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Population Composition and Status of Painted Stork (*Mycteria leucocephala*) In Chittaurgarh District, India with Special Reference to Aquatic Avian Fauna

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Abstract: A district survey to estimate the status of aquatic avian diversity with special reference to population composition and encounter rate of the Painted Stork (*Mycterialeucocephala*) was carried out from 2010 to 2014 in 6 tehsils of Chittaurgarh district. A total of 88 species of aquatic birds belonging to 58 genera, 19 families and 8 orders were recorded. Out of these 45.46%bird species were Winter Migratory and 54.54% species were Resident. Of these 22 were common, 32 uncommon and 34 were rare. According to IUCN category 1 species of bird is endangered, 1 species is Vulnerable and 6 species are Near Threatened category: The members of order Charadriiformes were dominant. A total of 1156 Painted Storks were counted during summer seasons of 5 years study. Maximum population of Painted Storks of 288 was recorded in 2014 whereas minimum 180 was recorded in 2010. Out of the total population, 92.99% adults and 7.01% juveniles were observed.Maximum numbers (23) of juveniles were recorded in 2012. Maximum encounter rate (1.0) was found in 2014 while minimum encounter rate (0.63) observed in 2010.From the tehsil-wise record it is reflected that Dungla tehsil stands at first place recording (mean 83.2.±18.94)during the five years while minimum (mean 14.0.±11.25) population was observed in Bari Sadri tehsil. During the study 9 reservoirs were identified that are used as major sites by most of the Painted storks.

Key words: Aquatic, avian diversity, Painted Stork (*Mycterialeucocephala*), population, adult, juvenile, encounter rate, habitat, elevation.

INTRODUCTION

Chittaurgarh district lies in south-eastern part of Rajasthan. It extends from 24°13 to 25°13' latitude and from 74°04' to 75°53' east longitude. The total geographical area of Chittaurgarh district is 7506.39 km^2.The Aravalli ranges are spreaded all over the district in continued as well as discontinued form. The district of Chittaurgarh has good forest resources as the total area under forests in the district is reported to be 2407 square kilometers. The major plant species available in the forest areas of Chittaurgarh include tree species like *Boswelliaserrata*, *Tectonagrandis*, *Lanneacoromandelica*, *Bauhinia racemosa*, *Cassia fistula*, *Tamarindusindica*, *Acacia leucophloea*, *Acacia catechu*, *Buteamonosperma*, *Anogeissuspendula*, *Wrightiatinctoria*, etc. As per the Champion and Seth[1]classification, the forest of Chittaurgarh region falls under– Tropical Forest.Many wetlands of southern Rajasthan have been studied on various aspects with avifauna[2-12]. Wetlands of the Chittaurgarh district harbor many migratory and residential aquatic birds especially Painted Stork (*Mycterialeucocephala*) which is found here abundantly.

Painted Stork (*Mycterialeucocephala*) is a large and brightly colored wading bird of South-West China and parts of South East Asia viz. India, Sri Lanka, Nepal, Myanmar, Vietnam and Cambodia[13]. In India, Painted storks are found virtually in the entire subcontinent[14], and can be found on fresh lakes, marshes and paddy fields[15-17]. It is white in color with black markings and delicate pink on the lower back[18], black and white lesser than wing covert, and a black band across the breast[15 &19]. Painted Stork had a large heavy yellow beak and orange-red head; the long legs are pinkish in color. Males and females look alike[15& 20].Painted Stork (*Mycterialeucocephala*) has been listed as a Near-threatened species under IUCN category[21]. The criteria itself reflects the threat to the species through various means.Like decline in habitat quality, hunting, agricultural pollution and competitors etc[22]. The present study has been conducted during the last five years 2010-14 to estimate the population of Painted Stork and other aquatic avifauna in and around the geographical boundary of the district.

MATERIAL AND METHODS

Regular monthly surveys were carried out following the imaginary grid method and line transect method after Gaston[23] from July 2010 to June 2014. Identification was based on Ali[13] and Grimmett[24]. To count aquatic species, a road transect was conducted with motorcycle at a speed about 20 to 40 km/hr. But when we reach at a particular reservoir we stop there and according to "Point count method" used to count total number of birds in a reservoir and its periphery.

Observations were also made with 10 X 50 binoculars. Bird records were maintained for the selected wetlands of the district viz. Bassi dam, Gousunda dam, Dunglatalab, Mangalwadtalab, Nangavali, Dhamana, Banakiya, Gambhridam.Based on the number of sightings and occurrence, the status of a given species was assigned as common, uncommon and rare. IUCN Red List status was followed IUCN Red List of Threatened Species[21].

RESULT AND DISCUSSION

A total of 88 species of aquatic birds belonging to 58 genera, 19 families and 8 orders were recorded. A list of bird species along with their local status and IUCN status is present in **Table 1**. Out of these 40(45.46%) bird species were Winter Migratory and 48 (54.54%) species were Resident. Of these 25.0% (n=22) were common, 36.36% (n=32) uncommon and 38.63% (n=34) were rare. (**Fig 1**)

Table 1: Aquatic avian species recorded in Chittaurgarh district during 2010 to 2014.

S. No.	Scientific name	Common name	Local status	IUCN status
ORDER : Podicipitiformes				
	Tachybaptusruficollis Pallas	Little Grebe	C, Re	
ORDER : Pelecaniformes				
	PhalacrocoraxnigerVieillot	Little Cormorant	C, Re	
	Phalacrocoraxfuscicollis Stephens	Indian Cormorant	R, Re	
	Phalacrocoraxcarbo Linn.	Great Cormorant	R,Re	
	Anhinga rufa melanogaster Pennant	Darter	R, Re	NT
ORDER : Ciconiiformes				
	Egrettagarzetta Linn.	Little Egret	C, Re	
	Ardeacinerea Linn.	Grey Heron	Uc,Wm	
	Ardeapurpurea Linn.	Purple Heron	Uc, Re	
	Ardea alba Linn.	Great Egret (Large Egret)	Uc, Re	
	EgrettaintermediaWagler	Intermediate Egret	C, Re	
	Bubulcus ibis Boddaert	Cattle Egret	C, Re	
	Ardeolagrayii Sykes	Indian Pond Heron	C, Re	
	ButoridesstriatusHorsfield	Little Heron	C, Re	
	Nycticoraxnycticorax Linn.	Black-crowned Night Heron	R, Re	
	Botaurusstellaris Linn	Eurassian bittern	R, Wm	
	Mycterialeucocephala Pennant	Painted Stork	R, Re	NT
	AnastomusoscitansBoddaert	Asian Openbill-Stork	R, Re	
	CiconiaepiscopusBoddaert	Woolly-necked Stork	R, Re	
	PlegadisfalcinellusLinne	Glossy Ibis	C, Re	
	Threskiornisaethiopicamelanocephalus Latham	Black-headed Ibis	C, Re	NT
	PseudibispapillosaTemminck	Black Ibis	C, Re	
	Platalealeucorodia Linn.	Eurasian Spoonbill	R, Re	
	Phoenicopterusroseus Pallas	Greater Flamingo	R, Wm	
ORDER : Anseriformes				
	DendrocygnajavanicaHorsfield	Lesser Whistling-Duck	R, Re	
	Anserindicus Latham	Bar-headed Goose	R, Wm	
	Tadornaferruginea Pallas	Ruddy Shelduck	R, Wm	
	Sarkidiornismelanotos Pennant	Comb Duck	R, Re	
	NettapuscoromandelianusGmelin	Cotton Pygmy-Goose	R, Re	
	Anseranser Linn.	Greylag goose	C, Wm	
	Anasstrepera Linn.	Gadwall	Uc,Wm	
	Anaspenelope Linn.	Eurasian Wigeon	Uc,Wm	
	Anasplatyrhynchos Linn.	Mallard	Uc,Wm	
	Anaspoecilorhyncha J.R. Forster	Spot-billed Duck	Uc, Re	
	Anasclypeata Linn.	Northern Shoveller	Uc,Wm	
	Anasacuta Linn.	Northern Pintail	Uc,Wm	
	Anascrecca Linn.	Common Teal	Uc,Wm	
	Aythyaferina Linn.	Common Pochard	Uc,Wm	
	Aythyafuligula Linn.	Tufted Pochard	Uc,Wm	
ORDER : Gruiformes				
	Grusantigone Linn.	Sarus Crane	R,Re	VU
	Grusgrus	Common Crane	R,Wm	
	Amaurornisphoenicurus Pennant	White-breasted Waterhen	Uc, Re	

	Porphyrioporphyrio Latham	Purple Swamphen (Purple Moorhen)	Uc,Re	
	Gallinulachloropus Blyth	Common Moorhen	C,Re	
	Fulicaatra Linn	Common Coot	C,Re	
	Sypheotidesindica Miller	Lesser Florican	R,Re	EN
ORDER : Charadriiformes				
	HydrophasianuschirurgusScopoli	Pheasant-tailed Jacana	Uc,Re	
	Metopidiusindicus Latham	Bronze-winged Jacana	R,Re	
	CharadriusdubiusLegge	Little Ringed Plover	Uc,Re	
	Charadriusalexandrinus Linn.	Kentish Plover	Uc,Wm	
	VanellusmalarbaricusBoddaert	Yellow-wattled Lapwing	R, Re	
	VanellusindicusBoddaert	Red-wattled Lapwing	C,Re	
	Vanellusleucurus Lichtenstein	White-tailed Lapwing	R,Wm	
	Gallinagostenura Bonaparte	Pintail Snipe	Uc,Wm	
	Gallinagogallinago Linn.	Common Snipe	Uc,Wm	
	Gallinago minima Brunnich	Jack Snipe	R, Wm	
	Limosalimosa Linn.	Black-tailed Godwit	Uc, Wm	NT
	Limosalapponica Linn.	Bar-tailed Godwit	Uc, Wm	
	Numeniusarquata Linn.	Eurasian Curlew	R, Wm	NT
	Tringaerythropus Pallas	Spotted Redshank	R, Wm	
	Tringatotanus Linn.	Common Redshank	C, Wm	
	TringastagnatilisBechstein	Marsh Sandpiper	Uc,Wm	
	TringanebulariaGunnerus	Common Greenshank	Uc,Wm	
	Tringaochropus Linn.	Green Sandpiper	Uc,Wm	
	Tringaglareola Linn.	Wood Sandpiper	C, Wm	
	Actitishypoleucos Linn.	Common Sandpiper	C, Wm	
	CalidrisminutaLeisler	Little Stint	C, Wm	
	Philomachuspugnax Linn.	Ruff	Uc,Wm	
	Himantopushimantopus Linn.	Black-winged Stilt	C,Re	
	Recurvirostraavosetta Linn.	Avocet	R,Wm	
	Burhinusoedicnemus Linn.	Eurasian Thick-knee	R,Re	
	Esacusmagnirostris Cuvier	Great Thick-knee	R,Re	
	CursoriuscoromandelicusGmelin	Indian Courser	Uc,Re	
	GlareolalacteaTemminck	Small Indian Pratincole	R,Re	
	LarusbrunnicephalusJerdon	Brown-headed Gull	R,Wm	
	GelochelidonniloticaGmelin	Gull-billed Tern	R,Wm	
	Sterna aurantia J.E. Gray	River Tern	C,Re	
	Sterna acuticauda Gray	Black-bellied Tern	Uc,Re	NT
	Chlidoniashybridus Stephens	Indian Whiskered Tern	R,Wm	
ORDER : Columbiformes				
	Columba livia Strickland	Indian Blue Rock Pigeon	C,Re	
ORDER : Coraciiformes				
	AlcedoatthisReichenbach	Small Blue Kingfisher	R,Re	
	Pelargopsiscapensis Linn.	Storkbilled Kingfisher	R,Re	
	Halcyon smyrnensis Linn.	White-breasted Kingfisher	C,Re	
	CerylerudisReichenbach	Lesser Pied Kingfisher	Uc,Re	
	Motacilla alba Linn.	White Wagtail	Uc,Wm	
	MotacillamadaraspatensisGmelin	Large Pied Wagtail	Uc,Re	
	Motacillacitreola Pallas	Yellowheaded Wagtail	Uc,Wm	
	MotacillaflavaBillberg	Yellow Wagtail	Uc,Wm	
	MotacillacinereaTunstall	Grey Wagtail	R,Wm	

Status: C= Common, Uc= Uncommon, R=Rare, Re= Resident, Wm = winter migrant,
IUCN Status: EN= Endangered, VU=Vulnerable, NT= near threatened.

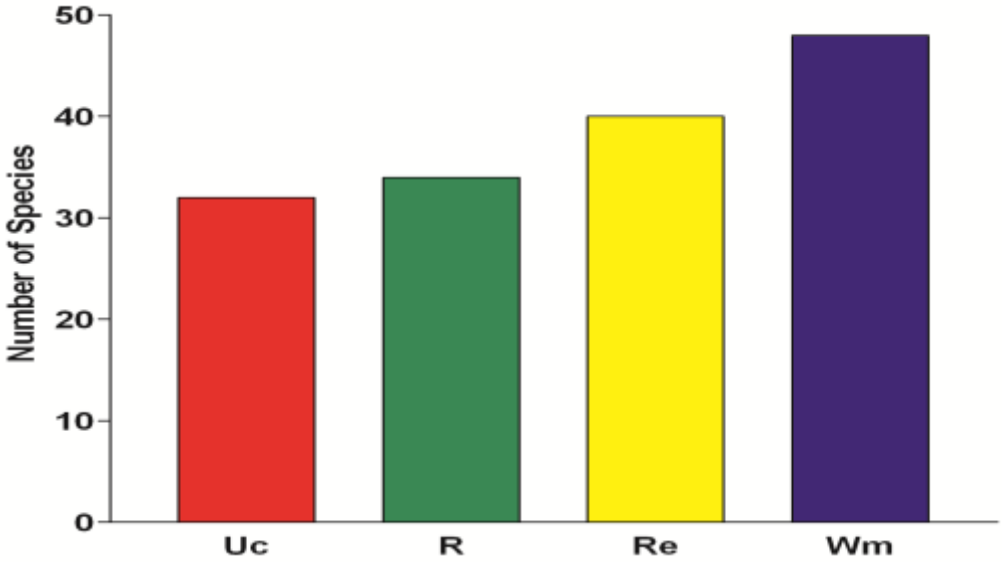

Figure 1: Graph showing status and occurrence of avian diversity in the study area.

(Status: C= Common, Uc= Uncommon, R=Rare, Re= Resident, Wm = winter migrant)

According to IUCN category 1 species of bird is Endangered Lesser Florican*Sypheotidesindica*, 1 species is Vulnerable Indian Sarus crane*Grusantigoneantigone* and 6 species are Near Threatened category:Darter*Anhinga rufa melanogaster*, Painted Stork*Mycterialeucocephala*, Black-headed Ibis*Threskiornisaethiopicamelanocephalus*, Black-tailed Godwit*Limosalimosa*, Eurasian Curlew*Numeniusarquata*, Black-bellied Tern*Sterna acuticauda*,). The members of order Charadriiformes weredominant by 33 species followed by Ciconiiformes with 18 species (**Fig 1**), Anseriformes with 15 species, Coraciiformes with 9 species, Gruiformes with 7 species, Pelecaniformes with 4 species, and Podicipitiformes andColumbiformeswith one species each (**Fig 2**).

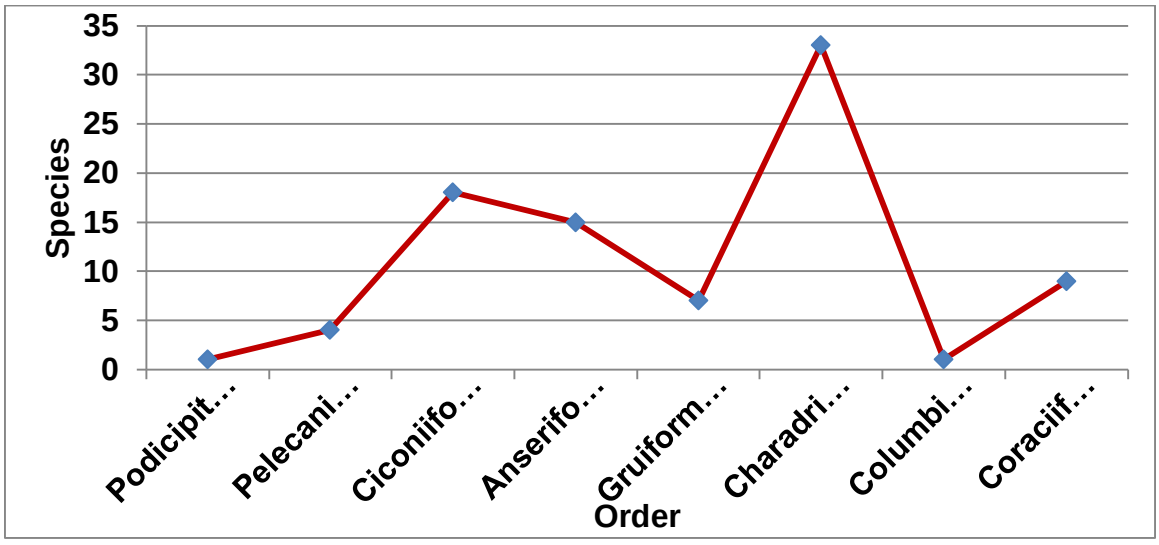

Figure 2: Total number of species in each order recorded in Chittaurgarh District during study period.

ABUNDANCE OF PAINTED STORK

A tehsil wise survey was conducted in 35 reservoirs in the district and Painted storks were counted in 18 reservoirs of six tehsils of the districts (**Fig. 3**).

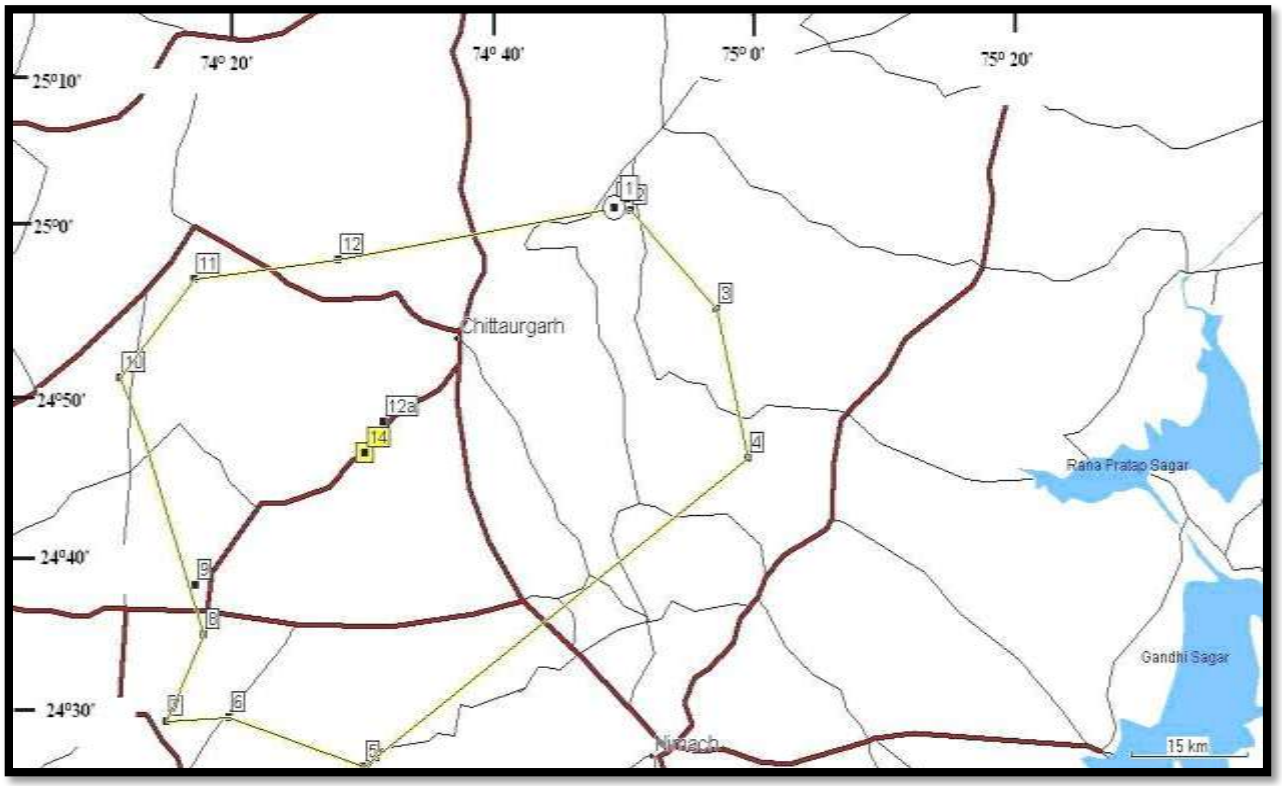

Figure 3: Distribution Range of painted strok (*Mycterialeucocephala*) in Chittaurgarh District.

A total of 1156 Painted Storks were counted during summer seasons of 5 years study. Maximum population of Painted Storks of 288 was recorded in 2014 whereas minimum 180 was recorded in 2010 (mean 231.2± 47.85). Out of the total population, 1075 (92.99%) adults and 81 (7.01%) juveniles were observed (**Table 2**).

Table 2: Population composition and encounter rate of painted storks in Chittaurgarh district in between 2010 to 2014.

Year	Population composition of Painted Storks			Encounter rate
	Adult	Juvenile	Total	
2010	171	9	180	0.63
2011	188	14	202	0.7
2012	253	23	276	0.96
2013	195	15	210	0.73
2014	268	20	288	1.0

A total of 180 Painted storks were counted in 2010, 202 in 2011, 276 in 2012, 210 in 2013 and 288 in 2014 during survey. During 2010 survey, 95% (n=171) adults and 5% (n=9) juveniles were reported. In

2011, 93.07% (n=188) adults with 6.93% (n=14) juveniles and during 2012, 91.67 % (n=253) adult and 8.33% (n=23) juvenile were observed. In 2013, 92.86% (n=195) adults with 7.14% (n=15) juveniles and during 2014, 93.06 % (n=268) adult and 6.94% (n=20) juvenile were observed. Maximum numbers (23) of juveniles were recorded in 2012. Maximum encounter rate (1.0) was found in 2014 while minimum encounter rate (0.63) observed in 2010.

TEHSIL - WISE OCCURRENCE

From the pooled data of five years census of summer in six tehsils, it is reflected that the maximum share of total painted stork remained highest in Dungla tehsil whereas, lowest record was found in Bari Sadri through summers (**Fig 4**).

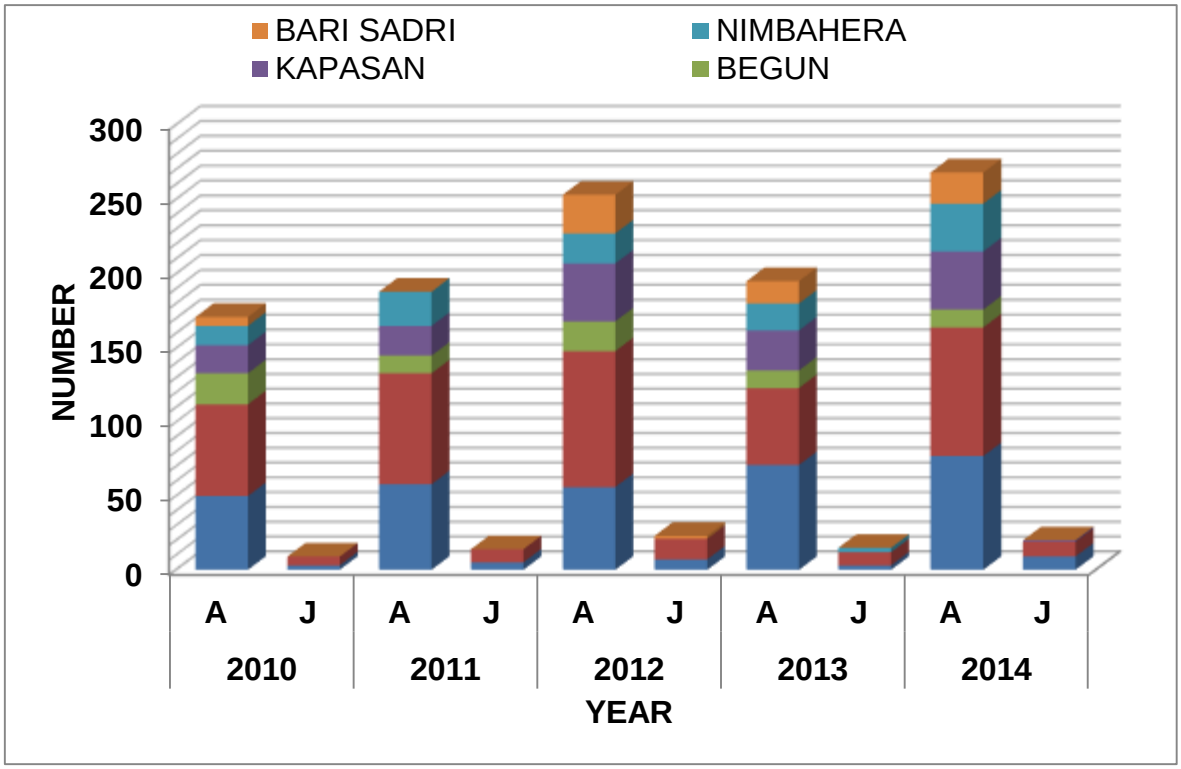

Figure 4: Tehsil wise population composition of painted strok (*Mycterialeucocephala*) in Chittaurgarh District in the study period.

From the tehsil-wise record it is reflected that Dungla tehsil stands at first place recording 35.98% (mean 83.2.±18.94) during the five years. Chittaurgarh tehsil recorded 29.32% (67.8.±12.8), Kapasan tehsil 12.5% (29.0.±10.07), Nimbahera tehsil 9.42% (21.8.±6.83) and stood at second, third and fourth place respectively. Minimum 6.05% (14.0.±11.25) population wasobserved in Bari Sadri tehsil (**Fig 5**). In 2010, 37.8% (68) Painted storks were found at Dungla tehsil. 29.44% (53) storks preferred Chittaurgarh tehsil, while 11.67% (21) in Begun tehsil. 19 (10.56%) at kapasan tehsil and 13 (7.22%) storks at Nimbahera tehsil were recorded. Minimum number found at Bari sadri (6). In 2011, maximum 84 (41.58%) Painted storks preferred Dungla tehsil. Chittaurgarh tehsil was second most preferred site with 63 (31.19%) storks, followed by 23 (11.39%) storks at Nimbahera tehsil. kapasan tehsil had 9.9% (20) storks, followed by Begun tehsil with 5.94% (12) storks. Bari sadri did not have any stork population in this year.

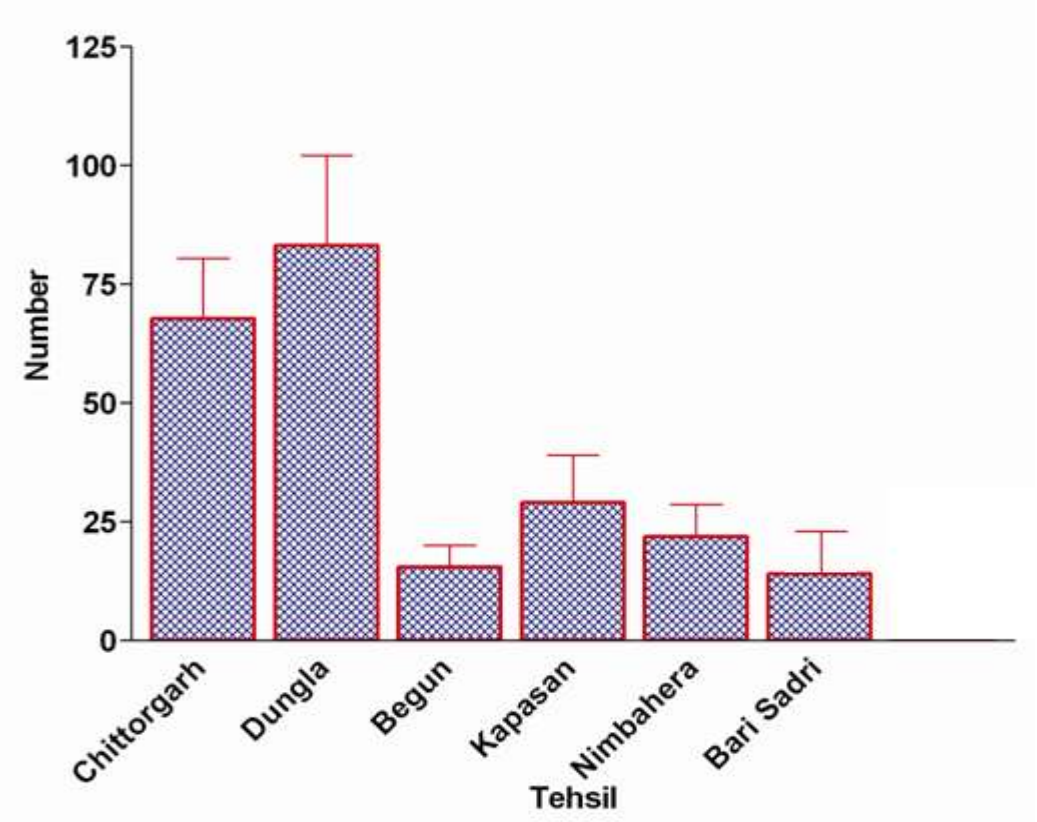

Figure 5: Tehsil wise mean population of painted strok***Mycterialeucocephala*** in the study area.

In 2012, 38.41% storks were found at Dungla tehsil, followed by 22.83% at Chittaurgarh tehsil, 14.13% at kapasan, 10.14% at Barisadri, 7.25% storks each at Nimbahera and Begun were recorded.

In 2013, 74 Painted storks were found at Chittaurgarh tehsil. 61 storks preferred Dungla tehsil, while 27 in kapasan. 21 at Nimbahera and 15 storks at Barisadri were recorded. Minimum number found at Begun (12).During the entire study period 9 reservoirs were identified that are used as major sites by most of the Painted storks. From the year wise record of total Painted stork population in these wetlands, it is evident that total 180Painted storks, constituting approximately 78.88% part of the summer census were found in 2010. 202Painted stork (78.21%) were found in 2011. 276Painted stork (82.97%) in 2012, 210 (83.8%) in 2013 and 288 (78.81%) in 2014 were found in the nine wetlands.

JUVENILE TO ADULT RATIO

Throughout the study duration the maximum juvenile-adult ratio was found in Dungla, while, minimum was found in Kapasan tehsil. The maximum and minimum juvenile-adult ratio during summer counts was 0.13 and 0.007 (0.05±0.05).

RANGE DENSITY

The range density within the Occurrence, obtained in the present research was minimum 5.2 individuals/100 km^2 and maximum 8.32 individuals/100 km^2.

DISTRIBUTION OF PAINTED STORKS AT DIFFERENT HEIGHTS

In the study area, Painted Storks at different elevations were counted during summer of the last five years i.e 2010, 2011, 2012, 2013 and 2014 in six tehsils. The data reveals the fact that maximum average population (Mean) of Painted Storks is found during year 2014 followed by that in 2012, 2013, 2011 and 2010 (**Table 3**).

Table 3: Population of Painted Storks in Summer Seasons in Different Altitudinal Zones (2010-2014).

Elevation (in feet)	2010			2011			2012			2013			2014			Total		
	A	J	T	A	J	T	A	J	T	A	J	T	A	J	T	A	J	T
1300-1400	53	3	56	65	5	70	72	7	79	89	6	95	95	9	104	374	30	404
1400-1500	51	-	51	40	-	40	87	2	89	54	-	54	81	1	82	313	3	316
1500-1600	67	6	73	83	9	92	94	14	108	52	9	61	92	10	102	388	48	436

The population study at different elevations reveals that maximum population of Painted Storks (87.8.±19.77) is found in summer season at the height of 1500-1600 fts, followed by the population at the height of 1300-1400 fts (80.8.±19.2) and 1400-1500 fts (63.2.±21.16) (**Fig 6**).

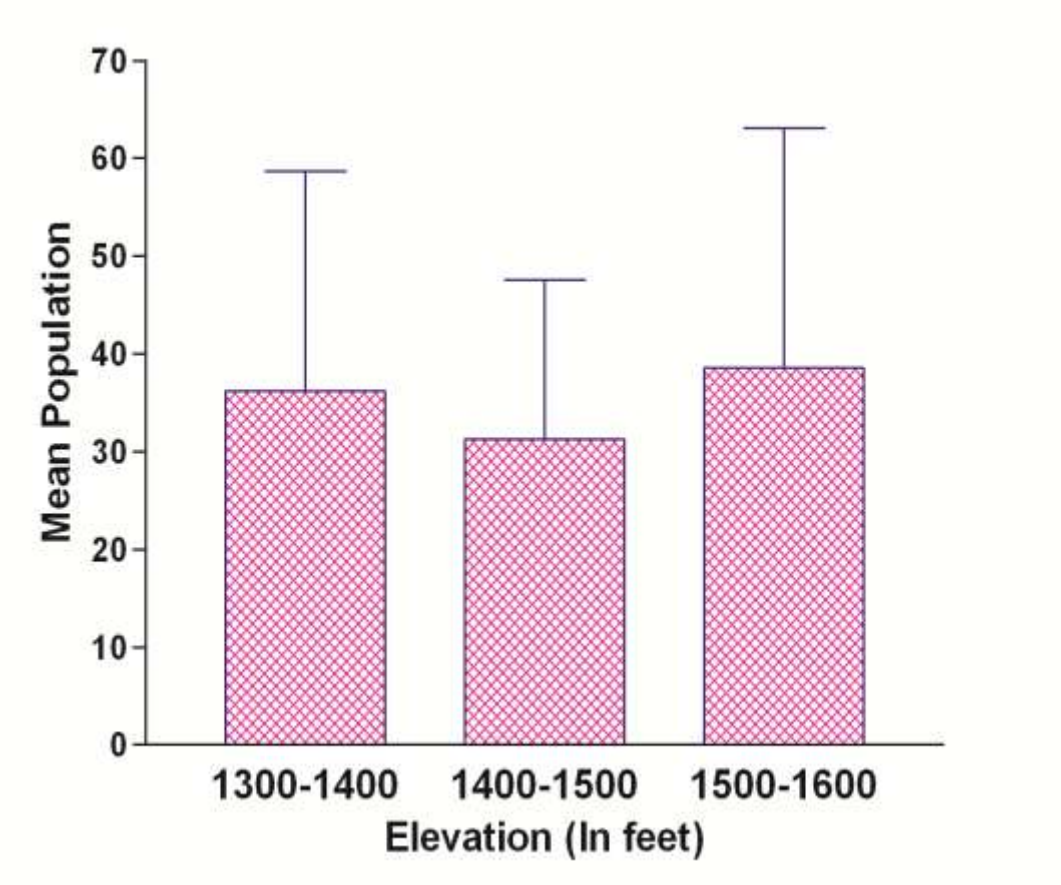

Figure 6: Mean Population of Painted Storks in summer seasons in different elevation ranges in the study area (2010-2014).

Earlier census[11] was carried out in 6 districts of South Rajasthan during 2008 and 2009 and highest count, 138 and 158 number of painted stork was found in Chittaurgarh district. The encounter rate found by Koli*et al*.[11] in Chittaurgarh district was 1.31 in 2008 and 1.51 in 2009.

In the present research summer counts of Painted storks' population in Chittaurgarh district (180, 202, 276, 210 & 288 during 2010 to 2014 respectively) are more than any other counts of the previous studies. Even the minimum counts of summer season during the study period stand more than any previous record. The encounter rate is lower than previous census[11] because in the present study the length of transect is higher than previous study.Sunder[25] observed that painted stork and some other aquatic bird prefer those wetlands having low level of human disturbance. Human activities affect nesting, loafing and foraging activities of water birds. Lowering feeding rates reduce energy uptake. So, birds prefer disturbance free wetlands to secure food for themselves and for their nesting.

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