

## Temporal variations in Avian Fauna in Rawalpindi division, Punjab Pakistan

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### Original Research Article

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### ABSTRACT

The present study was conducted to examine the temporal variations that took place in the bird richness and diversity in the Rawalpindi division of Punjab during 2007-2015. Secondary sources of data were utilized for the study. The district-wise data for 12 bird species was obtained from the Zoological Survey of Pakistan, Islamabad and Arid Agriculture University, Rawalpindi from 2007-2015. The collected data was arranged and tabulated in Microsoft Excel 15 and SPSS 22 and were analyzed for linear regression. The most common bird species found were House Sparrow, Common Quail and House Crow. The declining trend was seen in Shikra, Chukor, and Bank Myna with a more than 50% reduction in their population during 2007-2015. The results of linear regression showed a strong relationship between bird decline and time. The study suggests a detailed analysis of the possible environmental and anthropogenic factors which played a role in the decline of bird richness in the study area.

**Keywords:** Bird species diversity, Avian Fauna, Linear Regression, Punjab

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### INTRODUCTION

Worldwide biodiversity is altering at an unprecedented rate as a composite response to human-induced modifications in the global environment. This substantial degree of change is strongly linked to the process of the ecosystem and society utilization of natural resources; hence biodiversity change is considered an important modification. Though for the ecosystem functioning and human wellbeing, alterations in biodiversity are equally important (Sala *et al.*, 2011). To understand the temporal patterns in species' richness and abundance along environmental gradients are basic challenges in the ecosystem. The woodlands are home to precious species of birds, animals and plants yet nature productivity and climate determine the species assemblage structure across larger geographical scales (Santillan *et al.*, 2018). Human practices like encroachment of forestland for agriculture, livelihood, settlements, civil establishments, hunting, overexploitation etc. have resulted in the deterioration in numbers of wildlife especially birds (Umar *et al.*, 2018; Rias *et al.*, 2013). Consequently, precious animals and plants are becoming endangered or vanished due to the rapid changes in their habitats (Mustafa *et al.*, 2017).

It has been extensively reported that birds are a very valuable indicator of species abundance and endemism patterns in an ecosystem eventually to gauge the environmental deterioration. Any decline or change in bird assemblage is a strong indicator of environmental pollution in diverse ecosystems. So far, the mechanisms that drive spatio-temporal dynamics of species assemblages have received little attention (Santillan *et al.*, 2018). Various studies have reported the changes in bird's diversity for instance, Mustafa *et al.*, (2017) examined the large scale deteriorations in the population of house sparrow (*Passer domesticus*) in European towns, London, Brussels, and Dublin. Balmori & Hallberg (2007) examined the role of electromagnetic radiations in the decline of the common house sparrow in urban areas. Santillan *et al.*, (2018) studied the impact of cellular phones on the posturing problems for the bird population

Pakistan, due to its inimitable climatic and geographical conditions, hosts an extensive range of ecosystem and habitat types and related organic diversity (Mirza & Wasiq, 2012). Birds are intensively captured and hunted in Pakistan, for sports and consumption due to which indigenous populations are declining, but the overall species status is considered as stable. Historically, migratory birds have been a chief component of

human diets found that the non-domesticated bird population is decreased owing to predation. Due to hunting and disturbance activities, Dalmatian pelican (*Pelecanus crispus*), a winter season visitor in Pakistan, has shown deterioration in its population. Likewise, black-headed Ibis is an irregular and local migratory visitor of Pakistan currently facing very high-risk habitat destruction due to extensive hunting. Similar trends of decline are in the 141 bird species of the Mangla dam due to overgrazing and extensive wood cutting (Khan & Ali, 2015; Umer *et al.*, 2018). Furthermore, 14 bird species of Hingol National Park were affirmed as near to threat. The major reasons behind the bird's population decline in Pakistan are rapid population growth and accelerated anthropogenic activities (Ghalib *et al.*, 2008).

Previously, no study was conducted on temporal variations of birds' assemblage in the Rawalpindi division. Therefore, due to the gap found in literature, the present study was focused on assessing the change that took place in birds' species in the Rawalpindi division during 2007-2015.

## MATERIALS AND METHODS

### Selection of study area

The present study was performed in the Rawalpindi division of Pakistan (Fig. 1). It is situated between 32° 30' to 34° 10' north latitudes and 71° 45' to 73° 45' east longitudes. The division is bounded from north by Margalla Hills and the Kala-Chitta Ranges, from the west by River Indus, from the east by River Jhelum whereas Salt range is found on its southern side. Its total land area is approx. 22,254 Km<sup>2</sup> and general elevation lies between 472-610 meters above mean sea level. Generally, Rawalpindi division experiences an intense climate with regional variations from hot to warm summers and mild to cool winters with great annual rainfall diversity ranging between 21 to over 60 inches (Iqbal & Iqbal, 2018). Administratively, the division consists of 04 districts and 22 tehsils. It is one of the most populous zones in the province with a total population size approx. 89,560,000 and an average annual growth rate of 2.17% (GOP, 2015). For the present study, the four districts i.e. Rawalpindi, Attock, Jhelum and Chakwal, were undertaken as the sample sites.

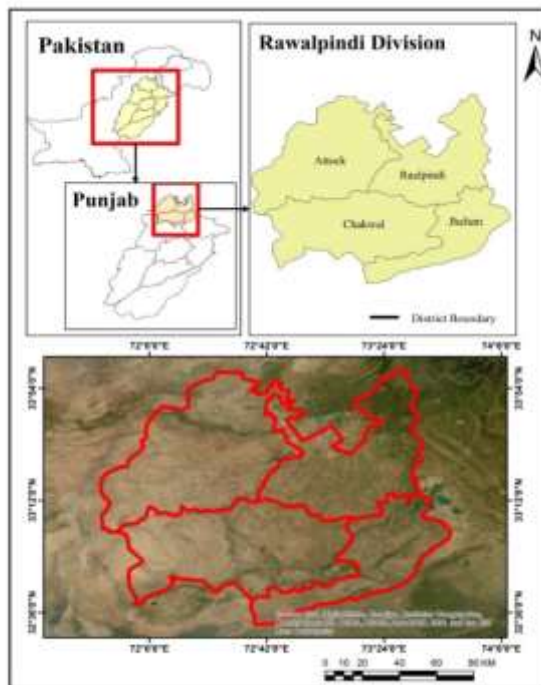


Fig. 1: Rawalpindi Division

### Data collection and analysis

Secondary Data sources were used for the present study. The district-wise details of the bird species were collected from Arid Agriculture University Rawalpindi, Pakistan. While as, the year-wise number of bird species found in the study area from 2007 to 2015 was obtained from the Zoological Survey of Pakistan, Islamabad. The collected information was arranged and tabulated in Microsoft Excel 365 and was further analyzed in SPSS 21. Linear regression analysis was performed to estimate the correlation between bird species and time. Numbers of years (Time unit) were taken as independent variables and bird species were dependent variables. The equation of linear regression used by Seber and Lee (2012) was utilized and mentioned as under:

$$Y = \alpha + \beta x$$

Where

Y the value of the dependent variable (bird species)  
 $\alpha$  the coefficient freedom reflecting y dependent on x.

$\beta$  the angle coefficient (slope) of the regression line, reflecting the change of y variable and x variable increase one unit.

x the independent variable (No. of years)

R<sup>2</sup> the coefficient to determine variable y, with respect to change of X.

The range for R<sup>2</sup> is 0 to 1. The more the value of R<sup>2</sup> is, the more dependent Y on X is.

## RESULTS AND DISCUSSION

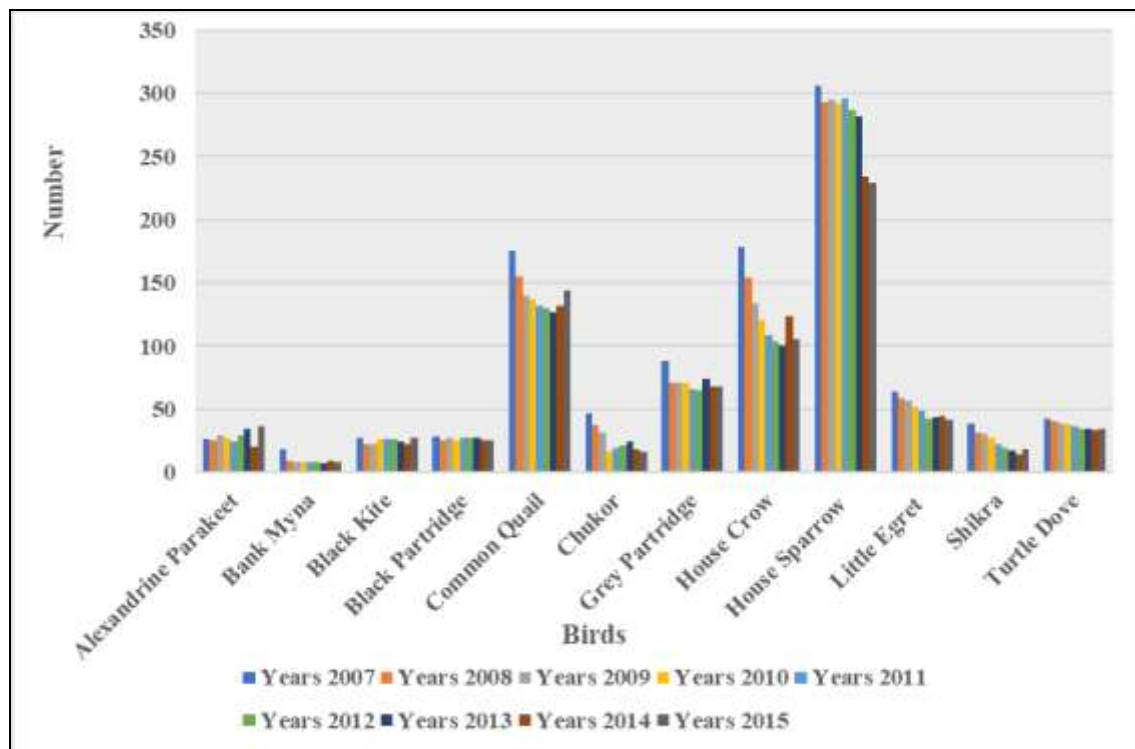
Twelve different bird species were identified in Rawalpindi division with a total population of 7,582 birds during 2007-15. The most abundantly found species included House Sparrow (33.2%), Common Quail (16.8%), House Crow (14.9%), Grey Partridge (8.5%) and Little Egret (6%). The least common bird species were Bank Myna (1.1%), Shikra (2.9%) and Black Kite (2.9%). Furthermore, a decline of 27.5% was observed in the overall population size from 1039 birds in the year 2007 to

753 birds only in the year 2015 (Table I). Only one bird species experienced population growth which was Alexandrine Parakeet, while the population of Black Kite remained the same from 2007 to 2015. However, a great population decline was observed in the rest of the bird species. The most affected species were Shikra, Chukor and Bank Myna that experienced a decline of more than 50% in their total size. The least affected species included Black Partridge, Grey Partridge, Common Quail and Turtle Dove (see Fig. 2)

**Table I: Bird Species and population in Rawalpindi Division 2007-2015**

Name of Birds	Years									Total
	2007	2008	2009	2010	2011	2012	2013	2014	2015	
Alexandrine Parakeet	26	25	29	27	24	29	34	20	37	251
Bank Myna	18	9	8	8	8	8	7	9	8	83
Black Kite	27	22	22	26	26	26	24	22	27	222
Black Partridge	28	25	27	25	27	27	27	25	25	236
Common Quail	175	155	140	137	132	130	127	132	144	1272
Chukor	47	38	31	16	19	21	24	18	16	230
Grey Partridge	88	71	71	71	66	65	74	68	68	642
House Crow	178	154	134	121	108	103	100	124	105	1127
House Sparrow	306	293	295	292	296	287	282	234	229	2514
Little Egret	64	59	57	52	49	43	44	45	42	455
Shikra	39	31	30	27	22	19	17	14	18	217
Turtle Dove	43	41	39	39	36	34	34	33	34	333
<b>Total</b>	<b>1039</b>	<b>923</b>	<b>883</b>	<b>841</b>	<b>813</b>	<b>792</b>	<b>794</b>	<b>744</b>	<b>753</b>	<b>7582</b>

Source: Zoological Survey of Pakistan, Islamabad & Arid Agriculture University, Rawalpindi



**Fig. 2:** Temporal Trends in bird population, Rawalpindi Division 2007-2015

Furthermore, great regional variations were observed at the district level in the distribution and diversity of bird species within Rawalpindi division. It was mainly due to temperature variations, and other associated physical factors. Rawalpindi district possessed the most diversity in bird's assemblage with 06 different bird species found over there. They included Alexandrine Parakeet, Bank Myna, Black Kite, Black Partridge, Common Quail and House Crow (Fig. 3). House crow was the most commonly found species with 41% bird population and Bank Myna was the least common with only 5% population in Rawalpindi. Only 03 species were found at Jhelum district during 2007-2015 which were mainly Common Quail, Grey Partridge and Little Egret. The population of Little Egret was comparatively low than the rest of the two species within Jhelum. Similarly, Attock district also had only 03 bird species including Chukor, Grey Partridge and Turtle Dove. Besides, 05 bird

species were found at Chakwal district which included Common Quail, Grey Partridge, House Crow, House Sparrow and Shikra. House Sparrow was the most abundant in number while the rest were found in smaller figures within district Chakwal. Moreover, the largest bird population was found at Chakwal district with 3,352 birds and the smallest at Attock with 829 birds during 2007-2015.

Another noticeable observation was that certain bird species were found more commonly distributed than others within the study area. For instance, Common Quail was found fairly distributed among the districts of Rawalpindi, Jhelum, and Chakwal. Likewise, Grey Partridge was also found in three districts of the study area namely Jhelum, Chakwal and Attock. House Crow was found at Rawalpindi and Chakwal districts. However, the rest of the species were confined to their relative districts only.

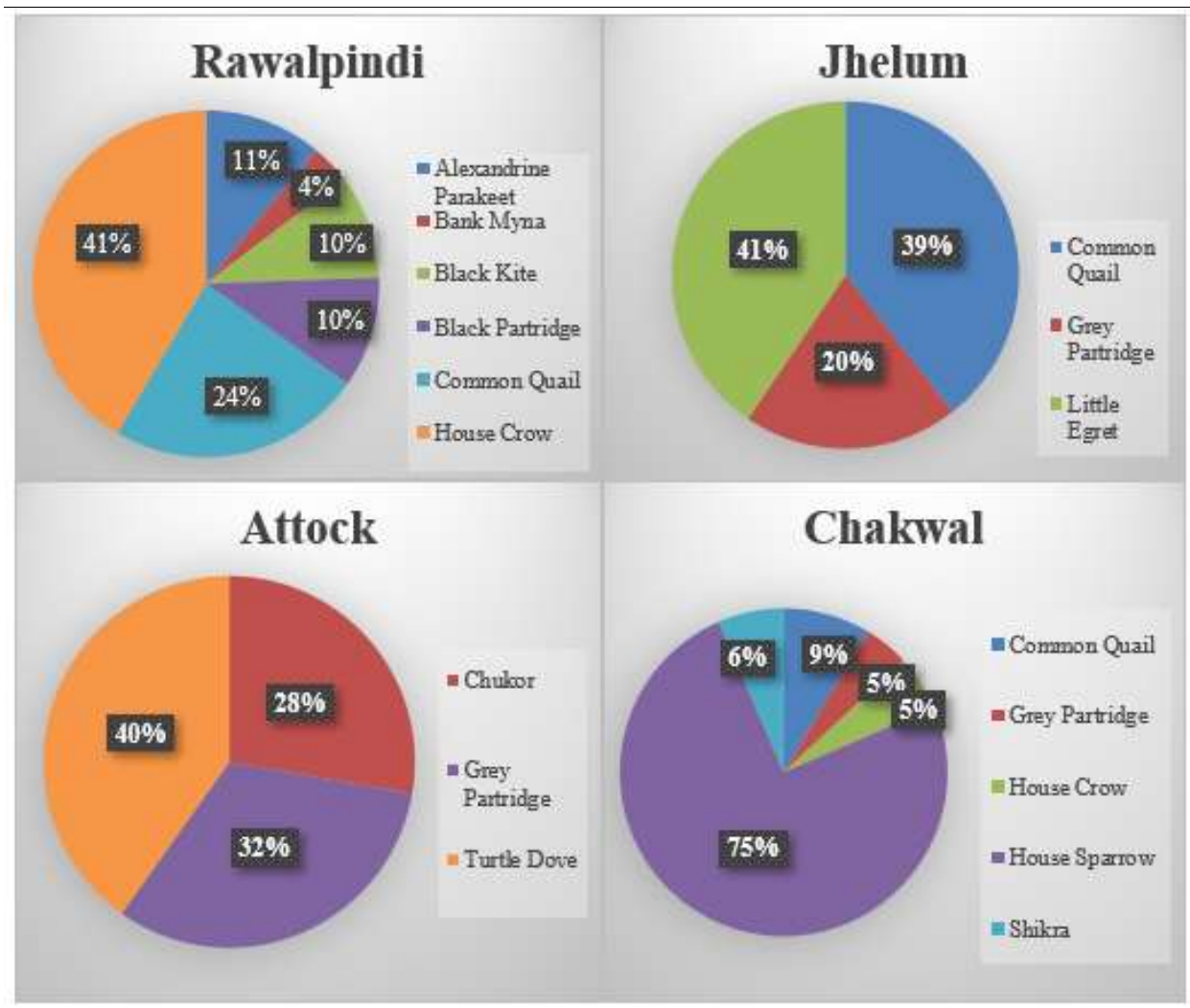


Fig. 3: Bird's Diversity in the districts of Rawalpindi division 2007-2015

Finally, the district-wise results for linear regression analysis revealed that a strong relationship was found between time period and the bird species in Rawalpindi division during the study period. In Rawalpindi District, the strongest relationship was found between Grey Partridge ( $R^2$  0.7049) and time, as with every passing year, Grey Partridge witnessed a continuous decline in its population (Fig. 4). The weakest relationship was

exhibited between Common Quail ( $R^2$  0.0067) and time. No relationship was seen between Black Kite ( $R^2$  0.007) and time as its population remained the same with no change during the study period. Only Alexandrine Partridge showed an upward trend while Bank Myna and Black Partridge showed a rapidly declining trend in their population since the year 2007 in district Rawalpindi.

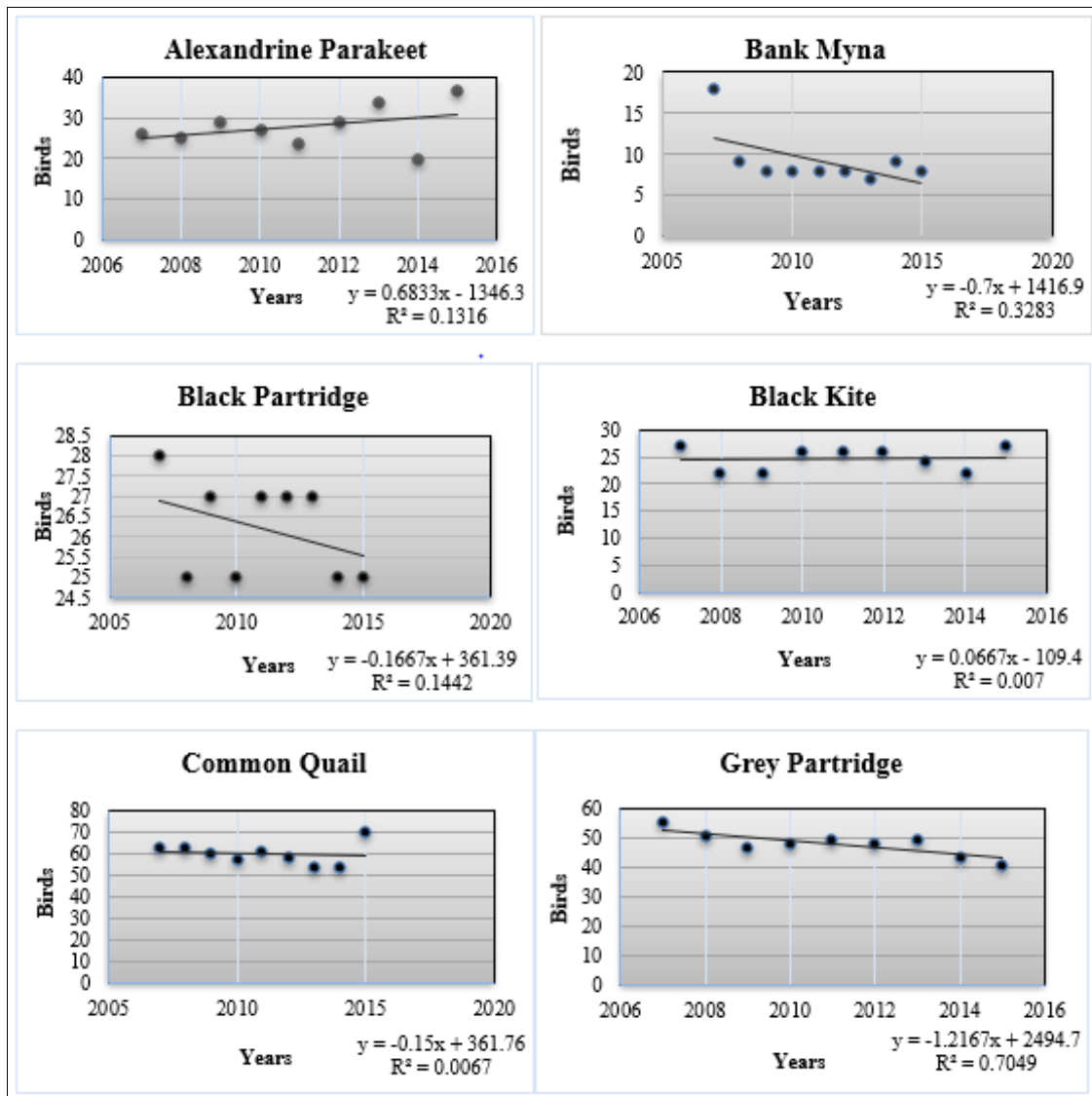
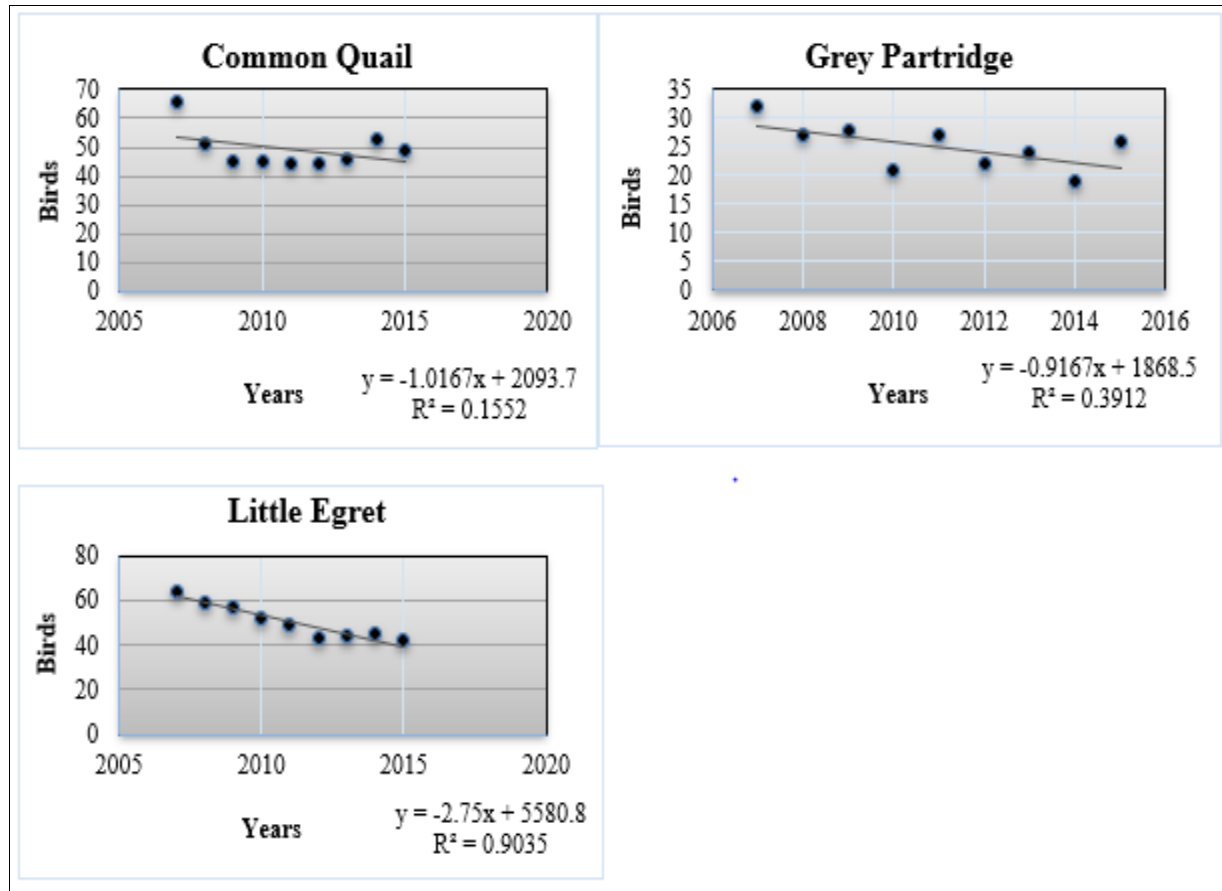


Fig. 4: Temporal trend of bird population at Rawalpindi district 2007-2015

Similarly, the strongest relationship was seen among Little Egret ( $R^2$  0.9035) and time in district Jhelum from 2007 to 2015 with a gradual decrease in its population. However, Common Quail somehow exhibited a weak relationship

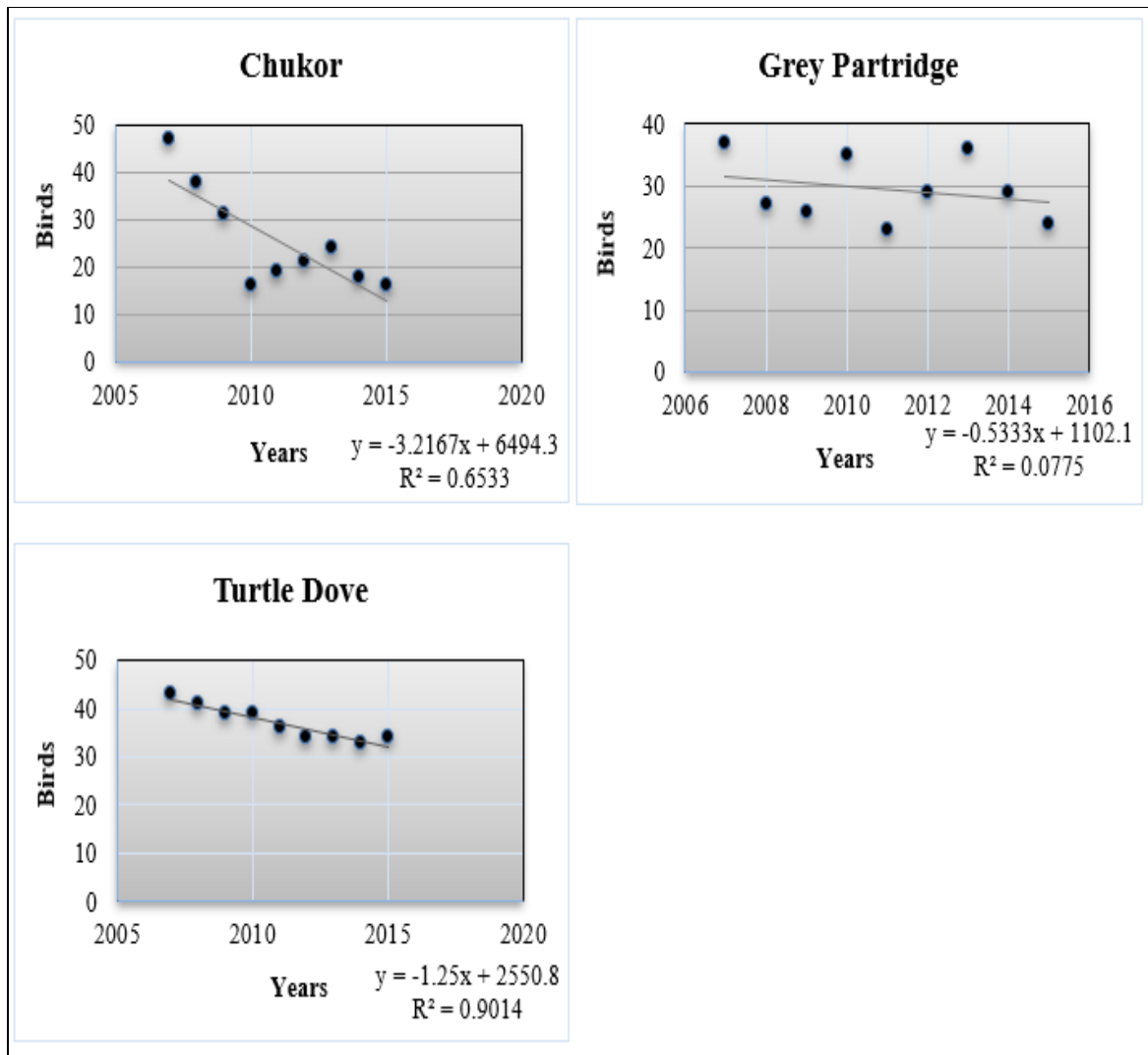
( $R^2$  0.1552) with time and seemed to be the least affected species in district Jhelum (see Fig. 5). Besides, Grey Partridge also showed a declining trend in its population through time and so on.



**Fig. 5:** Temporal trend of bird population at Jhelum District 2007-2015

The results of linear regression for district Attock revealed that the bird species found here were endangered as all of them had a declining trend in terms of population (see Fig. 6). The strongest relationship was seen between Turtle Dove ( $R^2$  0.9014) and time. In addition to this, a

strong relationship was also seen among Chukor population ( $R^2$  0.6533) and time. This species had witnessed a rapid decline in its population with every passing year in district Attock. However, Grey Partridge ( $R^2$  0.0775) seemed less affected species at Attock as it exhibited a weak relationship with time.



**Fig. 6:** Temporal trend of bird population at Attock District 2007-2015

The native bird species at district Chakwal were also found to be greatly endangered due to their declining trend in population with passing time. The results for linear regression analysis presented that Shikra, Common Quail and House Sparrow had a very strong relationship with time as their

population was rapidly vanishing out. On the other hand, House Crow seemed to be less affected as it exhibited a weak relationship ( $R^2$  0.0711) concerning time. However, the relationship between Grey Partridge ( $R^2$  0.0019) and time was found negligible in Chakwal during 2007-15 (see Fig. 7).



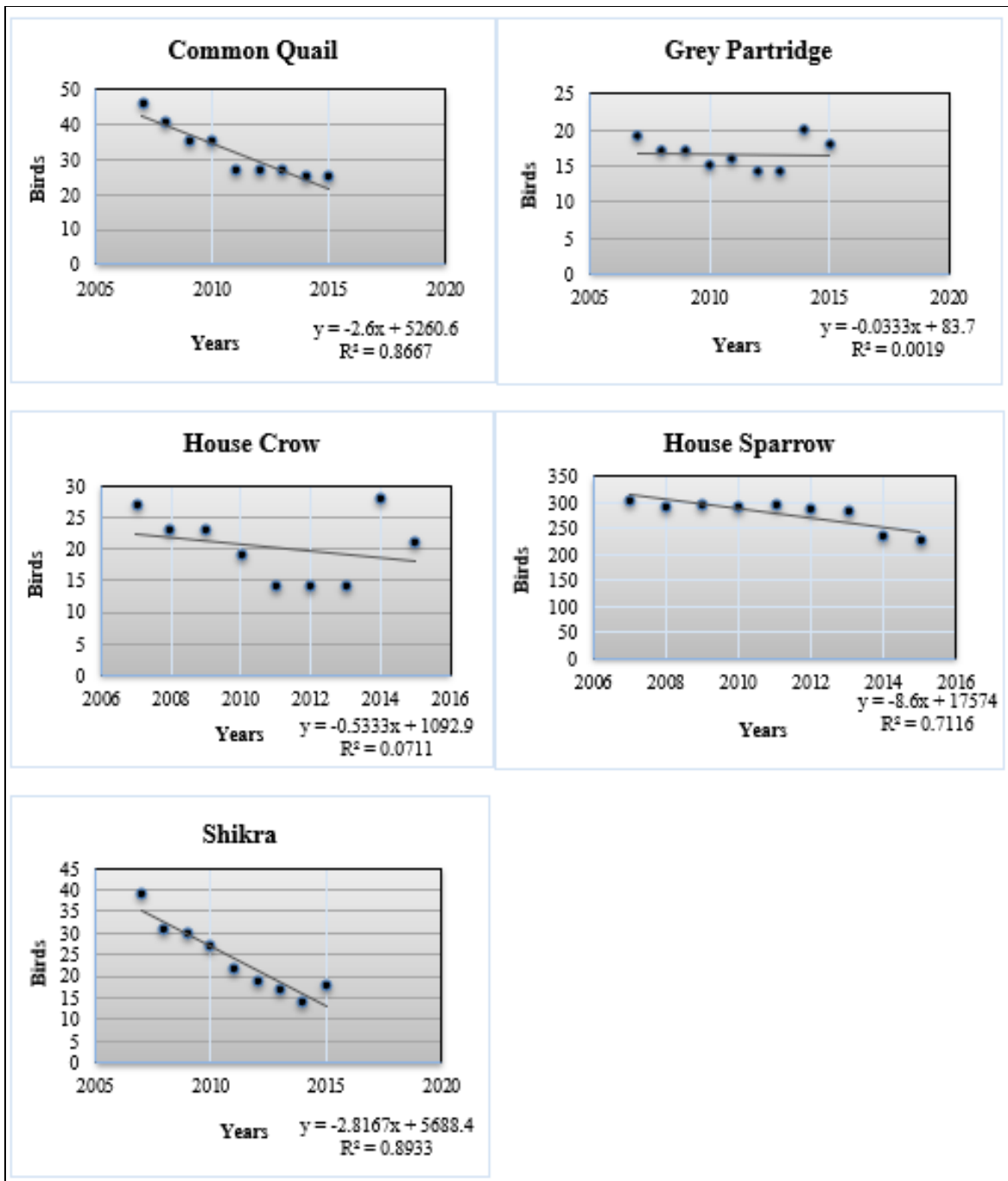


Fig. 7: Temporal trend of bird population at Chakwal District 2007-2015

**CONCLUSION**

The study concludes that Avian fauna has witnessed population decline and continuous decay in bird's richness in Rawalpindi division from 2007 to 2015. Most of the species which previously found

in abundance in the study area were latterly vanishing rapidly. The declining trend observed in bird's assemblage was mainly because of alterations in the natural environment due to population growth, urbanization, and climate modification took place in the study area. If serious

conservation actions not taken by the responsible authorities, then these species may become extinct locally. Anthropogenic activities like hunting, excessive tree cutting, and overgrazing should also be controlled for the preservation of biodiversity. Future researches should be carried out on the detailed analysis of the possible environmental and anthropogenic factors which have played an important role in the deterioration of bird richness and population decline within the study area.

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