RESEARCH ARTICLE

SPATIO-TEMPORAL GROWTH OF POPULATION OF BANKURA DISTRICT OF WEST BENGAL AFTER INDEPENDENCE IN INDIA

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ARTICLE INFO	ABSTRACT
	Population growth of an area over a period of time is likely to create dynamic spatial mosaic. Such spatio-temporal demographic dynamics may be perceived through size and density growth of population in the concern area through different statistical measures. All the different measures prompt concentration, de-concentration and spilling of population in different segments of the area over time. This enquiry attempts to capture the reality of block wise size and density growth of Bankura district from 1951 to 2011. Apparently silent up to 1981, the district is showing spilling of population in different parts, except the Western most blocks marked by hilly terrain, forest cover and thinner soil surface.

INTRODUCTION

In the demographic perspective of West Bengal, Bankura and Puruliya are the two misfit districts as those response in a low tune in contrast to the rapid pace of demographic change of the state (census of India-2011). West Bengal for the first time earned the dubious distinction of becoming the most densely populated state with a density of 767 persons per square kilometer in 1991 (Guchhait, 2005). In 2002 census, it held its position with a density of 903 persons per square kilometer, but in 2011 census, it has been dethroned by Bihar (1102 persons per square kilometer) with a density of 1029 persons per square kilometer (Census of India, 2011), Under such a backdrop population density of Bankura district is far below in reference to these three census years, representing almost half of the density of the state. Such a distinction is due to its location in the plateau fringe location characterized by relatively low rainfall, stupendous rocky surface and infertile soil that hinders immigration with a slow speed emigration. Within this silence response of demography, the district represents a diversified spatial mosaic of demography pointing clear cut divide between Western part, central and South-astern part. The foregoing discussion therefore attempts to capture the

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reality of spatio-temporal growth perspective in terms of size, density and consistency of growth within the time frame of 1951-2001. Present paper attempts to focus on the temporal, spatial as well as spatio-temporal block wise population growth of size and density of population. Thereby the following objectives are taken into consideration: Index of size growth of population of the district over the time period under consideration, Index of density growth of population of the district, Block-wise threshold and rate of size growth of population from 1951-2011, Block wise threshold and rate of density growth of population from 1951-2011, Consistency and inconsistency of size growth and Consistency and inconsistency of density growth,

METHODS AND DATABASE

Location of the Study Area

The district Bankura belongs to a large size district in West Bengal has an area of about 6882sqkms. Geographically the district is situated between $22^{0}38'$ and $23^{0}38'$ north latitudes and $86^{0}36'$ and $87^{0}46'$ east longitudes. It is bounded by Barddhaman in the north, Barddhaman and Hugli district in the east, Medinipur and Puruliya district in the West and Paschim Medinipur in the south. Physiographically the district is situated in the extended fringe of Chotonagpur Plateau. The district is described as the 'connecting link between the plain of

Bengal and Chotonagpur plateau in the west'. The entire area is located in plateau tract marked by residual hills in the western part, with the exception of low lying plain in Kotulpur and Indus blocks.

MATERIALS AND METHODS

This study is based on a quantitative analysis to represent spatio-temporal demography in respect of size, density and index of growth. Index of growth has been calculated in terms of base year while size and density of block wise population over the time period is assessed through regression and correlation analysis (Coffy 1981). In such an analysis of size and density, both the threshold and rate of growth are analyzed to perceive the growth initials and growth momentum (Guchhait, 2005). Index of growth is represented by curve while threshold and rate of growth are mapped by cartographic techniques (Yetes, 1965). On a different perspective, consistency and inconsistency of growth have been measured by C.V.

Database

This study vehemently depends on secondary data base to portray the demographic dynamics of the district on the basis of blocks. Therefore, secondary data over the census years from 1951 to 2001 has been collected from the census hand book, Human Development Report of the district. For some reference data research work of other researchers has been used. Some supportive data have been collected from district gazetteers.

RESULTS AND DISCUSSION

Population growth and index of decadal size growth

In perceiving population growth, size, density growth of population of the district as a whole and the blocks thereafter is analyzed to perceived dimensions of temporal growth as well as spatial pattern of growth. Size growth indicates the growth of absolute population over space in reference to time as well as an administrative unit, while density growth includes population per square kilometer over time and space. Size growth of the population of the district starting from 1951 to 2011is depicted in terms of index of growth at first and percentage of decadal growth at the 2nd phase (Fig.1). Considering 1951 as a base year, the decadal population of the district is represented in respect of 1951 population. Here 1961,1971 and 2001 as showing almost same pace of index of growth with a variation of 2-5% only .On the other hand, 1981 and 2011have registered higher differences from the preceding years (34.06% and 47.15% respectively). Interestingly, 1991 is showing the lowest index growth in comparison to previous decade with the amount of only 15.4%. The huge growth of population of 2011 in comparison to 2001 is a indication of relatively higher increase of population in future.

Index of density growth of the district

Density growth of the population is certainly a more reflective measure than the size growth as it considers growth per unit area. In terms of size growth blocks with larger area coverage normally respond in a different tune than that of the blocks with lower area coverage.

Table 1. Index of decadal size growth of the District

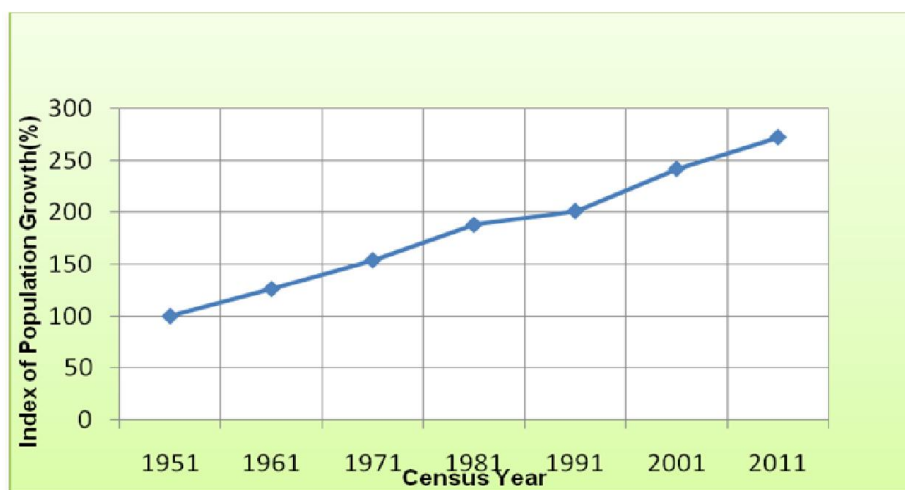| Year	Population	Index of decadal growth	Difference from preceding decade	% of decadal growth
1951	1319259	100%	-	-
1961	1664513	126.17%	26.17	26.17
1971	2031039	153.95%	27.78	22.02
1981	2374815	188.01%	34.06	16.93
1991	2683468	203.41%	15.4	12.99
2001	2974613	225.48%	22.07	10.83
2011	3596674	272.63%	47.15	20.91

Figure 1. Index of population growth in Bankura District

Table 2. Decadal Density Growth and Index Growth of the District

Year	Density	Index of Growth	Difference From Preceding Decade	% of Decadal Growth
1951	192	100%		
1961	243	126.56%	26.56	26.56
1971	295	153.65%	27.09	21.4
1981	345	179.69%	26.04	14.49
1991	390	203.13%	23.44	13.04
2001	432	225%	21.87	10.77
2011	532	272.40%	47.4	21.06
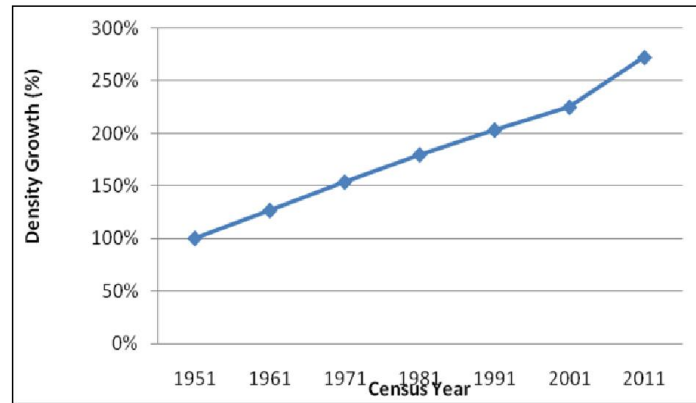
Figure 2. Density Growth (%) of Population in Bankura District

Table 3. Decadal Size Growth Rate (in %)

Blocks	1961-1951	1971-61	1981-71	1991-81	2001-91	2011-01	A	B
Bankura	24.6	24.59	17.17	18.77	13.57	10.89	28.27	-2.86
Onda	29.57	19.69	22.26	18.8	15.44	14.69	29.14	-2.59
Chhatna	14.92	17.08	12.42	15.75	8.37	15.26	16.08	-0.6
Gangajalhati	26.19	19.82	16.57	15.05	12.82	11.71	26.52	-2.71
Barjora	31.48	24.33	18.88	17.21	12.54	12.87	32.56	-3.72
Mejia	22.78	20.73	21.63	12.81	9.86	13.22	25.76	-2.55
Saltora	19.28	18.85	12.68	17.1	9.58	11.87	20.94	-1.73
Khatra	20.84	14.79	13.36	14.77	15.46	14.73	18.37	-0.78
Indpur	19.38	21.36	12.9	21.27	10.17	13.57	21.87	-1.55
Ranibandh	15.13	15.75	7.55	13.07	11.28	14.15	14.1	-0.37
Raipur	14.66	29.21	13.23	16.96	14.15	12.89	21.88	-1.44
Simlapal	22.49	23.11	22.86	20.68	14.5	12.24	27.24	-2.26
Taldangra	21.27	24.68	21.41	19.81	15.39	14.87	25.72	-1.76
Bishnupur	37.3	13.81	22.94	21.01	17.09	11.9	32.58	-3.4
Joypur	35.56	22.03	18.27	19.18	15.9	10.9	34.38	-4.02
Kotulpur	43.38	28.81	20.14	19.79	15.93	12.67	42.71	-5.5
Sonamukhi	34.77	28.16	16.31	20.42	14.41	10.67	36.55	-4.5
Patrasayer	36.85	19.29	16.36	21.46	16.69	12.2	33.07	-3.6
Indus	43.3	30.96	17.25	9.54	23.92	11.08	41.67	-5.43

Table 4. Threshold and Rate of Decadal Size Growth (Source: Census Data 1951-2011 and computed)

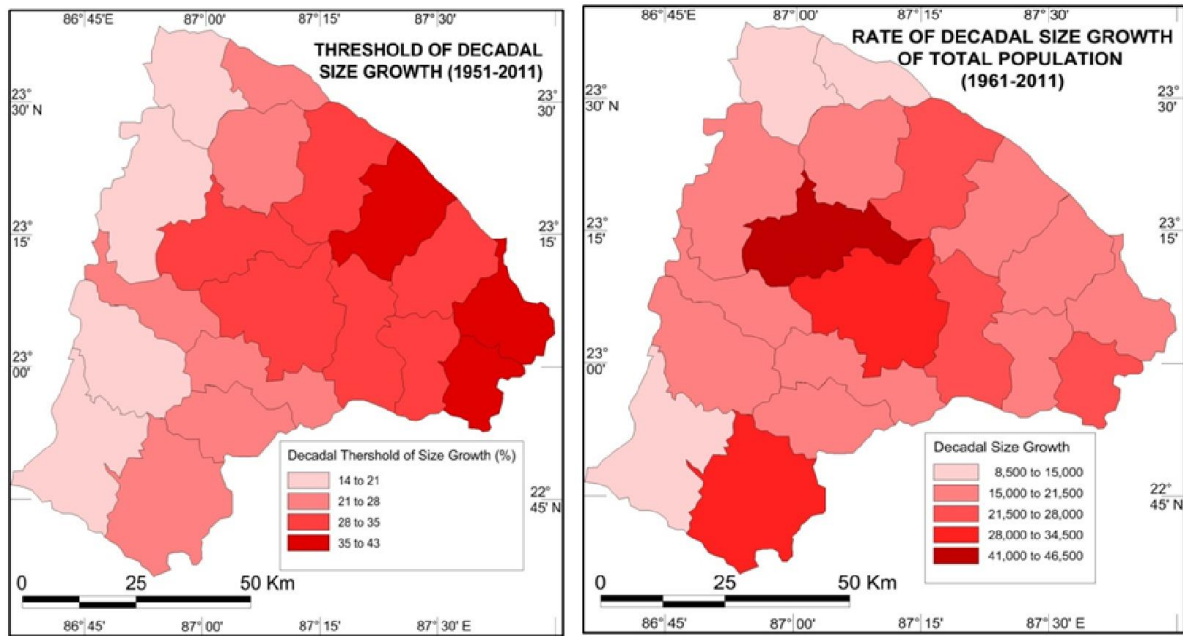| BLOCKS	1951	1961	1971	1981	1991	2001	2011	a	b	r
Bankura	141850	176746	220213	258014	306454	348036	385935	96596	41467	0.999
Onda	84829	109913	131552	160838	191078	220572	252984	52351	28047	0.998
Chhatna	89182	102488	119994	134900	156147	169215	195038	68541	17399	0.996
Gangajalhati	70817	89366	107075	124814	143595	162007	180974	52339	18295	0.999
Barjora	69831	91817	114154	135703	159060	179007	202049	47954	21998	0.999
Mejia	34068	41827	50499	61424	69294	76123	86188	25097	8705	0.998
Saltora	59304	70736	84073	94734	110929	121552	135980	45542	12804	0.999
Khatra	84020	101529	116550	132121	151630	175071	200864	61298	19025	0.994
Indpur	63069	75292	91374	103162	125106	137825	156522	44742	15684	0.997
Ranibandh	57850	66604	77094	82911	93748	104326	119089	46544	9851	0.998
Raipur	110028	126157	163009	184574	215870	246421	278185	75198	28495	0.997
Simlapal	49782	60978	75068	92232	111308	127445	143038	30130	16034	0.997
Taldangra	50733	61525	76709	93129	111573	128747	147893	31406	15904	0.997
Bishnupur	73741	101243	115224	141652	171414	200715	224605	45838	25276	0.996
Joypur	52359	70980	86614	102435	122082	141497	156920	34672	17507	0.999
Kotulpur	54374	77960	100424	120652	144528	167547	188775	32540	22374	0.999
Sonamukhi	61307	82624	105890	123156	148308	169682	187782	40399	21284	0.999
Patrasayer	60940	83396	99486	115758	140600	164060	184070	39497	20423	0.997
Indus	51175	73332	96037	112606	123344	152847	169783	33852	19363	0.995

Figure 3. a)Threshold of Decadal Size Growth (1951-2011) and b) Rate of Decadal Growth of Total Population (1961-2011)

Table 5. Spatial Distribution of Size C.V ff Blocks

Blocks	1951	1961	1971	1981	1991	2001	2011	C.V.
Bankura	141850	176746	220213	258014	306454	348036	385935	
Onda	84829	109913	131552	160838	191078	220572	252984	34.15
Chhatna	89182	102488	119994	134900	156147	169215	195038	25.28
Gangajalhati	70817	89366	107075	124814	143595	162007	180974	29.15
Barjora	69831	91817	114154	135703	159060	179007	202049	32.37
Mejia	34068	41827	50499	61424	69294	76123	86188	29.09
Saltora	59304	70736	84073	94734	110929	121552	135980	26.49
Khatra	84020	101529	116550	132121	151630	175071	200864	27.84
Indpur	63069	75292	91374	103162	125106	137825	156522	29.26
Ranibandh	57850	66604	77094	82911	93748	104326	119089	23.05
Raipur	110028	126157	163009	184574	215870	246421	278185	30.2
Simlapal	49782	60978	75068	92232	111308	127445	143038	34.09
Taldangra	50733	61525	76709	93129	111573	128747	147893	34.47
Bishnupur	73741	101243	115224	141652	171414	200715	224605	34.51
Joypur	52359	70980	86614	102435	122082	141497	156920	33.46
Kotulpur	54374	77960	100424	120652	144528	167547	188775	36.67
Sonamukhi	61307	82624	105890	123156	148308	169682	187782	33.93
Patrasayer	60940	83396	99486	115758	140600	164060	184070	33.78
Indus	51175	73332	96037	112606	123344	152847	169783	34.93
Total District	1319259	1664513	2031039	2374815	2683468	2974613	3596674	

Table 5. Thresholds and Rate of Density Growth

| Blocks	1951	1961	1971	1981	1991	2001	2011	A	B	r
Bankura	347	433	539	632	750	852	939	238.14	100.9	0.999
Onda	169	219	262	320	380	439	504	104.28	55.82	0.998
Chhatna	199	229	268	301	354	378	436	152.85	39.11	0.996
Gangajalhati	191	241	288	336	387	442	494	138.42	50.35	0.999
Barjora	176	233	290	345	404	455	514	120.71	56.14	0.999
Mejia	209	257	310	377	425	467	529	154.14	53.39	0.998
Saltora	188	225	267	301	350	389	434	143.57	41.03	0.999
Khatra	195	235	270	306	316	414	475	138.14	44.42	0.973
Indpur	210	251	305	344	417	455	517	151.14	51.46	0.997
Ranibandh	135	155	180	194	219	243	278	108.57	23	0.994
Raipur	187	214	277	314	364	415	468	129.57	47.57	0.997
Simlapal	161	197	243	298	360	412	461	97.85	51.67	0.997
Taldangra	145	176	219	266	319	368	423	85.42	47.07	0.997
Bishnupur	194	267	304	373	414	529	579	124.42	63.89	0.992
Joypur	200	272	331	392	465	536	594	135.14	65.85	0.999
Kotulpur	217	311	401	482	577	669	755	129.42	89.5	0.999
Sonamukhi	161	217	279	324	390	447	480	110	54.57	0.997
Patrasayer	189	259	309	360	437	509	570	123.14	63.25	0.998
Indus	227	287	376	441	487	599	666	147.28	13.28	0.996
Total District	192	243	295	345	390	432	523	136.28	52.35	0.994
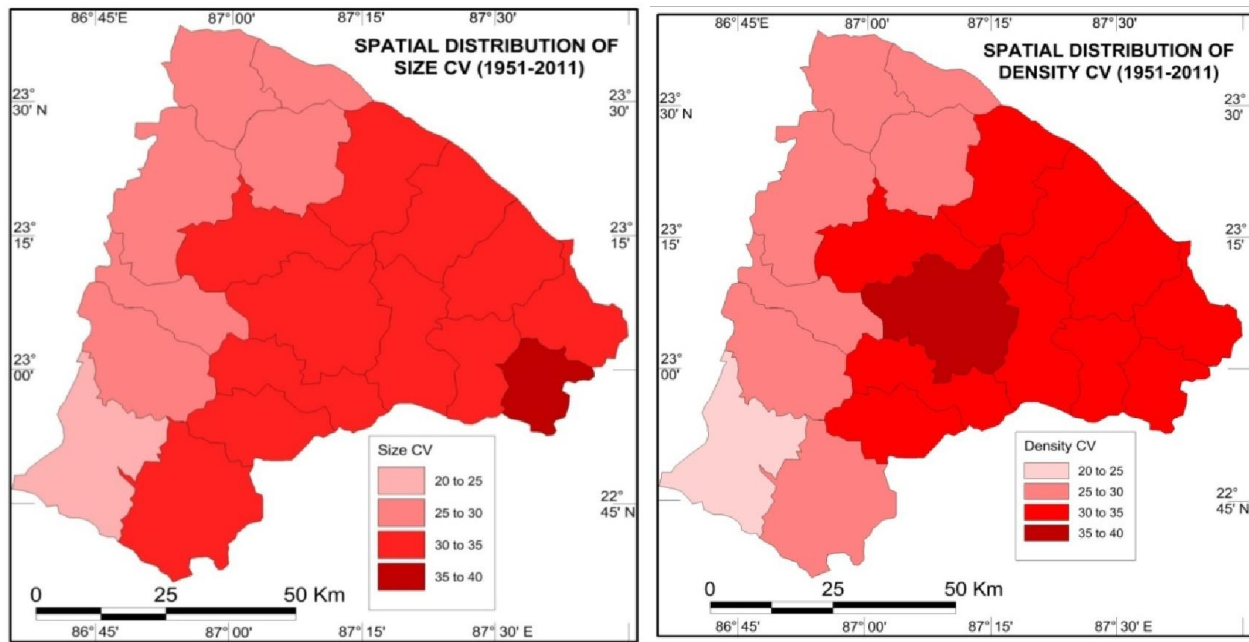
Figure 4. Variability of Population size (a) and Density (b) in 1951-2011
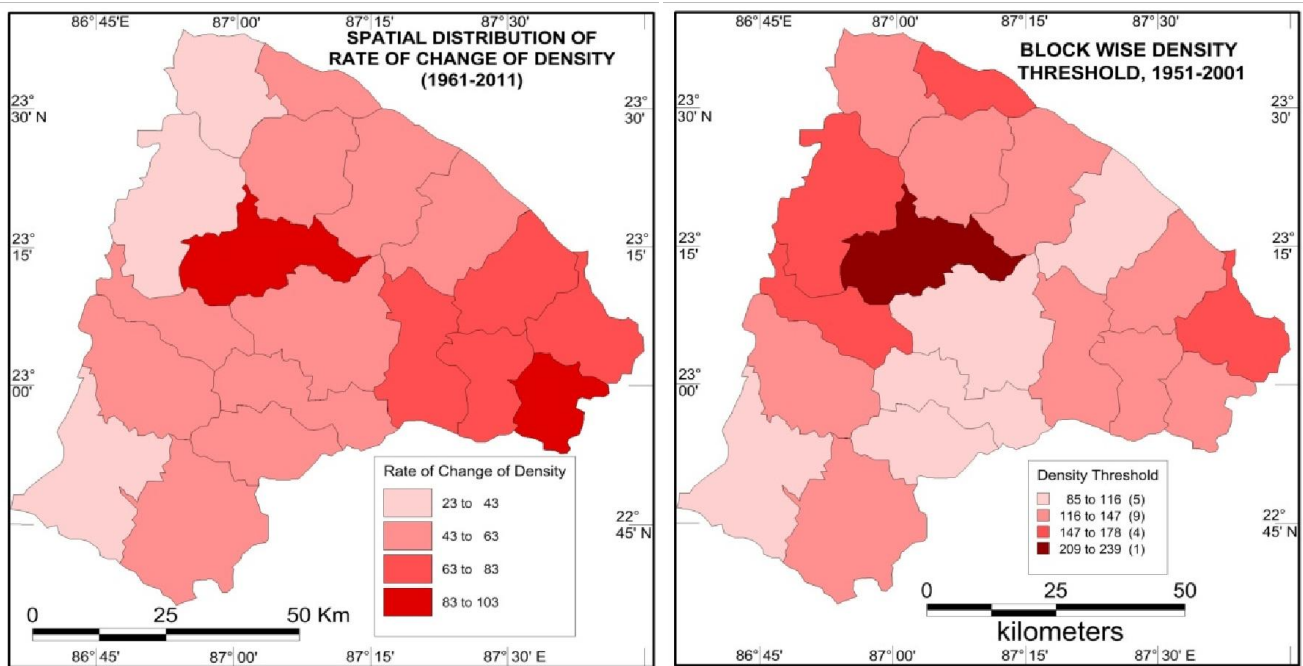

Figure 5 a) Spatial Variation of Rate of Change of Density, b) Threshold of Population Density

So it's become really difficult to make a comparison among the blocks of different sizes. Considering this perspective, density growth dynamics of the district is examined to focus on the nature of population growth on a uniform platform (unit area). Decadal density growth of Bankura District over the same period of time span of investigation is represented through the index of density growth to perceive the differential growth of density over the decades (Fig. 2). In terms of density, Kings and Jerks are observed with higher index of density growth in 2011 while low index of growth in 1991 and 2001. Apart from these three decades, other four decades have registered almost homogeneous index of growth very close to 26%. Index of growth of density was homogeneous up to 1981 and has declined thereafter in both 1991 and 2001 and thereafter a sharp rise in 2011. So both in the index of size growth and density growth the last census enumeration are showing an

alarming growth of population within the district that critically assumes higher growth of population in future.

Decadal size growth of the blocks

Decadal growth of population is reflecting a different scenario with continuous decrease of decadal growth (Table). In the 1961 and 1971, decadal growth rate was above 20% (26.17% in 1961 and 22.02% in 1971). The population of the District in 1981, 1991, 2001 has experienced a continuous low level of growth rate. Such a continuous decrease rate of population size growth is an indication towards the stabilization of population. Size growth of the blocks is examined within a span of 20 years (1961-1981-2001) to perceive the pace of size growth (Table 3). At the initial point (1961) blocks are showing differential rate of decadal size growth. It can easily be segregated into 5

tires with blocks more than 35%, within 30-35%, within 25-30%, within 20-25% and below 20%. Indus, Kotulpur, Bishnupur, Patrasayer and Joypur are showing very high rate of decadal size growth with more than 35% (Fig 3a). In the next category (30-35%), Sonamukhi, Barjora, Onda are included whereas Gangajalghati, Bankura, Mejia, Simlapal, Taldangra and Khatra have registered decadal size growth in the range of 20-25%, decadal size growth less than 20% is observed for Indpur, Saltora, Ranibandh, Raipur and Chhatna. Such a diversified growth rates have got homogeneity in 1981 with highest value of 22.94% and the lowest value of 12.42% neglecting very low value of Ranibandh. In this census remuneration all the blocks are showing decreased amount of decadal growth rate expect Simlapal and Taldangra. A further decrease of decadal growth rate is found in 2011 census with the exception of Indus, Ranibandh and Raipur where decadal growth is higher than 1981. In 2001 all the blocks other than Indus have registered decadal growth rate less than 20%. The previous census has enumerated all almost homogeneous size growth rates for all the blocks which is below 15% and above 10% for most of the blocks. Thus there is a clear indication of decreasing rate of size growth as well as uniformity of growth rate of size certainly indicates stabilization of population size (Fig. 3b).

Threshold and rate of decadal size growth

Earlier discussion basically prompts on decadal growth rate in terms of index measure and percentage analysis. Such analysis is relative one. Therefore to find out the reflection of the blocks in terms of specific growth aspect and consistency of growth time series analysis has been opted which is helpful for critical appreciation of the rate of size growth as well as threshold for almost all the blocks (Sadhukhan and Sadhukhan, 1989). Size growth of population is so uniform that all the blocks have been registered correlation 0.99. So linear time series regression have been assigned for each block for the time series analysis with the equation of Y= a+bx where Y is the population and x is the time period. Here is the threshold population (a) of the beginning year and (b) is the rate of population per decade. Now from the table 4 it is clear that blocks are responding different in terms of rate of decadal size growth (b). Blocks like Bankura, Onda, Barjora, Bishnupur, Raipur and Kotulpur are showing higher rate of size growth. All the blocks showing higher rate of growth can be explained by their urban status and agricultural prosperity. Bankura and Bishnupur blocks are associated with municipal town while Barjora is a census town. On the other hand, Raipur and Kotulpur are the prosperous agricultural blocks of the Bankura District. Moderately developed agricultural area like Indus, Patrasayer, Sonamukhi are showing moderate rate of size growth very close to 20,000. On the contrary, blocks of the plateau area like Indpur, Ranibandh, Taldangra, Simlapal, Joypur have registered low rate of growth of population size. In terms of threshold, Bankura, Chhatna, Onda, Raipur, Khatra and Gangajalhati are showing higher threshold value more than 50,000 and for Bankura it is almost double. Those blocks are relatively larger in area coverage and thus are showing higher size of population from the very beginning of the census enumeration under study (from 1951). Due to higher size of population, the thresholds are also higher. In contrast to this, Mejia, Simlapal, Taldangra, Joypur, Kotulpur and Indus are showing relatively low threshold, below 35,000. This is due to low population size from the very beginning of the census enumeration considered here (1951). Those blocks have

relatively lower area coverage less than 300 sq.kms only with the exception of Simlapal and Taldangra which have the area coverage more than 300 sq.kms. Moderate rate of threshold within the range of 35,000-50,000 are formed for Bishnupur, Sonamukhi, Patrasayer, Indpur, Saltora and Barjora. Among them, Barjora is very close to 50,000 due to its recent time industrial growth. Combining the threshold and the rate of size growth blocks some blocks are showing appreciable high performance. Those are Bankura, Onda, Raipur and Bishnupur. Those four blocks have registered higher size (more than 45,000) as well as higher rate of size growth (more than 25,000). In future those blocks will certainly add population.

Consistency and Inconsistency of Size Growth

Consistency and inconsistency developed in Bankura District is reflected through C.V of the size of population within the period of 1951-2011 (Table 5). In terms of the C.V all the blocks have registered relatively low C.V value pointing neither a stupendous growth nor drastic depopulation within the timeframe considered here. In such a plateau fringe block has experienced less migration or depopulation over the last 60 years. But considering 30% as a demarcating line, southern blocks i.e. plateau fringe and plain area are showing relatively higher C.V (more than 30%). Among the northern blocks, Bankura, Onda and Barjora have registered higher C.V of size population because of historical growth perspective or urban dynamics (Fig 4 a & b). Apart from these blocks other northern blocks are showing relatively low C.V (less than 30%), these are Chhatna, Gangajalhati, Mejia, Saltora, khatra, Indpur and Ranibandh. Ranibandh have achieved lowest C.V (23%) indicating more consistency of population growth. This block is situated in the proper plateau area with huge tribal population which has responded consistent growth of population over the last 60 years.

Threshold and rate of density growth

Index of density growth is a crude measure. Such analysis is relative one. To find out the reflection of the blocks in terms of specific growth aspect, time series analysis has been opted which is helpful for critical appreciation of the density growth rate as well as threshold. For almost all the blocks, density growth of population is uniform because almost all the blocks have registered correlation 0.99 with the exception of Khatra block. Therefore linear time series analysis has been assigned for each block for the time series analysis with the equation Y=a+bx (Yeats, 1968) where Y is the population density and X is the time period. Here 'a' is the threshold population density of the beginning year (1951) and 'b' is the rate of growth of population density per decade. Now from the table 1.5 it is clear that blocks are responding differently in terms of rate of decadal population density growth (b). Bankura Sadar block has highest density growth which is invariably due to urban status, employment opportunities and socio-cultural preferences. Blocks like Onda, Barjora, Mejia, Indpur, Simlapal, Bishnupur, Joypur, Kotulpur, Patrasayer and Indus are showing higher density growth (Fig 5a). All these blocks showing higher rate of growth can be explained by either their urban status or agricultural prosperity. On the contrary, blocks of the plateau area like Chhatna, Gangajalhati, Saltora, Khatra, Ranibandh, Raipur and Taldangra have registered low density growth rate. Developed blocks like Bankura, Onda, Barjora and Indpur are showing higher rate of density growth, while other northern blocks like Raipur, Khatra, Saltora, Chhatna are showing low rate of density growth (below 50). Surprisingly

Mejia which is silence in rate of size growth is expressing higher rate of density growth. On the other hand, southern blocks like Raipur, Taldangra, Bishnupur, Joypur, Kotulpur, Sonamukhi, Patrasayer and Indus are showing higher rate of density growth (Fig. 5b). A slightly low pace of density growth is observed foe Simlapal (47) within the southern blocks. In terms of threshold of decadal density, Bankura block is fur above than the others (238). Among the northern blocks, Chhatna, Mejia and Indpur are showing relatively high threshold value (above 150). All these four blocks of the northern Bankura are practically showing high threshold as well as high rate of decadal density growth indicating continuous increase of population over the last 60 years that will perhaps be continued in future also. Southern blocks on the other hand, are showing low threshold but high rate of density growth. All these southern blocks apart from Taldangra have registered decadal density growth rate more than 50. So in future all these southern blocks will accumulate more population by din top these higher decadal density growth rate.

Consistency and inconsistency of density growth

Consistency and inconsistency of density growth in Bankura District is reflected through C.V of the density of population within the period of 1951-2011(Guchhait, 2005). In terms of value all the blocks have registered relatively low C.V pointing moderate variation of population over space within the time frame considered here. Considering 30% as a demarcating line (density C.V of the District is 30.45%), southern blocks i.e plateau fringe area and plain area are showing relatively higher C.V (more than 30%). Among the central blocks, Bankura, Onda and barjora have registered higher C.V of density of population because of high population size and urban dynamics. Apart from these three blocks, other northern blocks are showing relatively low C.V (less than 30%). These are Chhatna, Gangajalhati, Mejia, Saltora, Khatra, indpur and Ranibandh. Ranibandh has achieved lowest C.V (23.06).

This block is situated in the proper plateau area with the highest amount of tribal concentration in the district.

Conclusion

Demographic mosaic of the Bankura district is different in terms of population size and density. Western most blocks are showing low response in terms of size growth as well as density growth whereas central blocks like Bankura, Onda, Bishnupur and Barjora are show the high threshold of size as well as density. The rates of density growth are also high capturing the reality of consistency of population growth over the time period. Smaller district on the other hand are showing threshold of size but higher threshold of density coupled with high rate of growth of density. Therefore, apart from the western part, historical growth of central part are becoming at par with momentary growth of south-Eastern blocks and north-eastern strip making a uniform response of population growth dynamics at present.

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