World Population Projections to 2150

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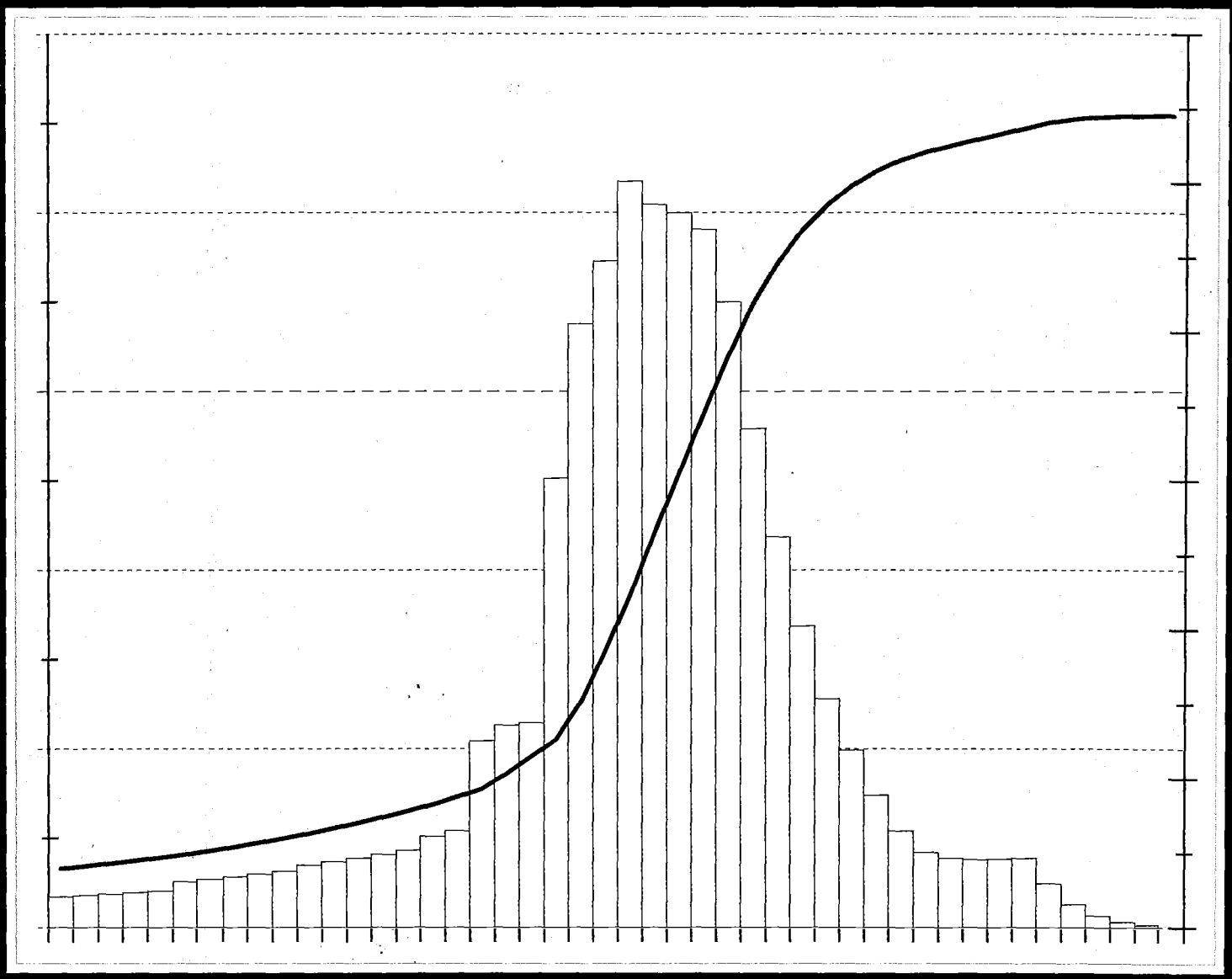

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Department of Economic and Social Affairs
Population Division

World Population Projections to 2150

United Nations • New York, 1998

NOTE

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The term "country" as used in the text of this publication also refers, as appropriate, to territories or areas.

The designations "developed" and "less developed" regions are intended for statistical convenience and do not necessarily express a judgement about the stage reached by a particular country or area in the development process.

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PREFACE

Every two years, the Population Division of the Department of Economic and Social Affairs at the United Nations Secretariat prepares the official United Nations estimates and projections of world, regional and national population size and growth, and demographic indicators. The latest of these revisions is the *1996 Revision* which was published in 1998 (United Nations, 1998). These biennial projections refer to the period 1950-2050.

The United Nations also prepares, as warranted, supplementary world population projections, extending the regular biennial projections into the long term. The present publication updates the previous long-range population projections based on data as assessed in the 1968, 1978, 1980 and 1990 rounds.

The United Nations Population Division is grateful to The David and Lucile Packard Foundation whose grant helped support this study. Acknowledgement is also due to Guy Stecklov, who assisted the Population Division in the preparation of the report.

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EXECUTIVE SUMMARY

The long-range population projections presented here, prepared by the United Nations Population Division, cover the period from 1950 to 2150. A total of seven projections for each of the eight major areas of the world are considered in this report. The variants are distinguished by their assumptions regarding future scenarios in total fertility rates. The range of potential demographic outcomes underscores the difficulty of focusing on any particular scenario and also highlights the critical importance of current policies and actions for the long-range future of the world population.

The seven main conclusions from these long-range population projections are:

- According to the medium-fertility scenario, which assumes fertility will stabilize at replacement levels of slightly above two children per woman, the world population will grow from 5.7 billion persons in 1995 to 9.4 billion in 2050, 10.4 billion in 2100, and 10.8 billion by 2150, and will stabilize at slightly under 11 billion persons around 2200.

- Although the high- and low-fertility scenarios differ by just one child per couple – half a child above and half a child below replacement fertility levels – the size of the world population in 2150 would range from 3.6 billion persons to 27.0 billion.

- If fertility rates were to stay constant at 1990-1995 levels for the next 155 years, the world in 2150 would need to support 296 billion persons.

- If all couples of the world had begun to bear children at the replacement-fertility level in 1995 (about 2 children per couple), the growth momentum of the current age structure would still result in a 67 per cent increase in the world population, to 9.5 billion by 2150.

- The future will see a continued geographical shift in the distribution of the world population as the share living in the currently more developed regions will decrease from 19 to 10 per cent between 1995 and 2150.

- Declining fertility and mortality rates will lead to dramatic population aging. In the medium-fertility scenario, the share aged 60 years or above will increase from 10 to 31 per cent of the world population between 1995 and 2150.

- The ultimate world population size of nearly 11 billion persons, according to the medium fertility scenario of these projections, is 0.7 billion persons fewer than previously published by the United Nations in 1992, mainly due to larger-than-expected declines in fertility in many countries.

FUTURE SIZE OF THE WORLD POPULATION

The medium-fertility scenario assumes that total fertility rates will ultimately stabilize by the year 2055 at replacement levels, which are slightly above two children per woman. The medium-fertility scenario, which lies in the centre of the projection scenarios, indicates that the world population will reach 9.4 billion by 2050, 10.4 billion by 2100, and 10.8 billion by 2150 (table A and figure A). The population of the world will ultimately stabilize at just under 11 billion persons around 2200.

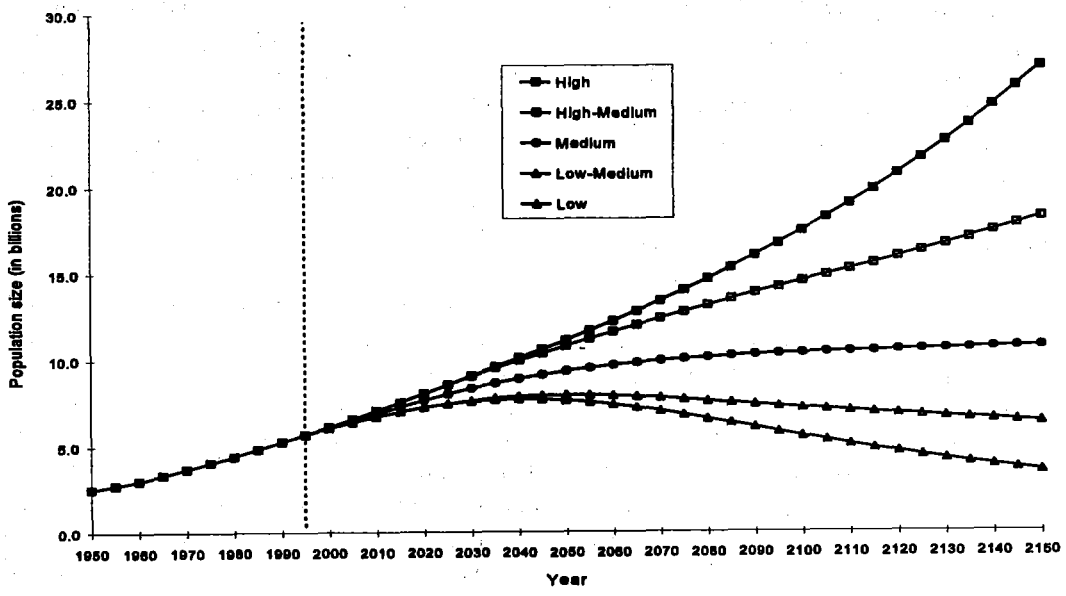
TABLE A. WORLD POPULATION PROJECTIONS BASED ON SEVEN SCENARIOS, 1950-2150

(Billions)

	Fertility scenarios						
Year	*Medium*	*High*	*High/Medium*	*Low/Medium*	*Low*	*Constant*	*Instant Replacement*
1950	2.5	2.5	2.5	2.5	2.5	2.5	2.5
1995	5.7	5.7	5.7	5.7	5.7	5.7	5.7
2050	9.4	11.2	10.8	8.0	7.7	14.9	8.4
2100	10.4	17.5	14.6	7.2	5.6	57.2	9.0
2150	10.8	27.0	18.3	6.4	3.6	296.3	9.5

Source: Population Division of the Department of Economic and Social Affairs at the United Nations Secretariat, *World Population Projections to 2150*, (United Nations, 1998).

FIGURE A. WORLD POPULATION SIZE ACCORDING TO THE MAIN FERTILITY SCENARIOS, 1950-2150



Source: Population Division of the Department of Economic and Social Affairs at the United Nations Secretariat, *World Population Projections to 2150*, (United Nations, New York, 1998).

The fertility gap separating the high- and the low-fertility scenarios is about one child. The high-fertility scenario assumes that total fertility rates will converge by 2050 to between 2.50 and 2.60 children per woman and the low-fertility scenario assumes that the total fertility rates will eventually stabilize at levels between 1.35 and 1.60 children per woman. According to the high-fertility scenario, world population will grow to 11.2 billion persons by 2050, 17.5 billion by 2100, and 27.0 billion by 2150. The low-fertility scenario is in sharp contrast and shows a world population increasing to 7.7 billion persons by 2050 but then declining to 5.6 billion in 2100 and eventually falling to 3.6 billion by 2150.

There are two intermediate scenarios, the high/medium- and low/medium-fertility scenarios, which assume that fertility rates will follow the high and the low patterns respectively until about 2025 after which they converge to 10 per cent above replacement level (in the high/medium-fertility scenario) and 10 per cent below replacement level (in the low/medium-fertility scenario). According to these two scenarios, the world population in 2150 would reach 18.3 billion and 6.4 billion respectively.

The constant-fertility scenario presents the results of future world population growth if fertility rates were to remain at 1990-1995 levels through the year 2150. The results highlight the unsustainability of the current situation: the world population under the constant-fertility scenario would reach 296 billion by the year 2150.

An additional analytical scenario demonstrates the vital role of age structure in influencing long-term population growth. Even if all couples in the world had begun in 1995 to bear children at the replacement-fertility level (instant replacement fertility scenario, which is roughly two children per couple), the built-in growth momentum of the population age structure would mean that the population of the world would continue to grow to 9.5 billion by the year 2150—a 67 per cent increase from 1995.

The ultimate world population size of nearly 11 billion persons according to the medium-fertility scenario of these United Nations long-range projections is 6 per cent lower than the 11.6 billion previously projected by the United Nations in 1992. The reduction of about 0.7 billion persons is mainly due to larger declines in the fertility rates in the developing countries than previously projected.

GEOGRAPHICAL DISTRIBUTION OF THE WORLD POPULATION

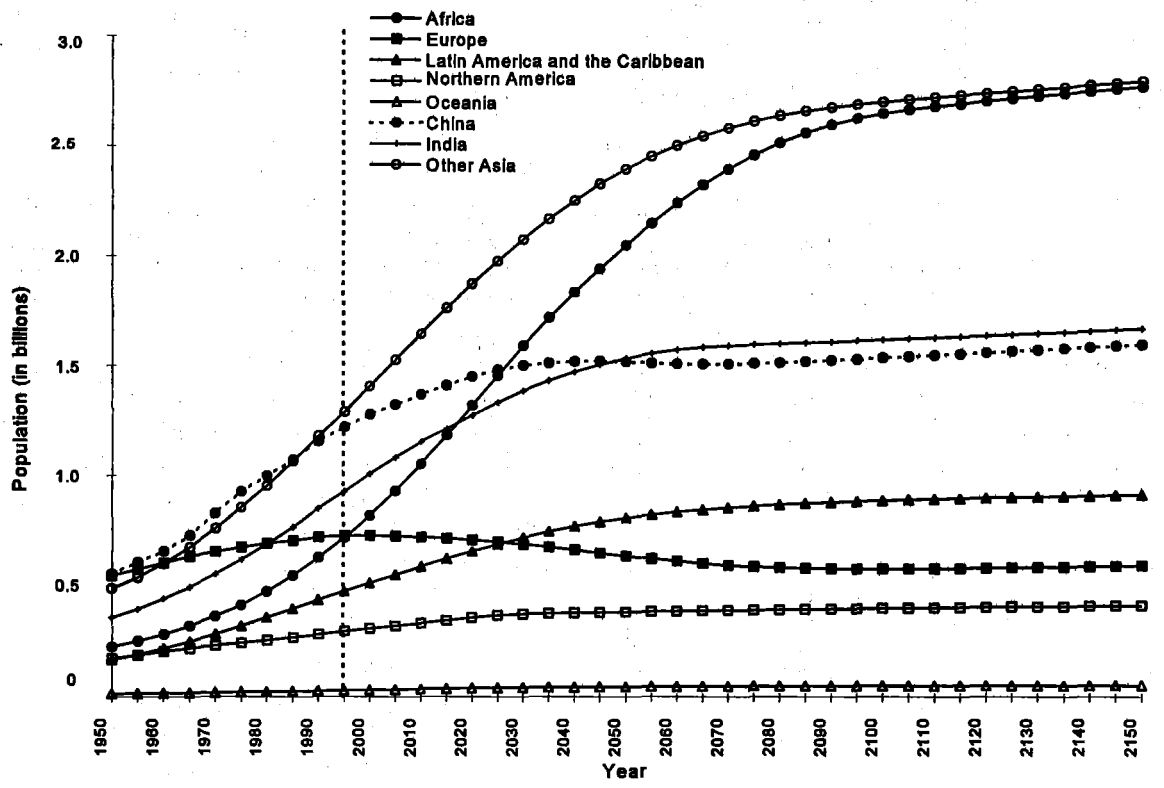
The growth of the major areas of the world is far from homogeneous. Separate projections for each major area are presented in figure B and table B. According to the results of the medium-fertility scenario, population growth will continue in all major areas except Europe. The population of Africa will nearly quadruple over the 155-year period—increasing from 0.7 billion persons in 1995 to 2.8 billion in 2150. Growth is also projected for Asia, with China growing from 1.2 billion persons to 1.6 billion, India from 0.9 billion persons to 1.7 billion, and the rest of Asia from 1.3 billion persons to 2.8 billion. The population of Latin America and the Caribbean is projected to rise from 477 million persons in 1995 to 916 million in 2150.

Northern America's population in 1995 is estimated at 297 million persons and it is expected to increase to 414 million by 2150. Oceania is expected to increase from 28 million persons to 51 million. Europe is the only major area whose population is projected to decline over time. In 1995, Europe's population stood at 728 million persons. By 2150, it is projected to fall to 595 million persons—a decline of 18 per cent over 155 years.

The different growth paths of the major areas of the world will lead to a substantial redistribution of the world population across the globe. The medium-fertility scenario projects a decline in the proportion of the world population living in Europe and

Northern America and an increase in the proportion found in Africa and several other parts of the world that are today categorized as less developed regions. In 1950, the population of Europe was more than twice that of Africa. However, by 2150, the population of Europe is projected to be one fifth the size of Africa according to the medium-fertility scenario.

FIGURE B. POPULATION SIZE OF THE MAJOR AREAS OF THE WORLD: MEDIUM FERTILITY SCENARIO, 1950-2150



Source: Population Division of the Department of Economic and Social Affairs at the United Nations Secretariat, ***World Population Projections to 2150***, (United Nations, 1998).

TABLE B. WORLD POPULATION PROJECTIONS BASED ON SEVEN FERTILITY SCENARIOS, MAJOR AREAS, 1950-2150
(*Millions*)

Year	*Fertility scenarios*						
	Medium	*High*	*High/Medium*	*Low/Medium*	*Low*	*Constant*	*Instant replacement*
			World				
1950	2,524	2,524	2,524	2,524	2,524	2,524	2,524
1995	5,687	5,687	5,687	5,687	5,687	5,687	5,687
2050	9,367	11,156	10,816	7,969	7,662	14,941	8,396
2100	10,414	17,497	14,587	7,228	5,583	57,182	9,041
2150	10,806	26,979	18,294	6,400	3,550	296,333	9,457
			Africa				
1950	224	224	224	224	224	224	224
1995	719	719	719	719	719	719	719
2050	2,046	2,408	2,319	1,807	1,731	4,492	1,234
2100	2,646	4,328	3,559	2,022	1,580	30,509	1,385
2150	2,770	6,873	4,547	1,835	1,061	212,720	1,463
			Asia (including China and India)				
1950	1,402	1,402	1,402	1,402	1,402	1,402	1,402
1995	3,438	3,438	3,438	3,438	3,438	3,438	3,438
2050	5,443	6,501	6,304	4,576	4,405	8,234	5,218
2100	5,851	9,917	8,267	3,921	3,038	23,176	5,594
2150	6,059	15,191	10,292	3,433	1,915	76,822	5,845
			China				
1950	555	555	555	555	555	555	555
1995	1,220	1,220	1,220	1,220	1,220	1,220	1,220
2050	1,517	1,765	1,729	1,246	1,198	1,479	1,694
2100	1,535	2,412	2,120	951	697	1,303	1,796
2150	1,596	3,467	2,618	824	397	1,151	1,875
			India				
1950	358	358	358	358	358	358	358
1995	929	929	929	929	929	929	929
2050	1,533	1,885	1,819	1,266	1,231	2,535	1,453
2100	1,617	2,968	2,414	1,044	820	6,494	1,566
2150	1,669	4,736	3,050	905	510	17,109	1,641
			Europe				
1950	547	547	547	547	547	547	547
1995	728	728	728	728	728	728	728
2050	638	742	731	567	538	614	786
2100	579	945	833	417	277	418	827
2150	595	1,379	1,041	368	137	281	862

TABLE B (*continued*)

Year	Fertility scenarios						
	Medium	*High*	*High/Medium*	*Low/Medium*	*Low*	*Constant*	*Instant replacement*
			Latin America and the Caribbean				
1950	166	166	166	166	166	166	166
1995	477	477	477	477	477	477	477
2050	810	1,001	967	671	650	1,164	770
2100	889	1,585	1,300	587	471	2,579	830
2150	916	2,470	1,619	516	307	5,857	865
			Northern America				
1950	172	172	172	172	172	172	172
1995	297	297	297	297	297	297	297
2050	384	452	442	310	301	379	349
2100	401	644	563	246	191	382	365
2150	414	950	714	217	112	383	380
			Oceania				
1950	13	13	13	13	13	13	13
1995	28	28	28	28	28	28	28
2050	46	53	52	39	37	57	38
2100	49	78	67	34	26	119	40
2150	51	115	82	30	17	269	42

Source: Population Division of the Department of Economic and Social Affairs at the United Nations Secretariat, *World Population Projections to 2150*, (United Nations, 1998).

AGE STRUCTURE OF WORLD POPULATION

The growth in the size of the world population is matched by a large shift in the age structure of the world population (see figure C). The medium-fertility scenario indicates that the median age of the world population will rise from 25.4 years in 1995, to 36.5 years in 2050, to 42.9 years by 2150.

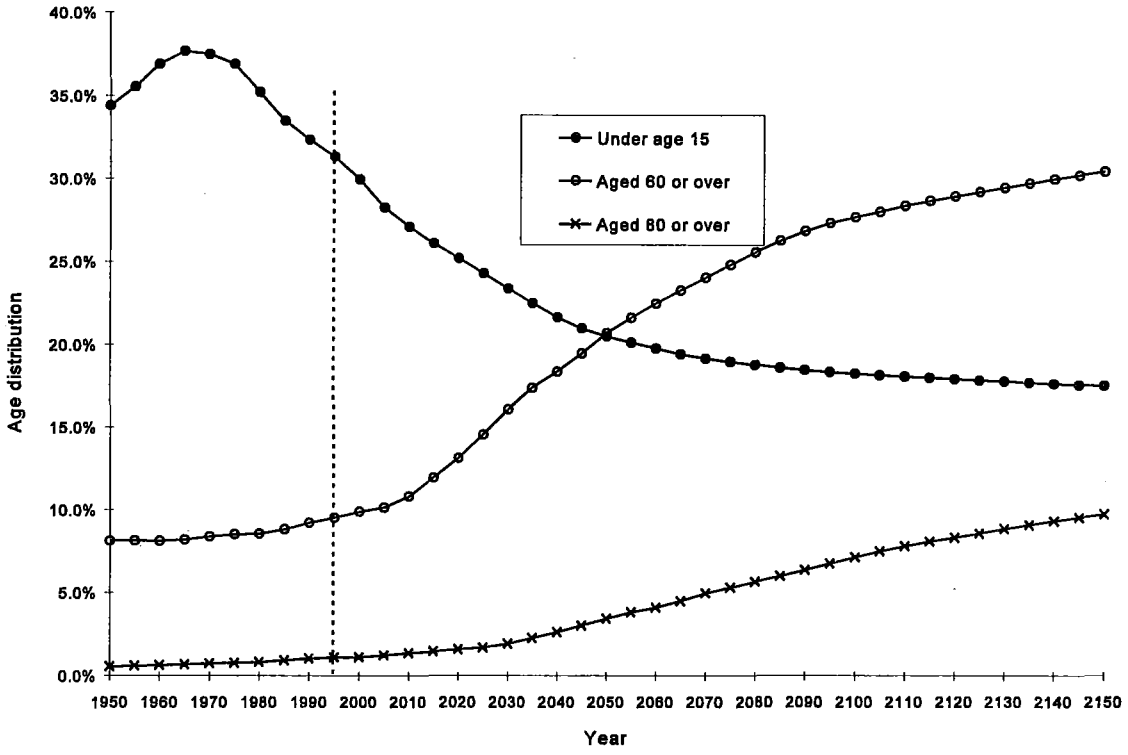
The share of the world's population under 15 years of age will decline from 31 per cent in 1995 to 17 per cent by 2150. In contrast, the percentage of the population of the world aged 60 or above will increase rapidly from 9 per cent in 1995 to 30 per cent in 2150. Among the elderly age groups, it is the oldest old—those aged 80 or over—that will increase the most rapidly over time. According to the medium fertility scenario, the number aged 80 or over will grow from 61 million in 1995 to 320 million in 2050 and 1,055 million by 2150.

CONCLUSION

While it is certain that the world population will continue to grow significantly in the medium term, there is less certainty in the longer term. The medium fertility scenario projects that world population could reach 10.8 billion persons by 2150 and would ultimately stabilize at nearly 11 billion persons around 2200. However, the low and high fertility scenarios put a large band around the numbers—from 3.6 billion persons in 2150 to 27.0 billion in 2150. This range of potential demographic outcomes underscores the difficulty in focusing on any particular scenario and also highlights the critical importance of current policies and actions for the long-range future of the world population.

FIGURE C. WORLD POPULATION UNDER AGE 15, AGED 60 OR OVER, AND AGED 80 OR OVER, 1950-2150: MEDIUM FERTILITY SCENARIO

(*Percentage*)



Source: Population Division of the Department of Economic and Social Affairs at the United Nations Secretariat, ***World Population Projections to 2150***, (United Nations, 1998).

INTRODUCTION

This publication presents estimates of the future size, geographical distribution and age structure of the world population until the year 2150. While the mathematics of demographic processes are well-understood, the future of marriage and fertility as well as the continued progress against disease and morbidity are far more difficult to gauge. In the end, population projections are only as accurate as the ability to assess the evolution in the basic demographic variables: fertility, mortality, and migration. By presenting several possible scenarios—each portraying a different vision of future demographic behaviour—this report offers a range of estimates of the future population of the world.

Every two years, the United Nations prepares revised estimates and four variants (medium-, high-, low- and constant-fertility) of projections of the world, the major areas, and national population size, age structure, and demographic indicators. These biennial projections currently refer to the period 1950-2050. The latest *Revision* was completed in 1996 and is referred to as the "*1996 Revision*" (United Nations, 1998). However, realization of the full consequences of changes in fertility on population growth may require longer than half a century. The long-range projections presented here extend the projection horizon for an additional 100 years (to the year 2150).

Seven projection scenarios to the year 2150 are presented. Six are extensions of the *1996 Revision*, using as a base the population and demographic characteristics from 2050 or 2025 from one of the four variants of the *1996 Revision*. These six scenarios vary according to the assumed trend of expected fertility. The six extensions are the medium-, high-, high/medium-, low/medium-, low-, and constant-fertility scenarios. The seventh scenario, the instant-replacement-fertility scenario, is not a direct extension of the *1996 Revision*.

Although an unlimited number of potential long-range projection scenarios may be hypothesized, six of the seven scenarios presented here are chosen because they follow directly from the four variants of the *1996 Revision* and are designed to be consistent to the extent possible with the assumptions underlying the *1996 Revision*. The instant-replacement-fertility scenario is presented because of its importance in demonstrating the underlying role of age structure in affecting future population growth. Each of the various scenarios reflects different assumptions about future fertility rates and the results demonstrate the long-term consequences of these assumptions. Specific details about the fertility levels assumed for each of the scenarios are provided below.

The present publication updates the 1992 long-range population projections (United Nations, 1992). The update is important because of recent improvements in the quality and availability of data and because of important changes in demographic trends during this decade. Of particular interest is the accumulation of recent data, particularly from the Demographic and Health Surveys, which point to fertility declines in a number of sub-Saharan African countries. The data collected from the Demographic and Health Surveys as well as the earlier World Fertility Surveys have also allowed for better estimates of trends in infant and child mortality. One additional modification in this revision is that maximum life expectancy has been extended to 87.5 (males) and 92.5 (females) to take account of recent increases. Earlier projections limited life expectancy at 82.5 (males) and 87.5 (females) (United Nations, 1992).

As a result of changing baseline data and assumptions, the population size and characteristics at the start of these projections are different from those in the earlier 1992 long-range projections. Table 1 shows the projected populations in 2025 in both the

1990 Revision and the *1996 Revision* as well as the total fertility rates for 2020-2025 for the three main variants: medium-, high-, and low-fertility. Since there has been some shift in the regional aggregations and geographical definitions since the *1990 Revision*, table 1 replicates the exact categories used in the *1990 Revision*. According to the medium-fertility variant, the population size of the world in 2025 is projected in the *1996 Revision* to be smaller by 465 million persons (5.5 per cent) than that projected in the *1990 Revision*. The difference in expected population sizes in 2025 is even more pronounced in the high-fertility variant, with the *1996 Revision* estimating the population to be smaller by 863 million persons. However, the low-fertility variant projects a slightly large population in 2025 in the *1996 Revision* compared to the 2025 estimate from the *1990 Revision*. The most pronounced differences in the population estimates for 2025 are for Africa and the former USSR. The former USSR, which is allocated to Europe and Other Asia in the *1996 Revision* medium-fertility variant, is estimated in 2025 to be about 19 per cent smaller than was estimated in the *1990 Revision*. Africa's population in 2025 is also estimated to be about 9 per cent smaller than in the *1990 Revision*. These differences in population sizes are primarily driven by the different fertility schedules as well as slight variations in projected life expectancies.

TABLE 1. PROJECTED POPULATION IN 2025 AND FERTILITY LEVELS FOR 2020-2025: WORLD AND MAJOR AREAS, ACCORDING TO THE UNITED NATIONS 1990 AND 1996 REVISIONS

Areas	*Medium variant*		*High variant*		*Low variant*	
	1990	*1996*	*1990*	*1996*	*1990*	*1996*
			Population in 2025 (millions)			
World	8,504	8,039	9,444	8,581	7,591	7,662
More developed regions	1,354	1,319	1,466	1,393	1,254	1,240
Less developed regions	7,150	6,721	7,978	7,188	6,336	6,234
Europe	515	502	550	524	481	479
Northern America	332	369	375	394	297	336
Former USSR	352	297	375	319	331	281
Oceania	38	41	43	43	35	38
Africa	1,597	1,454	1,807	1,546	1,375	1,371
Latin America and the Caribbean	757	690	832	753	682	632
Asia	4,912	4,686	5,464	5,002	4,389	4,338
China	1,513	1,480	1,680	1,561	1,369	1,367
India	1,442	1,330	1,567	1,439	1,294	1,223
			Total fertility rates in 2020-2025			
World	2.27	2.35	2.78	2.78	1.79	1.85
More developed regions	1.94	1.88	2.25	2.23	1.56	1.42
Less developed regions	2.32	2.43	2.87	1.92	1.83	1.92
Europe	1.85	1.78	2.17	2.09	1.52	1.37
Northern America	1.94	2.09	2.25	2.47	1.58	1.50
Former USSR	2.10	1.81	2.41	2.22	1.60	1.39
Oceania	2.02	2.22	2.30	2.63	1.62	1.67
Africa	3.04	3.28	4.01	3.74	2.31	2.83
Latin America and the Caribbean	2.39	2.18	2.81	2.65	2.11	1.66
Asia	2.06	2.19	2.50	2.62	1.63	1.67
China	1.80	2.10	2.10	2.43	1.50	1.50
India	2.07	2.10	2.58	2.60	1.56	1.60

Source: Population Division of the Department of Economic and Social Affairs at the United Nations Secretariat, *World Population Prospects: The 1990 Revision* and *World Population Prospects: The 1996 Revision*..

I. DESCRIPTION OF THE APPROACH AND GEOGRAPHICAL DETAIL

A. THEORETICAL FOUNDATION OF THE LONG-RANGE PROJECTIONS

The long-range projections are based on a cohort-component approach with five-year projection intervals. The cohort-component approach updates a base population, distributed by sex and five-year age group, at five-year intervals, using assumed age- and sex-specific probabilities of surviving for each five-year period, assumed age- and sex-specific probabilities of migrating for each five-year period and assumed age-specific probabilities of a woman experiencing a birth during the five-year interval. A detailed description of the cohort-component approach can be found in *World Population Prospects: The 1996 Revision* (United Nations, 1998).

The long-range projections presented here are a time-extension through the year 2150 of the *1996 Revision* of the United Nations world population estimates and projections. They extend the *1996 Revision* for an additional 100 years (to the year 2150), using as a base the population size and characteristics that are estimated on a country by country basis from the *1996 Revision.* This approach ensures that the long-range forecasts are compatible with the *1996 Revision.*

The four projection variants presented in the *1996 Revision* are maintained in the long-range projection, and three additional scenarios are examined. Thus, a total of seven fertility scenarios are projected in these long-range projections of world population, and while they all project population evolution through the year 2150 (the medium-fertility scenario continues until 2200), there are differences in the date until which the *1996 Revision* data are used and after which the extension to 2150 begins.

Of the seven scenarios presented in this report, five are intended as potential future population trends and two are included for purposes of illustration and analytical comparison with the potential scenarios. The medium-fertility scenario continues from the estimated population size and structure, and the fertility and mortality rates projected until 2050 in the medium variant of the *1996 Revision,* and assumes that fertility levels eventually stabilize at the exact replacement-fertility level in each of the eight major areas of the world. The high- and the low-fertility scenarios assume that population size and structure and the fertility and mortality levels evolve as projected in the high and the low variants of the *1996 Revision.* Then, beginning in 2050, the populations are projected forward by assuming that total fertility rates in the high variant eventually stabilize at between 2.5 to 2.6 children per woman, and in the low variant between 1.35 to 1.6.

The high/medium and the low/medium scenarios are based on the high and the low projections of the *1996 Revision* until 2025 and then assume that total fertility rates between 2025-2050 converge to a level either 10 per cent above the replacement-fertility level (2.3 in the "high/medium" scenario) or 10 per cent below the replacement-fertility level (1.9 in the "low/medium" scenario).

The constant-fertility scenario continues the constant-fertility variant of the *1996 Revision* and assumes that the total fertility rates remain constant for an additional 100 years from 2050 to 2150. The final long-range projection is the instant-replacement scenario. According to this scenario, fertility levels in the 1995-2000 period are immediately reduced (or increased for certain major areas) to the replacement-fertility level and are maintained at the replacement level for each five-year period through 2150. Neither the constant- nor the instant-replacement-fertility scenarios are intended as plausible population projections but they are useful for analytical purposes by clarifying the long-term consequences of demographic factors.

All seven scenarios assume the same trend in life expectancy over time. This is not necessarily because

mortality trends are inherently more predictable, but because mortality variations have a much smaller effect on future population trends than fertility variations. The scenarios also assume no net international migration after 2025 for the world's major areas. The fertility, mortality, and migration assumptions are described in more detail in the following sections.

B. GEOGRAPHICAL DETAIL

The biennial United Nations publication, *World Population Prospects,* estimates population change for each country in the world separately. The long-range projections, in contrast, independently project eight separate major areas of the world starting from 2050. The geographical units used in these projections are termed major areas and comprise Africa, Europe, Latin America and the Caribbean, Northern America, Oceania, China, India, and Other Asia (Asia excluding China and India). The definitions of Europe and Other Asia differ slightly from those used in the 1992 long-term projection because of the breakup of the Soviet Union. Now, the 15 states of the former Soviet Union are incorporated within Europe or Other Asia. The term "major area" is purely intended to facilitate the description of this analysis since China and India are single countries (albeit very large ones).

These geographical groupings were further consolidated into two aggregations. Group 1 includes Europe, Northern America, and Oceania. Group 2 includes Africa, Latin America and the Caribbean, China, India, and Other Asia (Asia excluding China and India). Most countries in the major areas included in Group 1 are at the end of the fertility transition and currently exhibit relatively low levels of fertility and mortality. Most of the countries in the major areas included in Group 2 began the fertility transition later (or have not yet begun) and tend to exhibit higher fertility and mortality levels. The Groups 1 and 2 aggregations used here are quite similar to the "more developed regions" and "less developed regions" classifications accepted for the *1996 Revision* and often used by the United Nations. However, a number of important exceptions should be pointed out. Melanesia, Micronesia, and Polynesia (in Oceania) are included in Group 1 in these projections but they were included as part of the less developed regions in the *1996 Revision.* Japan (in Other Asia) is included here as part of Group 2 but was included in the more developed regions in the *1996 Revision.* Because China weighs so heavily in the Group 2 region but is closer in demography to the major areas included in Group 1, Group 2 estimates are sometimes provided with China excluded.

C. MORTALITY ASSUMPTIONS

Trends in mortality for each of the eight major areas of the world are expressed in terms of life expectancies at birth, by sex. As in the biennial population projection as well as in the previous long-range projections, only one scenario of mortality decline is examined. Incorporating additional mortality scenarios would have generated a far larger number of results, but the ultimate effect would be small compared to the effect of variation in fertility levels.

For each of the eight areas, life expectancy at birth is projected to improve from the levels assumed in 2045-2050, according to the United Nations working model for mortality improvement (see *1996 Revision*). The limits to life expectancy have been increased since the previous long-range projections were done in 1992. This is an important modification, and reflects the realization that the mortality levels are rapidly declining worldwide and, in particular, that some developed countries such as Japan and Sweden were projected to be on the verge of surpassing the previous upper limit by the year 2050. In fact, the estimated life expectancy for women in Japan in 1995-2000 is already higher than the previous upper limit for males. The new, modified limit assumes an ultimate life expectancy at birth of 87.5 for males and 92.5 for females for each major area, with no further declines in mortality levels once these levels are reached. These limits are also higher than the limits incorporated in the *1996 Revision,* but since no countries in the *1996 Revision* actually reach the lower limits of 82.5 for males and 87.5 for females, the projections remain fully compatible. Life expectancies are assumed to increase according to this

one model in all major areas. Life expectancies of the major areas which are composed of multiple countries, are also affected by the changing composition of each area. Faster growing countries contribute increasing large weight to the life expectancy values of each major area over time. The evolution of life expectancy levels is summarized in table 2 below:

TABLE 2. WORKING MODEL FOR IMPROVEMENTS IN LIFE EXPECTANCY

Initial mortality level (e_0 in years)	*Male*	*Female*
55.0-57.5	2.5	2.5
57.5-60.0	2.5	2.5
60.0-62.5	2.3	2.5
62.5-65.0	2.0	2.5
65.0-67.5	1.5	2.3
67.5-70.0	1.2	2.0
70.0-72.5	1.0	1.5
72.5-75.0	0.8	1.2
75.0-77.5	0.5	1.0
77.5-80.0	0.4	0.8
80.0-82.5	0.4	0.5
82.5-85.0	0.4	0.4
85.0-87.5	0.4	0.4
87.5-92.5	-	0.4

Source: Population Division of the Department of Economic and Social Affairs at the United Nations Secretariat, *World Population Projections to 2150*, (United Nations, 1998).

Table 3 presents the assumed life expectancies for the world, Groups 1 and 2, and for each of the major areas in 1990-1995, 2020-2025, 2070-2075 and 2145-2150. Since life expectancy is assumed to increase more rapidly for major areas starting with lower life expectancy levels, the variance in life expectancies across major areas will decline over time. Whereas female life expectancy for Group 1 in 1990-1995 is more than 13 years higher than in Group 2, the difference is less than four years by the end of the projection in 2145-2150. For the world as a whole, life expectancy is assumed to increase from 62.2 for males and 66.5 for females in 1990-1995 to 83.4 for males and 88.2 for females. Thus, over this 155-year period, the average length of life is anticipated to increase by more than 21 years. Northern America is the only one of the eight major areas where life expectancy is assumed to rise to the upper limit, as female life expectancy in Northern America is projected to reach 92.5 by 2145-2150.

TABLE 3. LIFE EXPECTANCY AT BIRTH FOR THE MAJOR AREAS OF THE WORLD; ESTIMATES FOR 1990-1995, ASSUMPTIONS FOR 2020-2025, 2070-2075 AND 2145-2150: MEDIUM FERTILITY SCENARIO

	1990-1995		2020-2025		2070-2075		2145-2150	
Areas	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*	*Male*	*Female*
World	62.2	66.5	69.7	74.5	77.2	82.2	83.4	88.2
Group 1	70.4	78.0	75.1	81.6	79.9	85.8	86.0	91.8
Europe	68.5	76.9	73.5	80.5	79.1	85.3	85.2	91.3
Northern America	72.8	79.5	76.9	82.7	81.1	86.7	87.1	92.5
Oceania	70.3	75.6	75.7	80.7	80.3	85.4	86.3	91.4
Group 2	60.6	63.7	68.8	72.9	76.9	81.7	83.1	87.9
Africa	50.4	53.3	62.8	66.1	74.9	79.3	81.8	86.2
Latin America and the Caribbean	65.3	71.8	71.8	78.2	77.7	83.8	83.7	89.8
China	66.7	70.5	72.6	76.7	78.3	82.9	84.4	88.9
India	60.3	60.6	69.3	72.4	76.5	81.2	82.7	87.5
Other Asia	62.7	66.6	71.3	75.8	77.9	82.6	83.9	88.5

Source: Population Division of the Department of Economic and Social Affairs at the United Nations Secretariat, *World Population Projections to 2150*, (United Nations, 1998).

D. FERTILITY ASSUMPTIONS

Variations in the anticipated future trends in fertility are primarily responsible for generating the differences in the United Nations world population projections. The assumptions about fertility are incorporated in terms of the projected total fertility rates of each of the eight major areas. The total fertility rate (TFR) is a convenient single index of fertility which represents the expected number of children a representative woman would bear throughout her life if she gave birth according to the age specific fertility rates prevailing during a given reference period.

The fertility assumptions of the long-range projections are based on those of the *1996 Revision* through the year 2050. Following 2050, the variants are extended by assuming fertility trends consistent with those prior to 2050. Although projections for the *1996 Revision* are carried out only as far as 2050, fertility assumptions are made in terms of the ultimate levels at which fertility will stabilize and the periods in which the ultimate levels will be reached (see *1996 Revision*). For all individual countries, the *1996 Revision* medium variant assumes that the total fertility rates will eventually stabilize at the replacement-fertility level, which fall just below 2.1. The high variant for individual countries in the *1996 Revision* assumes that total fertility rates will stabilize at either 2.5 or 2.6 and the low variant assumes that they will stabilize between 1.14 and 1.60.

The fertility assumptions for the major areas for the medium-, high- and low-fertility scenarios of the long-range projections are hence set to be consistent with the ultimate fertility levels and periods assumed for the individual countries for the medium-, high- and low-fertility variants of the *1996 Revision*. They are designed as simple extensions of the *1996 Revision*, albeit on a more aggregated level. The high/medium and low/medium scenarios provide alternative future fertility assumptions above and below the medium scenario. In these two intermediate scenarios, the high and low levels are assumed until 2025 and are then tempered by a shift towards the replacement-fertility levels. Therefore, intermediate projections present the effect of high and low fertility in the relatively near future but not in the more distant future

(i.e. post-2050). This is important because of the "cumulative effect" of population growth which implies that even small deviations from replacement-fertility levels will lead to rapid population growth. Two additional illustrative scenarios have also been prepared: the constant-fertility scenario and the instant-replacement-fertility scenario. Both of these scenarios incorporate an unrealistic assumption about future trends in fertility but they nonetheless provide a very useful comparative standard with which to examine the range of demographic outcomes.

The following section provides details about the demographic assumptions which are at the basis of each of the seven scenarios. Table 4 presents the estimated total fertility rates for each major area in 1990-1995 and the ultimate total fertility rate for 2050-2055 for all scenarios. Figure I presents the evolution of the total fertility rate in the medium-fertility scenario for all major areas of the world. In addition, the evolution of fertility rates for the different scenarios between 1950 and 2060 can be observed for each major area in figure II.

TABLE 4. ESTIMATED FERTILITY IN 1990-1995 AND ASSUMED FERTILITY IN 2050-2055 FOR MAJOR AREAS OF THE WORLD: ALL FERTILITY SCENARIOS

Area	*Estimated TFR 1990-1995*	*2050-2055*						
		Medium	*High*	*High/ Medium*	*Low*	*Low/ medium*	*Instant replacement*	*Constant*
World	2.96	2.07	2.58	2.30	1.57	1.90	2.09	4.27
Africa	5.71	2.06	2.60	2.30	1.60	1.90	2.10	6.05
Asia (China)	1.92	2.09	2.50	2.30	1.50	1.90	2.10	1.92
Asia (India)	3.39	2.08	2.60	2.30	1.60	1.90	2.07	3.39
Asia (Other)	3.43	2.07	2.60	2.30	1.60	1.90	2.10	4.39
Europe	1.57	2.06	2.50	2.30	1.35	1.90	2.08	1.62
Latin America and the Caribbean	2.93	2.06	2.60	2.30	1.60	1.90	2.09	3.22
Northern America	2.02	2.06	2.50	2.30	1.50	1.90	2.08	2.02
Oceania	2.51	2.06	2.54	2.30	1.54	1.90	2.11	3.35

Source: Population Division of the Department of Economic and Social Affairs at the United Nations Secretariat, *World Population Projections to 2150*, (United Nations, 1998).

Medium-fertility scenario

The medium-fertility scenario assumes that total fertility rates will follow the trends of the medium variant of the *1996 Revision* through 2050 and then stabilize at replacement-level by 2050-2055. In order to base the long-range projections on the *1996 Revision* through 2050, it is necessary to assume that the fertility rates nearly converge to 2.1 by 2050 and then drop slightly to reach exact level of replacement-fertility. Whereas the *1996 Revision* simply used 2.1 as the replacement level, the replacement-fertility level in the long-range projections is calculated based on the total fertility rate at which the net reproduction rate is equal to 1 in the final year of the projection (2150). The long-range projections require this extra degree of precision since even a small deviation from the exact replacement level would mean that population growth would continue indefinitely. Since life expectancy rises consistently throughout the projection years, the calculated replacement-level total fertility rate will be slightly below the actual replacement level of the period until the last period when life expectancy reaches its maximum.

Prior to 2050, fertility in the major areas is based on the *1996 Revision* and, as shown in figure I (TFR's from 1950-1955 to 2055-2060), fertility in all major

areas but Europe has already reached the ultimate medium-fertility target. It is assumed that European total fertility rates will reach 2.06 by 2050-2055. According to the medium-fertility scenario, Europe, Northern America and China are assumed to experience a rise in total fertility rates between 1990-1995 and 2050-2055. This is because the underlying assumption of the medium-fertility scenario is that fertility levels will converge to the replacement level. Oceania's total fertility rate is assumed to fall from 2.51 to 2.06. Total fertility rates in Latin America and the Caribbean are estimated to decline from 2.93 to 2.06; in India from 3.39 to 2.08; and in the Other Asia from 3.43 to 2.07. Fertility levels in Africa are assumed to make the biggest decline over the 55 year period, starting at 5.71 in 1990-1995 and eventually falling to the replacement level of 2.06 by 2050-2055.

Although fertility rates in all major areas are at the replacement level by 2050-2055, population will continue to grow for an extended period. This is due to the "growth momentum", which is the effect of age structure in propelling population growth after fertility levels are reduced to replacement-levels. All major areas in the world have relatively young age distributions, which are inherited from the higher fertility levels of the past. Even after fertility rates have dropped to the replacement-fertility level, relatively large cohorts will continue to enter their reproductive ages resulting in continued population increases.

High-fertility scenario

The high-fertility scenario follows the high-fertility variant of the *1996 Revision* until 2050 and assumes for the most part that the total fertility rate for 2045-2050 from the *1996 Revision* continues. The only exception is Europe where the total fertility rate reaches its ultimate high level of 2.50 only in 2050-2055. Otherwise, it is assumed that the total fertility rates in Northern America and China eventually stabilize at 2.50; in Oceania the total fertility rate stabilizes at 2.54, and in Africa, India, Other Asia, and Latin America and the Caribbean the total fertility rates stabilize at 2.60.

High/Medium-fertility scenario

The high/medium-fertility scenario assumes that the total fertility rate in each major area follows the high-fertility variant from the *1996 Revision* until 2025, whereupon total fertility rates converge to 2.3—roughly 10 per cent above the replacement total fertility rate. Thus, following the first 30 years of relatively high fertility, fertility levels decline to a level closer to replacement, although still above. All of the major areas reach the 2.3 level between 2035-2045. The transition from the high-fertility level to 2.3 is assumed to take on the form of a logistic curve which can be seen in figure II where the transition of total fertility rates from 1990-2060 for all major areas is shown.

Low/Medium-fertility scenario

The low/medium-fertility scenario assumes that the total fertility rate in each major area follows the low-fertility variant from the *1996 Revision* until 2025 whereupon total fertility rates converge to a level of 1.9—roughly 10 per cent below the replacement level total fertility rate. Thus, fertility levels are low for the initial 30 years but they then rise by 2050 to levels only slightly below replacement. Fertility in all of the major areas is assumed to reach the 1.9 level between 2035-2050. The transition from the low-fertility level to 1.9 is assumed to take a logistic trend between 2025 and 2050 and the exact patterns are presented in figure II.

Low-fertility scenario

The low-fertility scenario follows the low-fertility variant of the *1996 Revision* until 2050 and assumes that the total fertility rate for 2045-2050 from the low-variant of the *1996 Revision* continues. It is assumed that the European total fertility rate stabilizes at 1.35, the Northern American and Chinese total fertility rates stabilize at 1.50, the Oceanian total fertility rate stabilizes at 1.54, and the African, Indian, Other Asian, and Latin America and Caribbean total fertility rates stabilize at 1.60.

Instant-replacement-fertility scenario

The instant-replacement scenario determines the size of the world population if fertility rates are immediately lowered to replacement levels and maintained at replacement levels during each future period. This scenario is interesting because it offers a useful perspective with which to compare the future growth of world population and the consequences of age structure for population growth. Although fertility is instantly reduced (or increased in certain major areas) to the replacement level in 1995, the population of all major areas continues to grow owing to the "growth momentum" built into the age structure at the time that replacement fertility is reached.

The replacement-level fertility is calculated for each five-year period. Since life expectancy is assumed to continue rising over time through 2150, the replacement-level fertility is constantly declining and is adjusted in the projection. Using Africa as an example, the replacement-level total fertility rate is equal to 2.57 in 1995-2000 when female life expectancy is estimated at 55.3 and male at 52.3. By 2145-2150, female life expectancy is estimated to rise to 86.3 and male to 81.8 and the replacement-level total fertility rate falls to 2.06. Unlike the medium-fertility scenario, the impact of rising life expectancies is not included within the population momentum effect. Thus, the instant-replacement fertility scenario isolates the long-term effects of the population age structure on future population growth, net of any effects of changes in fertility and mortality rates.

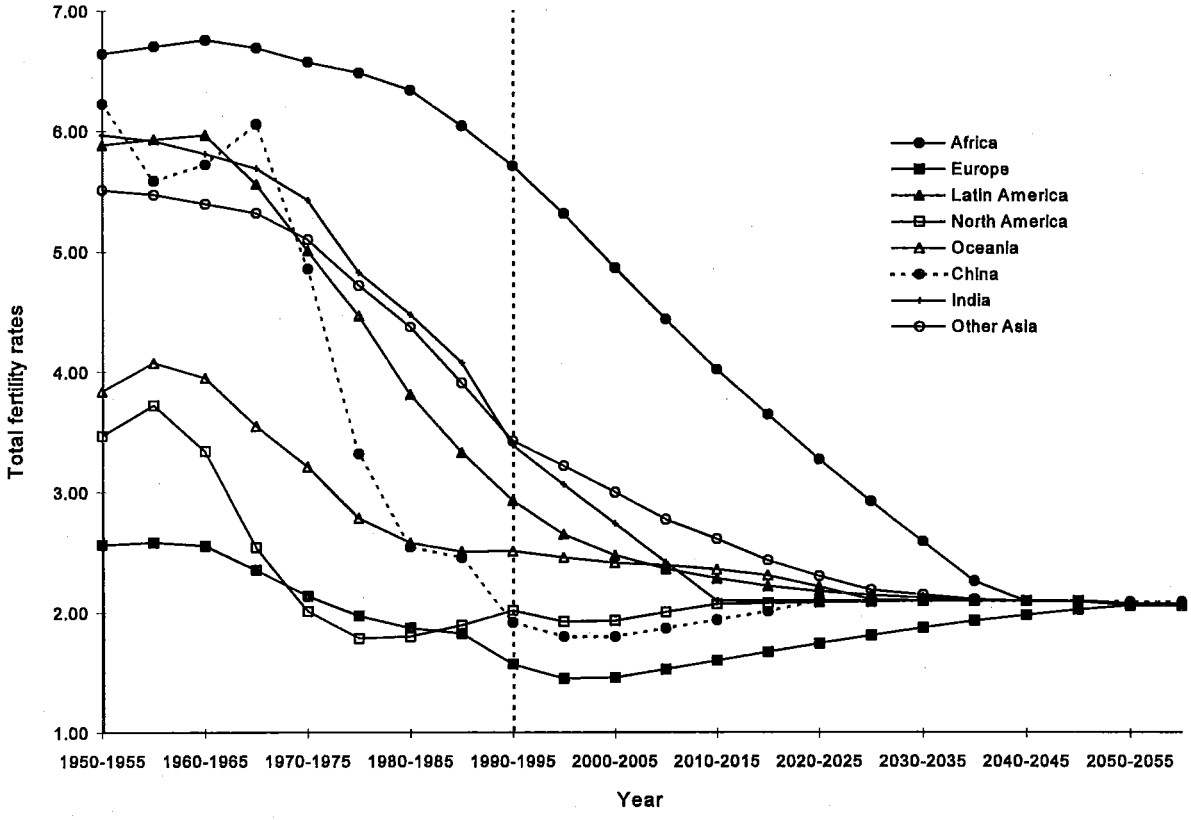
Constant-fertility scenario

The constant-fertility scenario assumes that fertility levels continue from 1995 to 2150 at their 1990-1995 levels. This is intended as a useful analytical tool and a comparison for other projections—not as a realistic expectation of future fertility trends. The actual assumption in this case is to maintain the total fertility rates from the constant variant of the *1996 Revision* for 2045-2050 for each major area through 2150. These total fertility rates are presented in table 4. It is interesting to note that although fertility rates for individual countries are assumed to remain constant, the fertility rate for the world continues to rise from 1990-1995 to 2045-2050 for individual major areas and until 2150 for the world as a whole. This is due to the increasing share of the world's population that inhabits the faster growing countries and major areas of the world. In fact, the total fertility rate for the entire world will rise from 2.96 in 1990-1995 to 4.27 in 2045-2050 and to 5.46 by 2145-2150 owing to the increased weight of high fertility areas in the world average.

E. MIGRATION ASSUMPTIONS

International migration patterns are highly unpredictable in the long run. Therefore, the projections in the *1996 Revision* assume no net migration after 2025. International migration is incorporated into the long-range projections to the extent they are included for the 1995-2025 period in the *1996 Revision* (see *1996 Revision* for details).

FIGURE I. TOTAL FERTILITY RATES FOR ALL MAJOR AREAS: MEDIUM-FERTILITY SCENARIO, 1950-1955 TO 2055-2060



Source: Population Division of the Department of Economic and Social Affairs at the United Nations Secretariat, ***World Population Projections to 2150***, (United Nations, 1998).

FIGURE II. TOTAL FERTILITY RATES FOR ALL MAJOR AREAS: SIX FERTILITY SCENARIOS, 1950-2060

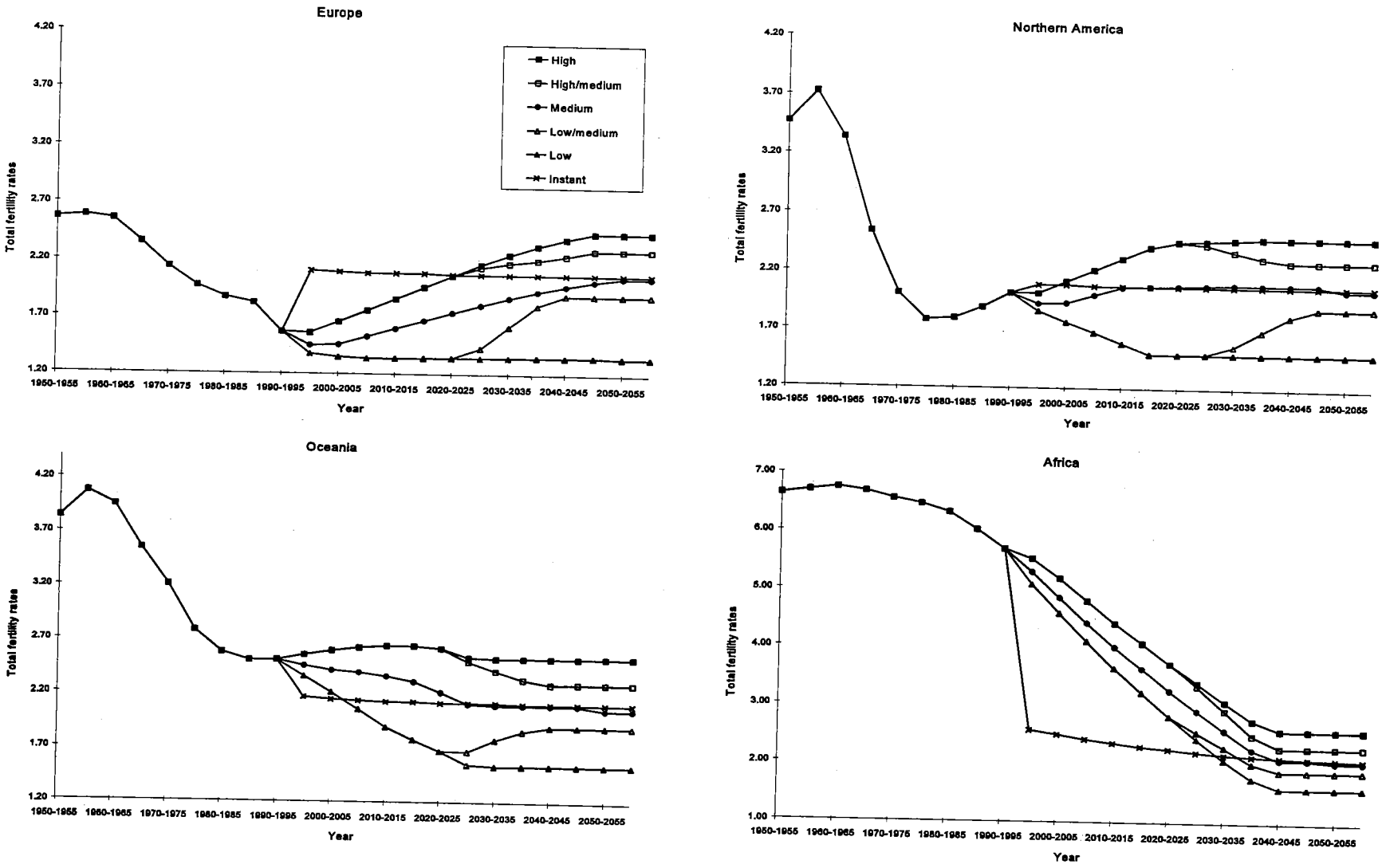
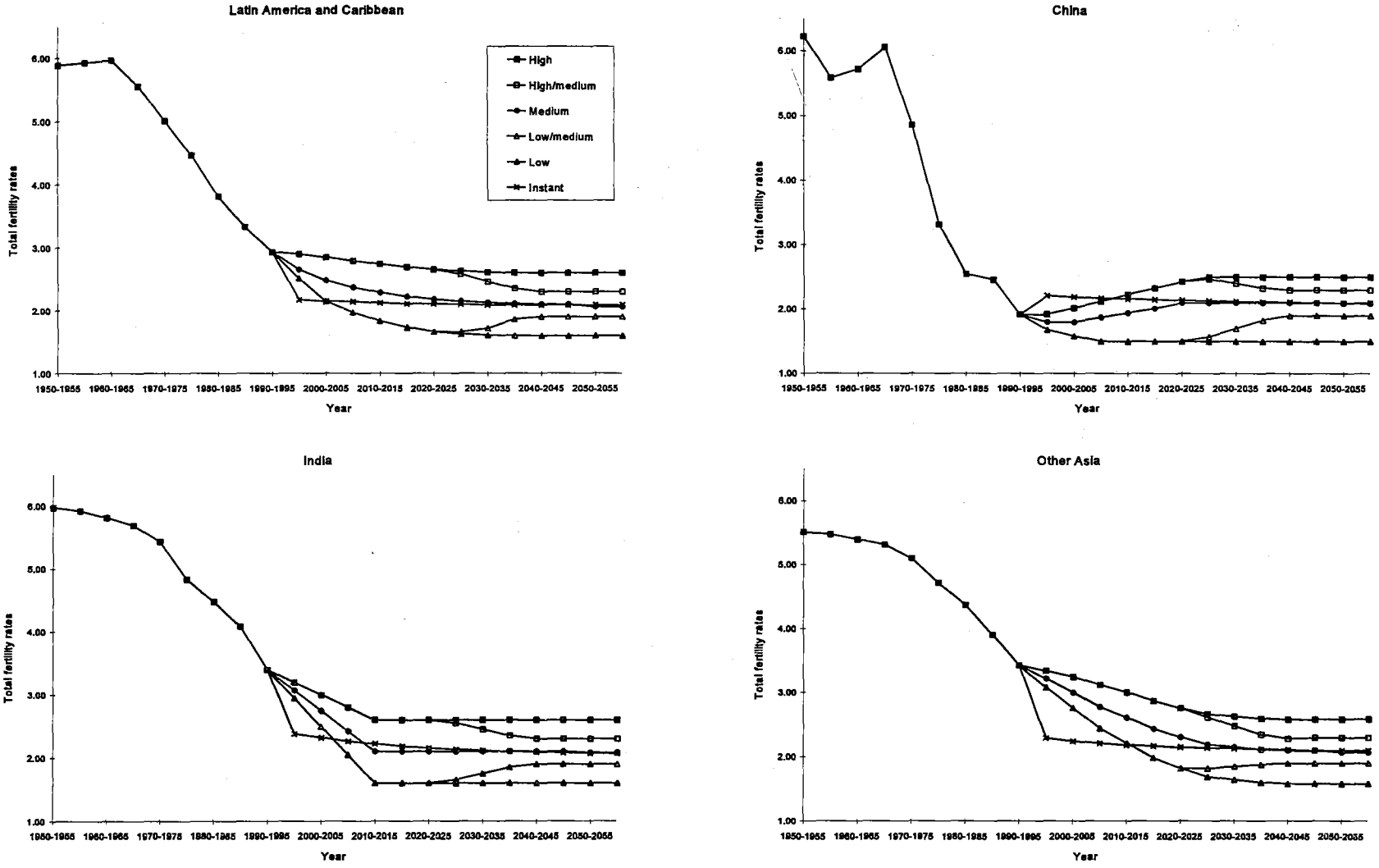


FIGURE II. (CONTINUED)



Source: Population Division of the Department of Economic and Social Affairs at the United Nations Secretariat, *World Population Projections to 2150* (United Nations, New York).

II. PROJECTION RESULTS

The second half of this report presents and analyses the results of the long-range population projections. The focus is on the five main analytical projections, although the two illustrative scenarios are also discussed below. It is divided into two main sections. The first section explores the results of the projections in terms of aggregated world population totals and age distributions. The second section examines the evolution of population size and distribution over time for each of the separate major areas. The results are printed in the following tables and charts and the most important ones are emphasized in the text.

A. WORLD POPULATION IN THE FUTURE

Medium-fertility scenario

Population size

The population of the world in 1995 was 5.7 billion persons, and according to the medium-fertility scenario the world's population will reach 10.8 billion in 2150 (see table 5 and figure III). This implies that the population of the world will increase by about 90 per cent between 1995 and 2150. The population size of the world in 2150 will have grown fourfold since 1950 and more than thirteen and a half times since 1750.

In 1990-1995, the world population is estimated to be growing at about 1.4 per cent per year (see figure III). This represents a substantial decline from the peak growth rates of about 2.0 per cent which were experienced between 1960 and 1975. In the future, the annual population growth rate is expected to fall to 0.38 per cent in 2045-2050, 0.08 per cent in 2095-2100, and 0.07 per cent by 2145-2150.

Despite the decline in the growth rates, the increasing size of the base population will mean substantial increases in the number of people in the world. Between 1995 and 2000, the world population is estimated to grow by about 81 million people each year. This number is projected to fall to roughly 41 million additional people per year between 2045 and 2050, about 10 million people added annually between 2095 and 2100, and roughly 8 million between 2145 and 2150.

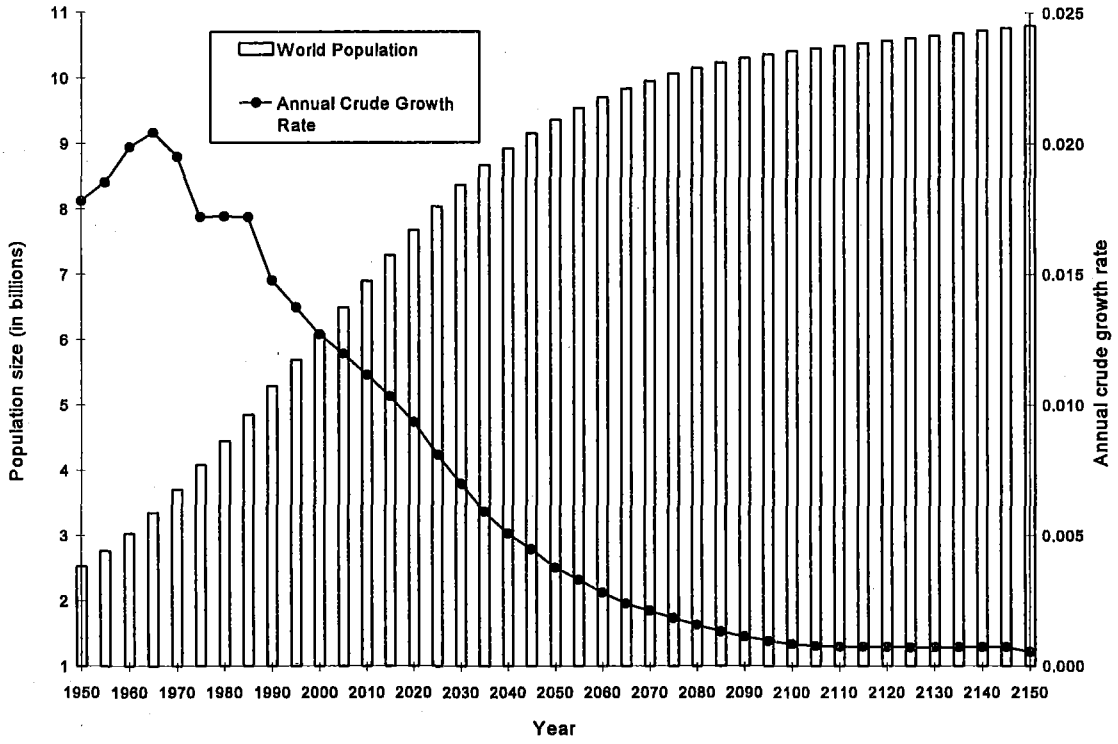
TABLE 5. ESTIMATED AND PROJECTED POPULATION OF THE WORLD: ALL SCENARIOS, 1950-2150

(Millions)

Year	*Medium*	*High*	*High/ medium*	*Low/ medium*	*Low*	*Instant replacement*	*Constant*
1950	2,524	2,524	2,524	2,524	2,524	2,524	2,524
1975	4,081	4,081	4,081	4,081	4,081	4,081	4,081
1995	5,687	5,687	5,687	5,687	5,687	5,687	5,687
2000	6,091	6,123	6,123	6,062	6,062	5,990	6,141
2025	8,039	8,581	8,581	7,474	7,474	7,504	9,212
2050	9,367	11,156	10,816	7,969	7,662	8,396	14,941
2075	10,066	14,047	12,795	7,711	6,813	8,769	27,648
2100	10,414	17,497	14,587	7,228	5,583	9,041	57,182
2125	10,614	21,709	16,338	6,797	4,455	9,258	127,003
2150	10,806	26,979	18,294	6,400	3,550	9,457	296,333

Source: Population Division of the Department of Economic and Social Affairs at the United Nations Secretariat, *World Population Projections to 2150*, (United Nations, 1998).

FIGURE III. WORLD POPULATION SIZE AND ANNUAL CRUDE GROWTH RATES: MEDIUM-FERTILITY SCENARIO, 1950-2150



Source: Population Division of the Department of Economic and Social Affairs at the United Nations Secretariat, *World Population Projections to 2150*, (United Nations, 1998).

If the fertility rates continue at the replacement level and if life expectancies are held constant following 2150, the population of the world is expected to stabilize at about 10.9 billion. While the population will continue to grow due to population momentum, the actual number added each year will decline rapidly. By the year 2200, the annual population growth rate is projected to fall to 0.003 per cent with less than 350,000 people added every year. Given that the population in 1995 is estimated at 5.7 billion, according to the medium scenario the world in 1995 has just passed the halfway mark (52 per cent) of its eventual stationary size of 10.9 billion. The world population will reach the 90 per cent mark by 2065 and the 99 per cent mark by 2150.

Population age structure

The growth in the size of the world population is matched by the unparalleled shift in the age structure of the world population. The medium-fertility scenario indicates that the population of the world will have aged tremendously by 2150. The median-age will have risen from 25.4 years in 1995, to 36.5 years in 2050, to 42.9 years by 2150. Table 6 presents details on the age distribution for the world as well as Groups 1 and 2 for the 7 variants.

The share of the world's population under 15 years of age will decline from 31.3 per cent in 1995, to 20.5 per cent in 2050 and to 17.5 per cent by 2150. De-

spite the increase in the world's population throughout the period 1950-2150, the numbers of persons under age 15 increases from 1.8 billion in 1995 to 2.0 billion in 2030, and then begins a gradual decline to 1.9 billion in 2150.

The percentage of the population of the world aged 60 or above will increase rapidly from 9.5 per cent in 1995 to 20.7 per cent in 2050, and to 30.5 per cent in 2150. In absolute numbers, this will mean an increase in the population 60 or above from 542 million in 1995 to 1.9 billion in 2050 and 3.3 billion in 2150. In fact, although in 1995 the population under age 15 is estimated to be 3.3 times the size of the population aged 60 or over, the elderly are expected to surpass the number under 15 years of age by the year 2050. By 2150, the population aged 60 or over will be 74 per cent larger than the number under 15 years of age.

Among the elderly age groups, it is the oldest old—those aged 80 or over—that will increase the most rapidly over time. According to the projections, the number aged 80 or over will multiply by a factor of 17 between 1995 and 2150: from 61 million in 1995 to 320 million in 2050 and 1,054 million by 2150.

High-, Low-, High/Medium-, and Low/Medium-fertility scenarios

While the medium-fertility scenario indicates that the world population will almost double by the year 2150, four additional scenarios based on alternative assumptions of future fertility trends produce a wide range of outcomes. According to the high-fertility scenario, the population of the world will reach 27.0 billion by 2150, growing by a factor of 4.7 between 1995 and 2150. On the other hand, the low-fertility scenario indicates that the world population will eventually decline to 3.6 billion by 2150, a level that is only two thirds the size of the 1995 population. Since all scenarios assume similar patterns of improvements in life-expectancy for any particular major area, the variance in the projected population sizes are generated entirely by differences in the assumptions for future fertility.

The high- and low-fertility scenarios continue the *1996 Revision* projections for the 2050 population of each major area for an additional 100 years. According to the high-fertility scenario, fertility is assumed to stabilize at total fertility rate levels between 2.5 to 2.6 after 2050, while the low-fertility scenario assumes that fertility stabilizes at a below-replacement total fertility rate between 1.35 and 1.6. Thus, the high-fertility scenario assumes a future trend of child bearing where roughly one child more on average is born to women than in the low-fertility scenario. This difference accounts for the wide margin in the estimated 2150 population of these two scenarios and highlights the long-term impact of fertility differentials where even a relatively small difference in fertility generates a large divergence in total population in the long-run. In 2050, the high-fertility scenario projects that the population of the world will be less than 50 per cent greater than that in the low-fertility scenario. By the final year of the long-range projections, 2150, the high-fertility scenario estimate of the world population is 7.6 times the size of the low-fertility scenario.

The high/medium- and low/medium-fertility scenarios provide useful intermediate assumptions to complement the high- and low-fertility scenarios. The high/medium- and low/medium-fertility scenarios explore the eventual size of the population if fertility rates are initially higher and lower than replacement but then converge to levels that are closer to the replacement-fertility levels. The high/medium- and low/medium-fertility scenarios assume that after following the high- and low-fertility levels until 2025, the levels in each of the major areas converge to either 10 per cent above replacement (the high/medium-fertility scenario) or 10 per cent below replacement (the low/medium-fertility scenario). Thus, the projected population sizes are moderated and fall in between the medium-fertility scenario results and the results of the more extreme scenarios. According to the high/medium-fertility scenario, the world population in 2150 will be at 18.4 billion while the low/medium-fertility scenario projects a much smaller world population of 6.4 billion. As can be viewed in

TABLE 6. SHARE OF POPULATION IN SELECTED AGE GROUPS, ALL SCENARIOS: WORLD AND GROUPS 1 AND 2

(*Percentage*)

World, aged under 15

Year	*Medium*	*High*	*High/ medium*	*Low/ medium*	*Low*	*Instant replacement*	*Constant*
1995	31.3	31.3	31.3	31.3	31.3	31.3	31.3
2000	30.0	30.3	30.3	29.6	29.6	28.8	30.5
2025	24.3	27.1	27.1	20.8	20.8	22.5	30.8
2050	20.5	24.9	23.1	17.6	15.1	19.8	34.6
2075	19.0	24.2	21.5	16.6	13.1	18.9	38.2
2100	18.3	23.7	20.8	16.2	12.4	18.4	40.5
2125	17.9	23.4	20.5	15.9	12.0	17.9	42.0
2150	17.5	23.2	20.2	15.5	11.7	17.5	43.1

World, aged 60 or over

Year	*Medium*	*High*	*High/ medium*	*Low/ medium*	*Low*	*Instant replacement*	*Constant*
1995	9.5	9.5	9.5	9.5	9.5	9.5	9.5
2000	9.9	9.8	9.8	9.9	9.9	10.1	9.8
2025	14.6	13.6	13.6	15.6	15.6	15.5	12.7
2050	20.7	17.4	17.9	24.3	25.3	22.8	13.0
2075	24.8	19.4	21.2	29.5	33.2	25.5	10.5
2100	27.7	21.0	24.3	30.9	37.6	27.5	9.0
2125	29.2	22.0	25.6	32.4	39.6	29.1	8.2
2150	30.5	22.8	26.7	33.7	41.2	30.4	7.7

World, aged 65 or over

Year	*Medium*	*High*	*High/ medium*	*Low/ medium*	*Low*	*Instant replacement*	*Constant*
1995	6.5	6.5	6.5	6.5	6.5	6.5	6.5
2000	6.8	6.8	6.8	6.9	6.9	6.9	6.8
2025	10.0	9.4	9.4	10.7	10.7	10.6	8.7
2050	15.1	12.7	13.1	17.7	18.5	16.6	9.5
2075	19.1	14.6	16.0	23.3	26.2	19.6	7.8
2100	22.0	16.3	19.2	24.8	30.9	21.8	6.6
2125	23.6	17.3	20.5	26.4	33.0	23.5	6.0
2150	24.9	18.2	21.5	27.8	34.8	24.9	5.6

World, aged 80 or over

Year	*Medium*	*High*	*High/ medium*	*Low/ medium*	*Low*	*Instant replacement*	*Constant*
1995	1.1	1.1	1.1	1.1	1.1	1.1	1.1
2000	1.1	1.1	1.1	1.1	1.1	1.1	1.1
2025	1.7	1.6	1.6	1.8	1.8	1.7	1.5
2050	3.4	2.9	3.0	4.0	4.2	3.7	2.1
2075	5.3	3.8	4.2	6.9	7.8	5.9	1.9
2100	7.1	4.8	5.8	8.7	11.2	7.2	1.7
2125	8.6	5.7	7.0	10.1	13.5	8.6	1.5
2150	9.8	6.4	8.0	11.3	15.3	9.7	1.5

TABLE 6 (*continued*)

Group 1, aged under 15 [a]

Year	*Medium*	*High*	*High/ medium*	*Low/ medium*	*Low*	*Instant replacement*	*Constant*
1995	20.1	20.1	20.1	20.1	20.1	20.1	20.1
2000	18.8	19.1	19.1	18.6	18.6	20.1	19.1
2025	16.9	19.2	19.2	13.7	13.7	18.9	16.5
2050	17.2	21.1	20.0	14.3	11.4	18.7	15.8
2075	17.7	22.3	20.4	15.2	10.5	18.2	16.0
2100	17.6	22.5	20.3	15.6	10.1	17.8	16.6
2125	17.3	22.3	20.0	15.4	9.8	17.5	17.4
2150	17.0	22.0	19.7	15.1	9.5	17.1	18.6

Group 1, aged 60 or over [a]

Year	*Medium*	*High*	*High/ medium*	*Low/ medium*	*Low*	*Instant replacement*	*Constant*
1995	18.0	18.0	18.0	18.0	18.0	18.0	18.0
2000	18.9	18.8	18.8	18.9	18.91	8.6	18.8
2025	26.2	24.9	24.9	27.8	27.8	24.9	26.1
2050	30.5	26.3	26.9	35.5	36.9	26.5	30.9
2075	29.8	23.8	25.5	36.0	41.7	28.1	32.3
2100	30.0	23.4	26.1	33.6	44.3	29.5	32.6
2125	31.0	24.1	27.1	34.3	46.0	30.7	32.2
2150	32.2	25.0	28.1	35.4	47.6	32.0	31.3

Group 1, aged 65 or over [a]

Year	*Medium*	*High*	*High/ medium*	*Low/ medium*	*Low*	*Instant replacement*	*Constant*
1995	13.3	13.3	13.3	13.3	13.3	13.3	13.3
2000	13.8	13.8	13.8	13.9	13.9	13.7	13.8
2025	19.4	18.4	18.4	20.6	20.6	18.5	19.3
2050	24.0	20.6	21.2	28.0	29.0	21.0	24.3
2075	24.0	18.9	20.4	30.0	34.6	22.6	26.2
2100	24.5	18.7	21.1	27.6	37.5	24.0	26.9
2125	25.5	19.4	22.0	28.4	39.4	25.2	26.7
2150	26.7	20.2	23.0	29.7	41.1	26.4	26.1

Group 1, aged 80 or over [a]

Year	*Medium*	*High*	*High/ medium*	*Low/ medium*	*Low*	*Instant replacement*	*Constant*
1995	3.0	3.0	3.0	3.0	3.0	3.0	3.0
2000	2.9	2.9	2.9	2.9	2.9	2.9	2.9
2025	4.3	4.1	4.1	4.6	4.6	4.1	4.3
2050	7.6	6.6	6.8	9.0	9.3	6.9	7.8
2075	9.2	6.8	7.4	12.3	14.0	7.5	9.7
2100	9.6	6.7	7.8	12.1	16.8	9.0	10.8
2125	10.3	7.1	8.4	12.2	18.7	10.1	11.2
2150	11.2	7.8	9.2	13.0	20.4	11.1	11.2

TABLE 6 (*continued*)

Group 2, aged under 15 Year [b]

Year	*Medium*	*High*	*High/ medium*	*Low/ medium*	*Low*	*Instant replacement*	*Constant*
1995	33.9	33.9	33.9	33.9	33.9	33.9	33.9
2000	32.3	32.7	32.7	32.0	32.0	30.7	32.9
2025	25.5	28.4	28.4	21.9	21.9	23.1	32.7
2050	20.9	25.4	23.5	18.0	15.6	20.0	36.0
2075	19.1	24.4	21.7	16.8	13.4	19.1	39.0
2100	18.3	23.9	20.9	16.3	12.6	18.4	40.9
2125	17.9	23.6	20.5	15.9	12.2	18.0	42.2
2150	17.6	23.3	20.2	15.6	11.8	17.6	43.2

Group 2, aged 60 or over [b]

Year	*Medium*	*High*	*High/ medium*	*Low/ medium*	*Low*	*Instant replacement*	*Constant*
1995	7.6	7.6	7.6	7.6	7.6	7.6	7.6
2000	8.0	7.9	7.9	8.0	8.0	8.2	7.9
2025	12.7	11.9	11.9	13.7	13.7	13.8	10.9
2050	19.4	16.3	16.8	22.8	23.8	22.2	11.6
2075	24.2	18.9	20.7	28.7	32.3	25.1	9.7
2100	27.4	20.7	24.1	30.6	37.0	27.2	8.6
2125	29.0	21.8	25.4	32.1	39.0	28.8	8.0
2150	30.3	22.6	26.5	33.5	40.7	30.2	7.6

Group 2, aged 65 or over [b]

Year	*Medium*	*High*	*High/ medium*	*Low/ medium*	*Low*	*Instant replacement*	*Constant*
1995	5.0	5.0	5.0	5.0	5.0	5.0	5.0
2000	5.3	5.3	5.3	5.4	5.4	5.5	5.3
2025	8.5	7.9	7.9	9.1	9.1	9.1	7.2
2050	14.0	11.7	12.1	16.4	17.1	15.9	8.4
2075	18.5	14.1	15.5	22.5	25.3	19.1	7.1
2100	21.8	16.1	19.0	24.5	30.3	21.5	6.3
2125	23.4	17.1	20.3	26.2	32.5	23.2	5.8
2150	24.7	18.0	21.4	27.7	34.2	24.6	5.5

Group 2, aged 80 or over [b]

Year	*Medium*	*High*	*High/ medium*	*Low/ medium*	*Low*	*Instant replacement*	*Constant*
1995	0.7	0.7	0.7	0.7	0.7	0.7	0.7
2000	0.7	0.7	0.7	0.7	0.7	0.7	0.7
2025	1.2	1.2	1.2	1.3	1.3	1.3	1.1
2050	2.9	2.4	2.5	3.4	3.5	3.2	1.7
2075	4.9	3.5	3.8	6.3	7.1	5.7	1.7
2100	6.9	4.6	5.6	8.4	10.6	7.0	1.5
2125	8.4	5.6	6.9	9.8	13.0	8.3	1.5
2150	9.6	6.3	7.9	11.2	14.9	9.5	1.4

Source: Population Division of the Department of Economic and Social Affairs at the United Nations Secretariat, *World Population Projections to 2150*, (United Nations, 1998).

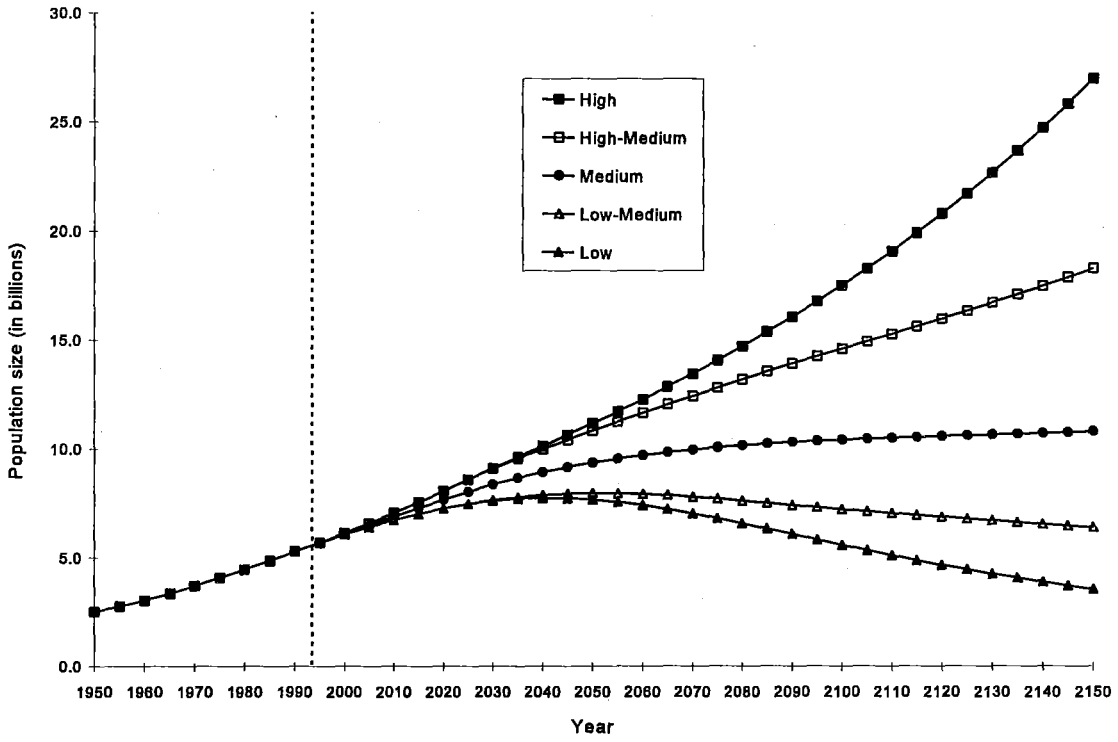
a/ Group 1 includes Europe, Northern America and Oceania.

b/ Group 2 includes Africa, Latin America and the Caribbean, China, India and Other Asia.

figure IV, the high/medium-fertility scenarios almost falls in the middle of the 2150 estimates of the medium- and high-fertility scenarios. Similarly, the low/medium-fertility scenario also falls in between the medium- and the low-fertility scenario although in this latter case it falls closer to the low- than the medium-fertility scenario.

The medium-fertility scenario projection of 10.8 billion in 2150 is surrounded in figure IV by a range of projections from the alternative fertility scenarios. The wide range of ultimate population sizes suggested by these scenarios illustrates the difficulty in suggesting any single plausible estimate for the 2150 world population.

FIGURE IV. WORLD POPULATION PROJECTIONS, FIVE MAIN FERTILITY SCENARIOS, 1950-2150



Source: Population Division of the Department of Economic and Social Affairs at the United Nations Secretariat, *World Population Projections to 2150*, (United Nations, 1998).

However, the fertility scenarios do provide realistic patterns for the evolution in world fertility and the high- and low-fertility scenarios might be considered plausible although not necessarily firm bounds based on current understanding and expectations. Thus, if 27.0 billion is suggested as a higher bound and 3.6 billion is offered as a lower bound, the eventual size of the population in 2150 is likely to fall somewhere in between, although not necessarily in the middle. All the scenarios show that the world population will increase; even the low-fertility scenario indicates that the growth will continue for at least 50 years.

In addition, all four of these fertility scenarios show dramatic shifts in the future age structure of the world population. For example, it is estimated that 31 per cent of today's world population is under age 15. In contrast, the 2150 high-fertility scenario indicates that this percentage will decline to 23 per cent and according to the low-fertility scenario will decline to almost one third of today's level (12 per cent). The decline in the share of society which is young is balanced by the increase in the proportion of the world's population which is aged 60 or over as well as those 80 or over. In 1995, 10 per cent of the world population is 60 or over and only 1 per cent is 80 or above. By the year 2150, the high-fertility scenario indicates that 23 per cent will be 60 or over and 6 per cent will be 80 or over. The low-fertility scenario projects an even older future society with 41 per cent aged 60 or over and 15 per cent aged 80 or over. While the implications of these vast changes in the age structure of society are difficult to determine, it is clear that the future world population will comprise a far greater share of elderly individuals than is seen today in even the oldest countries.

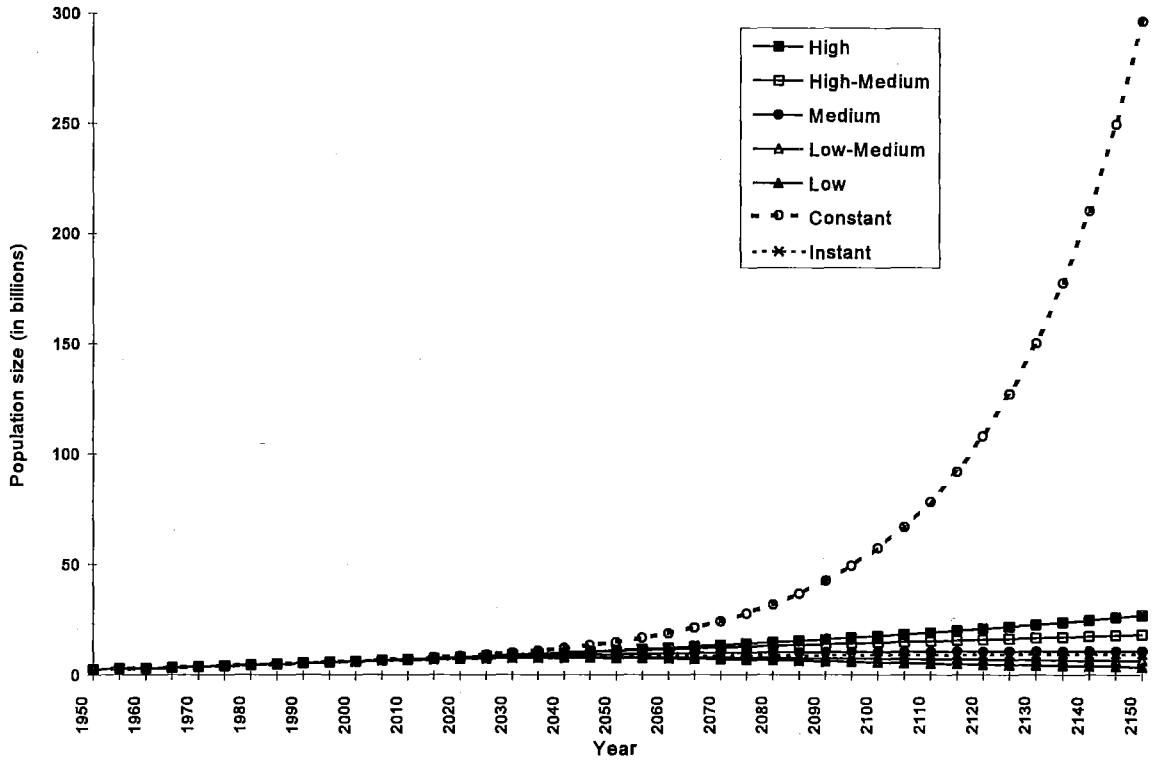
Illustrative analytical scenarios: instant-replacement fertility and constant fertility

The five main scenarios discussed above offer what may be considered plausible assumptions for the future course of fertility of the world population. The illustrative scenarios do not purport to present realistic alternatives; rather, they are interesting because their assumptions are useful to compare with the five above scenarios. The two illustrative scenarios are included in figure V below.

The instant-replacement-fertility scenario shows the ultimate size of the world population if fertility rates were to immediately decline (or rise for a few select major areas where fertility is already below-replacement) to the replacement level. This scenario of future fertility decline contrasts the medium-fertility scenario where total fertility rates also reach the replacement level but the process is more gradual and plausible. Despite the immediate reduction of fertility to replacement levels, there is a momentum growth effect which is due to the large portions of the population in the child bearing ages. The focus of the instant-replacement scenario is therefore on the impact of the population age structure on continued population growth, rather than on the impact of fertility on population growth. Since life expectancy is projected to continue to rise over time, the replacement-level fertility is estimated to continue to decline to account for the fact that women are more likely to survive through their reproductive years. According to this scenario, the world population would reach 8.4 billion in 2050, 9.0 billion in 2100, and 9.5 billion in 2150. Thus, in the hypothetical scenario that fertility is immediately reduced to and remains at replacement levels, the embedded population momentum would still generate a future growth of 66 per cent. Comparing the medium-fertility scenario with the instant-replacement scenario shows that most (3.8 out of 5.1 billion or 77 per cent) of the world population growth in the medium scenario results from the population momentum effects of age structure.

The constant-fertility scenario presents the results of future world population growth if fertility were to remain roughly at the 1990-1995 level through the year 2150. The resulting projection highlights the multiplicative potential behind geometrically growing populations. The constant-fertility scenario is presented alongside the six other projections of the world population (see figure V below), and it clearly stands apart from the other scenarios. According to the constant-fertility scenario, the world population would reach 15 billion in 2050, 57 billion in 2100, and 296 billion persons by 2150. This estimate for the world population in 2150 is 27 times the size of the estimate which is based on the medium-fertility scenario. Needless to say, such growth is likely unsustainable. Whatever the carrying capacity of the planet, no serious estimate has ever approached such numbers.

FIGURE V. WORLD POPULATION PROJECTIONS: ALL SCENARIOS, 1950-2150



Source: Population Division of the Department of Economic and Social Affairs at the United Nations Secretariat, *World Population Projections to 2150*, (United Nations, 1998).

B. REGIONAL POPULATION IN THE FUTURE

Medium-fertility scenario

Population size

The growth of the total world population is now analysed in more geographical detail as the medium-fertility scenario estimates for each major area are presented from 1950-2150 in table 7 and figure VI. Trends for Groups 1 and 2 are presented in order to facilitate the discussion of general trends. Group 1 includes Europe, Northern America and Oceania. Group 2 includes Africa, Latin America and the Caribbean, China, India and Other Asia (Asia excluding China and India). It is important to recall that the projections assume no international migration following 2025. Migration across major areas of the world following 2025 could lead to substantial revisions in these estimates for some areas.

TABLE 7. REGIONAL TOTAL POPULATIONS BY 25-YEAR PERIOD: MEDIUM FERTILITY SCENARIO

(*Millions*)

	1950	*1995*	*2000*	*2025*	*2050*	*2075*	*2100*	*2125*	*2150*
World	2524	5687	6091	8039	9367	10066	10414	10614	10806
Group 1	732	1053	1068	1111	1067	1030	1029	1043	1061
Europe	547	728	729	701	638	589	579	585	595
Northern America	172	297	309	369	384	393	401	407	414
Oceania	13	28	30	41	46	48	49	50	51
Group 2	1792	4634	5023	6928	8299	9036	9385	9572	9745
Africa	224	719	820	1454	2046	2457	2646	2715	2770
Latin America and the Caribbean	166	477	515	690	810	864	889	903	916
China	555	1220	1276	1480	1517	1509	1535	1565	1596
India	358	929	1007	1330	1533	1595	1617	1641	1669
Other Asia	490	1289	1405	1974	2393	2611	2698	2747	2795

Source: Population Division of the Department of Economic and Social Affairs at the United Nations Secretariat, *World Population Projections to 2150*, (United Nations, 1998).

The results of the medium-fertility scenario indicate that the growth in the world population from 5.7 billion in 1995 to 10.8 billion in 2150 will be primarily driven by population increases in the Group 2 aggregation. In fact, 99.8 per cent of the estimated growth in the world population is expected from increases in the Group 2 population size and only 0.2 per cent is attributed to Group 1.

The population of Group 1 is estimated to have increased by 43.9 per cent between 1950 and 1995. The substantial population growth of the past is projected to decline rapidly and the population of Group 1 will remain nearly constant after 1995. Between 1995 and 2050, the population is expected to grow by only 1.3 per cent and then to decline by 0.6 per cent by 2150.

Closer examination of the individual major areas shows that the population of one of the three major areas in Group 1, Europe, is actually estimated to decline from 728 million persons in 1995 to 638 million in 2050 and eventually to 595 million by 2150. This 22 per cent decrease in Europe's population over the 155 years of the projection sharply contrasts the trends in the rest of the world as shown in figure VI. The peak in the size of Europe's population is expected around the year 2000: about 729 million persons. Thereafter, the population is expected to decline until it begins to slowly stabilize after 2075.

The other two major areas in Group 1 do not experience population declines: both Northern America and Oceania are estimated to increase by 39 per cent and 82 per cent respectively. Northern America is projected to grow from 297 million in 1995 to 384 million in 2050, to 414 million in 2150. While Oceania is by far the smallest of the 8 major areas included in this study, it is estimated to increase its population from 28 million in 1995 to 46 million in 2050 and finally to 51 million in 2150.

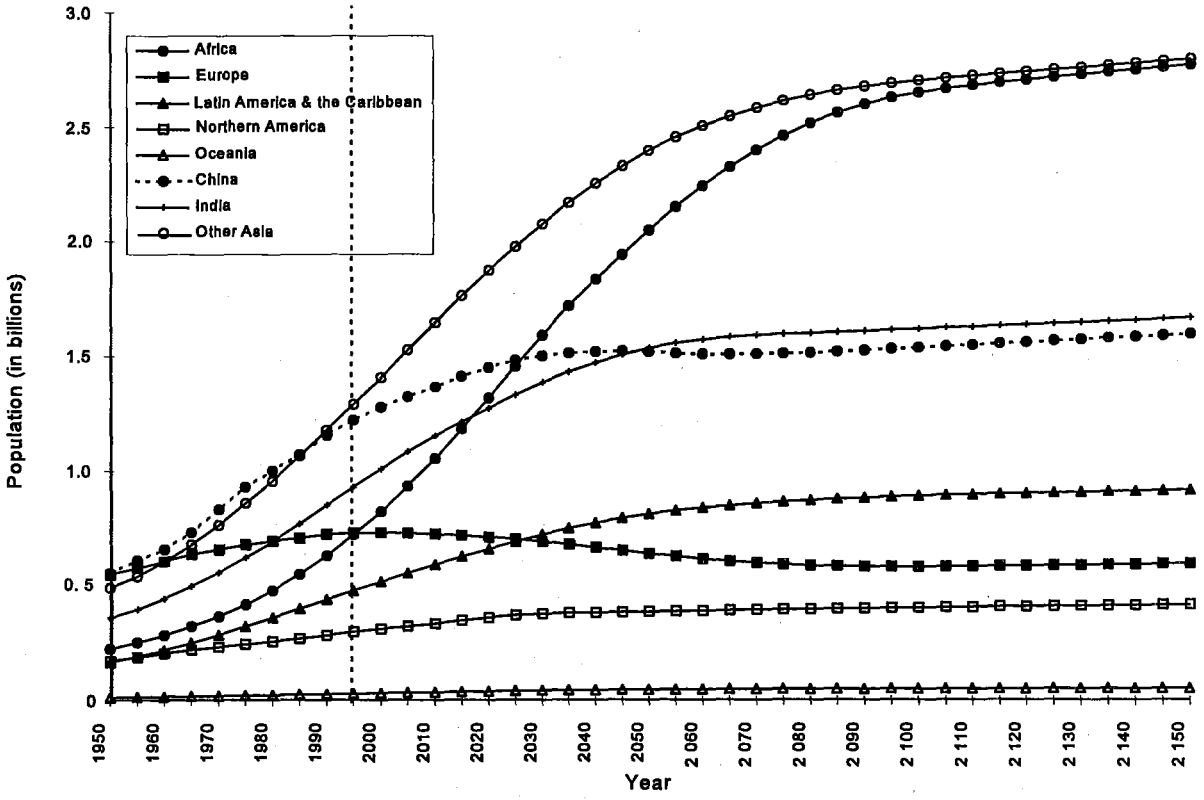
Africa's growth from 1995 to 2150 stands out, since its initial population of 719 million is projected in this scenario to increase to 2.7 billion. Africa's growth of 285 per cent between 1995 and 2150 is by far the fastest of the 8 major areas. None of the other major areas in Group 2 increases by such a degree: the

population of Latin America and the Caribbean is expected to grow by 92 per cent, that of Other Asia by 117 per cent, India's population by 80 per cent and China's by only 31 per cent.

In contrast to the 0.8 per cent population growth of Group 1 over the 155-year period, the population of Group 2 is estimated to grow by 110 per cent. When China is excluded from Group 2, the population is anticipated to grow by 139 per cent. This is because China stands out among the Group 2 major areas and is projected to grow more slowly between 1995 and 2150 than both Northern America and Oceania.

A dramatic shift is anticipated in the distribution of the world's population between the regions of Group 1 and Group 2, and this is visible in figure VII and table 8.

FIGURE VI. POPULATION GROWTH OF THE MAJOR AREAS: MEDIUM FERTILITY SCENARIO, 1950-2150



Source: Population Division of the Department of Economic and Social Affairs at the United Nations Secretariat, *World Population Projections to 2150*, (United Nations, New York, 1998).

TABLE 8. DISTRIBUTION OF THE WORLD POPULATION BY MAJOR AREA: MEDIUM FERTILITY SCENARIO, 1950-2150

Area	*1950*	*1995*	*2050*	*2150*
Group 1	29.0	18.5	11.4	9.8
Europe	21.7	12.8	6.8	5.5
Northern America	6.8	5.2	4.1	3.8
Oceania	0.5	0.5	0.5	0.5
Group 2	71.0	81.5	88.6	90.2
Africa	8.9	12.7	21.8	25.6
Latin America and The Caribbean	6.6	8.4	8.7	8.5
China	22.0	21.5	16.2	14.8
India	14.2	16.3	16.4	15.4
Other Asia	19.4	22.7	25.6	25.9
World	100.0	100.0	100.0	100.0

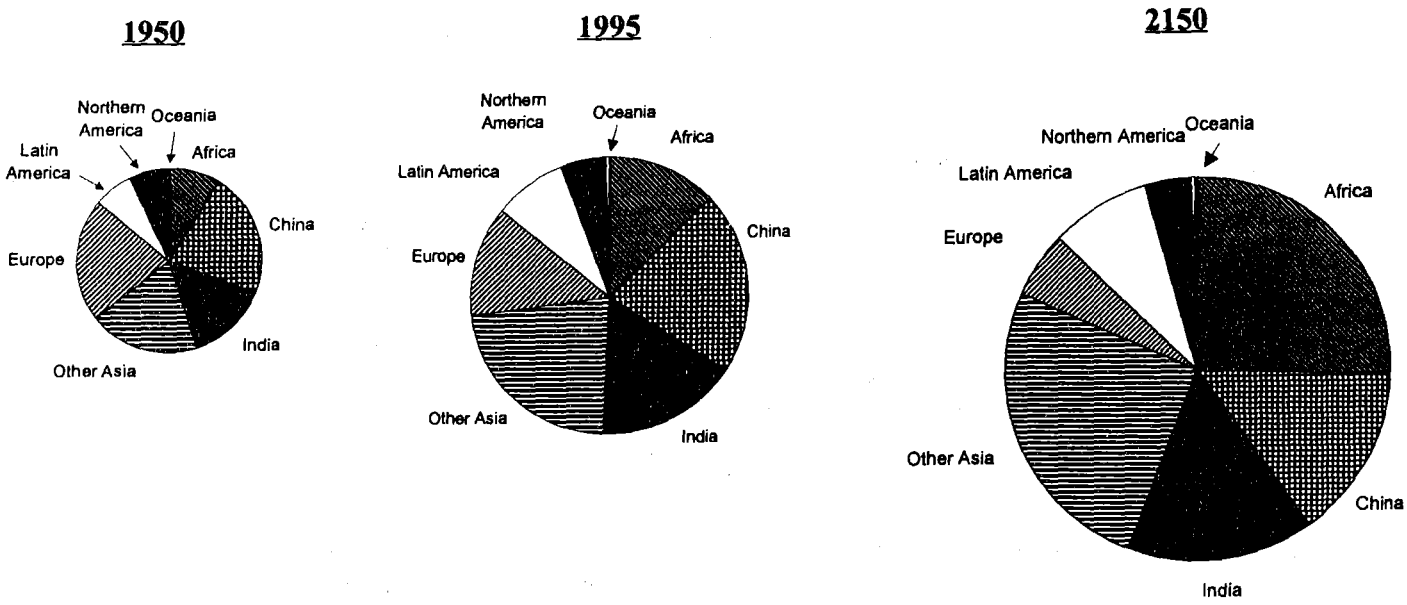
Source: Population Division of the Department of Economic and Social Affairs at the United Nations Secretariat, *World Population Projections to 2150*, (United Nations, 1998).

The share of the world's population living in Group 1 declined from 29.0 per cent in 1950 to 18.5 per cent in 1995, and will decline to 11.4 per cent in 2050 and to 9.8 per cent by 2150. Europe's gradual decline from the second largest major area in the world to the third smallest area highlights the fundamental shift in the geographical distribution of the world population. Nearly all of the growth in the world population will take place in Group 2. The proportion of the world living within Group 2 is projected to increase from 81.5 per cent in 1995 to 88.6 per cent in 2050 and finally to 90.2 per cent by 2150. Within Group 2, Africa will grow the fastest: in 1950 the population of Africa was less than half that of Europe, in 1995 they were about equal, and in 2150 the population of Africa will be nearly five times that of Europe.

The age structure of a population in the long run is primarily determined by its vital rates. Since all the major areas in the world are projected to converge at replacement fertility levels and because life expectancies are projected to increase but at diminishing increments, the differences in age structure of the separate major areas are likely disappear over time. Primarily for this reason, the current focus is on the trends for the aggregated world areas, Group 1 and Group 2, rather than for individual major areas.

The percentage of the populations in Group 1 and Group 2 that are under age 15 are expected to decline rapidly in the next few decades (see figure VIII). While 26.5 per cent of the population in Group 1 is estimated in 1950 to have been under 15 years of age, that figure has decreased to 20.1 per cent by 1995 and is projected to decrease further to 17.0 per cent by 2150 (with little change since 2010). In contrast, the percentage of the population under age 15 in Group 2 was 37.6 in 1950 and has only declined to 33.9 per cent by 1995. However, this figure is expected to drop rapidly to 20.9 per cent in 2050, and by 2150 only 17.6 per cent of the population is projected to be less than 15 years of age.

FIGURE VII. REGIONAL DISTRIBUTION OF THE WORLD POPULATION: MEDIUM FERTILITY SCENARIO, 1950, 1995 AND 2150

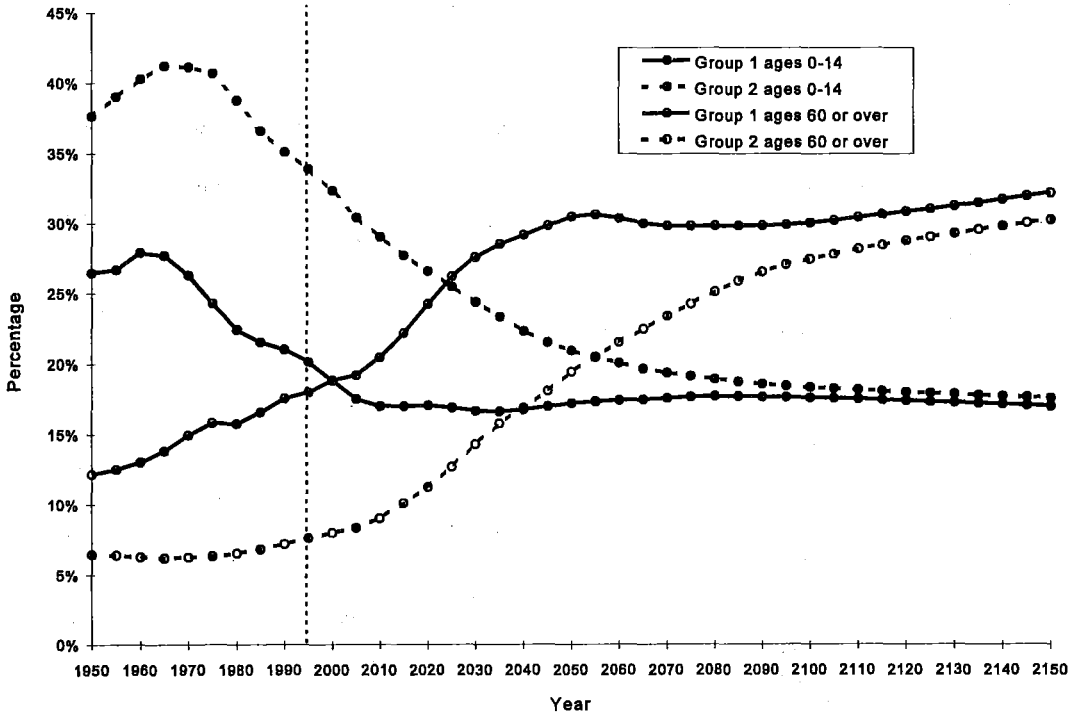


Source: Population Division of the Department of Economic and Social Affairs at the United Nations Secretariat, *World Population Projections to 2150*, (United Nations, 1998).

As shown in figure VIII, the decline in the percentage of the population in both Groups 1 and 2 that are young is balanced by an increase in the percentage that are 60 or over. Only 12.2 per cent of the population in Group 1 was in the elderly age categories in 1950 but in 1995 that percentage had increased to 18.0 per cent.

More dramatic changes are expected in the future as the share of the population aged 60 or above will climb to 30.5 per cent by 2050 and eventually to 32.2 by 2150. By 2000, the percentage of the population of Group 1 that is aged 60 or above (18.9 per cent) is anticipated to equal the percentage that is under 15 years. The shifting distribution of the population to

FIGURE VIII. EVOLUTION OF THE AGE STRUCTURES OF GROUP 1 AND GROUP 2 REGIONS: MEDIUM FERTILITY SCENARIO, 1950-2150



Source: Population Division of the Department of Economic and Social Affairs at the United Nations Secretariat, ***World Population Projections to 2150***, (United Nations 1998).

older ages is even more pronounced in Group 2. In 1950, only 6.5 per cent of the population of Group 2 was aged 60 or above. This proportion had only risen to 7.6 per cent by 1995. However, it is expected to more than double to 19.4 per cent by 2050 and eventually to 30.3 per cent by 2150—only slightly below the percentage for Group 1. By the year 2055, the proportion of the population aged 60 and over will be equal to that under 15 years of age. By 2150, the population 60 or over is expected to be larger than the size of the entire population of the world in 1965.

High-, Low-, High/Medium, and Low/Medium-fertility scenarios

The population projections for all scenarios and for each region are presented in detail in table 9. According to the high-fertility scenario, the population of Group 1 is expected to grow from today's level of 1.1 billion to 2.4 billion by 2150.

This estimate implies that the population of Group 1 in 2150 will be 2.3 times the population in the medium scenario projection. Group 2 is projected to

TABLE 9. ESTIMATED AND PROJECTED POPULATION OF THE MAJOR AREAS OF THE WORLD: ALL SCENARIOS, 1950-2150
(*Millions*)

Year	*Medium*	*High*	*High/ medium*	*Low/ medium*	*Low*	*Instant replacement*	*Constant*
			World				
1950	2,524	2,524	2,524	2,524	2,524	2,524	2,524
1975	4,081	4,081	4,081	4,081	4,081	4,081	4,081
1995	5,687	5,687	5,687	5,687	5,687	5,687	5,687
2000	6,091	6,123	6,123	6,062	6,062	5,990	6,141
2025	8,039	8,581	8,581	7,474	7,474	7,504	9,212
2050	9,367	11,156	10,816	7,969	7,662	8,396	14,941
2075	10,066	14,047	12,795	7,711	6,813	8,769	27,648
2100	10,414	17,497	14,587	7,228	5,583	9,041	57,182
2125	10,614	21,709	16,338	6,797	4,455	9,258	127,003
2150	10,806	26,979	18,294	6,400	3,550	9,457	296,333
			Group 1 [a]				
1950	732	732	732	732	732	732	732
1975	941	941	941	941	941	941	941
1995	1,053	1,053	1,053	1,053	1,053	1,053	1,053
2000	1,068	1,073	1,073	1,064	1,064	1,076	1,072
2025	1,111	1,173	1,173	1,044	1,044	1,146	1,116
2050	1,067	1,247	1,225	915	876	1174	1050
2075	1,030	1,404	1,317	781	669	1205	971
2100	1,029	1,667	1,462	697	494	1232	918
2125	1,043	2,014	1,636	652	362	1258	903
2150	1,061	2,444	1,836	615	266	1284	934
			Group 2 [b]				
1950	1,792	1,792	1,792	1,792	1,792	1,792	1,792
1975	3,140	3,140	3,140	3,140	3,140	3,140	3,140
1995	4,634	4,634	4,634	4,634	4,634	4,634	4,634
2000	5,023	5,050	5,050	4,998	4,998	4,914	5,069
2025	6,928	7,407	7,407	6,431	6,431	6,357	8,096
2050	8,299	9,909	9,591	7,053	6,787	7,223	13,890
2075	9,036	12,643	11,478	6,930	6,144	7,564	26,677
2100	9,385	15,830	13,125	6,531	5,089	7,809	56,264
2125	9,572	19,695	14,702	6,145	4,092	8,001	126,100
2150	9,745	24,535	16,458	5,784	3,284	8,173	295,399

[a] Group 1 includes Europe, Northern America and Oceania.
[b] Group 2 includes Africa, Latin America and the Caribbean, China, India and Other Asia.

TABLE 9 (*continued*)

Year	*Medium*	*High*	*High/ medium*	*Low/ medium*	*Low*	*Instant replacement*	*Constant*
			Europe				
1950	547	547	547	547	547	547	547
1975	676	676	676	676	676	676	676
1995	728	728	728	728	728	728	728
2000	729	732	732	727	727	741	732
2025	701	737	737	669	669	771	705
2050	638	742	731	567	538	786	614
2075	589	807	760	470	391	809	509
2100	579	945	833	417	277	827	418
2125	585	1,138	929	390	195	845	343
2150	595	1,379	1,041	368	137	862	281
			Northern America				
1950	172	172	172	172	172	172	172
1975	243	243	243	243	243	243	243
1995	297	297	297	297	297	297	297
2000	309	311	311	307	307	306	310
2025	369	394	394	336	336	340	368
2050	384	452	442	310	301	349	379
2075	393	533	498	274	246	357	382
2100	401	644	563	246	191	365	382
2125	407	781	633	230	146	372	382
2150	414	950	714	217	112	380	383
			Oceania				
1950	13	13	13	13	13	13	13
1975	21	21	21	21	21	21	21
1995	28	28	28	28	28	28	28
2000	30	30	30	30	30	30	30
2025	41	43	43	38	38	35	43
2050	46	53	52	39	37	38	57
2075	48	64	60	37	32	39	81
2100	49	78	67	34	26	40	119
2125	50	94	74	32	21	41	178
2150	51	115	82	30	17	42	269
			Africa				
1950	224	224	224	224	224	224	224
1975	414	414	414	414	414	414	414
1995	719	719	719	719	719	719	719
2000	820	825	825	815	815	756	829
2025	1,454	1,546	1,546	1,371	1,371	1,032	1,836
2050	2,046	2,408	2,319	1,807	1,731	1,234	4,492
2075	2,457	3,343	3,016	2,026	1,786	1,322	11,591
2100	2,646	4,328	3,559	2,022	1,580	1,385	30,509
2125	2,715	5,459	4,030	1,931	1,300	1,429	80,502
2150	2,770	6,873	4,547	1,835	1,061	1,463	212,720

TABLE 9 (*continued*)

Year	*Medium*	*High*	*High/ medium*	*Low/ medium*	*Low*	*Instant replacement*	*Constant*
			Latin America and the Caribbean				
1950	166	166	166	166	166	166	166
1975	320	320	320	320	320	320	320
1995	477	477	477	477	477	477	477
2000	515	520	520	512	512	508	520
2025	690	753	753	632	632	671	788
2050	810	1,001	967	671	650	770	1,164
2075	864	1,267	1,144	635	573	806	1,722
2100	889	1,585	1,300	587	471	830	2,579
2125	903	1,977	1,450	550	381	848	3,880
2150	916	2,470	1,619	516	307	865	5,857
			China				
1950	555	555	555	555	555	555	555
1975	928	928	928	928	928	928	928
1995	1,220	1,220	1,220	1,220	1,220	1,220	1,220
2000	1,276	1,283	1,283	1,270	1,270	1,299	1,283
2025	1,480	1,561	1,561	1,367	1,367	1,581	1,486
2050	1,517	1,765	1,729	1,246	1,198	1,694	1,479
2075	1,509	2,028	1,901	1,064	924	1,751	1,390
2100	1,535	2,412	2,120	951	697	1,796	1,303
2125	1,565	2,888	2,356	883	525	1,836	1,223
2150	1,596	3,467	2,618	824	397	1,875	1,151
			India				
1950	358	358	358	358	358	358	358
1975	621	621	621	621	621	621	621
1995	929	929	929	929	929	929	929
2000	1,007	1,011	1,011	1,002	1,002	984	1,018
2025	1,330	1,439	1,439	1,223	1,223	1,275	1,613
2050	1,533	1,885	1,819	1,266	1,231	1,453	2,535
2075	1,595	2,364	2,125	1,157	1,041	1,517	4,026
2100	1,617	2,968	2,414	1,044	820	1,566	6,494
2125	1,641	3,743	2,712	970	646	1,605	10,525
2150	1,669	4,736	3,050	905	510	1,641	17,109
			Other Asia				
1950	490	490	490	490	490	490	490
1975	857	857	857	857	857	857	857
1995	1,289	1,289	1,289	1,289	1,289	1,289	1,289
2000	1,405	1,412	1,412	1,399	1,399	1,367	1,419
2025	1,974	2,108	2,108	1,839	1,839	1,799	2,372
2050	2,393	2,850	2,757	2,063	1,976	2,071	4,219
2075	2,611	3,640	3,292	2,048	1,820	2,168	7,948
2100	2,698	4,537	3,732	1,927	1,521	2,232	15,379
2125	2,747	5,627	4,154	1,812	1,240	2,282	29,970
2150	2,795	6,989	4,624	1,704	1,009	2,329	58,563

Source: Population Division of the Department of Economic and Social Affairs at the United Nations Secretariat, *World Population Projections to 2150*, (United Nations, 1998).

increase more rapidly, growing from today's 4.6 billion to 24.5 billion by 2150. Thus, the high-fertility scenario projected population for Group 2 is two and a half times the size of the population projected in the medium-fertility scenario.

The low-fertility scenarios indicate that the populations of both Group 1 and Group 2 will decline from today's levels by the year 2150. However, the decline in Group 1 will be more pronounced since the age structure of Group 2 countries is distributed towards much younger ages. The population of Group 1 is expected to decline from 1.053 billion today to 355 million by 2150. The population is expected to begin to decline following 2010. The population size is anticipated to be about one third the ultimate population size projected in the medium-fertility scenario.

By 2150, the population of Group 1 in the high-fertility scenario will be nine times the population in the low-fertility scenario and the population of Group 2 in the high-fertility scenario will be seven times the population in the low-fertility scenario. Meanwhile, in both Group 1 and Group 2 in 2150, the population in the high/medium scenarios will be three times the size of the population in the low/medium scenarios.

Illustrative scenarios: instant-replacement fertility and constant fertility

The value of the instant-replacement scenario is that it describes the eventual population size if fertility rates were hypothetically reduced to replacement levels all at once. Once fertility is reduced to replacement levels, population size continues to increase due to the growth momentum which is inherent in their age distributions. Each major area begins with its own particular age structure and thus the effect of reducing fertility to the replacement level varies. Examining the results for Group 1 and Group 2 emphasize this. The population of Group 1 is projected to increase from 1.05 billion to 1.28 billion between 1995 and 2150. This constitutes a 22 per cent increase in the population of Group 1. In comparison, Group 2 is expected to increase its population by 76 per cent over the same period—growing from 4.63 billion to 8.17 billion. Europe's age structure is already the oldest in 1995 and for this reason it exhibits the smallest effect of population momentum, resulting in only an 18 per cent increase in its population size by 2150. Africa, on the other hand, begins with the youngest age structure and displays the largest effect of population momentum, resulting in a 103 per cent increase between 1995 and 2150.

The constant-fertility scenario offers the widest range of outcomes, since fertility is assumed to continue at its current level within each major area until 2150. The projections highlight the implausibility of such an assumption owing to the exponential nature of population growth. While the population of Group 1 would decline from 1.053 billion in 1995 to 0.934 billion in 2150, the population of Group 2 would increase from 4.6 billion in 1995 to 295 billion in 2150. The former would be declining by 11 per cent and the latter increasing to 63 times its initial value. Within the aggregations, Europe would decline by 61 per cent from its 1995 size and Africa's population would increase to nearly 300 times its size in 1995. Over time, the annual crude growth rate of the world would continue to rise, as it is increasingly influenced by Africa, the fastest growing major area in the world.

Additional illustrative scenarios: the separate roles of fertility and mortality change

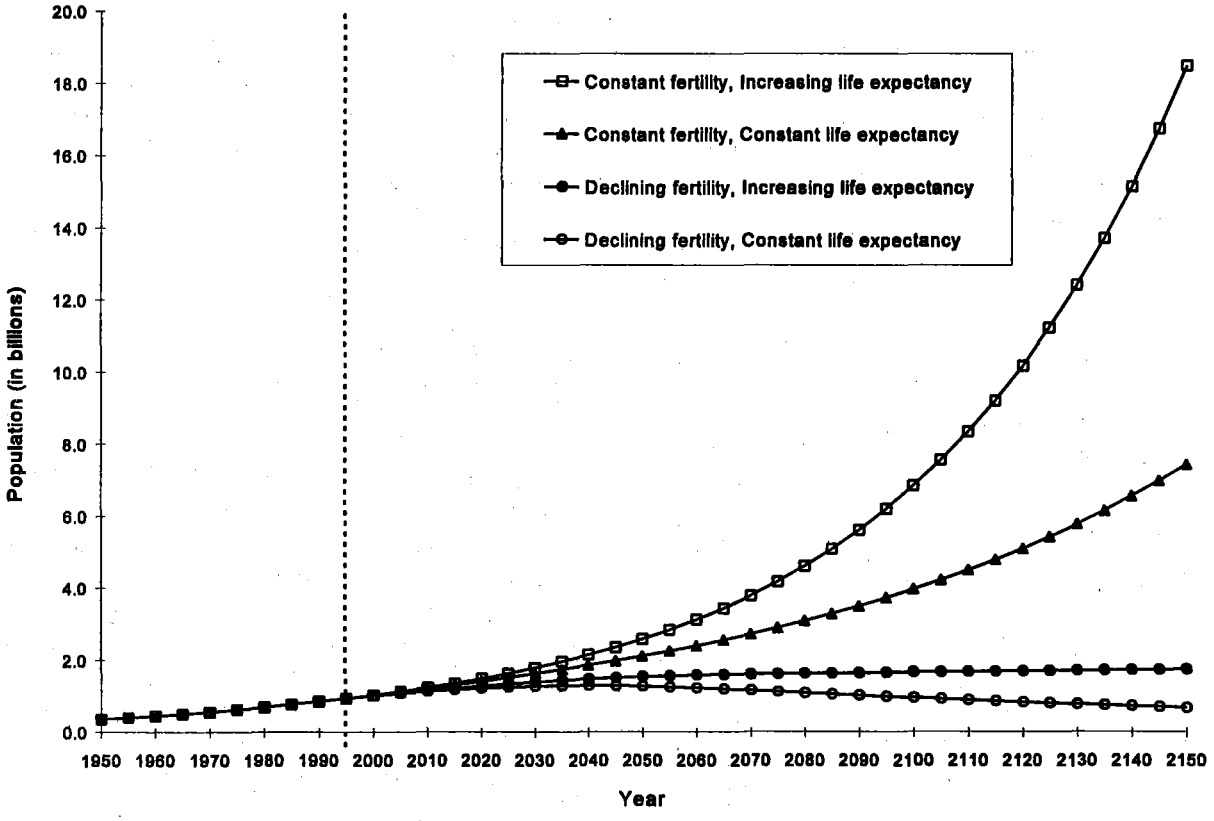
The two illustrative projections described above are interesting, but they are unable to single out the separate effects of fertility decline and mortality decline in generating future population growth. The purpose of this final analysis is to show how India's population projection would differ were either fertility or mortality to hold constant from 1995 to 2150. India has been chosen because it offers a representative case as both its current fertility and mortality levels are close to the average levels of the less developed regions of the world. It should be noted that the actual scenarios presented here do not include migration between 1995 and 2025, so they differ slightly from the actual scenarios discussed in the rest of the report.

In figure IX, four separate projections are presented for India from 1950-2150. Each projection represents a separate combination of fertility and mortality trends. According to the *1996 Revision*, the popula-

tion of India in 1995 is estimated at 929 million persons, the total fertility in 1990-1995 at 3.39 and the life expectancy for males at 60.3, for females at 60.6. The first projection "Declining fertility, Increasing life expectancy" represents the medium-fertility scenario. This projection indicates that the population of India will grow by about 65 per cent by 2050, reaching 1.5 billion persons, and about 88 per cent over the course of the 155 years, when the population reaches 1.7 billion. In the second projection, "Constant fertility, Constant life expectancy," the population will reach 2.1 billion by 2050, 37 per cent more than in the medium projection, and 7.4 billion by 2050, more than four times the level in the medium. The third projection, "Declining fertility, Constant life expectancy," assumes that fertility rates will decline, as in the medium-fertility scenario, but mortality rates stay constant. According to this projection, the population will grow to 1.3 billion in 2050, 15 per cent less than in the medium, and decline to 700 million in 2150, 60 per cent less than in the medium, and 90 per cent less than if both fertility and life expectancy remained constant.

A fourth projection provides a different contrast to the medium variant and isolates the impact of the fertility decline on the population growth. The fourth projection, "Constant fertility, Increasing life expec-

FIGURE IX. FOUR INDIAN SCENARIOS WITH CONSTANT AND CHANGING FERTILITY AND LIFE EXPECTANCY, 1950-2150



Source: Population Division of the Department of Economic and Social Affairs at the United Nations Secretariat, *World Population Projections to 2150*, (United Nations, 1998).

tancy," has life expectancy increasing, as in the medium projection. It indicates that by 2050, the population size will reach 2.6 billion, a 70 per cent increase over the medium variant, and that by 2150, it will be 18.5 billion, or more than 10 times as large as in the medium variant, and two and a half times as large as in the "Constant fertility, constant mortality "projection.

The effect of fertility changes on population growth can be evaluated by comparing projections with similar life expectancies but with different fertility levels. The results presented here indicate that the reduction of fertility leads to a population size in 2150 that is only one tenth the size that it would have been with constant fertility. This relationship holds true in both cases: when life expectancy is increasing and when it is constant. Similarly, the assumed increase in life expectancy leads to a population in 2150 that is two and a half times the size that it would have been had life expectancy remained constant.

This is true regardless of whether the constant fertility or the declining fertility projections are compared. Thus, the effects of the assumed changes in fertility between 1995 and 2150, in the medium variant, are four times as large as those of the assumed changes in life expectancy. This analysis further shows that long-range population projections, beyond the year 2050, can be extremely helpful in elucidating the effect of different demographic assumptions on population growth.

III. COMPARISON WITH PRIOR LONG-RANGE PROJECTIONS

There are a number of important differences in the assumptions between this projection and the previous long-range projection of 1992. First, the data used in the projections have been updated and are based on the results of the *1996 Revision* whereas the 1992 long-range projections were based on the *1990 Revision.* For example, the *1990 Revision* medium-fertility variant projected the 1995 world population size at 5.770 billion or 1.4 per cent below the size of the world population in 1995 in the *1996 Revision.* In addition, since the *1990 Revision* projections only extended to 2025, the long-range projections at the time were constructed from 2025-2150. This time, since the 1996 projections extend to 2050, the long-range projections take over in 2050.

The basic scenarios are the same and this is important and allows a degree of comparison across revisions. Nevertheless, in terms of assumptions that are built into the projections, both fertility and mortality have been modified. The ultimate low-fertility levels that are employed in this scenario are somewhat lower than the levels utilized in the 1992 long-range projections. In the current long-range projections, ultimate total fertility levels fall between 1.35 and 1.6, whereas all levels in the prior round were 1.7. This modification is based on the *1996 Revision* and reflects the continued decline in fertility in much of Europe to levels far below replacement.

It is interesting to note how the estimates have declined since the 1992 long-range projection. In 1992, the constant-fertility scenario estimate for the year 2150 was 694 billion, about 2.4 times the population estimated in the current revision. The difference between these two estimates emphasizes the importance of the decline in fertility in the intervening years between the two revisions. In the 1992 projection, the total fertility rate for the world for 1990-1995 was projected at 3.31. According to the *1996 Revision*, the total fertility rate for the same period, 1990-1995, is estimated at 2.96—a reduction of 10.6 per cent from that estimated in the 1992 projection.

The underlying life expectancy assumption in the 1992 long-range projection was that life expectancy was limited at 82.5 for males and 87.5 for females. In this revision, life expectancies have been revised upwards in line with the recent trends that continue to show declining mortality rates at the upper ages. Accordingly, life expectancies in this revision reach as high as 87.5 for males and 92.5 for females.

The above differences account for the variation in projected population size and distribution to the year 2150. In the 1992 projection the medium-fertility scenario projected the world population in 2150 at 11.5 billion or 6.8 per cent larger than the current revision's estimate of 10.8 billion. The ultimate stationary population was projected by the year 2200 as 11.6 billion in the 1992 projection and about 6 per cent smaller (10.9 billion) in the current projection.

IV. SUMMARY AND CONCLUSION

Five principal projections of the population of the entire world and the eight major areas of the world are described in the present report. Each of the projection scenarios suggests a different demographic future for the world and its major regions between 1995 and 2150. All the projection scenarios assume similar increases in life expectancy over time scenarios; however, they differ according to their assumptions regarding the evolution of total fertility rates. These scenarios are based upon and are fully compatible with the *1996 Revision* of *World Population Prospects*, which projects populations to 2050 under four separate variants.

The medium-fertility scenario assumes that fertility will stabilize at the replacement-fertility level by 2055 and will continue at that level through 2150. This implies that the 1995 world population of 5.7 billion will increase by roughly 90 per cent by 2150 to reach 10.8 billion. The rate of increase in the population is expected to slow considerably over the next 155 years. The population of the world is estimated to be growing at about 1.4 per cent annually in 1995, a figure that is substantially less than the 2 per cent annual rate of growth between 1960 and 1975. By 2050, the annual growth rate of the world is expected to decline to 0.4 per cent and to less than 0.1 per cent by 2150. Although the growth rate of the world is now declining, the absolute number of people added to the planet continues to be very large due to the growing size of the population base. Owing to the effect of population momentum, the world population will continue to grow despite the reduction of fertility to replacement levels and will eventually stabilize at nearly 11 billion people by 2200.

The four other main scenarios assume that fertility will stabilize above and below the replacement-level fertility. The high- and the low-fertility scenarios provide the upper and lower bounds of the projections in this report. According to the high-fertility scenario, total fertility rates will converge by 2050 between 2.5 and 2.6, about half-a-child above replacement level. The low-fertility scenario assumes that in the future, mothers will bear about one child less, with the total fertility rates eventually falling to between 1.35 and 1.6 children per woman by 2050, about half-a-child below replacement level. Even the small absolute differential separating the high- and the low-fertility scenarios—a differential in the order of roughly one additional child per woman -- results in dramatically different population estimates in the long-run. The high-fertility scenario projects that the population of the world will reach 11.2 billion by 2050 and 27.0 billion by 2150. Thus, the high-fertility projection is roughly 2.5 times greater than the medium. In contrast, the low-fertility scenario projects that the world population will increase to about 7.7 billion by 2050 before falling to 3.6 billion in 2150. Compared to the medium-fertility scenario, the low-fertility projection shows a world one third the size in the year 2150 and 63 per cent smaller than the 1995 world population.

As demonstrated in these projections, the implications of demographic processes may be difficult to gauge in the short term. By 2050, the world population in the high-fertility scenario will be only 46 per cent larger than in the low-fertility scenario. However, by 2150, with fertility after 2050 remaining fixed in both scenarios, the population in the high-fertility variant will be 7.6 times greater than the population in the low-fertility scenario. Thus, it is important to consider long-range projections in order to fully comprehend the consequences of medium-term fertility assumptions on population growth.

The increasing size of the world population represents only one of many potential demographic changes in store for the future. The age distribution of the world is also expected to dramatically change as the younger age groups decrease and the older age groups increase as a proportion of the population. The medium-fertility scenario suggests that the median age in the world population will rise from 25.4 years in 1995 to 36.5 in 2050 and to 42.9 by 2150. The share of the population under 15 years of age is predicted to decline from 31.3 per cent in 1995 to 17.5 per cent in 2150 while the share that is 60 years or over will climb from 8.4 per cent in 1995 to 20.7 per cent in 2150. In fact, although the population under age 15

(1.8 billion) is estimated to be 3.7 times larger than the population 60 or over (0.5 billion) in 1995, the elderly are expected to outnumber the young by 2050 and the elderly are anticipated to be 74 per cent larger than the young by 2150 (2.2 billion elderly versus 1.9 billion under age 15). Among the elderly, it is the oldest old—those aged 80 or over—that will increase the most rapidly over time. The number 80 or over is projected to grow 1700 per cent between 1995 and 2150: from 61.4 million in 1995 to 1.054 billion in 2150.

The redistribution of the world population among its major areas is equally impressive. The medium-fertility scenario projects a dramatic decline in the proportion of the world population living in Europe and Northern America and a large increase in the proportion found in Africa and other parts of the world that are today categorized as less developed regions. In fact, whereas Europe's population was more than twice that of Africa in 1950, it is projected to decline to one fifth the population size of Africa by 2150.

There are important differences in the fertility and mortality assumptions used in these latest projections relative to the assumptions from the 1992 long-range projection. At least for the medium-fertility scenario, both projections assume that fertility will eventually reach replacement in the long run but there are differences in the expected date at which they will converge. In addition, data availability has improved, particularly in many developing countries, owing to the increased availability of nationally representative surveys. The current projection of a world population growing to 10.8 billion is lower than the previous projection estimate of 11.5 billion. Furthermore, the current projection indicates an eventual stationary population in the year 2200 of 10.9 billion, also less than the 11.6 billion indicated in the previous long-range projection.

One point that clearly stands out across the two projections is the wide range of estimates obtained according to the assumptions of the projections. In the last revision, the high-fertility scenario for the world population in 2150 was 6.5 times greater than the low-fertility scenarios. The high-fertility scenario in this projection is 7.5 times greater than the low-fertility one. The wider range in this projection is mainly due to the raising of the ultimate fertility in the high scenario and the lowering of the ultimate fertility in the low scenario. In both sets of projections, however, there is a vast gulf separating the projections of the high- and the low-fertility scenarios. The range of outcomes represents the uncertainty involved in any projection of populations into the far future.

Finally, it should be noted that these population projections are based on demographic considerations. No attempt is made to incorporate other factors such as ecological constraints and their potential influence on the future growth of human populations. Cohen's (1995) review of estimates of the world's carrying capacity suggests the difficulty in reaching a consensus on the ultimate, ecologically-viable population size. Of the 65 estimates in Cohen's sample, the middle half, lying between the first and third quartile, appear to fall roughly between 5 billion and 30 billion persons, surprisingly close to the range between the high and low scenarios presented here. While the population of the world will grow or decline in the future depending on the evolution of fertility and mortality rates, those demographic rates will themselves depend on changes in the socio-economic and physical characteristics of the world. However, the projections presented here suggest that it is likely that the population of the world will continue to grow for several decades and that policies should be geared towards improving the capacity of the world to accommodate increasing numbers of people.

ANNEX

WORLD POPULATION AND DEMOGRAPHIC INDICATORS: MEDIUM-FERTILITY SCENARIO, 1950-2200

Year	*Population (thousands)*	*Rate of natural increase* (percentage)*	*Crude birth rate* (per 1,000)*	*Crude death rate* (per 1,000)*	*Total fertility Rate**	*Life expectancy* (both sexes)*	*Median age*
1950	2,523,878	1.780	37.4	19.8	5.00	45.1	23.5
1995	5,687,113	1.480	24.1	9.3	2.96	65.6	25.4
2050	9,366,724	0.377	13.7	10.0	2.07	77.3	36.5
2055	9,544,981	0.330	13.4	10.1	2.07	77.9	37.3
2060	9,703,986	0.281	13.2	10.4	2.07	78.5	38.0
2065	9,841,404	0.240	13.0	10.6	2.07	79.1	38.6
2070	9,959,958	0.211	12.9	10.8	2.07	79.6	39.2
2075	10,065,818	0.183	12.7	10.9	2.07	80.1	39.7
2080	10,158,473	0.157	12.6	11.0	2.07	80.6	40.0
2085	10,238,589	0.132	12.5	11.2	2.07	81.0	40.4
2090	10,306,473	0.112	12.4	11.3	2.07	81.4	40.7
2095	10,364,404	0.096	12.3	11.4	2.07	81.8	41.0
2100	10,414,493	0.084	12.2	11.4	2.07	82.2	41.2
2105	10,458,341	0.077	12.2	11.4	2.07	82.6	41.4
2110	10,498,442	0.074	12.1	11.4	2.07	83.0	41.6
2115	10,537,078	0.074	12.1	11.3	2.07	83.4	41.8
2120	10,575,938	0.073	12.0	11.3	2.07	83.8	42.0
2125	10,614,431	0.071	12.0	11.3	2.07	84.2	42.1
2130	10,652,025	0.072	11.9	11.2	2.07	84.6	42.3
2135	10,690,154	0.072	11.9	11.2	2.07	85.0	42.4
2140	10,728,521	0.072	11.8	11.1	2.07	85.4	42.6
2145	10,767,160	0.072	11.8	11.1	2.07	85.8	42.8
2150	10,805,998	0.072	11.7	11.0	2.07	86.2	42.9
2155	10,835,018	0.073	11.7	11.0	2.07	86.6	43.1
2160	10,856,708	0.075	11.7	10.9	2.07	86.9	43.2
2165	10,873,136	0.076	11.6	10.9	2.07	87.3	43.4
2170	10,885,451	0.076	11.6	10.8	2.07	87.7	43.5
2175	10,894,638	0.077	11.5	10.8	2.07	88.1	43.6
2180	10,901,395	0.078	11.5	10.7	2.07	88.4	43.8
2185	10,906,130	0.078	11.5	10.7	2.07	88.8	43.9
2190	10,909,491	0.078	11.4	10.7	2.07	89.1	44.1
2195	10,911,914	0.074	11.4	10.7	2.07	89.3	44.2
2200	10,913,653	---	---	---	---	---	44.3

* All rates refer to the 5-year period beginning with the date indicated in the first column of the table.

Source: Population Division of the Department of Economic and Social Affairs at the United Nations Secretariat, *World Population Projections to 2150*, (United Nations, 1998).

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