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Seasonal variation in the population of Black kite (Milvus migrans), inhabiting the Arid Zone of Rajasthan

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Abstract

The population of Black kite (*Milvus migrans*) inhabiting rural and urban area of Churu city, Rajasthan was seasonally determined by the direct count method. The counting of the Black kite was made at roosting sites of Churu city (28^{o} 15' N and 74^{o} 55' E, 286 msl) and it's out skirts area of 400 km^{2}. Total 46 roosting sites were identified in the study area of which 34 were located in the urban area and 12 in the rural areas. It was found that number was relatively higher from June to September 2012, 2013 and 2014. However, the maximum numbers of Black kite were during August 2012 and July 2014 and minimum were during November 2012 and February 2012. The maximum number of adult was noticed in the rainy months of every year. A sharp decline in the juvenile population was observed from September 2014 to December 2014. Maximum 28 and 22 juvenile birds were observed in the month of August 2012 and July 2013 while the minimum 4 juvenile were observed in February 2012, March 2013 and November 2014. An average 25.41 ±SD12.4 and 42.33 ±SD 18.82in 2102, 27.33 ±SD 9.19 and 54.25 ±SD 14.9 in 2013, 20.90 ±SD 5.05and 43.08 ±SD 12.75in 2014 Black kites were observed in rural and urban areas, respectively. The maximum number of Black kites i.e. 134 individuals, occurred in the month of August 2012. But in general, the population remained more or less constant with seasonal variations involving dispersion during the monsoons and aggregation during the winters. The winter season adversely affects the population of Black kite in the study area because of the non-availability of preferential food.

Key words*:* Seasonal variation, population, Black kite, arid zone, Rajasthan, India

Introduction

Birds are most beautiful, graceful, important, warm-blooded and flying vertebrates. These birds are important to mankind. It has been said that man would be in difficult situation without birds but birds can exist without man. These birds are pollinating and scavengers agent of nature and also useful to dispersal of seeds.

There are some methods to census the terrestrial birds (Ralf and Scott 1981, Davis 1982). That's true any census technique is not perfect for population estimation of diverse avian species because each census technique has profits and losses (Pyke and Recher 1984, Pyke 1986). Several methods of estimating the size of raptors population have been thoroughly investigated in the past. According to Bibby *et al.* (1992) census of raptor population's poses special problems and the techniques used to census other groups of birds are often inappropriate for raptors.

Fuller and Mosher (1981) suggested only methods considered to be valid to census raptor populations are those involving direct counts, specially the detection of nests or occupied territories. Newton (1979) and Heredia *et al*. (1991) reported during census of Red kites are not tied to a territory at winter season, and may be very mobile depending on the weather or on the availability of food.

Many factors could affect applicability of census method, like habitat type, weather condition, and time of census, influence of observer and behaviour of species (Conant *et al*. 1981). The circular plot method to count birds in forest has been applied by (Reynolds*et al.* 1980). This relies are to regular estimation of distance.

He made a grid in an area with coloured tape and then added birds in a list. There are no new birds were added from day to day yet. When the area is fairly big then marking of an area may be time consuming. It is problematic for birds to adding birds to the list every day without marking with a band, coloured tag or a dye. Spot mapping in terrestrial (Williams 1936, Nillson 1979, Franzred 1981) also presents problems as most of the birds defend territories only during the breeding season. This method was being selected by the international census committee later.

Verner (1985) integrate these and other modification into a complete set of instructions that must be applied. They should increase the accuracy of results from the mapping method.

Census method of road survey is used for raptors and estimate of abundance of raptor species (Eakle 1997, Cardiel 2006). In this technique of counting of birds from a car moving at low speed is relatively easy and provides accurate population estimates (Bibby *et al*. 1992 and Vinuela 1997). A number of Indian bird's species are roosting communally (Gadgil and Ali 1975). Although the Black kites are medium size bird counting of individuals at roost site easily that the species totally as per its communal roosting habitat (Cramp and Simmons 1980). A large number of birds returned to tendency in fairly equal numbers from one night to the following at the selected site were seen during the pilot study. This behaviour was considered in designing the study method to cover all located and identified roost sites monthly to perform a population census, including individuals scattered in the study area.

Usually raptor censuses are restricted in the breeding season when they are easy to record (Diesel 1984). In the case of colonial or flocking raptors, census work is facilitated by tracing the birds in localized areas such as their colonies or

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communal roosts (Parker 1975). Accurate estimates of their population can be made by conducting surveys in these sites during certain months of the year and times of the day (Taylor 1983). As a result, improved monitoring techniques consist of counting birds at their breeding or roosting sites early in the morning or late in the evening before or after their daily foraging trips.

According to Gadgil and Ali (1975) the birds select as there roost sites location nearest to their feeding sites. The population estimation of Black kite by Roost Count Method was used. In this method, birds returning to a communal roost at dusk were counted, as the bird highly clumped at the roost and efficiently census at the time due to easy identification against the sky (Sutherland 1996, Oelke 1966). The counting of the Black kite in and around Churu city of arid zone of Rajasthan was carried out by using various methods as mentioned in materials and methods.

Materials and methods

The study was carried out in and around Churu city, Rajasthan, India covering 400 km^2area (28^o 15' N, 74^o 55' E).The study area was surveyed and roost sites located either by following the flocks of Black kite returning from their feeding grounds to night roost or by listening to their calls from roost sites early in the morning, and by gathering information from the local people. Observations were made with the help of a binocular (Olympus, 10×50) at the distance of about 40 meter from the roosts to avoid interruption of the birds behaviour. All observations were made in clear weather. Data on rainfall, temperature and humidity were collected from the Meteorological Department of Churu to seek any affect inclement weather may have on the population's fluctuation. The population of Black kite was decided by using counting at roosting site, counting at foraging site. Method was supported by photography. Roost sites of the Black kite were identified by following some returning birds to their roost during late evenings, by listening for calls during early mornings, and by gathering information from the local people. Based on a pilot study of consecutive 7 days counts of the Black kite at the roost sites selected, it was henceforth assumed that the average number of kite at any one roost remains more or less constant for a period of at least three week. Each census was carried out during first two weeks of the month. The roosting and nesting colonies were surveyed from early morning 8.00 a.m. well before the kites leave these sites and in the evening from 5.00 p. m. to dusk well after they had settled at nesting and roosting sites. Foraging sites of the Black kite were identified by surveying the study area. On the basis of characteristics, the foraging sites were divided into twelve microhabitats.

Results

Total 46 roosts sites were identified in the study area of which 34 were located in the urban area and 12 in the rural area. All of the sites were monitored once a month to record the number of birds at each site.

Birds were counted at roosting on wall of ground, mobile tower, high buildings, Neem, Vilayati babool, Peepal during day time. They were also counted at roosting on Ardu, Keekar, Jantee, Rohida, Firash during night. It was found that number was relatively higher from June to September in 2012, 2013 and 2014 (Table-1). However, the maximum numbers of Black kite were during August 2012 and July 2013 and minimum were during November 2012 and February 2012 (Figure 1).

Figure 2 highlight the population trend of juvenile and adult Black kite during the study period. The maximum number of adult was noticed in the rainy months of every year. Maximum 106, 92 adult birds were observed in the month of August 2012 and July 2013 while the minimum 36 adult were observed in November 2012. Maximum 28 and 22 juvenile birds were observed in the month of August 2012 and July 2013 while the minimum 4 juvenile were observed in February 2012, March 2013 and November 2014. There was not a single month when we did not find juvenile and adult.

Figure 3 highlight a positive relationship between the size of the Black kite population and rainfall during rainy season. The population of the Black kite attained maximum average 81.53 ±SD 18.66 during 2013 when the study area received 449.5 mm rain, whereas population was found to lower average of 64 ±SD 15.38 in 2014 when the study area received only 398.4 mm rain.

In 2012, rainfall was 430.2 mm and above the average but population were 67.5 ±SD 26.05 and noticeably lower in comparison to year 2013 and higher to year 2014 (Table 2). An average of 71.09 ±SD 9.23 Black kite were recorded during the study period 36 months from January 2012 to December 2014 while highest number of kite are found in 2013 and lowest number are found in 2014 because the rainfall in 2013 more than 2014.

Table 3 depicts that an average 25.41 ±SD 12.4 and 42.33 ±SD 18.82 Black kites are recorded during 2012, in rural and urban area respectively. While, it was 27.33 ±SD 9.19 and 54.25 ±SD 14.9 in 2013 and 20.90 ±SD 5.05 and 43.08 ±SD 12.75 in 2014 in rural and urban area respectively. The bird showed a strong preference for the urban area for roosting in 2012, 2013 and 2014.

However, there was much great difference in preference for rural and urban area during the study period of 2012 to 2014. An average 24.54 ±SD 3.30 and 46.55 ±SD 6.67 Black kites were recorded in the rural and urban area respectively during the study period of January 2012 to December 2014.

Figure 4 depicts that in overall study period of 36 months from January 2012 to December 2014 the bird preferred urban roosting site in 34 months and rural roosting sites in 2 months.

The maximum number of Black kite, 134 individuals, occurred in the month of August 2012. But in general, the population remained more or less constant with seasonal variation involving dispersion during the monsoon (Figure 1).

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Maximum 28 juvenile birds were found in the month of August, 2012. The lowest number of juveniles occurred in the month of February 2012 and March 2013.

Discussion

The population of the birds follows fluctuations as per climatic changes, so also the Black kite. The population count of this bird through two methods viz. counting at roosting sites, at foraging sites shows seasonal variation. Large aggregations of Black kite also occur where food is abundant (Bernis 1980, Cramp and Simmons 1980). The large aggregations have seen during rainy season. The reason of more number during rainy season may be due to high prey availability. It can be stated that the species would be expected to be more packed as environmental variation decreases, resulting in monophasia (May and Mac Arthur 1972).

Data presented in Figure 1 show that population of the Black kite was maximum during the rainy season of 2012 and 2013 while it was comparatively low in the rainy season of 2014 due to low rain fall in this year. The population of this bird was medium during the summer season and low during the winter season of 2012 to 2014. It may be due to low availability of food during these seasons.

Data presented in Figure 2 depicts that the juvenile numbers was more during 2013 and minimum in 2014. The maximum juveniles were found in 2013 because of good rainfall and quantity of good food in arid zone of Rajasthan.

Data of Figure 3 indicates that there is direct relationship between rainfall and the number of population of the Black kite. Because of good rainfall is result availability of insects, amphibians, mammals, reptiles and rodents. During rainy season abundance of prey, especially slow-moving and injured animals as well as food obtained by scavenging (Valverde 1967, Arroyo 1978). However, low rainfall during 2014 could not improve the numbers of birds in the rainy season of this year. The diet of the Black kite suggests the bird is largely a generalist, including, macro invertebrates and human garbage. Similar observations have been made in Black kite (Pomeroy 1975, Roberts 1991). The generalist nature of the Black kite in diet decides its population in different microhabitats in different seasons.

Data of Figure 4 show that there were some correlations between the availability of food in the rural and urban area of the study area and the population of the Black kite. The number of Black kite was comparatively more in urban area during all three seasons summer, winter and rainy season. Desai and Malhotra (1979), Brown *et al.* (1982), Ali and Ripley (1983), Naoroji (2006) observed in Asia and Africa, the population of Black kite in fully urban condition.

The ability to exploit diverse feeding grounds enables the Black kite to traverse both natural and man-made microhabitats. The scattered form of flocking during a normal rainfall year would allow the birds forage in a variety of grounds, such as grazing field, agriculture farm houses, out skirts area of highways, graveyard and garden area. An exact opposite situation occurs in the drought period. A phenomenon of the normal rainfall results in unlimited food supply, which leads to provincial emigration. However, lower rainfall restricts the useable foraging grounds, leading to the utility of limited resources, such as municipal garbage dumping station, waste water bodies, animal dead bodies dumping station and human inhabitation in urban area.

That is why higher numbers of individuals prefers roost in close proximity of feeding sites in the urban area. Even distribution of the birds supports this hypothesis that aggregation or dispersion is related to the availability of food recourses. Thus conclusion can be drawn that the dispersal of the Black kite depends upon climatic condition affecting food availability.

Post winter is a beginning of the breeding season for the majority of the avifaunal species all over the world. Besides heat regulation and its anti-predation mechanism, a communal roost influences pair formation and pair bonding for the following breeding season. Observations by Gurr (1968) on the courtship behaviour of the Australian harrier on the roost supports the probable fact of communal roosting provides better mate selection and flow of stronger genes in future generations.

And finally large conservatives practices, religious attitude of multimillionaire people of the area and biodiversity of the Rajasthan state supports continuance of a substantive number of the Black kite in both its rural and urban areas with periodically internal variations depending on climatic changes, food availability and breeding strategies.

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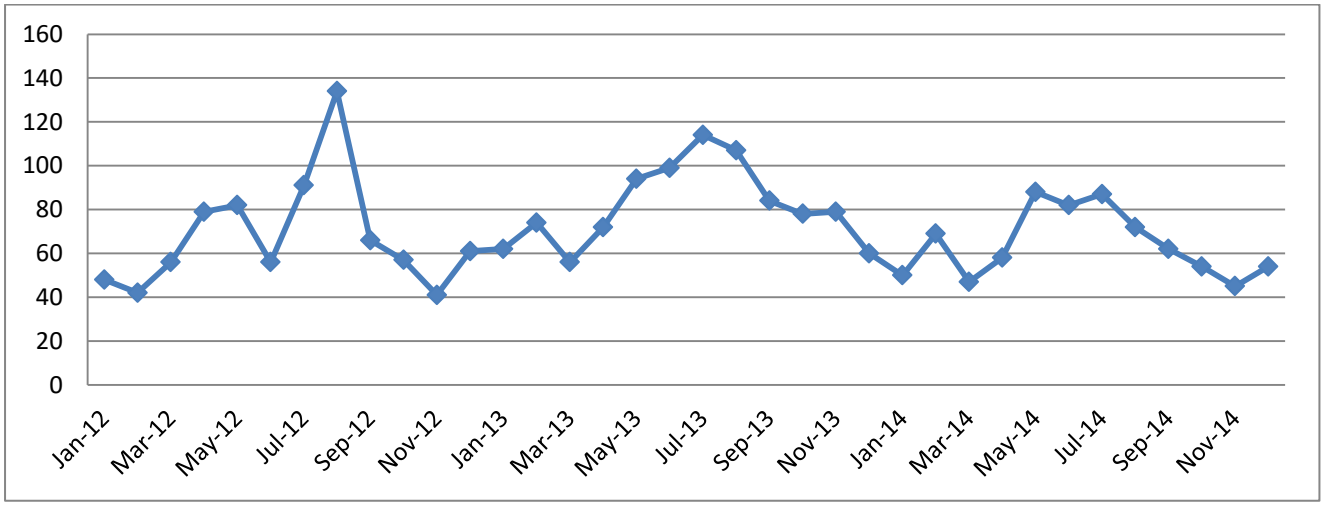

Figure 1.Monthwise population trend of the Black kite from January 2012 to 2014

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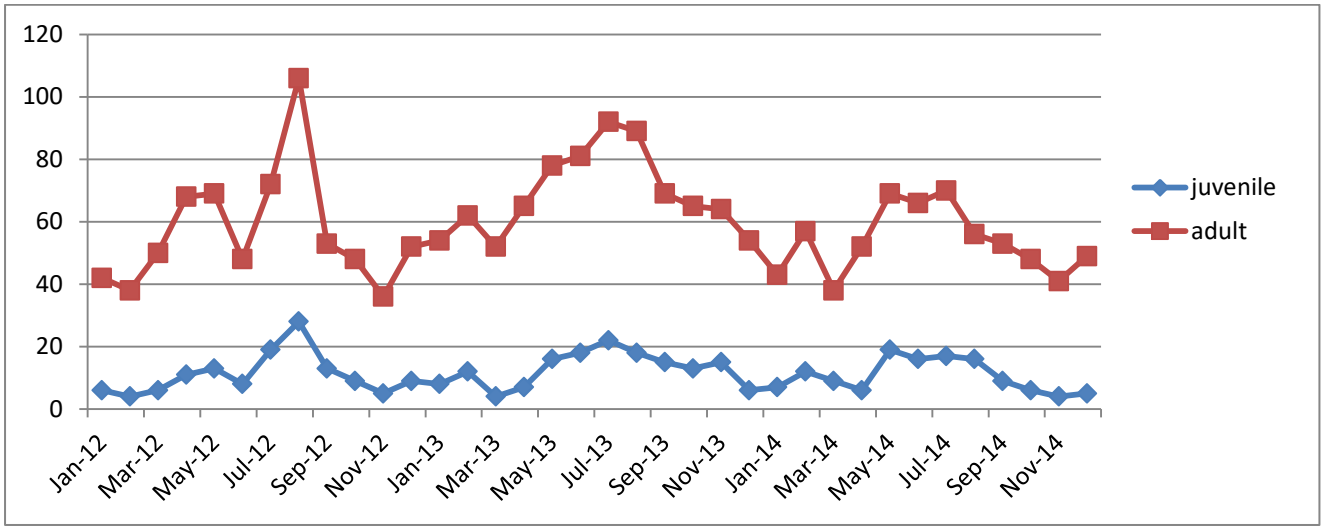

Figure 2.Monthwise population trend of juvenile and adult Black kite from January 2012 to December 2014

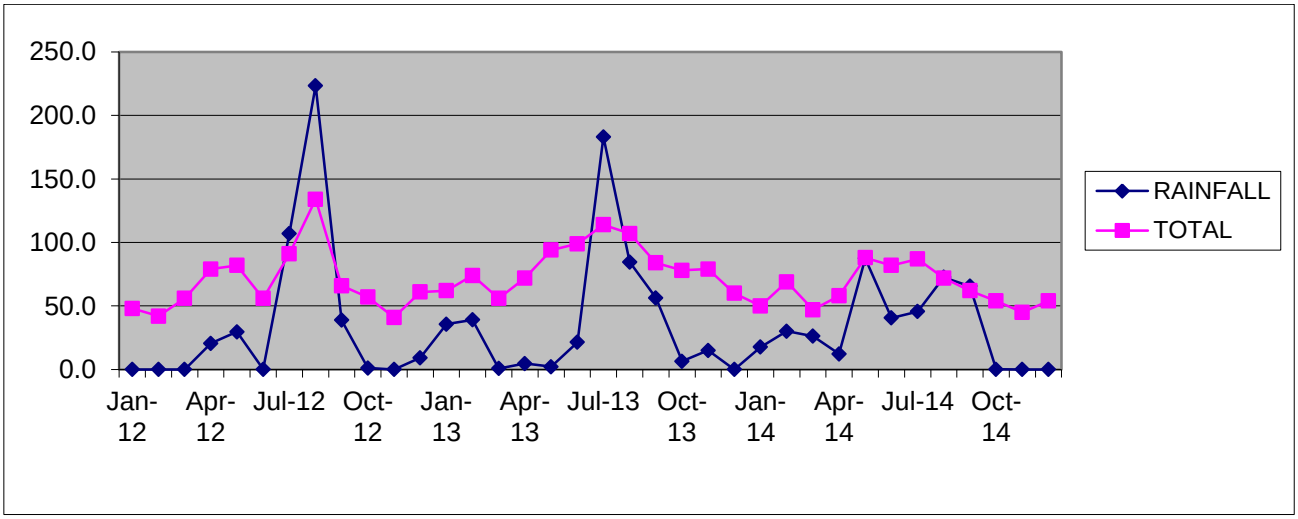

Figure 3. Graph showing correlation between rainfall and population of Black kite from January 2012 to December 2014

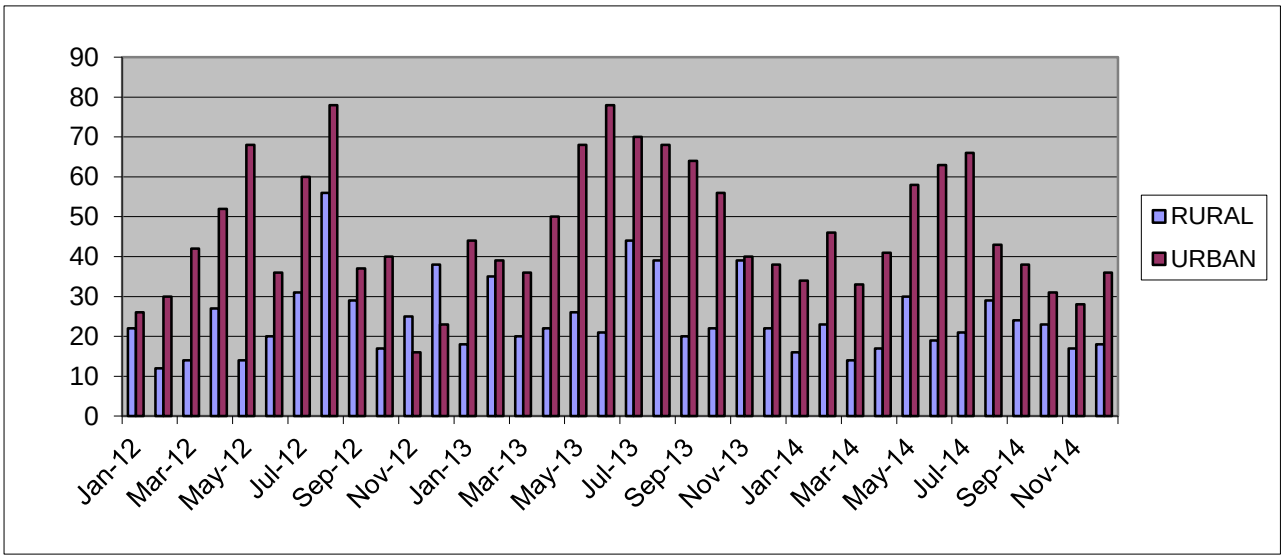

Figure 4.Monthwise population of the Black kite in rural and urban roost sites from January 2012 to December 2014

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Table: 1. Monthwise population of the Black kite from January 2012 to December 2014 at roosting sites.

Year	2012			2013			2014		
Month	**Juvenile**	**Adult**	**Total**	**Juvenile**	**Adult**	**Total**	**Juvenile**	**Adult**	**Total**
January	6	42	48	8	54	62	7	43	50
February	4	38	42	12	62	74	12	57	69
March	6	50	56	4	52	56	9	38	47
April	11	68	79	7	65	72	6	52	58
May	13	69	82	16	78	94	19	69	88
June	8	48	56	18	81	99	16	66	82
July	19	72	91	22	92	114	17	70	87
August	28	106	134	18	89	107	16	56	72
September	13	53	66	15	69	84	9	53	62
October	9	48	57	13	65	78	6	48	54
November	5	36	41	15	64	79	4	41	45
December	9	52	61	6	54	60	5	49	54
Total	131	682	**813**	154	825	**979**	126	642	**768**
Average monthly population	10.91	56.83	67.75	12.83	68.75	81.53	10.5	53.5	64
±SD	6.82	19.46	26.05	05.55	13.47	18.66	05.28	10.27	15.38

Table: 2.Annual population of the Black kite recorded at the study area and occurrence of rainfall during same period.

N indicates number of observations per year.

X indicates average number of the Black kite.

±SD indicates standard deviation.

Year of observation	Population	Rainfall (mm)
2012 N = 12	X: 67.5 ±SD 26.05	430.2
2013 N = 12	X: 81.53 ±SD 18.66	449.5
2014 N = 12	X: 64 ±SD 15.38	398.4

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Table: 3. Monthwise population of the Black kite from January 2012 to December 2014 in rural and urban area.

Year	2012			2013			2014		
Month	**Rural**	**Urban**	**Total**	**Rural**	**Urban**	**Total**	**Rural**	**Urban**	**Total**
January	22	26	48	18	44	62	16	34	50
February	12	30	42	35	39	74	23	46	69
March	14	42	56	20	36	56	14	33	47
April	27	52	79	22	50	72	17	41	58
May	14	68	82	26	68	94	30	58	88
June	20	36	56	21	78	99	19	63	82
July	31	60	91	44	70	114	21	66	87
August	56	78	134	39	68	107	29	43	72
September	29	37	66	20	64	84	24	38	62
October	17	40	57	22	56	78	23	31	54
November	25	16	41	39	40	79	17	28	45
December	38	23	61	22	38	60	18	36	54
Total	305	508	**813**	328	651	**979**	251	517	**768**
Average monthly population	25.41	42.33	67.75	27.33	54.25	81.58	20.90	43.08	64
±SD	12.4	18.82	26.05	09.19	14.9	18.66	05.05	12.75	15.38

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