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HOME RANGE COMPARISON OF MALE AND FEMALE GREY FRANCOLIN (*FRANCOLINUS PONDICERIANUS*) USING RADIOTELEMETRY.

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SUMMARY

Attempts were made to map species distribution to consider identification of appropriate surrogates (i.e. habitat features, food, climatic zones and various biotic factors). The use of sophisticated technologies, particularly Remote Sensing and GIS, has opened up a new paradigm in mapping spatial pattern of species distribution and wildlife habitat (Worah *et al.*,1989, Buckland and Elston, 1993, Mladenoff *et al.*, 1995, Nagendra and Gadgil, 1999, Gough and Rushton, 2000). The present study was conducted in the district of Yamunanagar which lies between 30°24′ N Latitude and 77°32′ E longitude. Yamunanagar is situated in the state of Haryana in India and constitutes important habitats for grey francolins. The study area was centered at Yamuna Nagar along the Western Yamuna canal. Radiotelemetry was carried to obtain home ranges of male and female grey francolin. Trapping was done with trap and leg-hold traps fixed on thin rope. The francolins were fitted with backpack radio-transmitters weighing 5 gm. and released back. During the present study intensive radio tracking, about 296 sequential radiolocations were obtained for the grey francolins. Radio-locations were then plotted on classified habitat maps of study area during the Rabi and kharif cropping seasons and home ranges were estimated in hectares using the minimum convex polygon (MCP) and Kernel methods. During the present investigations the home range of male francolins were bigger than the female. The mean core area of home ranges, as determined by the Kernel methods, of male Grey francolin was also bigger than that of female.

INTRODUCTION

The use of sophisticated technologies, particularly Remote Sensing and GIS, has opened up a new paradigm in mapping spatial pattern of species distribution and wildlife habitats (Worah *et al.*, 1989, Buckland and Elston, 1993, Mladenoff *et al.*, 1995, Nagendra and Gadgil, 1999, Gough and Rushton 2000). This is primarily because these tools are cost effective for the vast areas of landscape and help in establishing linkages between diverse potential correlates that affect the presence of species and consequently, enables modeling species distribution. The studies conducted so far in India have focused largely on image processing and visual interpretation of satellite data for vegetation characterization (e.g. Negi, 1980, Porwal and Pant, 1989, Pant and Roy, 1992, Singh, 1999, Sen, 2000, Uniyal, 2001), detecting changes in land cover or land use (Lal *et al.*, 1991, Pant and Kharakwal, 1995, Das *et al.*, 1996, Ghosh *et al.*, 1996, Awasthi, 2001) and preparation of wildlife habitat maps (Dutt *et al.*, 1986, Worah *et al.*, 1989, Porwal and Roy 1991, Roy *et al.*, 1995, Porwal *et al.*, 1996, Kushwaha 1997, Behera *et al.* 2000, Naithani 2000, Alfred *et al.*, 2001).

Preparation of distribution maps can range from a simple one, by connecting outer most points of location data to application of advanced mathematical functions such as prescriptive or probabilistic models (Bonham-Carter 1994, Lenton *et al.* 2000).

Availability of food resources, climatic conditions and biotic disturbances are highly variable in space and time. As a result, species distribution is generally aggregated in patches, thus exhibiting relative preference to such areas. Therefore, documentation of such patterns becomes a necessity in any basic research on the species and more significantly, it has conservation implication. The information generated through intensive field research on one or more species not only provide useful insight of their ecology, but also helps in generating spatial distribution maps, which could be used to address conservation issues both at the local and landscape levels.

Attempts to map species distribution would have to consider identification of appropriate surrogates (such as habitat features, food, climatic zones and various biotic factors). Though identification of 'appropriate surrogates' may be a relatively simple task, but it is often impossible to correctly measure all the factors involved. Also, some factors exert only a limited influence on the species and effects of several factors are unknown (Gough and Rushton 2000). It is also redundant to quantify each one of them, when there is scope to detect fewer surrogates that can potentially explain the species occurrence. Therefore, it becomes important to develop a model (a simplified representation of the relationship between species and, biotic and abiotic factors) using minimum possible variables that account for maximum influence on the species occurrence. The other important aspect or usefulness of the model is that it allows for extrapolation in both space and time (Starfield and Bleloch 1986).

STUDY AREA AND METHODOLOGY

The study was conducted in district Yamuna Nagar which lies between 30°24′ N Latitude and 77°32′ E longitude. Yamuna Nagar is situated in state of Haryana in India and constitutes important habitats for Grey francolins. The study area was centered at Yamuna Nagar along the Western Yamuna Canal. Radiotelemetry was carried to obtain home ranges of male and female Grey francolin.

Trapping of Grey francolins was done with nets and leg-hold traps fixed on thin rope. Observers closely monitored the traps from a distance of at least 500 m. and trapped francolins were extracted immediately from the traps to prevent injury. The francolins were fitted with backpack radio-transmitters weighing 5 gm. and were released back in the same habitat where they were trapped. Radio-transmitters gives 138 to 174 Mhz signal at regular interval. A MARINER radio-telemetry receiver of 75 - 200 KHz frequency range was used to detect pulses emitted by transmitter. Radio-tracking was done with a three-element handheld YAGI Antenna. A MEGELLAN 12 - Channel GPS was used to obtain geographical co-ordinates of radio-tracked Grey francolins. Universal Transverse Mercator (UTM) co-ordinate system was used to record geographical co-ordinates.

For home-range analyses, point locations from radio-tracking data, taken at two-hour intervals during the daytime were used. The geographical co-ordinates at each point location of radio-tracked birds were recorded using a GPS receiver. The radio-locations were then plotted on classified habitat maps of the study area during the Rabi and Kharif cropping seasons and home ranges were estimated in hectares (ha) using the Minimum Convex Polygon (MCP) and Kernel methods.

For home-range analyses, ArcView 3.1 extension package "Animal Movement Analysis" was used. Models were run using the Universal Transverse Mercator (UTM) co-ordinate system. Two non-parametric methods, the Minimum Convex Polygon (MCP) method and Kernel method were used to estimate home-range sizes. 95% and 50% kernel contours were determined, and 50% interval was taken as the core area of home-range. The home-range sizes of the male and female Grey francolins were compared using Mann-Whitney test.

RESULTS

The MCP home ranges of the male was averaged 4.38 ha (Range = 3.50 – 5.26 ha), whereas, MCP home range of female Grey francolins was 4.11 ha (Range = 1.26 – 6.55 ha), (Table1.). The kernel (95%) home ranges of the male and female Grey francolins averaged 5.25 ha (Range = 4.62 – 5.89 ha), and 5.80 ha (Range = 1.56 – 10.04 ha), respectively (Table 2). The kernel (50%) home ranges of the male and female Grey francolins averaged 0.82 ha (Range =

0.65 – 1.00 ha), and 0.66 ha (Range = 0.27 – 1.04 ha), respectively.

The mean home range of the male Grey francolin was bigger than that of the female (Table 1, Fig. 1) but the difference was not significant (Mann-Whitney U test statistic [U] = 2, p = 1). The mean core area of home ranges, as determined by the kernel method, of the male Grey francolin was also bigger than that of the female.

Table 1. Mean home range estimates of radio-tracked Grey francolins using the minimum convex polygon and kernel methods.

	Home range estimate (Hectares)					
	MCP method		**Kernel method**			
			95%		**50%**	
Sex	Mean	S.E.	Mean	S.E.	Mean	S.E.
Male	4.38	0.88	5.25	0.64	0.82	0.18
Female	4.11	2.45	5.80	4.24	0.66	0.39

S.E. = Standard error of mean

DISCUSSION

Literature available on modeling species distribution in GIS reveals an increasing trend in such studies since 1990s, but largely on the associative category (e.g. Walker 1990, Buckland and Elston 1993, Carroll *et al.* 1999, Manel et al. 1999, Collingham *et al.* 2000, Franco *et al.* 2000, Lenton *et al.* 2000, Odom *et al.* 2001, Osborne *et al.* 2001). Difficulties in acquiring data on population responses compounded by lack of thorough knowledge on species biology and behaviour have perhaps resulted in a limited number of process-based models (Kareiva and Wennergren 1995, Wennergren *et al.* 1995, Lima and Zollner 1996, Allen *et al.* 2001). Nonetheless, the models based on associative approach can effectively depict and predict current pattern of distribution at varying scales and are no means inferior in planning and executing conservation actions. Home ranges of Grey partridge were variable and did not differ by season (Church and Porter 1990). Mean home ranges of female Grey partridge were smaller than males, and home ranges of birds in pairs with unsuccessful breeding were smaller than those of birds in a covey with young (Birkan *et al.* 1992). Birkan *et al.* (1992) measured home ranges of Grey partridge using Kernel analysis and analyzed that mean home ranges of female are smaller than males.

During intensive radio-tracking, 296 sequential radio-locations were obtained for the Grey francolins. The radio-locations were then plotted on classified habitat maps of the study area during the Rabi and Kharif cropping seasons and home ranges were estimated in hectares using the Minimum Convex Polygon and Kernel methods.

The mean home ranges of the male Grey francolins were bigger than that of the females. The mean core area of home ranges, as determined by the kernel method, of the male Grey francolin was also bigger than that of the female. As the female Grey francolin performs incubation activities, whereas male is not involved in any kind of incubation activity (Khan 1998). The role of female Grey francolin leads to the shrinkage of home range.

Prior knowledge on relationships between habitat features and presence/absence of animals would play a guiding role in mapping distribution. Rule-based models (an associative approach category) make effective use of such knowledge and determine the species distribution at least on a coarse scale by delineating area used/preferred by the species. When dealing with a large number of predictor variables, which is often the case, several multivariate statistics are helpful in removing redundancy that occur due to correlation within variables. Statistical methods such as regression and discriminant function analysis have the ability to deal with such data sets and enable construction of mathematical functions for predicting spatial distributions. However, the logistic regression technique has been more popular in GIS based spatial analysis as it works on the basis of binomial distribution theory. Hence, it can effectively deal with presence/absence data (dichotomous response variable) to map and predict distribution (Trexler and Travis 1993, Menard 1995, Manel *et al.* 1999, de Vasconcelos *et al.* 2001). The distribution predicted by these models is, however, not necessarily without bias as the probability of distribution in a given unit tends to be dependent upon the values at neighbouring units within a particular zone of influence (Legendre and Fortin 1989). The effect of neighbours in a spatial sense is generally referred to spatial autocorrelation and, it is important to investigate and incorporate such information while developing distribution models (Legendre 1993, Augustin *et al.* 1996, Gough and Rushton 2000).

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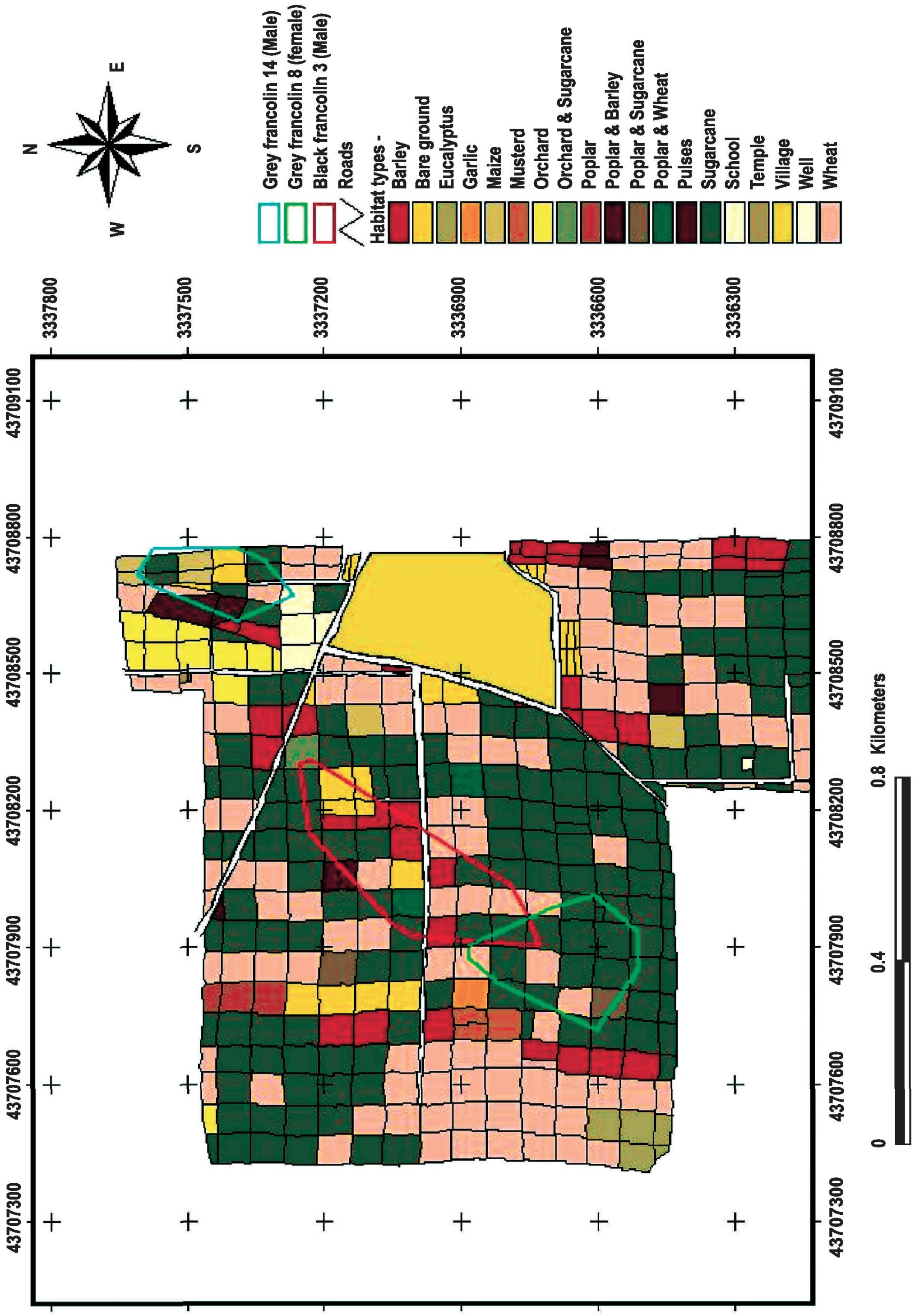

Fig. 1. Habitat map (Rabi season) with home ranges of Grey and Black francolins estimated by Minimum Convex Polygon (MCP) method.

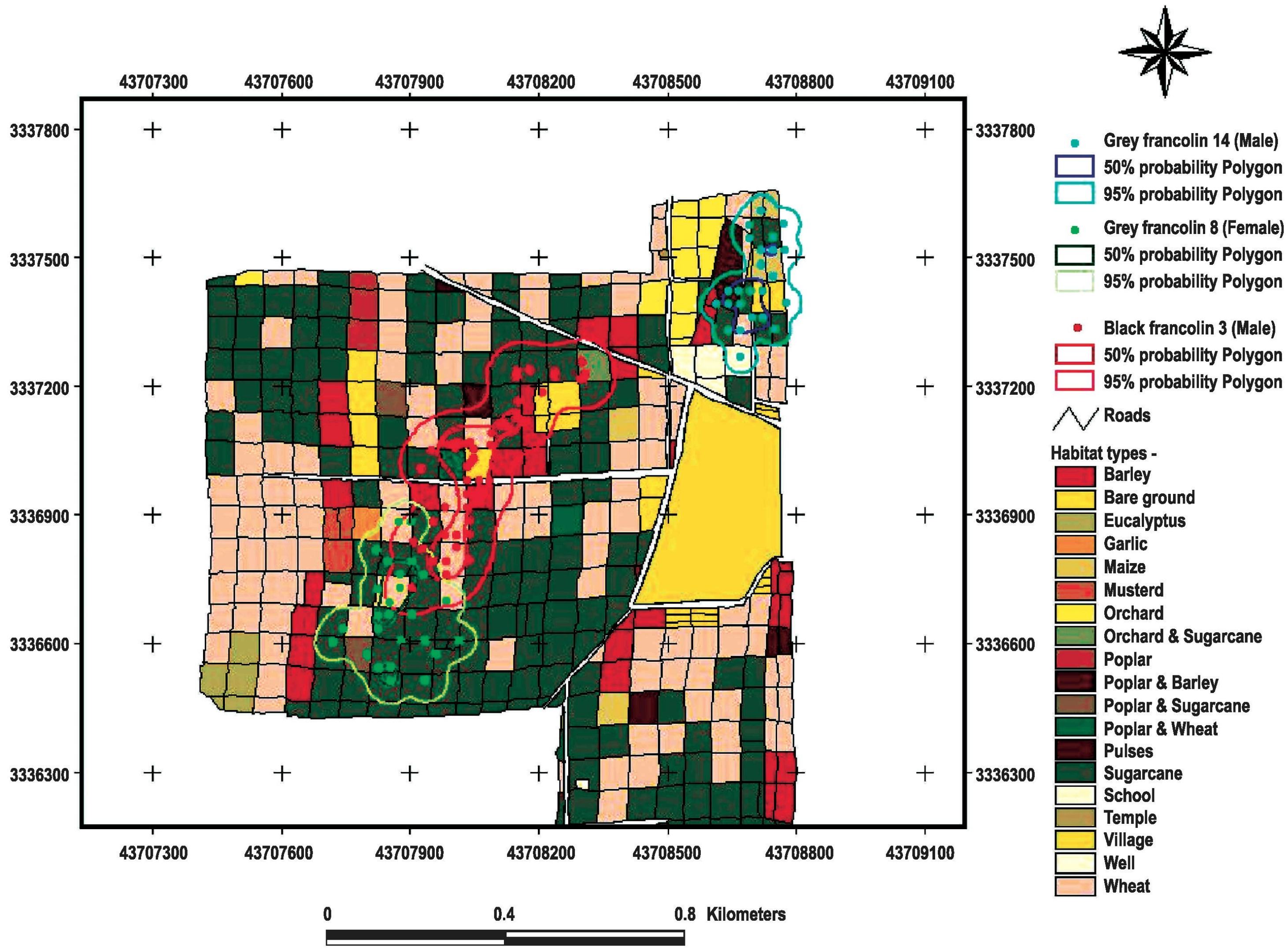

Fig. 2. Habitat map (Rabi season) with home ranges of Grey and Black francolins estimated by kernel method showing 50% and 95% probability polygons (dots indicate radio-locations).