	5.1	4.6	Omusati	5.7	6.1
Hardap	4.9	4.6	Oshana	5.6	6.2
Karas	3.8	3.7	Oshikoto	6.7	6.6
Khomas	4.1	3.7	Otjozondjupa	5.7	5.2

3.0 ESTIMATION OF CHILD MORTALITY: METHODOLOGY

3.1 The Proportions of Deceased Children Reported by Mothers

The only available data for estimation of childhood mortality, save those collected in the recent DHS of 1992, are the census returns on children ever born and surviving children by age of mother. The proportion deceased children by age of mother derived from these data can be used to estimate child mortality. Usually child mortality is estimated from the proportions of deceased children reported by women aged 15-19, 20-24 and 25-29. In this report a more refined approach building on single-year returns is used.

3.2 Methodology for Estimating Child Mortality

The most common methods are those based on Brass (1975). These methods make use of the observed mean parity ratios $\hat{P}_1 / \hat{P}_2$ and $\hat{P}_2 / \hat{P}_3$ for estimating multipliers which, when applied to the proportions of deceased children, convert these into estimates of surviving from birth until ages 1, 2 and 3. These probabilities, or proportions, are often written q(1), q(2), and q(3) (see e.g., Brass, 1975; Hill and Trussell, 1977; Sullivan, 1972; Trussell, 1975; United Nations Manual X, 1983).

The expression linking mortality and fertility with the proportions of deceased children reported by women aged x is

$$H_x = \frac{\int_{a_0}^{x-a_0} f(x-\alpha)\, q(\alpha)\, d\alpha}{\int_{a_0}^{x-a_0} f(x-\alpha)\, d\alpha} \tag{3.1}$$

where a_0 is the starting age of fertility, f the fertility function, and q the mortality function.

The fertility function f is such that for infinitesimal dt, f(t)dt is the probability that a woman aged t bears a child before age t+dt. The mortality function q(α) gives the probability that a newborn child dies before reaching age α, that is, q(α) = 1 - s(α) where s denotes the survival function. Essentially, it will be noted that for a woman aged x, f(x-a)da is the expected number of births she had between a and a+da years ago. A woman who has survived to the time of the census, and who at that time is aged x, has expected cumulated fertility (parity) $F_x = \int_{a_0}^{x-a_0} f(x-a)\,da$. The number of those children alive at the time of the census is $\int_{a_0}^{x-a_0} f(x-a)\, q(a)\, da$.

Hence, the proportion of deceased children to be reported by a woman aged x at the time of the census is H_x. A detailed discussion of (3.1) has been given by Brass and Coale (1968). A discussion of how (3.1) emerges as a model of the proportion of deceased children is also given in Hartmann (1991). In passing it may be noted that, clearly, H_x only depends on the age-pattern of fertility, not on the level of fertility; for if f were to be scaled by a factor R, say, then R would cancel in (3.1). [The statement that H_x does not depend on the level of fertility is however slightly oblique since the shape of a fertility schedule is closely associated with its level (total fertility rate). But, once the shape (age-pattern) is fixed, scaling the schedule slightly up or down to yield a desired fertility rate has no practical bearing on H_x].

Both the Gamma model (1.3) and the Brass fertility polynomial (1.4) are ideal for numerical work in the context of (3.1). With respect to a parametric model of child mortality, it has been shown that

$$q(\alpha) = \frac{\exp(-2a)\,\alpha^{2b}}{1+\exp(-2a)\,\alpha^{2b}}, \tag{3.2}$$

$0 \le \alpha \le 15$

is the best two-parameter model available for representation of child mortality (it gives results that are better than the Weibull model especially if the age range is from 0 to 15 (see e.g., Hartmann, 1989, pp. 241-251).

To take advantage of parametric models of fertility and child mortality, it is necessary to make an important assumption. This assumption involves that mortality functions are proportional. Specifically, let $q_s(\alpha)$ be a standard mortality function so that

$$q(\alpha) = \kappa\, q_s(\alpha), \quad 0 \le \alpha \le 15 \tag{3.3}$$

generates a family of related mortality functions. Clearly, this assumption is at odds with reality since one, and only one, value of κ is meaningful, namely $\kappa = 1$. However, for a limited age range e.g., $0 \le \alpha \le 15$, the assumption (3.3) is upheld by empirical observations.

For the sake of argument, let $q_s(\alpha, \hat{\psi})$ be a mortality function, given by (3.2), with estimated parameter vector $\hat{\psi} = (\hat{a}, \hat{b})$ that provides a first approximation to the mortality function underlying the observed proportion of deceased children reported by mothers aged x at the time of the census. Suppose also that $f(x;\hat{\theta})$, with estimated parameter vector $\hat{\theta} = (\hat{R}, \hat{c}, \hat{k})$, given by (1.3), gives a realistic representation of the mortality curve underlying the reported proportions of deceased children.

Let H_x^s be the proportion of deceased children for women aged x calculated numerically on the basis of (3.1), $f(x;\hat{\theta})$ and $q_s(\alpha, \hat{\psi})$. In what follows these will be referred to as standard proportions of deceased children. Let the observed proportion of deceased children at age x be $\hat{H}_x$. If $\hat{H}_x$ has underlying mortality function $\kappa q_s(\alpha, \hat{\psi})$ then according to (3.1), $\hat{H}_x = \kappa H_x^s$. In consequence, κ could be estimated by letting

$$\hat{\kappa} = \hat{H}_x / H_x$$

In practise, observed proportions of deceased children for a range of ages $x_1, \ldots x_n$ would be available for estimation of the mortality function. For example, $x_1, \ldots x_n$ could be the ages 18, 19, 20, 21, 22 and 23 (this age range has been used in the report). Generally, let these observed proportions of deceased children be denoted $\hat{H}_{x_1}, \ldots, \hat{H}_{x_n}$. Let the corresponding standard proportions of deceased children be denoted $H_{x_i}^s$. This means that if the observed proportions of deceased children $\hat{H}_x$ have underlying mortality function $\kappa q_s(\alpha, \hat{\psi})$ then for $x_1, \ldots x_n$

$$\hat{H}_{x_i} = \kappa H_{x_i}^s \tag{3.4}$$

In consequence, for observations $\hat{H}_{x_i}$, κ may be estimated by minimizing the sum of squares

$$S^2 = \sum_1^n \left[\hat{H}_{x_i} - \kappa H_{x_i}^s \right]^2$$

with respect to κ, whereby

$$\hat{\kappa} = \frac{\sum_1^n H_{x_i}^s \hat{H}_{x_i}}{\sum_1^n \left[H_{x_i}^s \right]^2} \tag{3.5}$$

The estimated mortality function then becomes

$$\hat{q}(\alpha) = \hat{\kappa}\, q_s(\alpha, \hat{\psi}) \tag{3.6}$$

This technique is illustrated below.

3.3 Numerical Illustration of Child Mortality Estimation

Table 3.1 shows standard proportions of deceased children resulting from using the graduations of the age-specific fertility rates for births during the twelve months before the census. These graduations are shown in fig. 1.1. The chosen mortality function $q_s(x,\hat{\theta})$ is(3.2) fitted to West model life table 18 for both sexes (sex ratio 1.05). The parameters are $\hat{a}= -1.2918$ and $\hat{b}= 0.0879$. This mortality function has to be scaled to give an estimate of child mortality. The values of $q_s(x,\hat{\theta})$ for ages less than 15 are shown in table 3.1.

Table 3.1 Standard Proportions of Deceased Children Using Two Graduated Fertility Schedules and the West 18 Child Mortality Function for Both Sexes*.

	Fertility		Cumulated Fertility		Survivors		Proportion Deceased	
Age	f_x^G	f_x^B	F_x^G	F_x^B	S_x^G	S_x^B	H_x^G	H_x^B
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
15	0.0073	0.0000	0.0000	0.0000	0.0000	0.0000		
16	0.0262	0.0285	0.0073	0.0000	0.0068	0.0000	0.9298	
17	0.0516	0.0604	0.0335	0.0285	0.0311	0.0265	0.9280	0.9298
18	0.0798	0.0889	0.0851	0.0889	0.0788	0.0824	0.9260	0.9271
19	0.1081	0.1140	0.1650	0.1778	0.1525	0.1644	0.9242	0.9248
20	0.1345	0.1360	0.2731	0.2918	0.2519	0.2692	0.9225	0.9227
21	0.1579	0.1549	0.4075	0.4278	0.3753	0.3939	0.9209	0.9208
22	0.1776	0.1710	0.5654	0.5827	0.5198	0.5356	0.9194	0.9192
23	0.1934	0.1843	0.7430	0.7537	0.6820	0.6916	0.9179	0.9176
24	0.2053	0.1950	0.9364	0.9379	0.8582	0.8593	0.9165	0.9162
25	0.2134	0.2032	1.1417	1.1329	1.0448	1.0364	0.9152	0.9148
26	0.2181	0.2091	1.3550	1.3361	1.2383	1.2205	0.9139	0.9135
27	0.2197	0.2128	1.5731	1.5451	1.4356	1.4096	0.9126	0.9123
28	0.2186	0.2144	1.7928	1.7579	1.6339	1.6017	0.9114	0.9111
29	0.2152	0.2142	2.0113	1.9723	1.8307	1.7948	0.9102	0.9100
30	0.2099	0.2122	2.2265	2.1865	2.0239	1.9873	0.9090	0.9089

Age	$H_{x+0.5}^G$	$H_{x+0.5}^B$
15.5	------	
16.5	0.0711	------
17.5	0.0730	0.0715
18.5	0.0749	0.0741
19.5	0.0766	0.0763
20.5	0.0783	0.0782
21.5	0.0799	0.0800
22.5	0.0814	0.0816
23.5	0.0828	0.0831
24.5	0.0842	0.0845
25.5	0.0855	0.0858
26.5	0.0868	0.0871
27.5	0.0880	0.0883
28.5	0.0892	0.0894
29.5	0.0904	0.0906

Age	${}_5H_{x+0.5}^G$	${}_5H_{x+0.5}^B$
15-19	0.0739	0.0555
20-24	0.0813	0.0815
25-29	0.0880	0.0882

West model life table 18 for both sexes with sex ratio at birth 1.05. United Nations Manual X, p. 282.

Table 3.1 Standard Proportions of Deceased Children Using Two Graduated Fertility Schedules and the West 18 Child Mortality Function for Both Sexes, (Continued).

(2): f_x^G are the Gamma graduated age-specific fertility rates based on children born during the 12 months before the census. Estimated parameters are $\hat{R} = 5.213$, $\hat{c} = 0.158$ and $\hat{k} = 3.065$ (see table 2.2). Notice that f_x^G is a graduation of the age-specific fertility rates for Namibia shown in table 2.1.

(3): f_x^B are the Brass fertility polynomial graduated age-specific fertility rates based on children born during the 12 months before the census. Estimated parameters are $\hat{C} = 0.00002348$, $\hat{a} = 15.19$ and $\hat{b} = 54.7$ (see table 2.2).

(4): $F_x^G = \sum_{15}^{x} f_j^G$ = cumulated fertility at age x for f_x^G.

(5): $F_x^B = \sum_{15}^{x} f_j^B$ = cumulated fertility at age x for f_x^B.

(6): S_x^G = surviving children at age x for f_x^G and chosen child mortality function. To calculated S_x^G it is assumed that childbearing starts at exact age 15. At age 16, survival is $S_{16}^G = f_{15}^G q(1)$. At age 17, survival is $S_{17}^G = f_{15}^G q(2) + f_{16}^G q(1)$. At age 18, survival is $S_{18}^G \; f_{15}^G q(3) + f_{16}^G q(2) + f_{17}^G q(1)$, and so on.

(7): S_x^B = surviving children at age x for f_x^B and chosen child mortality function.

(8): $H_x^G = 1 - S_x^G / F_x^G$ = proportion deceased children at age x for f_x^G and chosen mortality function.

(9): $H_x^B = 1 - S_x^B / F_x^B$ = proportion deceased children at age x for f_x^B and chosen mortality function.

(10): $H_{x+0.5}^G = (H_x^G + H_{x+1}^G)/2$ = standard proportions of deceased children corresponding to age x last birthday.

(11): $H_{x+0.5}^B = (H_x^B + H_{x+1}^B)/2$

Standard Mortality Function

Age	$q_s(x,\hat{\theta})$	Age	$q_s(x,\hat{\theta})$
0	0.0000	8	0.0981
1	0.0702	9	0.1000
2	0.0786	10	0.1017
3	0.0839	11	0.1032
4	0.0879	12	0.1046
5	0.0911	13	0.1060
6	0.0938	14	0.1072
7	0.0961	15	0.1084

The reason for using two parametric fertility representations is to show that the particular choice of fertility model is of relatively little importance: whether one uses a Brass fertility polynomial or a Gamma model makes little difference. [The importance hinges on whether the observed raw fertility rates (derived e.g., from births during the twelve months before the census, give a reliable portrayal of the fertility rates underlying the observed proportions of deceased children].Table 3.2 shows the observed proportions of deceased children as obtained in the census (data for the whole of Namibia). The standard proportions of deceased children from Table 3.1 are also given. It will be seen that the ratios between observed and standard proportions of dead children are close to 0.9 for both sets of standard proportions. Choosing the age range 18, 19, 20, 21, 22 and 23 for estimation, (3.5) gives a proportionality factor for $H^G_{x+0.5}$ of $\hat{\kappa}_{Gamma} =$ 0.950 and for $H^B_{x+0.5}$ of $\hat{\kappa}_{Brass} =$ 0.953. The mean of these two proportionality factors is $\hat{\kappa} = (\hat{\kappa}_{Gamma} + \hat{\kappa}_{Brass})/2 =$ 0.952. The estimated mortality function is therefore $\hat{q}(x) = 0.952\ q_s(x, \hat{\theta})$.

Table 3.2 Illustration of Child Mortality Estimation Method

Age	$H^G_{x+0.5}$	$H^B_{x+0.5}$	$\hat{H}_x$	$\hat{\kappa}_{Gamma}$	$\hat{\kappa}_{Brass}$
15.5	----	----	0.1156		
16.5	0.0711	----	0.0676		
17.5	0.0730	0.0715	0.0641		
18.5	0.0749	0.0741	0.0685	0.92	0.93
19.5	0.0766	0.0763	0.0675	0.88	0.89
20.5	0.0783	0.0782	0.0763	0.97	0.98
21.5	0.0799	0.0800	0.0771	0.97	0.96
22.5	0.0814	0.0816	0.0771	0.95	0.94
23.5	0.0828	0.0831	0.0840	1.01	1.01
24.5	0.0842	0.0845	0.0796	0.95	0.94
25.5	0.0855	0.0858	0.0828	0.97	0.96
26.5	0.0868	0.0871	0.0896	1.03	1.03
27.5	0.0880	0.0883	0.0845	0.96	0.96
28.5	0.0892	0.0894	0.0937	1.05	1.05
29.5	0.0904	0.0906	0.0961	1.06	1.06

$$\hat{\kappa}_{Gamma} = \frac{\sum_{18}^{23} H^S_{x_i} \hat{H}_{x_i}}{\sum_{18}^{23} \left[H^S_{x_i} \right]^2} = 0.035602/0.037468 = 0.9502$$

$$\hat{\kappa}_{Brass} = \frac{\sum_{18}^{23} H^S_{x_i} \hat{H}_{x_i}}{\sum_{18}^{23} \left[H^S_{x_i} \right]^2} = 0.035644/0.037398 = 0.9531$$

$$\hat{\kappa} = (\hat{\kappa}_{Gamma} + \hat{\kappa}_{Brass})/2 = 0.952$$

3.4 Estimates of Child Mortality

Table 3.3 gives the estimated child mortality functions for Namibia and its regions. The mortality functions have been shown for ages between 0 and 10. The constants for upgrading the standard mortality function are also given. For example, for Namibia $\hat{\kappa} = 0.952$. Together with these constants are given $\hat{K} = \hat{\kappa}/0.952$ which leads to a standardization of child mortality relative to the whole of Namibia (see bottom of table 3.3).

It should be noted that apart from giving infant mortality, table 3.3 also givens the probabilities of surviving from birth until ages 1,2, ... , 10. This is one of the advantages of the applied methodology.

Another advantage of the chosen method of estimation is that it does not build on preset standard five-year age groups of women but makes use of a conveniently chosen age range for estimation of current, or nearly current, infant and child mortality. It is for this reason that the age range 18, ... , 23 has been chosen. Beyond this consideration is that fertility associated with infant and child mortality is directly estimated from observed schedules of fertility (based on births during the 12 months before the census).

These considerations apart it is important to note that infant and child mortality is not independent of the age of mother. The children of young mothers often have higher infant and child mortality than the children of older and more mature mothers. While this is anticipated in many studies, the Namibian data illustrate this phenomenon quite well. Because data illustrating differentials in child mortality between children with young and older mothers are if not rare then at least sparse, figures showing the proportions of deceased children by single-year age groups of women have been included in this report. These figures are quite unique in not only do they show a marked increase in mortality for mothers around age 15 for nearly all regions but they also show the good quality of age reporting in Namibia.

Fig. 3.1. Infant Mortality (Mortality Below Age 1) Estimated from 1991 Namibia Census of Population and Housing

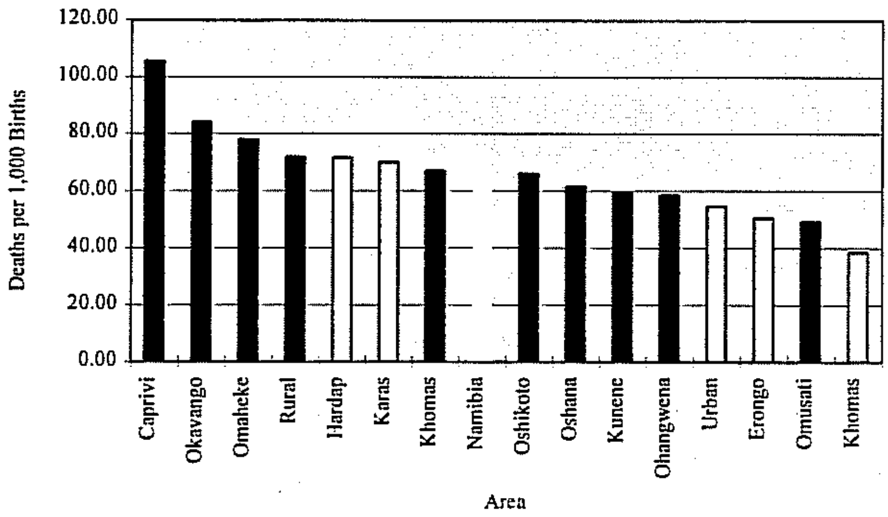


Table 3.3. Estimated Child Mortality Functions $\hat{q}(\alpha)$ for Ages Between 0 and 10*

Area Age	Namibia	Urban	Rural	Caprivi	Erongo	Hardap	Karas	Kho-mas
α	Proportions dying between birth and age α, $\hat{q}(\alpha)$							
0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1	0.0668	0.0546	0.0719	0.1056	0.0506	0.0717	0.0700	0.0386
2	0.0748	0.0611	0.0805	0.1182	0.0567	0.0803	0.0783	0.0432
3	0.0799	0.0653	0.0859	0.1262	0.0605	0.0857	0.0837	0.0461
4	0.0837	0.0684	0.0900	0.1322	0.0634	0.0898	0.0876	0.0483
5	0.0867	0.0709	0.0933	0.1370	0.0657	0.0931	0.0908	0.0501
6	0.0893	0.0729	0.0960	0.1410	0.0676	0.0958	0.0935	0.0516
7	0.0915	0.0748	0.0984	0.1445	0.0693	0.0982	0.0958	0.0528
8	0.0934	0.0764	0.1005	0.1476	0.0708	0.1003	0.0978	0.0540
9	0.0952	0.0778	0.1024	0.1504	0.0721	0.1022	0.0997	0.0550
10	0.0968	0.0791	0.1041	0.1529	0.0733	0.1039	0.1014	0.0559
$\hat{\kappa}$	0.952	0.778	1.024	1.504	0.721	1.022	0.997	0.550
$\hat{K}$	1.000	0.817	1.076	1.580	0.757	1.073	1.047	0.577

Area Age	Kunene	Ohang-wena	Oka-vango	Oma-heke	Omu-sati	Oshana	Oshikoto	Otjoz-djupa
α	Proportions dying between birth and age α, $\hat{q}(\alpha)$							
0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1	0.0594	0.0586	0.0841	0.0779	0.0492	0.0617	0.0660	0.0670
2	0.0665	0.0656	0.0941	0.0872	0.0551	0.0691	0.0739	0.0750
3	0.0710	0.0701	0.1005	0.0931	0.0588	0.0738	0.0789	0.0801
4	0.0743	0.0734	0.1053	0.0975	0.0616	0.0772	0.0826	0.0839
5	0.0770	0.0760	0.1091	0.1011	0.0638	0.0800	0.0856	0.0870
6	0.0793	0.0783	0.1123	0.1041	0.0657	0.0824	0.0881	0.0895
7	0.0813	0.0802	0.1151	0.1067	0.0674	0.0845	0.0903	0.0918
8	0.0830	0.0819	0.1176	0.1089	0.0688	0.0863	0.0923	0.0937
9	0.0846	0.0835	0.1198	0.1110	0.0701	0.0879	0.0940	0.0955
10	0.0860	0.0849	0.1218	0.1129	0.0713	0.0894	0.0956	0.0971
$\hat{\kappa}$	0.846	0.835	1.198	1.110	0.701	0.879	0.940	0.955
$\hat{K}$	0.889	0.877	1.259	1.166	0.737	0.924	0.987	1.003

$\hat{\kappa}$ is the estimated constant for upgrading the standard mortality function. $\hat{K} = \hat{\kappa}/0.952$ indicates the relative level of mortality. For example, here Namibia has standard mortality K = 1 and the Urban part has mortality K = 0.817 thus indicating that child mortality in the urban part is 82% of that of the national level. Another way of looking at it would be to say that for every one thousand infant deaths in Namibia, there are 757 in Erongo and 1,504 in Caprivi.

Fig. 3.2. Proportions of Deceased Children: Namibia 1991

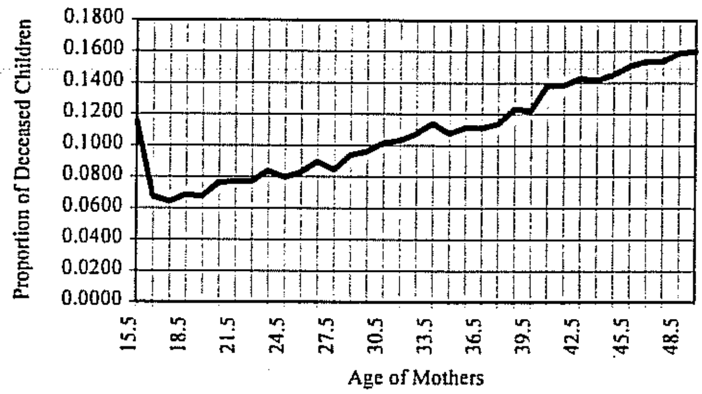


Fig. 3.3. Proportions of Deceased Children: Urban Namibia, 1991

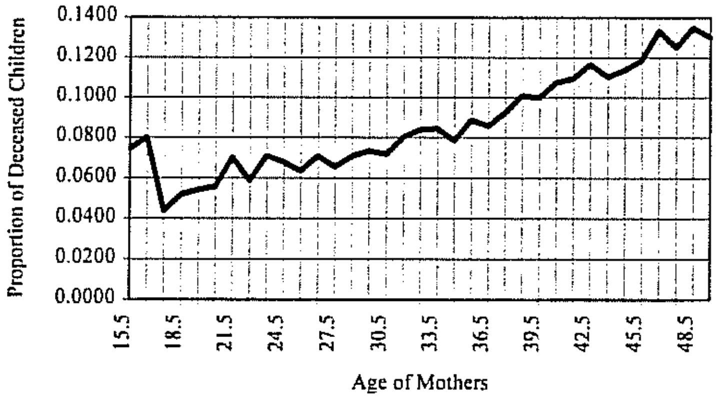


Fig. 3.4. Proportions of Deceased Children: Rural Namibia, 1991

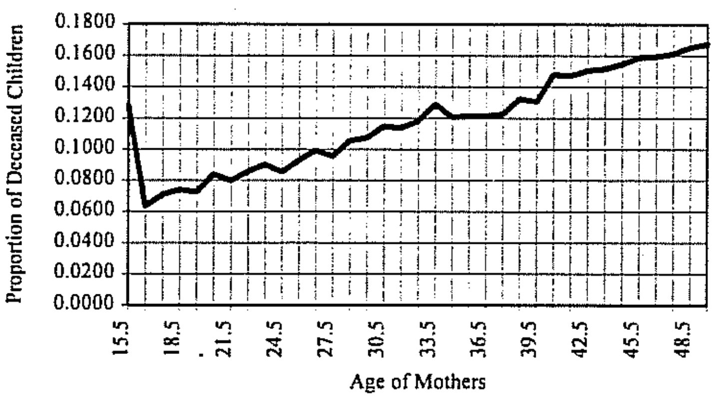


Fig. 3.5. Proportions of Deceased Children: Caprivi, 1991

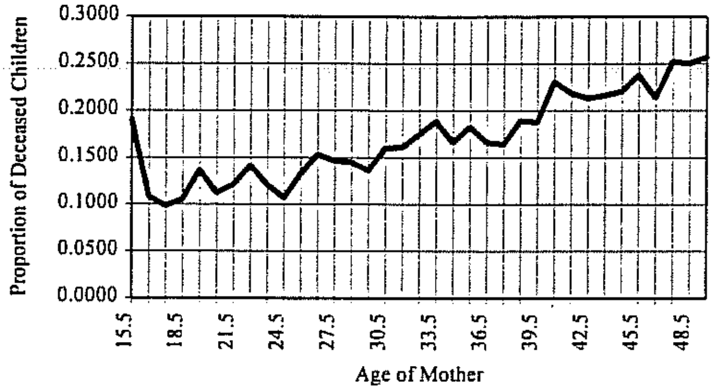


Fig. 3.6. Proportions of Deceased Children: Erongo, 1991

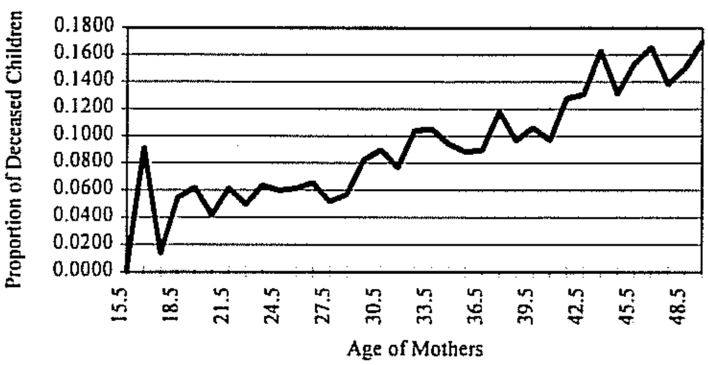


Fig. 3.7. Proportions of Deceased Children: Hardap, 1991

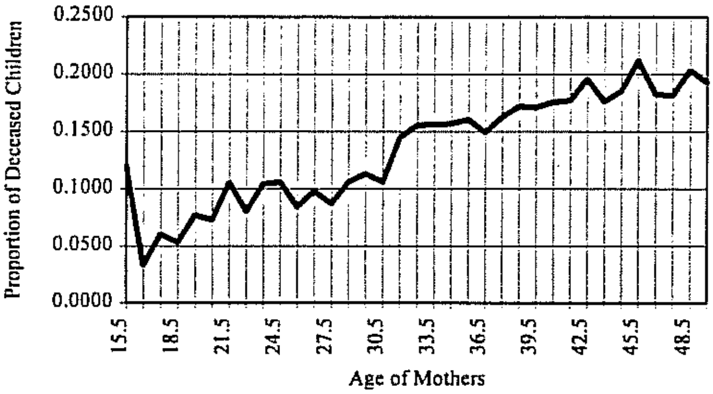


Fig. 3.8. Proportions of Deceased Children: Karas, 1991

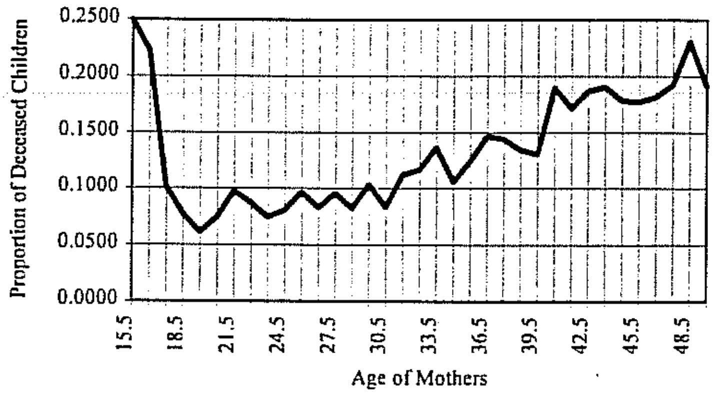


Fig. 3.9. Proportions of Deceased Children: Khomas, 1991

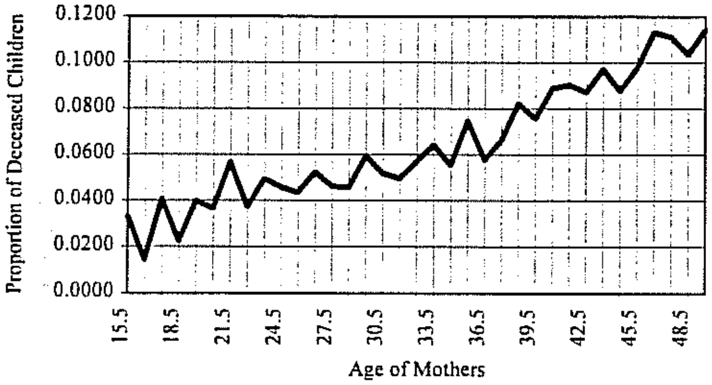
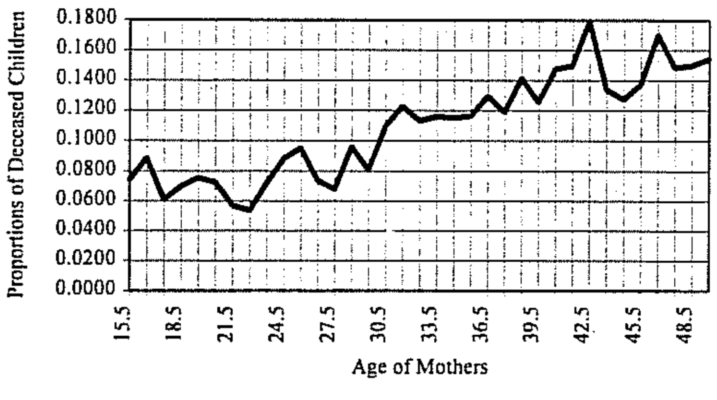


Fig. 3.10. Proportions of Deceased Children: Kunene, 1991



3.5 Mortpak Estimates of Child Mortality

The estimates of child mortality obtained from Mortpak are given in table 3.4.

Table 3.4 Estimates of Child Mortality

Per 1,000 Live Births	This Report	Mortpak	
Namibia	69	70	+
Urban	55	59	+
Rural	72	75	+
Caprivi	106	107	+
Erongo	51	50	-
Hardap	72	85	+
Karas	70	72	+
Khomas	39	42	+
Kunene	59	59	
Ohangwena	59	64	+
Okavango	84	85	+
Omaheke	78	85	+
Omusati	49	61	+
Oshana	62	71	+
Oshikoto	66	71	+
Otjozondjupa	67	65	-

+ indicates that Mortpak estimate is higher than obtained in this study.

4.0 SUMMARY

Table 4 summarizes the estimates presented in this paper. Table 4 is based on a projection using the indicated levels of mortality and fertility. Figures refer to 1994.

Table 4. Demographic Indexes for Namibia:1994

Namibia	
Mid-Year Population	1,533,124
Yearly Number of Births	65,621
Yearly Number of Deaths	14,944
Crude Birth Rate	42.8
Crude Death Rate	9.7
Yearly Population Increase (%)	3.3
Life Expectancy	
Males	58.6
Females	62.3
Both Sexes	60.4
Infant Mortality Rate	
Boys	76
Girls	62
Both Sexes	69
Total Fertility Rate (TFR)	6.1
Gross Reproduction Rate (GRR)	3.0
Net Reproduction Rate (NRR)	2.5
Male Population Aged	Percent
Less than 15	46.4
Between 15 and 64	52.2
65 and Above	1.4
Female Population Aged	Percent
Less than 15	41.3
Between 15 and 64	53.2
65 and Above	5.5

Table 4. Demographic Indexes for Namibia:1994 (Cont'd)

Caprivi	
Mid-Year Population	97,629
Yearly Number of Births	5,512
Yearly Number of Deaths	1,648
Crude Birth Rate	47.6
Crude Death Rate	14.6
Yearly Population Increase (%)	3.3
Life Expectancy	
Males	51.4
Females	54.5
Both Sexes	52.9
Infant Mortality Rate	
Boys	115
Girls	96
Both Sexes	106
Total Fertility Rate (TFR)	6.7
Gross Reproduction Rate (GRR)	3.3
Net Reproduction Rate (NRR)	2.5
Male Population Aged	Percent
Less than 15	45.0
Between 15 and 64	51.6
65 and Above	3.4
Female Population Aged	Percent
Less than 15	42.0
Between 15 and 64	53.6
65 and Above	4.4

Table 4. Demographic Indexes for Namibia:1994 (Cont'd)

Erongo

Mid-Year Population	59,184
Yearly Number of Births	2,200
Yearly Number of Deaths	547
Crude Birth Rate	37.3
Crude Death Rate	9.2
Yearly Population Increase (%)	2.8
Life Expectancy	
Males	62.7
Females	66.5
Both Sexes	64.5
Infant Mortality Rate	
Boys	57
Girls	45
Both Sexes	51
Total Fertility Rate (TFR)	5.1
Gross Reproduction Rate (GRR)	2.5
Net Reproduction Rate (NRR)	2.2
Male Population Aged	Percent
Less than 15	31.8
Between 15 and 64	63.6
65 and Above	4.6
Female Population Aged	Percent
Less than 15	35.4
Between 15 and 64	58.7
65 and Above	5.9

Table 4. Demographic Indexes for Namibia:1994 (Cont'd)

Hardap	
Mid-Year Population	70,105
Yearly Number of Births	2,390
Yearly Number of Deaths	776
Crude Birth Rate	34.1
Crude Death Rate	11.1
Yearly Population Increase (%)	2.3
Life Expectancy	
Males	57.9
Females	61.5
Both Sexes	59.7
Infant Mortality Rate	
Boys	80
Girls	65
Both Sexes	72
Total Fertility Rate (TFR)	4.9
Gross Reproduction Rate (GRR)	2.4
Net Reproduction Rate (NRR)	2.0
Male Population Aged	Percent
Less than 15	37.8
Between 15 and 64	57.5
65 and Above	4.7
Female Population Aged	Percent
Less than 15	38.3
Between 15 and 64	56.6
65 and Above	5.1

Table 4. Demographic Indexes for Namibia:1994 (Cont'd)

Karas

Mid-Year Population	63,436
Yearly Number of Births	1,674
Yearly Number of Deaths	672
Crude Birth Rate	26.4
Crude Death Rate	10.6
Yearly Population Increase (%)	1.6
Life Expectancy	
Males	58.4
Females	62.0
Both Sexes	60.1
Infant Mortality Rate	
Boys	77
Girls	63
Both Sexes	70
Total Fertility Rate (TFR)	3.8
Gross Reproduction Rate (GRR)	1.9
Net Reproduction Rate (NRR)	1.6
Male Population Aged	Percent
Less than 15	33.3
Between 15 and 64	62.3
65 and Above	4.4
Female Population Aged	Percent
Less than 15	34.4
Between 15 and 64	60.4
65 and Above	5.2

Table 4. Demographic Indexes for Namibia:1994 (Cont'd)

Khomas

Mid-Year Population	179,472
Yearly Number of Births	6,502
Yearly Number of Deaths	1,034
Crude Birth Rate	36.2
Crude Death Rate	5.8
Yearly Population Increase (%)	3.0
Life Expectancy	
Males	65.4
Females	69.4
Both Sexes	67.4
Infant Mortality Rate	
Boys	44
Girls	34
Both Sexes	39
Total Fertility Rate (TFR)	4.1
Gross Reproduction Rate (GRR)	2.0
Net Reproduction Rate (NRR)	1.9
Male Population Aged	Percent
Less than 15	28.3
Between 15 and 64	69.7
65 and Above	2.0
Female Population Aged	Percent
Less than 15	31.1
Between 15 and 64	66.4
65 and Above	2.5

Table 4. Demographic Indexes for Namibia:1994 (Cont'd)

Kunene	
Mid-Year Population	68,805
Yearly Number of Births	2,896
Yearly Number of Deaths	756
Crude Birth Rate	42.1
Crude Death Rate	11.0
Yearly Population Increase (%)	3.1
Life Expectancy	
Males	60.7
Females	64.5
Both Sexes	62.6
Infant Mortality Rate	
Boys	66
Girls	52
Both Sexes	59
Total Fertility Rate (TFR)	6.2
Gross Reproduction Rate (GRR)	3.0
Net Reproduction Rate (NRR)	2.7
Male Population Aged	Percent
Less than 15	40.9
Between 15 and 64	52.6
65 and Above	6.5
Female Population Aged	Percent
Less than 15	40.0
Between 15 and 64	53.8
65 and Above	6.2

Table 4. Demographic Indexes for Namibia:1994 (Cont'd)

Ohangwena

Mid-Year Population	195,426
Yearly Number of Births	9,220
Yearly Number of Deaths	2,150
Crude Birth Rate	47.2
Crude Death Rate	11.0
Yearly Population Increase (%)	3.6
Life Expectancy	
Males	60.9
Females	64.6
Both Sexes	63.0
Infant Mortality Rate	
Boys	65
Girls	52
Both Sexes	59
Total Fertility Rate (TFR)	7.7
Gross Reproduction Rate (GRR)	3.8
Net Reproduction Rate (NRR)	3.3
Male Population Aged	Percent
Less than 15	56.3
Between 15 and 64	37.5
65 and Above	6.3
Female Population Aged	Percent
Less than 15	46.5
Between 15 and 64	45.9
65 and Above	7.6

Table 4. Demographic Indexes for Namibia:1994 (Cont'd)

Okavango

Mid-Year Population	126,852
Yearly Number of Births	6,049
Yearly Number of Deaths	1,548
Crude Birth Rate	47.7
Crude Death Rate	12.2
Yearly Population Increase (%)	3.6
Life Expectancy	
Males	55.5
Females	59.0
Both Sexes	57.2
Infant Mortality Rate	
Boys	92
Girls	76
Both Sexes	84
Total Fertility Rate (TFR)	7.1
Gross Reproduction Rate (GRR)	3.5
Net Reproduction Rate (NRR)	2.8
Male Population Aged	Percent
Less than 15	52.3
Between 15 and 64	43.9
65 and Above	3.8
Female Population Aged	Percent
Less than 15	46.1
Between 15 and 64	49.9
65 and Above	4.0

Table 4. Demographic Indexes for Namibia:1994 (Cont'd)

Omaheke

Mid-Year Population	56,357
Yearly Number of Births	2,302
Yearly Number of Deaths	708
Crude Birth Rate	40.8
Crude Death Rate	12.6
Yearly Population Increase (%)	2.8
Life Expectancy	
Males	56.7
Females	60.3
Both Sexes	58.4
Infant Mortality Rate	
Boys	86
Girls	70
Both Sexes	78
Total Fertility Rate (TFR)	6.1
Gross Reproduction Rate (GRR)	3.0
Net Reproduction Rate (NRR)	2.5
Male Population Aged	Percent
Less than 15	38.4
Between 15 and 64	56.6
65 and Above	5.0
Female Population Aged	Percent
Less than 15	39.0
Between 15 and 64	55.3
65 and Above	5.7

Table 4. Demographic Indexes for Namibia:1994 (Cont'd)

Omusati

Mid-Year Population	202,989
Yearly Number of Births	7,657
Yearly Number of Deaths	1,858
Crude Birth Rate	37.7
Crude Death Rate	9.2
Yearly Population Increase (%)	2.9
Life Expectancy	
Males	63.0
Females	66.9
Both Sexes	64.9
Infant Mortality Rate	
Boys	55
Girls	43
Both Sexes	49
Total Fertility Rate (TFR)	5.7
Gross Reproduction Rate (GRR)	2.8
Net Reproduction Rate (NRR)	2.5
Male Population Aged	Percent
Less than 15	55.0
Between 15 and 64	39.2
65 and Above	5.8
Female Population Aged	Percent
Less than 15	45.3
Between 15 and 64	47.8
65 and Above	6.9

Table 4. Demographic Indexes for Namibia:1994 (Cont'd)

Oshana

Mid-Year Population	145,767
Yearly Number of Births	6,327
Yearly Number of Deaths	1,441
Crude Birth Rate	43.4
Crude Death Rate	9.9
Yearly Population Increase (%)	3.4
Life Expectancy	
Males	60.3
Females	64.0
Both Sexes	62.1
Infant Mortality Rate	
Boys	68
Girls	55
Both Sexes	62
Total Fertility Rate (TFR)	5.6
Gross Reproduction Rate (GRR)	2.7
Net Reproduction Rate (NRR)	2.4
Male Population Aged	Percent
Less than 15	48.3
Between 15 and 64	47.0
65 and Above	4.7
Female Population Aged	Percent
Less than 15	41.9
Between 15 and 64	52.5
65 and Above	5.6

Table 4. Demographic Indexes for Namibia:1994 (Cont'd)

Oshikoto

Mid-Year Population	139,159
Yearly Number of Births	6,185
Yearly Number of Deaths	1,512
Crude Birth Rate	44.4
Crude Death Rate	10.9
Yearly Population Increase (%)	3.4
Life Expectancy	
Males	59.3
Females	63.0
Both Sexes	61.1
Infant Mortality Rate	
Boys	59
Girls	73
Both Sexes	66
Total Fertility Rate (TFR)	6.7
Gross Reproduction Rate (GRR)	3.3
Net Reproduction Rate (NRR)	2.8
Male Population Aged	Percent
Less than 15	48.9
Between 15 and 64	46.0
65 and Above	5.1
Female Population Aged	Percent
Less than 15	43.9
Between 15 and 64	49.9
65 and Above	6.2

Table 4. Demographic Indexes for Namibia:1994 (Cont'd)

Otjozondjupa

Mid-Year Population	109,848
Yearly Number of Births	4,427
Yearly Number of Deaths	1,169
Crude Birth Rate	40.3
Crude Death Rate	10.6
Yearly Population Increase (%)	3.0
Life Expectancy	
Males	59.1
Females	62.8
Both Sexes	60.7
Infant Mortality Rate	
Boys	74
Girls	59
Both Sexes	67
Total Fertility Rate (TFR)	5.7
Gross Reproduction Rate (GRR)	2.8
Net Reproduction Rate (NRR)	2.4
Male Population Aged	Percent
Less than 15	34.7
Between 15 and 64	60.8
65 and Above	4.5
Female Population Aged	Percent
Less than 15	37.4
Between 15 and 64	57.8
65 and Above	4.8

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APPENDIX I

PROPOSAL FOR ANALYSIS OF THE 1991 NAMIBIA CENSUS PRODUCTS

1. INTRODUCTION

The tabulation plan for the 1991 Namibia Census of Population and Housing has been published in Report B, volumes I, II, and III. These three well-prepared volumes provide users with a formidable amount of information obtained in the first Namibian census taken after Independence. The table designs are highly user friendly, and it is not amiss to note that those who produced the tables deserve commendations for the professional work they carried out. From a technical point of view, the tables also reflect the lavish architectural flexibility in table design offered by IMPS.

Report B is a user friendly product and will undoubtedly be welcomed by the many users within and outside Government. Nevertheless, several of the tables require deeper analysis than that afforded by visual inspection. Furthermore, in several instances, diagrams would enhance interpretation and understanding of the tables. To highlight some of the tabulations in terms of diagrams and explanatory texts as well as to analytically analyse those of the tabulations that require such steps, it is proposed to produce an Analysis Report on the 1991 Census.

2. CONTENTS OF ANALYSIS REPORT

It is inevitable that some degree of additional reporting has to take place since childhood mortality, and fertility of women must be analytically estimated from the available tables. Furthermore, these estimates must be compared with other similar estimates in order to validate their qualitative relevance. Consequently, it is necessary to produce at least a report on the demographic analysis of the census.

However, it is not only the demographic aspects of the census that are important to users; indeed, the demographic component is only a small part of the total materials collected in the census. Specifically, the census also collected data on:

Nationality;
Place of birth;
Place of usual residence;
Disability;
Language;
Literacy;
School attendance;
Educational attainment;
Economic activity;
Occupation;
Industrial affiliation;
Employment status;
and,
Housing conditions.

Below is outlined the various data components that would be included in an over all analysis of the collected census data.

3. MATERIALS

3.1 Census Design

The Namibia 1991 Census was a standard *de facto* census focusing on the most important of variables but with little or no extension beyond that. Possibly the only non-standard element was the recording of dead children among those born during the 12 months before the census. While there is no standard methodology available for estimating child mortality from such data, it is nevertheless feasible to estimate it using certain parametric model applications.

Considering what is known so far, the data collected in the Census were of acceptable quality and would seem to support good substantive analysis.

3.2 Regional Breakdown

Although originally the census was taken by district, it has been possible to recode the data so that they coincide with the newly defined 13 regions. It is possible therefore to study the age structure for each of the regions and also, hopefully, population growth for each of the regions. Most characteristics recorded in the census have been tabulated by region.

3.3 Fertility and Child Mortality

The demographic data are undoubtedly those that call for the deepest analytical analysis. The data on children ever born and surviving children, by region, facilitate estimation of childhood mortality for the whole of Namibia as well as for the regions. These data are important for assessing, for example, the status of health care, especially for women and children, in the 13 regions. In addition, these data may be used, at least in a rough sense, to portray the over all level of mortality in the regions.

The data on children born during the preceding 12 months before the census and those of whom died before the census, are important for gauging levels of fertility and child mortality.

When the above mentioned data are related to the population age structure, it may be possible to infer a life table for Namibia. This life table may be used, for example, for making population projections. With respect to the data on reproduction these too of course provide a platform for making population projections.

The demographic estimation is currently in progress.

3.4 Migration

Because the place of birth has been recorded for each individual, it is possible to show the main streams of internal migration. For the foreign born population it is possible to show the main countries of birth.

3.5 Disability

Data concerning deafness, blindness, impaired speech and limbs as well as mental disorder were collected in the Census. These data will most be used for preparation of diagrams and charts.

3.6 Language Spoken

The main language of each respondent was recorded. The collected data mostly support brief descriptive analysis: diagrams, charts, and the like.

3.7 Education

Data on school attendance and educational attainment were obtained for all persons 6 years and over. The education data permit a good description of school enrollment, achievement and other education determinants.

3.8 Economic Activity, Occupation and Industry

Data on economic activity were obtained for all persons aged 10 years and over. The activities were: Worked, did not work, has job or business but did not work, unemployed, student, home maker, income recipient, disabled, retired, old age. These are the standard categories ordinarily used in census contexts. Along with economic activity, occupation was also recorded as well as industrial affiliation.

4. What Should a Census Analysis Look Like, and for Whom Should it be Produced?

The census analysis publication is often a highly technical document written for (ostensibly) the benefit of demographers and other social scientists. Its traditional main thrust is often more so in the direction of the applied methodology than in the direction of the substantive results. There are some historical reasons for this development.

To be of use to a broad range of users, the census analysis publication should be written in an easy style avoiding technicalities. Diagrams and figures should be used to explain the main features of the data.
For whom would such a publication be produced?

This users are government agencies, the business community, schools, universities, health care organizations, newspaper and television reporters, and, in fact, anyone who in his daily work require information about society. Consequently, it should not be viewed as a publication solely for use within government.

Once the publication has been completed its availability should be advertized in the local newspapers and on television.

5. THE CHAPTERS OF THE ANALYSIS REPORT

Below is suggested which chapters and materials might be included in the report as well as their sequence.

5.1 Preface

The preface gives details about the census and gratitude is extended to the many people who helped make the census successful. There may be a few notes about the 1991 census being the first one taken after Independence.

5.2 Summary

The summary is placed at the beginning of the publication. The summary consists, among other things, of fact charts summarizing each chapter in the publication. The summary is partly for the whole of Namibia, partly for each Region. For Namibia the fact chart might look as shown in the inset.

These fact charts should be such that they easily fit onto slides or overheads, that is, they should fall well within the A4 format. The fact charts all contain the same variables with the geographical sequence: Namibia, Namibia Urban, Namibia Rural, Region 1, Region 2, ... , Region 13.

The basic idea with the fact charts is not that they should contain as much information as can be squeezed onto a page, but rather that they contain those elements which in a summary context would of most interest. The final choice of variables to be included in the fact charts will be made in the course of advancing the analysis.

Central Statistics Office

1991 Census of Population & Housing
Namibia

Area .... sq. km
Population Total Males Females
Aged below 15 ....
Aged 15 and 64 ....
Aged 65 and over ....

Population Density ....

Infant Mortality .....
Life Expectancy
Males ....
Females ....

Total Fertility Rate ....
Net Reproduction Rate ....

School Enrollment %
Boys aged 7-15 # and %
Girls aged 7-15
Educational Attainment
Men aged 20 and over
....
Women aged 20 and over

Economically Active
Males # and %
Females
Employed in Private Sector
Males # and %
Females
Employed in Public Sector
Males # and %
Females
Main Occupations
(Mining & Quarrying,
Agriculture, Food
Processing, etc.

The fact charts can also be printed individually and used in various context. For example, if a parliamentary group visits one of the regions in order to take stock of the economic or health situation, then they can receive the fact chart for the region as background material. This gives them information about the particular region and also tells them from where they get the information.

It is conceivable that Summary is the wrong term since, after all, it is estimated at 17 pages. Maybe some other name can be found.

5.3 Chapter I
Census History
Although most likely the 1991 census was the first modern census taken in Namibia, some rudimentary enumerations were made before then. Both the German and South African Authorities undertook brief censuses. Materials on these enumerations may be found in various libraries. The Statistical Bureau in Pretoria may have some materials of interest.

This chapter also gives a brief historical outline of Namibia. Encyclopaedia Britannica has some interesting summarized materials on Namibia that may be partially quoted. The references quoted by Encyclopaedia Britannica may give some interesting clues as to where one may find additional information on past Namibia censuses.

5.4 Chapter 2
Population Distribution & Growth
This Chapter begins with a bar-chart showing the population size of the regions. Underneath the chart is a brief commentary: since the chart is self-explanatory there is no need for excessive text. And whenever text can be avoided, it should be avoided. Throughout the publication aims at being self-explanatory without being wordy.

Another chart gives population growth in percent per year for each of the regions and for Namibia. This chart shows which regions have fast and which have slow population growth. Estimates of population growth derive from the application of various models; there is no direct way of obtaining these estimates since vital registration is incomplete throughout Namibia.

There should be some mention of population density by region and also about migration between the regions; presumably, the growth of some regions is mainly determined by migration.

5.5 Chapter 3
Place of Birth & Place of Usual Residence
The place of birth and place of usual residence statistics show the main streams of lifetime migration. Various cross-tabulations are possible. Allowance may also be made for studying those in the population who have been born in South Africa and Germany.

5.6 Chapter 4
Economic Activity, Occupation & Industrial Affiliation
From the point of view of economic development this is the main chapter of the analysis report. Although the report should abstain from technicalities, it is here necessary to define all economic terms so that lay readers can benefit from the text. The chapter should also devote itself to the notion of gender statistics, that is, the extent to which women have employment in the private and public sector.

The chapter deals with economic activity, economically active and not economically active, occupation and industries within which occupations are rooted. The analysis will be carried out for Namibia, urban and rural areas and by region.

5.7 Chapter 5
Education
To many readers this will be one of the more important chapters. Education is an investment in the future. What does the education system look like? How large part of the child population regularly attends school? How far do students progress in school? Are there differences between girls and boys? Are there differences between rural and urban areas and between regions? These are some of the questions to be tackled in this chapter.

5.8 Chapter 6
Mother Tongue
This is only a short chapter explaining which languages are mainly spoken in Namibia.

5.9 Chapter 7
Marital Status
Marital Status if of interest in the context of fertility and population growth. The earlier women marry, the more children they bear and the higher is population growth. Marital status analysis involves looking at the pace in increasing the age at first marriage. Chapter 7 is closely related to Chapter 8 dealing with fertility.

5.10 Chapter 8
Fertility
In dealing with fertility, several different techniques are brought to bear. These techniques will not be discussed in the Analysis Report. Only final results will be presented. References in the text will guide the interested reader to technical materials explaining how the estimation processes have been carried out.

Fertility will be estimated at the national as well as at the regional levels, and in relation to various covariates such as marital status, education, employment and so on. The techniques that are used will have to be documented in a special technical publication.

5.11 Chapter 9
Mortality
Estimation of mortality requires a great many different approaches. It is the aim of this chapter to give estimates of life expectancies for males and females as well as for infant mortality. The techniques that are used will have to be documented in a special technical publication.

5.12 Chapter 10
Disability
This will be a relatively small chapter. The data are probably rather rough and can only point to approximate levels of disability. Nevertheless, they should be given in the Analysis Report.

5.13 Chapter 11
Housing Conditions
Several interesting questions concerning housing were asked in the Census. These concerned: Type of housing unit; tenure; Number of rooms; Main material used for walls and roof; main type of fuel used for cooking, lighting, and heating; water supply; toilet facilities; ownership of radio; television; and purchase of newspaper.

The returns on housing conditions should be carefully analyzed and illustrated by means of charts and diagrams; they explain a great deal about living conditions in Namibia. In the long run (as a second phase of the analysis may unfold) it will be interesting to use the housing conditions as covariates in the analysis of mortality and fertility. However, such more refined analysis can only take place after the main analysis has been completed.

5.14 Chapter 12
Population Projections
Based on the estimates of mortality and fertility, a set of population projections will be made. These projections will be at the national as well as at the regional levels. Technically, speaking the regional projections will be carried out by means of stipulating mortality and fertility assumptions for each region, the total population and its age distribution is then calculated from the regional totals (this is facilitated by the latest population projection program developed by Research Triangle Institute, North Carolina).

6. STYLE OF WRITING AND PRESENTATION
As noted, the analysis publication is written for a broad audience. Technical shibboleths should be avoided. The language should be lucid. There should be plenty of illustrations, diagrams, graphs, etc. The length of the publication is estimated at about 65 pages. In reality it will probably be around 75 pages. It is suggested however that it should not run much above 75 pages as otherwise the publication becomes too comprehensive for easy and fast use.

The general style of the publication is to provide the readers with facts but not with social, economic and political explanations; the publication presents the facts in so far as they can be presented objectively, the readers make up their own minds as to how the results should be interpreted.

Before the publication is taken to the printer, it should be scrutinized for spelling errors and poor syntax. Perhaps a professional editor should be involved in the final preparation of the report. Maybe one of the local artists could be asked to prepare the front cover for the publication.

Several of the results given in the Analysis Publication derive from the application of occasionally complicated statistical techniques. The Analysis Report will not give details about such matters. Instead it is suggested that a technical report be written which can provide interested readers with technical information necessary for understanding the derivation of the estimates.

Appendix II

Draft Layout of Census Analysis Publication

Seal of the Republic
of
Namibia

THE POPULATION OF NAMIBIA AND ITS SOCIAL, ECONOMIC AND DEMOGRAPHIC CHARACTERISTICS:

Results from the 1991 Namibia Census of Population and Housing

Central Statistics Office
National Planning Commission
Windhoek
Republic of Namibia

[Text in brackets are general comments on the layout and contents of the analysis publication.]

PREFACE

[The preface gives information about when the census was taken, the various organizations providing assistance, and sincere thanks to those who made contributions. The preface will be one page. In particular, the people of Namibia should be thanked for their willingness in providing the census information. Preface is signed by Mr. Harding or the Director General of the National Planning Commission.]

CONTENTS

CONTENTS (Continued)

1. BASIC FACTS: A Summary

[It is always difficult to summarize a long analysis. The general guidelines for the summary is that it should be as concise as possible. The information charts mentioned in the proposal, an example of which is shown below, are given towards the end of the summary.]

[Small captions are set with font size 10. Ordinary text is with font size 11. Font is Times New Roman]

SUMMARY

Fertility

[It is particularly important that the Summary is well written and that topics come in a natural order. Wordiness and the usual kind of linguistic padding that often shows up in this kind of publications should be carefully screened out. The Summary should contain page references so that readers easily can find the main bodies of text.]

[The way this page is column-organized is perhaps an example to follow. On the left-hand side we have small captions telling the reader what the text on the right hand side deals with. That way the reader can swiftly find what he is looking for.

While the Summary advances from topic to topic in the same order as they appear in the main text, the example below shows how one might summarize fertility.

The left hand-side mentions the basic fertility measures. The right-hand side catches up with definitions and results.

The total fertility rate (TFR)

The total fertility rate, that is, the number of live born children a woman is expected to have during her reproductive period has been estimated at TFR = 6.1 at the time of the Census in 1991. Since there is no strong indication that fertility is falling, it may be assumed that the total fertility rate at the moment of preparing this publication (1994) is close to TFR = 6.

The gross reproduction rate (GRR)

The gross reproduction rate, that is, the number of daughters a woman is expected to produce during her reproductive period is GRR = 3.

The net reproduction rate (NRR)

Natural population growth

Population growth in regions, see pp. xx-yy.

The population currently doubles its size once every 21 years

The net reproduction rate, that is, the number of daughters a woman is expected to have during her lifetime is NRR = 2.5. The net reproduction rate takes into account that a woman may die before she reaches the age of 50. On the average, therefore, a Namibian woman bears two and a half daughters during her lifetime. The result of this reproductive level is a natural population growth (the growth attributable to the excess of births over deaths) of about 3.3 percent per year. Given such a growth rate, it takes about 21 years for the population to double its size. Given the current life expectancy of about 60 years, the population could double three times during the lifetime of an individual.]

1.1 Information Charts by Region

[Charts like the one shown below are produced for each region. These charts summarize the main facts. The chart below illustrates the basic idea.]

Central Statistics Office/National Planning Commission

1991 Namibia Census of Population & Housing

Namibia

Area .... sq. km.
Population Density .... persons per sq. km.

Population	Both Sexes	Males	Females
Aged Below 15			
Aged 15-64			
Aged 65+			

Infant Mortality ......
Life Expectancy
Males...
Females...

Total Fertility Rate...
Gross Reproduction Rate...
Net Reproduction Rate...

School Enrollment
(by suitable division)
Boys aged 7-15 ....
Girls aged 7-15 ...

Educational Attainment
(by suitable division)

Economically Active

Employed in Private Sector

Employed in Public Sector

Main Occupations
(by suitable division)

2. A BACKWARDS GLANCE

[The first chapter is a backwards glance involving references to past censuses (to the extent that these can be unearthed).]

[The chapter should not be a long one. Perhaps one or two pages, but not much more than that.]

[If it is possible to give a diagram showing the growth of the population during this century, then that should be given here.]

[Contact should be made with the Statistical Office in Pretoria so that all possibilities of finding old materials are properly explored.]

3. POPULATION DISTRIBUTION, DENSITY AND GROWTH

3.1 Namibia

[Population distribution and growth usually attracts a great deal of attention. For this reason the substantive findings concerning population distribution and density are put already here. There will have to be a few words about doubling time.]

[Because the population density of Namibia is very low, it may be reasonable to have some international comparisons. Population densities from other African nations as well as from Asia, North America and Western Europe can be given in a table or figure.]

3.2 Regions

[Population growth in regions comes here.]

[We need software that generates the map of Namibia and its regions. (A digitalized map.)]

[We need to know the area of each region so that population density can be calculated.]

[Producing a publication of this nature will require that an additional laser printer is acquired. Because some of the maps look extremely good in color, it should be seriously contemplated to acquire a color laser printer.]

4. THE HOUSEHOLD POPULATION

4.1 What is a Household?

[The definition of household used in censuses is often slightly different from that used in surveys. At any rate, whichever definitions or operational procedures are used, the household compositions identified in censuses are rarely the same as those identified in surveys. This is especially the case when the census is taken on a *de facto* basis. One of the main reasons for this is the frequent occurrence of proxy reporting in the census. These matters should receive some attention so that readers are well informed about the mechanism by which the data have been collected. Also, it should be borne in mind that the statistical bureau should devote time and effort to validation of statistical results so that consumers can get a fair impression of data quality/reliability.]

[Additional topics: What are institutional households? How many people live in such households? How were tourists accounted for in the census?]

4.2 Household Composition by Region

[Following the definitions given in 3.1, the household composition of Namibia and its regions is given. There is a break-down by urban and rural areas as well.]

[This chapter should be richly illustrated by means of diagrams/figures.]

5. PLACE OF BIRTH AND PLACE OF USUAL RESIDENCE

[A relatively small internal-migration chapter. There aren't a great deal of data available for the write-up.]

6. ECONOMIC ACTIVITY

6.1 Economically Active, and Not Economically Active Populations

[Standard economic categories were used in the census. These categories are:

(1) Worked;
(2) Did not work but had job or business;
(3) Unemployed (worked before);
(4) Unemployed (seeking job for the first time);
(5) Students;
(6) Homemakers;
(7) Income recipients;
(8) Disabled;
(9) Retired;
(10) Other.

The economically active population consists (by definition) of categories (1), (2), (3) and (4). The remaining categories make up the economically not active population.]

6.2 The Employed and Unemployed

6.3 Employment Status

[This section deals with where people work. Response categories are Employer; Own Account Worker; Government Employee; Employee in Private Enterprise; Unpaid Family Worker.]

6.4 Occupations

6.5 Industrial Affiliation

6.6 Labor Force Projections

7. EDUCATION

7.1 Literacy

7.2 The School Going Population

7.3 Educational Attainment

7.4 The Population Attending Higher Education

7.5 Vocational Training (?)

7.6 Projections of the School Going Population

8. MOTHER TONGUE

9. FERTILITY

9.1 Fertility by Region

9.2 Fertility by Marital Status and Region

9.3 Fertility by Educational Attainment, and Region

9.4 Fertility by Employment Status of Mother, and Region

9.5 Fertility by Housing Standard, and Region

9.6 Fertility as Estimated by the 1992 Demographic and Health Survey

[Several tabulations will have to be prepared in order to undertake the above mentioned analysis.]

10. MORTALITY

10.1 Child Mortality by Region

10.2 Child Mortality by Marital Status of Mother

10.3 Child Mortality by Educational Attainment of Mother, and Region

10.4 Child Mortality by Employment Status of Mother, and Region

10.5 Child Mortality by Housing Standard, and Region

[Several tabulations will have to be prepared in order to undertake the above mentioned analysis.]

10.6 Child Mortality as Estimated by the 1992 Demographic and Health Survey

10.7 The life table for Namibia

10.8 Life Expectancies by Region

17

11. DISABILITY

12. HOUSING CONDITIONS

12.1 Population by Type of Housing

[Type of housing involves: detached housing unit; semi-detached house; apartment; guest flat; part commercial or industrial; mobile home; single quarters; kraal/hut; improvised housing unit.]

12.2 Population by Tenure

[Rented; owner-occupied; rent-free.]

12.3 Population by Number of Rooms

12.4 Main Material Used for Outer Walls

12.5 Materials Used for Roofing

12.6 Fuel for Cooking

12.7 Fuel for Lighthing

12.8 Heating Fuel

12.9 Water Supply

12.10 Toilet Facilities

12.11 Ownership of Radio

12.12 Ownership of Television

12.13 Purchase of Newspaper

13. POPULATION PROJECTIONS

REFERENCES