8. URBAN DEMOGRAPHY

8.1. INTRODUCTION

This chapter makes a study of selected aspects of urban demography in West Bengal. In the first place this analysis includes a study of the age-structure of urban population, since a knowledge of how population is distributed among the different age groups is essential in understanding the nature and growth of population of any region. Spatial variations in age structure has also been related to the degree of urbanisation in different districts so as to investigate the nature of relationship between these two variables.

Secondly, a detailed study of urban sex ratio has been made, as a study of the pattern of sex ratio 'helps explain employment and consumption patterns, social needs, and perhaps the psychological characteristics of a community' (Franklin, 1956). An attempt has also been made to explain variations in urban sex ratio in terms of various factors like growth rate, population size and level of industrialisation of urban centres.

A third aspect of urban demography that has been selected for analysis is urban literacy. In a developing country like India where it has not yet been possible to eradicate illiteracy, the level of literacy is an important measure of the socio-economic character of a specific region which in turn influence the nature of urbanisation of that region.

Finally, an attempt has been made to analyse spatial patterns of urban population densities by constructing density gradients for selected class I cities. The cities considered in this context are Calcutta, Chandannagar, Kharagpur and Asansol so that four out of a total of 24 Class I urban centres recognised by the 1981 census have been represented. Calcutta, the premier city of West Bengal reflects a functional pattern which is a leftover from the British Colonial rule. Growth of this city was primarily uncontrolled and without any kind of systematic planning. Chandannagar, which initially grew as a trade centre of the French is now primarily a residential satellite of Calcutta. As noted earlier in the chapter on urban functions, Asansol began as a planned
railway town which however grew to become a principal city of an area where urbanisation is mostly a result of industrial-cum-mining activities. The remaining city, Kharagpur is located outside the two major zones of urban concentration of the state and here growth is primarily associated with the development of transport functions. Thus, differences in respect of history, growth and functional character make it possible to draw useful comparisons of population density gradients in these cities. Temporal variations of the density gradient have been studied for Calcutta where relevant data is available for a number of years.

8.2. METHODOLOGY

8.2.1. Age-structure

The age structure of urban population of West Bengal has been analysed by computing the structure index after Coulson. "The age structure index provides a single quantitative measure of age structure" (Coulson, 1968). Computation of this index involves the calculation of the percentage of urban population in five year age groups for each district. Then age structure histograms are obtained for the districts by plotting the percentage of total population in each age-group (y) against the appropriate age-group (x). Next the linear relationship between the two variables is computed by employing the regression equation of the form $Y_c = a + bx$. Ideally an younger population should show a steeper slope than an older population. Thus the gradient of the lines provides a quantitative measure of the age structure of the population of an area and may be considered as the age structure index. In the above equation $b$ is the regression coefficient and thus indicates the slope of the regression line. Therefore, the value of $b$ is the age structure index for each district.

Computation of age structure indices for the different districts during the three decades, 1961, 1971 and 1981 shows that the values ranged from -0.118 to -0.183. Finally, the minus sign as well as the decimal point has been disregarded and the index has been used as a three digit number in which the larger the number, the younger the age
structure and vice versa.

In order to analyse the degree to which urban age structure is related to the levels of urbanisation (considered in terms of the percentage of urban population to total population in each district) in the state, Pearson's product-moment correlation coefficients have been calculated between the following pairs of variables.

a) Age structure index and percentage of urban population to total population in the districts.

b) Percentage decadal change in age structure index and percentage decadal variation in urban population.

8.2.2. Sex ratio

In this analysis sex ratio has been expressed as the number of females per thousand males. In order to obtain a clear picture of areal variations in urban sex ratio, maps have been prepared showing the location of urban centres and their sex ratio during 1961, 1971 and 1981.

Product moment correlation coefficient have also been calculated for the following pairs of variables:

a) Sex ratio in 1971 and 1981 with percentage decadal variation of urban population during 1961-71 and 1971-81 respectively.

b) Average sex ratio and average population size of the six size classes of urban centres during 1961, 1971 and 1981.

c) Sex ratio and percentage of working population engaged in industrial activities in the urban centres.

8.2.3. Literacy

Maps showing percentage of literate persons in the urban centres during 1961-81 have been prepared to analyse the spatial as well as temporal variations in urban literacy in West Bengal. Product moment correlation coefficients have been calculated to show the association between level of urbanisation considered in terms of percentage of urban population in the districts and the percentage of literate urban
8.2.4. Population density gradients

The areal pattern of population distribution in an urban centre may be analysed through a study of population density gradients from the core or nucleus of the city.

Bleicher (1892) was the first to note that density tends to decline as a negative exponential function of increasing distance from the centre of an urban area. This regularity was rediscovered by Clark (1951) who studied residential population density gradients for 36 cities over a period of 1801 to 1950 and found considerable evidence in support of the above argument. Though later workers (Tanner, 1961; Sherratt, 1960; Newling, 1966 and 1969) have proposed certain modifications, research has proved Clark's generalisation that urban population densities decline exponentially with distance away from the city centre, to be satisfactory for a number of urban centres over the world including India (Berry, Simmons and Tennant, 1963).

Therefore the spatial distribution of population densities within cities may be said to conform to the equation

\[ P_d = P_o e^{-bd} \]

where \( P_d \) is the population density at a given distance \( d \) from the centre of the city in km, \( P_o \) is the central density as extrapolated and \( b \) is the density gradient, indicating the rate of decline of density with distance, a negative exponential decline. Values of the density gradient can be easily computed by ordinary least squares by rewriting the equation as

\[ \ln P_d = \ln P_o - bd \]

The coefficient \( b \) can also be considered as a measure of the spread of a city. "With a high value of \( b \) the city is compact, i.e., density falls off rapidly to rural levels at quite a short distance from centre. With a low value of \( b \) density falls off gradually and the city spreads out over a considerable distance before rural density is reached"
The value of $b$ or the density gradient has been computed by solving the regression equation for each of the four cities mentioned earlier, namely Asansol, Kharagpur, Calcutta and Chandannagar. Correlation coefficients have also been calculated between distance and natural logarithm of density to find out whether a significant statistical relationship exists between the two variables.

It may be noted here that an important problem in population density gradient analysis of a city is to find out the location of the nucleus or the nodal point which forms the origin of the density profile. The methods of selection of the point of origin varies but it is usually the geographical centre, or the commercial node or the focus of maximum density of a city. In the four cities under consideration the origins of the density profiles correspond to either the identified city core (as for example B.B.D. Bag which may be considered as the central business district of Calcutta city) or the focus of the largest commercial areas.

8.3. ANALYSIS

8.3.1. Age structure of urban population

A study of the age structure indices for the different districts shows that there is a definite pattern of spatial variation of urban age structure in the state during the period under review.

In 1961 the index ranged between a maximum of 183 in Puruliya district to a minimum of 143 in Calcutta. It may be noted here that the entire urban district of Calcutta shows a much lower value of the index than the other districts of the state indicating a comparatively higher proportion of adult population. This corresponds to the fact that in Calcutta the percentage of population falling within the 20-59 age group was over 56% of the total population, a much higher figure than that of the other districts.

In the neighbouring districts of Haora, Hugli, Twentyfour Parganas and Nadia, the index appears to have varied between 159 (Haora) and
170 (Twentyfour Parganas). In contrast highest values of the index are seen in the northern districts of Darjiling (182), West Dinajpur (182) Maldah (181) and the Western district of Puruliya (183).

In 1971, the values of the index appears to have declined in a majority of the districts indicating that urban population in older age groups is rising. A considerable decrease is particularly noticeable in the three northern districts of Darjiling, Jalpaiguri and Koch Bihar where the indices have fallen from 182, 180 and 177 in 1961 to 176, 173 and 171 respectively in 1981. Among the districts with a high level of urbanisation, Calcutta and Twentyfour Parganas show considerable decline in the values of the index. However, exception to the declining trend may be noticed in districts like Barddhaman, Hugli and West Dinajpur where the index value increased during this decade.

Table 8.1. Districtwise age structure index of urban population in West Bengal, 1961-81

<table>
<thead>
<tr>
<th>District</th>
<th>1961</th>
<th>1971</th>
<th>1981</th>
</tr>
</thead>
<tbody>
<tr>
<td>Koch Bihar</td>
<td>177</td>
<td>171</td>
<td>155</td>
</tr>
<tr>
<td>Jalpaiguri</td>
<td>180</td>
<td>173</td>
<td>162</td>
</tr>
<tr>
<td>Darjiling</td>
<td>182</td>
<td>176</td>
<td>154</td>
</tr>
<tr>
<td>West Dinajpur</td>
<td>182</td>
<td>183</td>
<td>158</td>
</tr>
<tr>
<td>Maldah</td>
<td>181</td>
<td>177</td>
<td>161</td>
</tr>
<tr>
<td>Murshidabad</td>
<td>179</td>
<td>177</td>
<td>168</td>
</tr>
<tr>
<td>Nadia</td>
<td>166</td>
<td>162</td>
<td>147</td>
</tr>
<tr>
<td>Twentyfour Parganas</td>
<td>170</td>
<td>163</td>
<td>143</td>
</tr>
<tr>
<td>Calcutta</td>
<td>143</td>
<td>133</td>
<td>118</td>
</tr>
<tr>
<td>Haora</td>
<td>159</td>
<td>162</td>
<td>148</td>
</tr>
<tr>
<td>Hugli</td>
<td>160</td>
<td>156</td>
<td>141</td>
</tr>
<tr>
<td>Medinipur</td>
<td>178</td>
<td>177</td>
<td>160</td>
</tr>
<tr>
<td>Bankura</td>
<td>174</td>
<td>177</td>
<td>151</td>
</tr>
<tr>
<td>Puruliya</td>
<td>183</td>
<td>178</td>
<td>166</td>
</tr>
<tr>
<td>Barddhaman</td>
<td>176</td>
<td>181</td>
<td>157</td>
</tr>
<tr>
<td>Birbhum</td>
<td>177</td>
<td>179</td>
<td>167</td>
</tr>
</tbody>
</table>
The indices for 1981 show considerable decline in all the districts. The index for Calcutta has fallen to 118 indicating a decline of more than 11% during one decade. The decline appears to have been particularly remarkable in districts with a comparatively high proportion of urban population like Twentyfour Parganas and Barddhaman where the index declined from 163 and 181 in 1971 to 143 and 157 in 1981 respectively. This is not surprising since in Twentyfour Parganas the percentage of urban population in 0-19 age group has declined from 47.24% in 1971 to 43.12% in 1981 while in the age group 20-59, the percentage has risen from 47.63 to 50.87. Similarly in Barddhaman district, percentage of urban population in the former age-group has declined from 49.04 to 44.75 while in the latter age-group the percentage has increased from 47.14 to 50.99.

Among the lesser urbanised districts of the state, magnitude of the decline appears to have been less as for example, in the district of Murshidabad the index shows a decline from 177 to 168 in 1980-81. However, Bankura district provides an exception to this, since the value of the index declined from 177 in 1971 to 151 in 1981, showing a decline of 14.69% during the decade.

8.3.1.1. Urban age structure and level of urbanisation

A comparison of urban age structure and percentage of urban population in the districts appears to indicate a definite relationship between the two. The values of Pearson's correlation coefficient which summarises the relationship between the two variables are -0.88479, -0.96285 and -0.88355 for 1961, 1971 and 1981 respectively. Computed values of 't' show that the coefficients are significant at 0.001 level. Thus the period under review shows a statistically significant negative relationship between the variables, establishing the fact that the higher the percentage of urban population, lower the value of the age structure index. In other words, a high level of urbanisation in the state normally indicates a higher proportion of adult urban population.
8.3.1.2. Changes in age-structure and urban population growth

It has already been pointed out that there has been considerable fall in the values of the age structure index during 1961-81. In order to find out whether this decline could be related to variations in urban population growth, percentage variation in the age structure index during the decades 1961-71 and 1971-81 has been correlated with percentage variation of urban population during the corresponding decades. However, the values of the correlation coefficient is seen to be 0.10491 and 0.31379 for 1961-71 and 1971-81 respectively indicating that there is no statistically significant relationship between the two variables.

8.3.2. Urban sex ratio

Census statistics show that there is an overall deficiency of females in India. The country as a whole shows a sex ratio of 933 females per 1000 males in 1981. This disparity between the number of males and females is greater in urban areas than in rural areas (951 for rural India and 878 for urban India). The same is true for West Bengal where the overall sex ratio is 911 with 947 for rural areas and 819 for urban areas.

The causes of low sex ratio of urban population in the state as elsewhere may be attributed to various factors. It is known that more males are born than females. In developed countries this initial masculinity of the population is removed by lower female mortality. However, in a developing country like India, female mortality remains higher resulting in an unbalanced sex ratio with an excess of males. Another important determinant of low sex ratio especially in urban areas is male-selective rural-urban migration. Pressure of population upon land, lack of alternative employment, attractions of city life, better employment opportunities and so on lead to a movement of the male population to towns and cities. In addition, most of these men generally leave their families behind because of problems like high cost of living, shortage of housing and so on in urban areas.
WEST BENGAL
SEX RATIO IN THE URBAN CENTRES
1961

Figure 81
interaction of these factors naturally lead to an abnormally high male population in urban areas.

Table 8.2 which shows sex ratio during 1901-81 for India and West Bengal, reveals that for the country as a whole urban sex ratio declined during 1901-41. Since 1941, urban sex ratio began improving with a slight decline during 1961. West Bengal shows a more or less similar trend in that urban sex ratio began improving after 1941 but it is noticeable that the rate of increase has been much greater. Comparison with the country as a whole reveals that urban sex ratio has been exceptionally low in West Bengal, especially during the earlier decades. It is also interesting to note that there has always been a considerable gap between rural and urban sex ratios in the state and the greatest disparity is seen in 1941 after which decade, however, the gap between urban and rural sex ratios has been narrowing.

Table 8.2. Urban and rural sex ratio in India and West Bengal, 1901-81

<table>
<thead>
<tr>
<th>Year</th>
<th>1901</th>
<th>1911</th>
<th>1921</th>
<th>1931</th>
<th>1941</th>
<th>1951</th>
<th>1961</th>
<th>1971</th>
<th>1981</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indian Rural</td>
<td>979</td>
<td>975</td>
<td>970</td>
<td>966</td>
<td>965</td>
<td>965</td>
<td>963</td>
<td>949</td>
<td>951</td>
</tr>
<tr>
<td>Urban</td>
<td>910</td>
<td>872</td>
<td>846</td>
<td>838</td>
<td>831</td>
<td>860</td>
<td>845</td>
<td>858</td>
<td>878</td>
</tr>
<tr>
<td>West Rural</td>
<td>994</td>
<td>982</td>
<td>971</td>
<td>961</td>
<td>945</td>
<td>939</td>
<td>943</td>
<td>942</td>
<td>947</td>
</tr>
<tr>
<td>Bengal Urban</td>
<td>650</td>
<td>614</td>
<td>591</td>
<td>578</td>
<td>559</td>
<td>660</td>
<td>701</td>
<td>751</td>
<td>819</td>
</tr>
</tbody>
</table>

8.3.2.1. Areal variations in sex ratio

In 1961 urban sex ratio in the state varied between a maximum of 1067 (Kataganj and Gokulpur) to a minimum of 338 (Durgapur). A study of Figure 8.1 which shows sex ratios in the urban centres of West Bengal during 1961 reveals the following trends:

i) Comparatively high sex ratios of over 900 females per thousand males appear to be confined to the southern half of the state. This is especially true for the south eastern parts of the state.
comprising the districts of Murshidabad, Nadia and eastern Twentyfour Parganas. In these border districts urban growth during the post-partition period is mainly a result of large-scale influx of refugees from East Pakistan (now Bangladesh) rather than inmigration of mainly male population from surrounding rural areas. Consequently, these urban centres do not show the low sex ratio characteristic of towns and cities where industrial or commercial activities are expanding rapidly.

i) Comparatively high urban sex ratios are also noticeable in the western part of West Bengal in the districts of Bankura, Puruliya and Medinipur. Here high sex ratios indicate the non-industrialised nature of these urban centres which primarily serve as market centres for the agricultural output of surrounding rural areas. However, exceptions to this general trend may be noticed in western Puruliya and southern Medinipur where some urban centres show low to moderate sex ratios. In Puruliya district moderate sex ratio may be seen in Adra, a town where transport functions are dominant.

ii) Low to moderate sex ratios appear to be characteristic of the urban centres of North Bengal. Very low sex ratio (less than 700 females per thousand males) is particularly noticeable in Siliguri, the largest and most important transport and commercial centre of North Bengal. Mal in Jalpaiguri district is a comparatively new urban centre and shows a very low sex ratio.

iv) The Hugli Industrial Belt, in the southern part of West Bengal, which includes the Calcutta Urban Agglomeration shows considerable variation in sex ratio. Low sex ratios are characteristic of a large number of urban centres including either large cities like Calcutta and Haora or towns where industrial functions dominate like Bhatpara, Titagarh, Rishra and so on. Comparatively high sex ratios of over 900 females per thousand males is usually seen in urban centres located at the outer margins of the Hugli Industrial Belt (Domjur, Panchla) or in towns which serve primarily as residential towns within commuting distance of Calcutta, the primate city of the region.
Examples of the latter group include urban centres like Bansdroni and Madhyamgram.

v) Low to moderate sex ratios characterise the urban centres of the Asansol-Durgapur region in the western part of Barddhaman district. Low sex ratios in this area may be related to the fact that urban growth here is primarily a product of mining activities and the establishment of heavy and allied industries.

A study of Figure 8.2 which shows urban sex ratios in West Bengal in 1971, reveals considerable improvement of sex ratios in the urban centres of the state during the decade. However there appears to be little departure from the general trends of spatial variations observed during the earlier decade.

1) High urban sex ratios are generally found to occur in the south eastern parts of the state. Again this is especially true of the border districts of Murshidabad, Nadia and eastern Twentyfour Parganas.

ii) Western part of the state is also characterised by high to moderate urban sex ratios. Haldia, a port with oil refining and allied functions, in Medinipur district is, however, characterised by an exceptionally low sex ratio.

iii) Urban sex ratios in the northern districts show some improvement and the number of towns with moderate sex ratios have increased substantially.

iv) Increased urban sex ratio may also be seen in the Hugli Industrial Belt which is still characterised by wide variations in sex ratio. However, a comparison of the 1961 and 1971 maps shows that the proportion of urban centres with moderate to high sex ratios have definitely risen. However, it may be noted that the largest cities of the state, Calcutta and Haora are still characterised by exceptionally low sex ratios.

v) The Asansol-Durgapur zone, however, remains an area of low urban sex ratio.
Figure 8.3

WEST BENGAL
SEX RATIO IN THE URBAN CENTRES
1981

KEY TO INSERT A
1. Bandel Thermal
2. Konagar
3. Uluberia Kolbar
4. Nabagram Colony
5. Kaliakair
6. Haldia
7. Bellary
8. Bakkargram
5. Latipur
10. Jagadhari
11. Harasr
12. Haridevpur
13. Ambala
14. Dolahat
15. Andass
16. Chittha
17. Burdwan
18. Panchkula
19. Ranchhodpur

SEX RATIO
(lakhs per thousand males)

above 1000
900 to 1000
800 to 900
700 to 800
less than 700

KEY TO INSERT A
1. Bandel Thermal
2. Konagar
3. Uluberia Kolbar
4. Nabagram Colony
5. Kaliakair
6. Haldia
7. Bellary
8. Bakkargram
5. Latipur
10. Jagadhari
11. Harasr
12. Haridevpur
13. Ambala
14. Dolahat
15. Andass
16. Chittha
17. Burdwan
18. Panchkula
19. Ranchhodpur

SEX RATIO
(lakhs per thousand males)

above 1000
900 to 1000
800 to 900
700 to 800
less than 700

Figure 8.3
Further improvements in urban sex ratio may be seen in 1981. However, sex ratios continued to show considerable variation as, is seen from the fact that in 1981 urban sex ratio ranged between a maximum of 1037 (Domjur) to a minimum of 448 (Banupur). The spatial patterns of urban sex ratio as revealed by the map for 1981 are as follows:

i) Over the greater part of the state comparatively high sex ratio of over 900 females per 1000 males is seen to occur. Again this is especially true of the border districts in the south eastern parts of the state and the comparatively backward, primarily rural districts of Puruliya, Bankura and Medinipur districts in the west. However, some exceptions may be noticed especially in the latter area. In Medinipur district examples of low urban sex ratios include Haldia (as noted earlier), Kolaghat Thermal Power Project Town and Kharagpur. This is not only the largest city of the district but also an important transport node of the South Eastern Railways.

ii) A remarkable improvement in urban sex ratios may be seen in urban centres located in the northern half of West Bengal and moderate to high urban sex ratios are mostly found to occur. It may be noted here that the lowest sex ratio in this region is seen in Jaldhaka Hydel Power Project Town in Darjiling district.

iii) The Hugli Industrial Belt continues to show considerable variations in urban sex ratio. It is this region which contains both the highest and lowest sex ratios of the state. This wide variation in sex ratio may be explained in terms of the functional nature of urban centres. As noted earlier, low sex ratios are generally characteristic of towns where industrial functions dominate. On the other hand, high sex ratios are characteristic of those urban centres which serve as residential satellites of Calcutta like Jadabpur and Bidhannagar Township or other residential towns within commuting distance of either Calcutta or the various important industrial towns. Examples of the latter group include urban centres like Chandannagar, Hugli-Chinsurah, Madhyagram, Barasat and others.
A completely different picture is provided by the Asansol-Durgapur region in the western part of Barddhaman district. In this area, all the urban centres continue to show sex ratios of less than 900 females per 1000 males and nearly two-thirds (27 out of a total of 40) show sex ratios below 800.

Thus, an analysis of spatial distribution of urban sex ratio in West Bengal during 1961-81 shows considerable variations. Such variations may be said to reflect the interaction of several factors among which the influence of the following has been analysed, (i) growth of urban centres (ii) population size of urban centres and (iii) the level of industrialisation in the urban centres.

8.3.2.2. Urban sex ratio and growth of urban centres

It is generally observed that an urban centre which is growing rapidly is characterised by a preponderance of males over females. This may be related to the inmigration of a large number of males from surrounding rural areas moving to the city in search of employment. Thus, among the two determinants of urban population growth, namely, natural increase and migration, it is the latter which is more likely to influence the distribution of population between the sexes. Therefore, detailed data on migration into and out of urban centres for males and females is necessary to find out the relationship between sex ratio and rate of growth of urban centres. Unfortunately, such data for individual urban centres is not readily available so that the relationship between these two variables has been studied by correlating sex ratio with the decadal growth of population in the urban centres. The computed values of the correlation coefficients obtained by correlating sex ratio in urban centres in 1971 and 1981 with percentage decadal variation of urban population in 1961-71 and 1971-81 respectively are -0.10775 and +0.00965. Computed values of 't' shows that both coefficients are not significant at 0.05 level. However, it is interesting to note the change in the nature of the relationship during this period from a slight negative relation in the earlier decade to practically no relationship during the latter.
8.3.2.3. Urban sex ratio and population size of urban centres

A study of population size and urban sex ratio normally shows that the larger the population size of a town the lower its sex ratio. The larger towns and cities are usually important industrial, commercial, service and administrative centres and as a result attract large numbers of male inmigrants not only from surrounding rural areas but also from smaller urban centres. As a result the male population of the city grows, leading to a low sex ratio. West Bengal is no exception to this rule, for example, Calcutta, the primate city of the state shows one of the lowest sex ratios (712 females per 1000 males in 1981).

A study of average sex ratios for different categories of urban centres during 1961, 1971 and 1981 (Table 8.3) shows that sex ratios always decline steadily with increasing population size for Class I, Class II, Class III and Class IV urban centres. The Class IV and Class V urban centres generally show very similar sex ratios while in Class VI centres a much lower sex ratio is seen. This is especially true of the situation in 1981 where the Class VI urban centres are characterised by an average sex ratio of 803. This trend is a result of the inclusion of new

<table>
<thead>
<tr>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Class I</td>
<td>394871</td>
<td>401464</td>
<td>334888</td>
<td>638</td>
<td>690</td>
<td>774</td>
</tr>
<tr>
<td>Class II</td>
<td>67211</td>
<td>68561</td>
<td>72628</td>
<td>778</td>
<td>809</td>
<td>874</td>
</tr>
<tr>
<td>Class III</td>
<td>31753</td>
<td>30973</td>
<td>31368</td>
<td>774</td>
<td>856</td>
<td>902</td>
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<tr>
<td>Class IV</td>
<td>14137</td>
<td>13744</td>
<td>14284</td>
<td>815</td>
<td>844</td>
<td>869</td>
</tr>
<tr>
<td>Class V</td>
<td>7755</td>
<td>7473</td>
<td>7771</td>
<td>835</td>
<td>841</td>
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<td>Class VI</td>
<td>4357</td>
<td>4047</td>
<td>3473</td>
<td>773</td>
<td>867</td>
<td>803</td>
</tr>
</tbody>
</table>

*Population size classes: I 100,000 and above; II 50,000 to 99,999; III 20,000 to 49,999; IV 10,000 to 19,999; V 5,000 to 9,999; VI less than 5,000.
urban centres like Jaldhaka Hydel Power Project Town (sex ratio 637), Lalbazar, Ramnagar, Nimcha and others. Jaldhaka as its name suggests owes its existence to the hydel power project and consist of a dominantly male population. Urban centres like Lalbazar, Ramnagar and Nimcha in Barddhaman district are located in a highly industrialised zone which attracts predominantly male labour.

Calculation of Pearson's correlation coefficients between average population size and average sex ratio of the six size classes of urban centres during 1961, 1971 and 1981 (Table 8.4) show a negative relation between the variables throughout the period under consideration indicating that sex ratio diminishes with increasing population size. It may be noted that during 1981 the value of the correlation coefficient has declined considerably.

**Table 8.4.** Correlation: Average population size (x) and average sex ratio (y) in the different size classes of urban centres in West Bengal

<table>
<thead>
<tr>
<th>Year</th>
<th>Correlation Coefficient ( (r_{xy}) )</th>
<th>'t'</th>
</tr>
</thead>
<tbody>
<tr>
<td>1961</td>
<td>-0.94412</td>
<td>5.598*</td>
</tr>
<tr>
<td>1971</td>
<td>-0.98046</td>
<td>8.61**</td>
</tr>
<tr>
<td>1981</td>
<td>-0.66894</td>
<td>1.80</td>
</tr>
</tbody>
</table>

**significant at 0.001 level**

* significant at 0.01 level

**8.3.2.4. Urban sex ratio and industrial employment in the urban centres**

It has already been shown that the larger cities and towns are usually characterised by lower sex ratios. This relationship has also been related to the fact that larger urban centres provide many and varied employment opportunities and thus attract both skilled and unskilled labour from surrounding areas. Industrial development naturally attracts male population especially in the form of workers in the industrial units so that highly industrialised urban centres are
associated with low sex ratios. Therefore, variations in urban sex ratio may be said to reflect the influence of the level of industrialisation in the urban centres. Therefore, the level of industrialisation has been considered in terms of the percentage of working population engaged in industrial activities in each urban centre and related to urban sex ratio. Since the 1981 census does not provide data on the number of industrial workers at urban centre level, the correlation coefficients have been calculated using data for 1961 and 1971. The values of the correlation coefficients are -0.61205 for 1961 and -0.62828 for 1971. Computed values of 't' show that both coefficients are significant at 0.001 level. Thus both decades show a statistically significant negative relationship between the two variables, establishing the fact that the larger the industrial component of the workforce of an urban centre, the lower its sex ratio.

8.3.3. Literacy

According to the 1981 census the percentage of literate population in urban West Bengal is 62.66, a figure somewhat higher than the all India average of 57.40%. A comparison with other highly urbanised states like Maharashtra, Tamil Nadu, Gujarat, Karnataka and Punjab (all of which show higher percentage of urban population that West Bengal in 1981) reveals that only Maharashtra and Tamil Nadu have percentage of urban literacy higher than that of West Bengal.

8.3.3.1. Areal variations in urban literacy

In 1961 percentage of literacy in individual urban centres showed considerable variation from the state average of 52.89% for that year. Urban literacy in the state ranged between a maximum of 74.33% (Batanagar in Twentyfour Parganas district) to a minimum of 18.66% (Aurangabad in Murshidabad district).

A study of the map showing literacy rates in the urban centres of West Bengal in 1961 reveals the following patterns of spatial distribution:
1) The Hugli Industrial Belt shows considerable variations in levels of urban literacy. Urban centres with high literacy level (over 60% population literate) are seen to be confined primarily to this zone and more especially to the constituents of the urban agglomeration located in the Hugli and Twentyfour Parganas. It may be noted here that many of these towns are residential satellites located in the immediate neighbourhood of Calcutta, as for example Garfa, Santoshpur, Jadavpur and others. At the same time urban centres with lowest levels of literacy (less than 40% population literate) may also be seen to occur within this zone. This is especially true of the smaller industrial towns located in the Haora district and include examples like Uluberia, Chengail, Bauria and Sankrail where percentage of literate population are 39.60, 27.41, 33.84 and 27.44 respectively.

ii) Urban centres of the Asansol-Durgapur zone show comparatively low levels of literacy, the only exceptions being the two planned industrial towns of Chittaranjan and Durgapur where more than 60% of the population are literate.

iii) Low to moderate level of literacy appear to be characteristic of the urban centres of North Bengal.

iv) Nadia district, a part of which is included in the Calcutta Urban Agglomeration is characterised by moderate level of literacy in a majority of urban centres.

v) Low to very low levels of literacy characterise the urban centres over the remaining parts of the state. Very low percentages of literacy are particularly noticeable in the least urbanised comparatively backward districts of Puruliya, Bankura and Medinipur.

During the next decade literacy levels for urban West Bengal show a general improvement and percentage of literate urban population for the state as a whole increased to 55.93%. However there were still considerable variation from the state average and urban literacy ranged between a minimum of 21.91% (Aurangabad in Murshidabad) to a maximum of 83.45% (Batanagar in Twentyfour Parganas). It is interesting to note
that these two towns showed the lowest and the highest percentage respectively during the earlier decade as well.

A glance at figure 8.5. shows the following trends in the spatial distribution of urban literacy in the state during 1971:

i) Inspite of some improvements in the levels of literacy of the urban centres, there is not much departure from the general pattern of spatial distribution observed during the earlier decade. The Hugli Industrial Belt still shows considerable variations in urban literacy. However, it may be noticed that the number of urban centres with over 60% literate population has increased appreciably. Increased levels of literacy may also be seen in Haora district where more than 60% literate population is found in three urban centres (Andul, Dhuliya and Manikpur) and 50 to 60% of the population is literate in five urban centres (Haora, Bally, Chakapara, Jorhat and Sarenga).

ii) Comparatively low levels of literacy are still characteristic of the urban centres of the Asansol-Durgapur area. This zone still shows only two urban centres with over 60% literate population.

iii) Urban centres of North Bengal appear to be mostly characterised by moderate literacy levels.

iv) Similarly percentage of literate population in the urban centres of Nadia district, shows noticeable improvement so that urban literacy in the district generally varied between high to moderate levels.

v) Over the remaining parts of the state urban literacy remained low with a few exceptions like Jhargram (Medinipur) Baharampur (Murshidabad) and others.

Further improvements in urban literacy may be seen in 1981 and the percentage of literate urban population for the state as a whole increased to 62.66%. However, remarkable variations from the state average are still seen to occur since percentage of literate population in the individual urban centres ranged between a minimum of 19.41 (Paschim Funropara in Murshidabad) and a maximum of 85.17 (Kerulia
WES'T BENGAL
LITERACY IN THE URBAN CENTRES
1981

Figure 86

KEY TO INSERT A
1 Barrackpore
2 Dumdum
3 Santoshpur
4 Paschim Bazar
5 Belur
6 Bally (Nabaddange)
7 Barrackpur
8 Bankura
9 Chandernagor
10 Jhalda
11 Midnapore
12 Howrah
13 Bhatpara
14 Howrah
15 South 24 Parganas
16 North 24 Parganas
17 Kolkata
18 Bhatpara
19 Howrah
20 Midnapore
21 Santoshpur
22 Belur
23 Paschim Bazar
24 Barrackpur
25 Barrackpore
26 Santoshpur
27 Bally (Nabaddange)
28 Bankura
29 Chandernagor
30 Jhalda
31 Midnapore
32 Howrah
33 Bhatpara
34 Howrah
35 North 24 Parganas
36 South 24 Parganas
37 Kolkata
38 Bhatpara
39 Howrah
40 Midnapore
41 Howrah
42 Santoshpur
43 Belur
44 Paschim Bazar
45 Barrackpur
46 Barrackpore
47 Bankura
48 Chandernagor
49 Jhalda
50 Midnapore
51 Howrah
52 Howrah
53 North 24 Parganas
54 South 24 Parganas
55 Kolkata
56 Bhatpara
57 Howrah
58 Midnapore
59 Santoshpur
A study of spatial variations in urban literacy in the state during 1981 (Figure 8.6) reveals the following trends:

i) In the Hugli Industrial Belt almost all the urban centres located in Hugli and Twentyfour Parganas districts show high literacy levels of over 60%. Even in Haora district there has been remarkable improvements and the number of urban centres with over 60% literate populations has increased to eight. However it must be noted that there are still some urban centres with very low levels of literacy in this zone and more particularly in Haora district where industrial towns like Bauria and Fort Gloster continue to show low percentage of literate population. Besides, some of the larger urban centres located in Twentyfour Parganas, with primarily industrial functions continue to show low levels of literacy, as for example, Bhatpara and Titagarh.

ii) Improved literacy is particularly noticeable in districts like Puruliya and Medinipur. In the latter district except for a group of urban centres located in the northern part of the district, all urban centres show high to moderate levels of literacy.

iii) High to moderate percentages of literate population are also characteristic of the towns of North Bengal.

iv) With a few exceptions low to very low levels of literacy still persist in the Durgapur-Asansol area and also in the subsidiary zone of urban concentration developing at Farakka on the borders of Malda and Murshidabad districts.

8.3.3.2. Temporal variations in urban literacy, 1961-81

An analysis of urban literacy in West Bengal during 1961-81 shows that percentage of literate urban population in the state has improved considerably. A glance at table 8.5 which gives the percentage of the total number of urban centres characterised by different literacy levels during the three decades under consideration, shows that in 1961 less than 10% of the urban centres had literacy percentage higher than 60%.
In 1971 has figure rose to above 23% and in 1981 more than 38% of the urban centres show similar percentage of literacy. Further evidence for the improving literacy levels in the state is provided by the declining percentage of urban centres with very low levels of literacy. In 1961 more than 30% of the urban centres showed less than 40% literate population but in 1981 this figure has come down to less than 12%.

Table 8.5. Percentage frequency of urban centres in different categories of literacy

<table>
<thead>
<tr>
<th>Year</th>
<th>Literacy levels</th>
<th>50-60%</th>
<th>40-50%</th>
<th>less than 40%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Over 60%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1961</td>
<td>9.8</td>
<td>34.2</td>
<td>25.5</td>
<td>30.4</td>
</tr>
<tr>
<td>1971</td>
<td>23.3</td>
<td>31.4</td>
<td>25.6</td>
<td>19.7</td>
</tr>
<tr>
<td>1981</td>
<td>38.14</td>
<td>31.37</td>
<td>18.9</td>
<td>11.78</td>
</tr>
</tbody>
</table>

8.3.3.3. Urban literacy and level of urbanisation

A study of areal distribution of urban literacy seems to indicate that there is a relationship between the level of urbanisation and the percentage of literate urban population in the district. High literacy levels appear to be characteristic of districts with a large urban component, while districts with low proportions of urban population like Puruliya, Bankura and Medinipur appear to be characterised by comparatively lower percentage of literate population. Product-moment correlation coefficients for percentage of urban population and percentage of literate urban population in the district are +0.62366, +0.41915 and +0.52953 for 1961, 1971 and 1981 respectively. Computed values of 't' show that the coefficients for 1961 and 1981 are significant at 0.05 level. Thus correlation analysis reveals that a statistically significant, positive relationship existed between the variables during 1961 and 1981. Lack of a significant relationship between percentage or urban population and percentage of literacy in 1971 may be explained by the fact that the northern districts like
Figure 8.8 Population density gradient for Asansol, 1981
Koch Bihar and Jalpaiguri were characterised by comparatively high levels of literacy inspite of their low percentage of urban population. Another anomaly is introduced by Barddhaman district where percentage of literate urban population remained low even though percentage of urban population increased considerably in 1971.

8.8.4. Population density gradients

Results of analysis show that density-distance relationships have statistical significance and generally conform to Clark's model based on negative exponential decline of density with increase of distance from the city centre in three out of the four urban centres under consideration namely Calcutta, Kharagpur and Asansol. However, the nature of the relationship shows two distinct patterns.

The first type of density distribution may be seen in Asansol where the highest density of population is found in the central wards which contain or are situated near the most important commercial node of the city. Population density declines rapidly away from this central area. Thus, highest densities of over 60,000 persons per sq.km. may be observed in ward number 11, 12, 13 and 14 which occupy the central position and contain the most important bazar area of the city. Within half a km away from these wards population densities fall off rapidly to less than 20,000 persons per sq.km. In the peripheral wards, less than 2 km away from the centres, densities become as low as 6,000 to 7,000 persons per sq.km. or even lower. Thus the ratio between central density and peripheral density is approximately more than 10:1.

The computed equation for density-distance relationship for this city is

\[
\ln P_d = 10.58 - 0.83 d
\]

and the value of the correlation coefficient is -0.78732. Calculated value of 't' shows that it is significant at 0.001 level. Thus, computed value of \( b \) or the density gradient as well as the high level of statistical significance of the correlation coefficient between natural logarithm of population of density and distance in km shows that
KHARAGPUR
DENSITY OF POPULATION
1981

Density in persons per sq Km
above 8000
6000 to 8000
4000 to 6000
2000 to 4000
below 2000

boundary of municipal area
boundary of railway area
ward boundary
23
ward number

Figure 8.9

Km
0 1 2 3

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29
Figure 8.10 Population density gradient for Kharagpur, 1981

\[ \ln P_d = 9.03 - 0.29d \]
density-distance relationship corresponds very closely to the rule of negative exponential decline.

The second pattern of density distribution may be observed in the cities of Kharagpur and Calcutta where the city centre shows comparatively low population density. Maximum density is found at a distance of about 1.5 kins from the centre and beyond that density declines gradually with increasing distance.

Low central densities in Kharagpur may be related to the fact that a large proportion of the central part of the city is owned by the South Eastern Railways and consists of the railway station, railway yards as well as planned residential areas for the railway personnel. As a result this large tract of land shows a comparatively low population density. Thus in Kharagpur city central areas show comparatively low levels of density. It may be seen that maximum density of over 17,000 persons per sq.km. is reached at a distance of about 1.5 km. from the centre after which density declines rapidly and within a distance of about 7 km. becomes as low as about 750 persons per sq.km.

The regression equation for density-distance relationship for Kharagpur is

\[
\ln P_d = 9.03 - 0.29d
\]

showing that the b value of density gradient is much less than that obtained for Asansol. However, the correlation coefficient between distance and natural logarithm of density worked out to -0.65286 and the computed value of 't' which is significant at 0.001 level shows that a statistically significant, negative relationship exists between the variables.

In Calcutta, the central business district is occupied mostly by administrative offices, banks and other allied establishments. As a result density of population is relatively low at the city centre. In 1981 population density in the central areas is seen to be less than 10,000 persons per sq.km. but density increases rapidly with distance so that maximum densities of over 100,000 persons per sq.km. may be seen to occur within a distance of 1 to 1.5 km. from the city centre.
Figure 8.12 Population density gradient for Calcutta, 1951
Figure 814 Population density gradient for Calcutta, 1961
CALCUTTA
DENSITY OF POPULATION
1971

INDEX
Density in persons per sq. Km
- above 100,000
- 60,000 to 100,000
- 20,000 to 60,000
- below 20,000

--- boundary of municipal corporation
--- ward boundary
2% ward number

Figure 8.15
Figure 8.16 Population density gradient for Calcutta, 1971.
Figure 8.18 Population density gradient for Calcutta, 1981

\[ \ln P_d = 11.52 - 0.2d \]
Beyond this distance however densities begin declining with increasing distance so that at a distance of 8-9 km. densities become less than 15,000 persons per sq. km.

The computed equation for Calcutta for 1981

\[ \ln P_d = 11.52 - 0.20d \]

The value of the correlation coefficient is found to be -0.58717 and calculated value of 't' shows that the coefficient is significant at 0.001 level.

Values of the density gradient for Calcutta has also been computed for the years 1951, 1961 and 1971 in order to analyse temporal changes in the distribution of population within the city. Earlier studies have shown an inverse relationship between urban growth and population density (Newling, 1966; Clark, 1964-65). It has been shown that with increasing population size density tends to fall in the central areas of an urban centre and as a result there is a decline in the density gradient.

In Calcutta a similar trend may be noticed especially during the last decade, that is, 1971-81. Population densities show a tendency to decline in the wards located within a distance of about 1.5 km. from the centre. In addition maximum density for the city also declined from over 270,000 persons per sq.km. in 1971 to about 175,000 persons per sq.km. in 1981.

The computed equations for density-distance relationship during the earlier decades are \( \ln P_d = 11.40 - 0.26d \) for 1951, \( \ln P_d = 11.43 - 0.21d \) for 1961 and \( \ln P_d = 11.68 - 0.23d \) for 1971. Thus, values of the density gradient show an overall decline during the period under review inspite of the slight increase of the gradient during 1961-71.

Chandannagar, the fourth city considered in this analysis, is an exception in that it does not conform to the rule of negative exponential decline. The computed equation for this urban centre worked out to be

\[ \ln P_d = 9.37 - 0.002d \]
Figure 8.20 Population density gradient for Chandannagar, 1981
showing that the value of the gradient approaches zero. The value of the correlation coefficient between distance and natural logarithm of density is -0.00375 showing that there is no significant relationship between the variables.

Lack of conformity to the rule in this particular case is primarily related to the fact that the highest population densities in this city are found not at the centre or close to it but in three wards located at the south eastern extremity. This part of the city contains a jute mill and the most congested residential areas are located adjacent to it. Population densities in this part are as high as over 40,000 persons per sq.km. compared to a density of about 24,000 persons per sq.km. at the centre. As a result it is seen that density declines with increasing distance from the centre to a distance of about 2 km, beyond which it rises sharply with increasing distance to levels much greater than central density. Consequently, it is not possible to fit the distribution of population in this city to the Clark model.

8.4. CONCLUSION

On the basis of the above analysis of the selected attributes of urban demography in West Bengal the following conclusions may be drawn:

i) Urban age structure in West Bengal appears to be inversely related to the level of urbanisation. As a result highly urbanised districts like Calcutta, Twentyfour Parganas, Haora and Hugli show comparatively older age structures. As for example, Calcutta with its cent per cent urban population is characterised by the lowest values of the age structure index during the period under review. An exception to this rule is provided by Barddhaman district which shows a comparatively younger population in relation to the other highly urbanised districts of the state. However, in 1981 the index for the district shows considerable decline. Among the remaining districts age structure index appears to be quite high, especially in the less urbanised districts like Medinipur, Puruliya and Birbhum.
li) In most of the districts the age structure index recorded a sharp fall in 1961-81 but variation in urban population growth alone cannot explain this decline. A further investigation especially of the two components of urban population growth namely natural increase and migration as well as various socio-economic factors is necessary for explaining this phenomenon.

lii) Comparison with the all-India figure shows that West Bengal has always been characterised by a very low urban sex ratio. However steady improvement of urban sex ratio for the state as a whole since 1941 seems to indicate a more balanced distribution of urban population between the sexes in future.

iv) Variations in urban sex ratio in West Bengal appear to be related inversely to variations in population size and the percentage of industrial employment in urban centres.

v) A study of spatial variations of urban sex ratio shows that low and very low sex ratios are mostly confined to the Hugli Industrial Belt and the Durgapur-Asansol region. Over the remaining parts of the state high to moderate sex ratios are seen.

vi) A study of temporal variations in urban literacy during 1961-81 reveals that literacy rate in the urban areas of the state is improving rapidly.

vii) During all three decades high percentages of literacy were usually confined to the most urbanised zone of the state, that is, the Hugli Industrial Belt. In contrast, the towns (with some exceptions) of the Durgapur-Asansol region generally show low to moderate percentage of literacy. High to moderate percentage of literacy are also noticeable in the urban centres of North Bengal.

viii) Urban literacy in the state appears to show a positive relationship with the degree of urbanisation in the district. But a declining trend in the values of the correlation coefficient during the decades under review seems to indicate a need for further investigation into variations in urban literacy in relation to various socio-economic variables.
ix) Analysis of population density gradients shows that with one exception, distribution of population in the cities considered here, conform to Clark's generalisation that density shows a negative exponential decline with increasing distance.

x) A comparison of the density gradient obtained for Asansol, Kharagpur and Calcutta shows that the gradient declines with increasing area covered by the urban centre. Asansol which occupies the smallest area shows the highest b value while Calcutta with the largest area is characterised by the lowest b value. Thus, in accordance with Clark's views the gradient provides a measure of the spread of the cities.

xi) Study of temporal variations of the density gradient for Calcutta reveals an overall decline of the b values during 1951-81 indicating that the nature of population distribution in the city is becoming more dispersed with time.

REFERENCES


