



## People perception on wildlife in national Chambal sanctuary, Madhya Pradesh, India

Yogesh Singh<sup>1\*</sup>, Rajesh K Gurjwar<sup>2</sup>, Ramkumar Lodhi<sup>3</sup>, Rao RJ<sup>4</sup>

<sup>1</sup> SOS in Environmental Science (IGAEEER), Jiwaji University, Gwalior, Madhya Pradesh, India

<sup>2,3</sup> Conservation Biology Lab, SOS in Zoology, Jiwaji University, Gwalior, Madhya Pradesh, India

<sup>4</sup> Barkatullah University, Bhopal, Madhya Pradesh, India

### Abstract

Today, successful wildlife conservation plan involves not only an understanding of the biology of the species and its habitat, but also an understanding of local attitudes toward and knowledge about the wildlife species and attitudes toward possible management approaches to the wildlife species. Human-induced action in natural landscapes tends to increase interaction between wildlife and people inside and outside protected areas. People Perceptions provide an important means of assessing the performance of conservation projects so that better policies on wildlife may be developed for effective biodiversity protection and the wellbeing of people living near protected areas.

**Keywords:** people perceptions, wildlife species, conservation, etc

### Introduction

Over 20 million km<sup>2</sup> of the planet are covered by protected areas (PAs) that harbour extraordinary biodiversity while home to millions of people (Juffe Bignoli *et al.*, 2014) <sup>[9]</sup>. Much of world's biodiversity is concentrated in areas where dense human populations have grown by 15% between 2000 and 2010 (Williams, 2011) <sup>[21]</sup>. The existing PA network would need to expand from 12 to 17% of the planet to achieve conservation targets for terrestrial vertebrates alone, and even more if other species were to be included (Visconti *et al.*, 2016) <sup>[18]</sup>. Anthropogenic activities fragment natural landscapes, leading to increased interactions between wildlife and people inside and outside protected areas (PAs; Watson *et al.*, 2016). Such interactions could be positive such as nature-based tourism that encourages people's affinity for wildlife and wild places while providing revenue and employment (Sinha, Qureshi, Uniyal, & Sen, 2012) <sup>[15]</sup>. Other benefits include pollination or hydrological services (Chang, Karanth, & Robbins, 2018; Kremen *et al.*, 2007; Nesper *et al.*, 2017; Tschardtke *et al.*, 2011) <sup>[3, 23, 12, 17]</sup>. Among vertebrates, amphibians and reptiles are considered the most susceptible groups to the changes imposed by human activities (Barrett and Guyer, 2008; Cushman, 2006; Wake and Vredenburg, 2008). <sup>[1, 4, 19]</sup> In fact, amphibians and reptiles have a significantly higher proportion of threatened species than birds or mammals (IUCN, 2020; Nori 015; Stuart, 2004) <sup>[8, 13, 16]</sup> Madhya Pradesh is the second largest state in India with an area of 3, 08,245 km<sup>2</sup> covers almost 9.38% of geographical area of the country of which 25.13% is forested. It has the largest forest cover 77,462 km<sup>2</sup> among all the Indian states. It has 9 National Parks and 25 Wildlife Sanctuaries and 5 Tiger Reserves as Protected Areas which constitutes 3.25% of total geographic area (WII Report, 2016) <sup>[22]</sup>. People Perceptions provide an important means of assessing the performance of

conservation projects so that better policies may be developed for effective biodiversity protection and the wellbeing of people living near protected areas. Exploring perceptions in different facets of conservation initiatives can help identify aspects of the initiatives that are succeeding and those that are failing (Haruna and Raphael, 2020) <sup>[7]</sup>. Today, successful wildlife conservation plan involves not only an understanding of the biology of the species and its habitat, but also an understanding of local attitudes toward and knowledge about the species and attitudes toward possible management approaches to the species. The present paper was report the understanding the people perception on wildlife management in National Chambal Sanctuary.

### Study Area

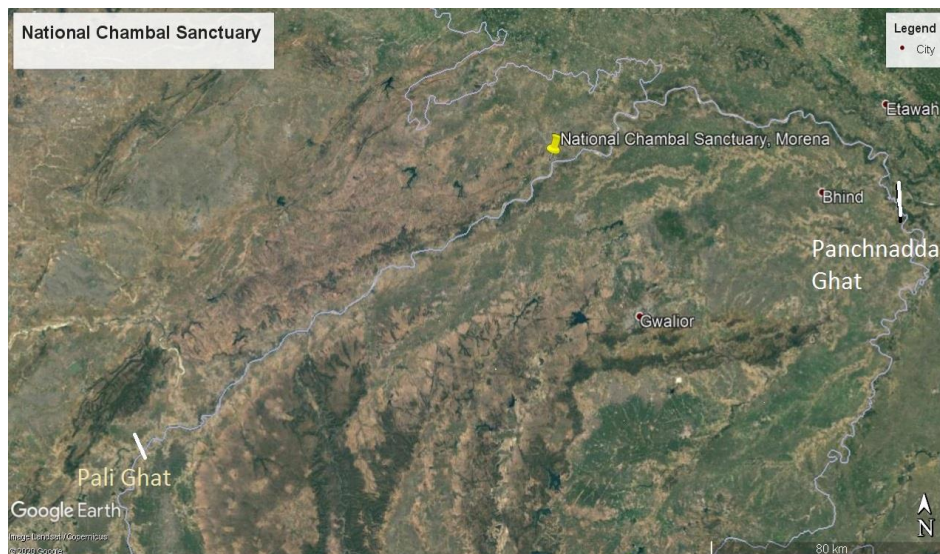
#### National Chambal Sanctuary

The National Chambal Sanctuary (NCS), was notified in 1978 by Madhya Pradesh, under Section 18(1) of the Wildlife Protection Act, 1972, comprises of 600km of the 965km long Chambal River. It was notified in after 1 year in 1979 by Rajasthan and Uttar Pradesh Governments. It is the longest riverine and first sanctuary in India and managed by three states viz., Madhya Pradesh, Rajasthan and Uttar Pradesh. The Chambal River originates from the summit of Janapav hill in the Vindhyan range at an altitude of 854m above the median sea level (MSL) at 22°27' N and 75°37' E in Mhow, Indore, Madhya Pradesh, India. The river has a course of 965 km up to its confluence with the Yamuna River in the Etawah districts of Uttar Pradesh. A 600 km stretch of the Chambal River between Jawahar Sagar dam and Panchhnada confluence (Yamunha and Chambal River) has been protected as the National Chambal Sanctuary for the conservation of wildlife species.

The upper Chambal basin is marked by hilly terrain of the

Vindhyan chain, with fairly sloping terrain along the Chambal River and its tributaries. The climate of the basin is affected by its location with respect to the Tropic of Cancer and the presence of the Vindhyan ranges in the upper reaches. The area is semiarid and the temperature in the region varies from 2° to 48°C during winter and summer, respectively. The study area is lies between Pali (upstream point of the National

Chambal Sanctuary, 0 km) and Panchhnada (downstream point of the Sanctuary, 425 km) (Fig.–01). The National Chambal Sanctuary is easily accessible from Gwalior (75km). The sanctuary is about 10 km away from South-East of Dholpur, Rajasthan which is the nearest railway station and the town and the sanctuary is 25km away from North-west of Morena town. The nearest airport is located at Gwalior



**Fig 1:** Map showing the area of National Chambal Sanctuary

### Methodology

Field visits was made in monthly basis in study area. Methodology are set of questions based on sources of data obtain from primary and secondary sources. Data was collected in two stages.

In first stage, interview based semi-structured questionnaire survey was conducted in randomly selected concern respondents in selected villages. At the second stage, we were set the questionnaire for the concerned departments which directly and indirectly related to wildlife management and thus, secondary data was obtained. Field visits to the study area were carried out between January 2017 to December 2019 I have interacted with the forest staff and officials to fill the questionnaire and an interview method was used for data

collection from the illiterate people in National Chambal Sanctuary.

### Sample Size

National Chambal Sanctuary has a large area, managed by 3 states and it has 226 total villages in 2 kilometer periphery of the sanctuary area under Madhya Pradesh (Table – 01). A total of 2240 respondents in 125 villages were selected for present study in National Chambal Sanctuary. Data of population in National Chambal Sanctuary was varied, the highest population were found in Khandoli (9601) village with total families 1814.

While the lowest population was lived in Kuroli (119) villages with total families 21.

**Table 1:** Selected Respondents in National Chambal Sanctuary

S. No.	Village	Family	Population	Respondents
1	Akon	336	1901	19
2	Arjunpura	79	459	29
3	Aroli	326	1948	15
4	Arrodari	512	2217	15
5	Atar	624	3231	22
6	Badpura	156	936	12
7	Banthar	55	329	10
8	Banwara	472	2229	16
9	Barhi	731	4098	32
10	Barkapura	102	723	21
11	Baroli	362	1592	12
12	Barotha	297	1359	12
13	Bateshavpa Dhavapura	455	1876	16
14	Beelpur	558	2473	25

15	Bhadawali	323	2141	22
16	Bhanpur	188	1190	13
17	Bhatpura	90	370	8
18	Bichpuri	308	1622	20
19	Bijora	247	1443	12
20	Biloni	62	250	10
21	Bindwa	341	1698	12
22	Bindwa Deogarh	321	2095	18
23	Brijgadhi	721	3967	31
24	Chainpur	103	450	10
25	Chapak	204	1306	12
26	Chhinwara	321	1678	16
27	Chilonga	200	1163	8
28	Dandoli	420	2002	29
29	Dang Sarkar	93	542	16
30	Danteti	364	1634	12
31	Digwar	369	1835	28
32	Dubawali	188	732	16
33	Fatehpur T. Manpur	42	205	10
34	Gadora	270	1689	21
35	Gaji Kheda	84	490	12
36	Gondoli	713	3168	34
37	Goonjh	351	1938	21
38	Gorkha	128	791	10
39	Gos Basai	66	389	12
40	Gudha Chambal	620	3683	31
41	Gurja	195	1080	12
42	Himmatpura	124	630	17
43	Jaini	888	3670	29
44	Jaitpur Chambal	41	244	12
45	Jajepura	148	874	13
46	Jakhona	1369	7413	19
47	Jamurdi	311	1211	16
48	Javai	36	197	5
49	Jawasa	262	1017	10
50	Jimarchha	326	1713	14
51	Kachhinda	35	236	12
52	Kachhpura	52	362	10
53	Kachhui	154	1102	13
54	Kaimara Khurd	192	1078	12
55	Kainthari	760	4437	31
56	Kalarghati	92	467	10
57	Kanera	819	4247	38
58	Kathawana	270	1344	16
59	Khandoli	1814	9601	56
60	Kheda Digwar	478	2352	31
61	Kherat	199	1059	12
62	Kheroda Khurd	110	587	19
63	Khirkhiri	274	1298	13
64	Khuavali	22	120	5
65	Kisroli	136	828	10
66	Kolhu Danda	283	1594	16
67	Koshath	556	3489	36
68	Kotara	189	1092	11
69	Kuraitha	899	5227	42
70	Kuroli	21	119	5
71	Kuthiyana	672	3252	31
72	Liloli	59	303	5
73	Ludhawali	936	5081	42
74	Maghora	182	1292	14
75	Makrod	303	1279	16
76	Mal Basai	173	1052	11
77	Masoodpur	241	1288	16

78	Mathurapura	90	577	11
79	Milaua	211	1308	15
80	Milawali	199	819	12
81	Nadigaon	450	2221	21
82	Nagra Porsa	563	3284	33
83	Nakhloli	139	938	13
84	Naripura	186	997	12
85	Nawali Brindawan	300	1387	15
86	Nayakpura	292	1533	18
87	Nimach	298	1163	16
88	Nitanwas	443	2009	22
89	Norawali Kheron	855	3871	39
90	Palari	125	671	13
91	Pali	37	227	5
92	Pancho	919	3731	48
93	Parashta	99	423	10
94	Pariyaya	244	1675	16
95	Piprai	553	3656	28
96	Piprani	91	408	12
97	Rachhed	624	3599	26
98	Rahu Ka Gaon	741	3700	23
99	Raipur	1365	7368	36
100	Rajiapura Limana	300	1260	10
101	Rama	513	3536	22
102	Ranipura	36	126	10
103	Ratan Basai	800	5127	43
104	Repura	95	537	12
105	Rijhenta	203	922	11
106	Rithaura Marjadgarh	69	364	8
107	Rithora Khurd	154	1033	10
108	Samanna	153	859	12
109	Samarsa	264	1070	14
110	Saraya	422	2733	25
111	Sarsaini	852	4146	41
112	Sathon	372	1723	17
113	Sewapur	164	720	12
114	Shankarpur	355	1644	15
115	Sikheda	189	748	10
116	Sirsod	90	426	11
117	Sudhara	493	1964	16
118	Sukhpura	281	281	10
119	Sukhwas	251	1184	14
120	Surajpura	65	370	8
121	Tajpur	256	1417	9
122	Tongni	147	605	12
123	Unchakheda	124	572	12
124	Useth	913	5247	42
125	Vindwa Chambal	166	886	10
	Total	42374	221142	2240

### Major Wildlife

The main aquatic wildlife in the National Chambal sanctuary are Mugger, Gharial seven species of freshwater turtles, dolphins, otters and 308 species of birds. The river system harbours the largest population of critically endangered

Gharial, which is endemic to the Indian subcontinent, and the highest density of the endangered Gharial endemic to Gangetic System. The fauna of the sanctuary also included Hyena, Jackal, Carakal, Cheetal, Chinkara, Neelgai, Sambhar, Mongoose, Monitor lizard etc. (Fig. – 02).

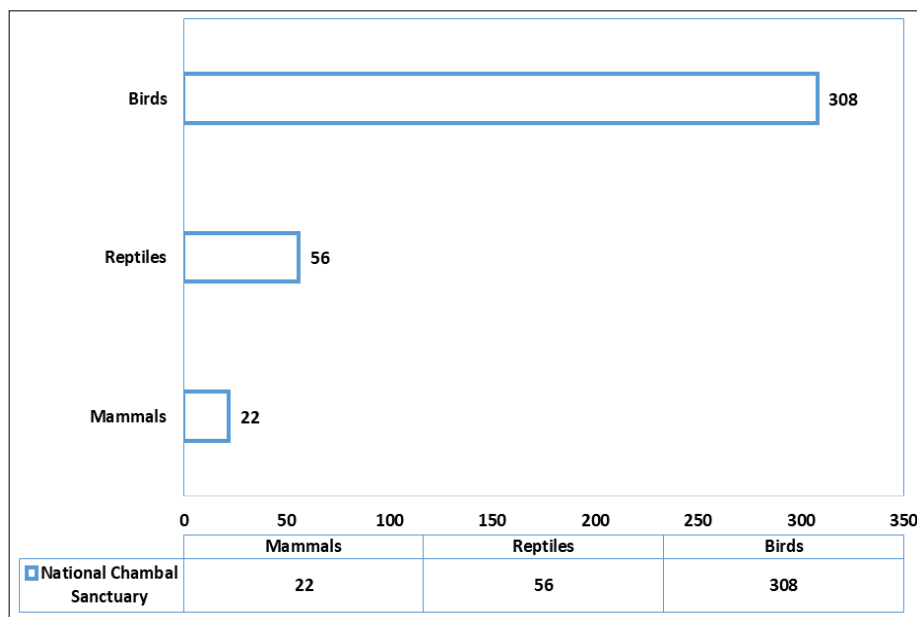


Fig 2: Important Wildlife Species in National Chambal Sanctuary

### Management Plan of National Chambal Sanctuary (NCS)

The most recent management plan for the National Chambal Sanctuary was written by the Conservator of Forest, Shri. R. Sreenivasa Murthy. This decade-long plan recommended a renewal of activities such as the annual survey; rear and release program for the Gharial and other wildlife species.

### Human Induced Activities in National Chambal Sanctuary

Major socio-economic issues in the sanctuary were poverty and illiteracy. These issues further give rise to anti-social elements. People are largely dependent on the river as a source of water. Locals also install individual water pumps to draw water for agriculture. Locals are also dependent on the Chambal River and the surrounding ravines for Non Timber Forest Produce (NTFP), fuel wood and fodder.

### Illegal Sand mining

Activities such as sand mining, stone mining and fishing have adverse effects on the quality of the habitat. Sand-mining along the banks of the Chambal has a severe negative impact on the Gharial's use of these sites for basking and nesting. Continuous human activity in the river bank precluded the Gharials from using these sites, and their numbers were consistently lower in areas with mining operations. Sand-mining common in the upper sections of the river, causes considerable disturbances to wildlife, destroys key breeding habitats like otter holts and provides easy access to ammunition for dynamite fishing.

### Funeral Activities

Locals in villages burn dead bodies on Chambal river bank and they thrushes burnt body ash in the river. it was observed during field survey in whole banks of the Chambal river in National Chambal Sanctuary.

### Idol immersion

The river is however used for immersing religious idols, especially during the 'Navratri' festival, when the villagers worship the goddess Durga. Idol immersion in National Chambal Sanctuary is totally banned but some areas of Chambal that have road connectivity to peoples so locals in the sanctuary do idol immersion stealthily in the Chambal river.

### Grazing of Livestock

Cattle, buffalo and goats were the most common livestock in this region. Livestock grazing was carried out throughout the year along the river banks. The river is also used for drinking and bathing for the livestock by their herders. During the field survey, grazing of livestock was observed in whole area of National Chambal Sanctuary that tend to habitat degradation (Table – 02).

Table 2: Total Livestock in National Chambal Sanctuary

livestock	NCS	
	Nos.	Per village Animal
Cow	30540	244
Bull	27042	216
Buffalo	77290	618
Goat/Sheep	35029	280
Others	3334	27
Total	173235	1386

### Water Extraction

Chambal River is main source of water. The people who does illegal agriculture practices on the bank of Chambal River so they do water extraction through motor pump. It was mainly observed in Rameswar ghat, Kuthiyana ghat, Rajghat, Nitanwas, Mal Basai and Useth ghat in National Chambal Sanctuary.

### People perception towards wildlife conservation

Locals in the sanctuary area had their own perception over the human-wildlife and wildlife conservation and in sanctuary areas, villager's awareness about wildlife were not too good. Most of the people give their opinion for the conservation of wildlife.

They do not support their view by direct involvement in wildlife conservation. Mostly, they were farmers and they depend on water, wood for their livelihood in all three protected areas. 51.99% (8.79±5.6%) people in NCS responded that they never saw wild animals in captivity and 48.01% (8.79±5.6) of respondents answered that they have seen wild animals in captivity.

73.00% (13.14±7.6) of respondents in National Chambal Sanctuary answered that they had experienced wild animals in habitat and all selected villages were in National Chambal Sanctuary so the number of respondents were high in experience with wildlife in natural habitat. 27.00% (4.78±2.8) responded that they did not see wild animals in the forest area. 36.41% of people in NCS were answered in 'good' and they would like the presence of wildlife in India. 41.56% of people responded in order they did not want the presence of wildlife in India and it was slightly higher as compared to those people who support wildlife in India.

Yet, 22.04% locals were neutral to the presence of wildlife in India. 39.47% (7.07±4.0) of respondent were support on presence of wildlife in National Chambal sanctuary. 38.86% (6.88±3.76) of people were responded that they were disliked support on presence of wildlife in National Chambal Sanctuary area and it was slightly low with compared to those support of presence of wildlife in National Chambal Sanctuary. 21.67% of people had no response on the presence of wildlife in sanctuary area (Table – 03).

**Table 3:** People Perception on wildlife

Question (n=2240)	Yes	No	
Have you seen wild animal in captivity?	1099(48.01%)	1141(51.99%)	
Have you seen wildlife in natural habitat?	1642(73.00%)	598(27.00%)	
Question (n=2240)	Good	Bad	Neutral
Presence of wildlife in India is for you?	798(36.41%)	931(41.56%)	511(22.04%)
Presence of wildlife in NCS is for you?	884(39.47%)	860(38.86%)	496(21.67%)

43.07% (7.45±4.2) response of respondent in National Chambal sanctuary were disagreed on the presence of wildlife in Chambal sanctuary area favours tourism in the forest department and 13.06% (2.26±1.27) were strongly disagreed. 22.99% (4.10±2.40) of respondent were agreed and 6.82% (1.22±1.0) were 'strongly agreed' on favour of the forest department does support to ecotourism in sanctuary area. 14.06% (2.50±1.45) of respondent responded as neutral on the presence of wildlife in National Chambal Sanctuary, favours ecotourism in the forest department. During the survey, 11.01% (1.95±1.21) people responded that they strongly disagreed on the reintroduction program of wildlife species. Similarly, 12.89% (2.33±1.4) of respondent were disagreed on reintroduction program of wildlife in National Chambal sanctuary. 28.53% (5.14±3.01) of household were favour on reintroduction program of wildlife and they feel that they will get job opportunities in wildlife reintroduction program. With this 8.88% (1.59±1.0) were strongly agreed on reintroduction of wildlife in the National Chambal Sanctuary. Although 38.70% (6.90±3.87) of respondents were neutral and it was slightly high (Table – 04)

**Table 4:** People perception on wildlife conservation

Question (n=2240)	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
The presence of wildlife in your area favours tourism in the Forest department?	283 (13.06%)	980 (43.07%)	312 (14.06%)	512 (22.99%)	153 (6.82%)
Reintroduction program of Wildlife Species in NCS?	244 (11.01%)	291 (12.89%)	863 (38.70%)	643 (28.53%)	199 (8.88%)

38.89% (6.98±3.9) of respondents agreed that mugger was most dangerous for humans as compared to gharial but other 28.10% (5.89±3.3) were considered that Gharial was most dangerous as compared with mugger. Although 33.01% (5.89±3.3) responded that both were the most dangerous wild animals for mankind (Table – 05).

**Table 5:** People Perception on Crocodile Species in National Chambal Sanctuary

Question (n=2240)	Mugger	Gharial	Both
Which animals are most dangerous to man?	38.89%	28.10%	33.01%

### Awareness on wildlife in National Chambal Sanctuary

Some questions in questionnaire were based on awareness about wildlife in National Chambal sanctuary that gives a trends on wildlife management in protected areas. 81.44% of people were responded that they were not aware on conservation of crocodile species. With 18.56% were aware of

crocodile is protected species in National Chambal Sanctuary. When asked to people on 'Do you go for Fishing?' then 22.46% of locals responded 'Yes' and 77.54% of people were denied on go for fishing in National Chambal sanctuary area. 68.30% of people were responded that they were denied, when asked are you thinking of on evacuation from here because of crocodile habitat. Yet 31.70% of people responded that they wanted to evacuate from sanctuary due to the presence of crocodiles. 18.39% respondents preferred the construction of public well/rain harvesting as an alternative source of drinking water but 51.27% were disliked to construction of public well/rain harvesting as an alternative source of drinking water and it was slightly high as compared with 18.29% preferred people. 28.58% of people responded that they had known and seen the dolphin in Chambal River but 71.42% of people responded that they had never seen the dolphin in the National Chambal sanctuary and it was the majority of people in the sanctuary (Table – 06).

**Table 6:** People awareness related wildlife

Questions (N=2240)	Yes	No	Neutral
Do You Know that crocodiles are protected?	18.56%	81.44%	-
Do you go for Fishing?	22.46%	77.54%	-
Are You thinking of Evacuation from here because of crocodile habitat?	31.70%	68.30%	-
Would You Prefer construction of Public Well/Rain Harvesting as an alternative Source of drinking water?	18.39%	51.27%	30.34%
Have you seen dolphins in the Chambal river?	28.58%	71.42%	-

### Discussions

Interactions between locals and wildlife can be positive, neutral or negative (Redpath *et al.*, 2015; Fisher, 2016) <sup>[14, 6]</sup> Positive interactions include benefits such as pollination, seed dispersal services, pest management and ecotourism (Zhang *et al.*, 2007) <sup>[23]</sup>. Negative interactions include loss of property, crops, livestock, and human lives, and pose a significant challenge to conservation efforts in wildlife reserves (Fernando *et al.*, 2005; Naughton-Treves & Treves, 2005) <sup>[5, 11]</sup>. During the field survey, positive and negative interaction observed in National Chambal Sanctuary. Perception was measured using four thematic areas: social impacts of conservation, ecological outcomes of conservation, legitimacy of conservation governance and acceptability of conservation management (Bennett, 2016) <sup>[2]</sup>. In present study, perception was measured in terms of wildlife conservation in National Chambal Sanctuary. Public perceptions on social impacts of conservation are usually assessed based on context-specific dimensions of particular areas and conservation projects. Equity in the distribution of social costs and benefits of conservation amongst stakeholders may engender positive attitudes and support for conservation projects (Bennett, 2016) <sup>[2]</sup>. Local perception is important in the Management of wildlife in protected areas because without local, conservation of wildlife species cannot be completed.

### Conclusions

Locals in protected areas are key factor in management of wildlife species. The study was conducted to assess the perception of locals on wildlife management in National Chambal Sanctuary. The presence or absence of human activities which creates forest disturbance or fragmentation was assessed. The major threats survival of wildlife are human encroachments like sand mining, agriculture, water extraction for drinking purpose, bathing and washing and disruption of populations through fishing and other hunting activities. Observation in the present study showed that locals play a unique role in wildlife protection and conservation. By the participatory projects, locals can interact with project on wildlife species and realize the importance of wildlife species. Most of the people were affected due to human-wildlife conflict. Residents in protected areas have faced many issues like crop-raiding, unemployment and human conflicts so they do not take part to support wildlife conservation and they engage with illegal sand and stone mining. Locals in the NCS believe that they don't have development in the village area due to wildlife in the sanctuary area.

### Recommendations

Present study is revealed that due to human wildlife interactions local and wildlife authority relation is not cordial.

Locals believed that wildlife conservation programmes in the protected areas are major hurdles for poverty improvement as they depend primarily on these forests for livelihood but the Government restricts the use of resources for wildlife conservation. Information collected in this study is useful and thereby provide an insight into the human-wildlife conflict in the north Madhya Pradesh and help in taking measures for the conservation management of crocodiles. There is a need for increase of awareness with the local villagers on the wildlife conservation programmes and their benefits. It is essential to monitor the conflict between wildlife and people living in the Sanctuary. Job opportunities should be created for locals to engage themselves in earning money so that they depending on forest resources is reduced.

### Acknowledgement

I thankful to M.P. forest department for providing me support during my research work and I want to also thankful to Jiwaji University, Gwalior.

### Reference

1. Barrett K, Guyer C. Differential responses of amphibians and reptiles in riparian and stream habitats to land use disturbances in western Georgia USA. *Biol. Conserv.* 2008; 141:2290-2300. 10.1016/j.biocon.2008.06.019,
2. Bennett NJ. Using perceptions as evidence to improve conservation and environmental management, *Conservation biology*, 2016, 1-11.
3. Chang CH, Karanth KK, Robbins P. Birds and beans: Comparing avian richness and endemism in arabica and robusta agroforests in India's Western Ghats. *Scientific Reports.* 2018; 8(1):3143.doi:10.1038/s41598-018-21401 1
4. Cushman SA. Effects of habitat loss and fragmentation on amphibians: a review and prospectus *Biol. Conserve.* 2006; 128:231-240. 10.1016/j.biocon.2005.09.031,
5. Fernando P, Wikramanayake E, Weerakoon D, Jayasinghe LKA, Gunawardene M, Janaka HK. Perceptions and patterns of human–elephant conflict in old and new settlements in Sri Lanka: insights for mitigation and management. *Biodiversity and Conservation.* 2005; 14:2465-2481.
6. Fisher M. whose conflict is it anyway? Mobilizing research to save lives. *Oryx.* 2016; 50:377-378.
7. Haruna A, Mwalyosi RB. Local communities' perceptions about the impact of protected areas on livelihoods and community development, *Global Ecology and Conservation.* 2020; 22:1-12.
8. IUCN. The IUCN Red List of Threatened Species International Union for Conservation of Nature and

- Natural Resources. <https://www.iucnredlist.org>, 2020.
9. Juffe-Bignoli D, Burgess ND, Bingham H, Belle EMS, de Lima MG, Deguignet M. Protected Planet Report 2014. Cambridge: UNEP-WCMC, 2014.
  10. Kremen C, Williams NM, Aizen MA, Gemmill-Herren B, LeBuhn G, Minckley R, *et al* Pollination and other ecosystem services produced by mobile organisms: A conceptual framework for the effects of land-use change. *Ecology Letters*. 2007; 10(4):299-314. doi:10.1111/j.1461-0248.2007.01018.x
  11. Naughton-Treves L, Treves A. Socio-ecological factors shaping local support for wildlife: crop-raiding by elephants and other wildlife in Africa. In *People and Wildlife: Conflict or Coexistence?* (eds R. Woodroffe, S. Thirgood & A. Rabinowitz) Cambridge University Press, Cambridge, UK, 2005, 252-277.
  12. Nesper M, Kueffer C, Krishnan S, Kushalappa CG, Ghazoul J. Shade tree diversity enhances coffee production and quality in agroforestry systems in the Western Ghats. *Agriculture, Ecosystems & Environment*. 2017; 247:172-181. doi:10.1016/j.agee.2017.06.024.
  13. Nori J, Lemes P, Urbina-Cardona N, Baldo D, Lescano, J, Loyola R. Amphibian conservation, land-use changes and protected areas: a global overview *Biol. Conserv.* 2015; 191:367-374. 10.1016/j.biocon.2015.07.028.
  14. Redpath SM, Bhatia S, Young J. Tilting at wildlife: reconsidering human-wildlife conflict. *Oryx*. 2015; 49:222-225.
  15. Sinha BC, Qureshi Q, Uniyal VK, Sen S. Economics of wildlife tourism-contribution to livelihoods of communities around Kanha Tiger Reserve, India. *Journal of Ecotourism*. 2012; 11(3):207-218. doi:10.1080/14724049.2012.721785
  16. Stuart SN. Status and trends of amphibian declines and extinctions worldwide, *Science*. 2004; 306:1783-1786. 10.1126/science.1103538.
  17. Tschardt T, Clough Y, Bhagwat SA, Buchori D, Faust H, Hertel D, *et al*. Multifunctional shade-tree management in tropical agroforestry landscapes-A review. *Journal of Applied Ecology*. 2011; 48(3):619-629. doi:10.1111/j.1365-2664.2010.01939.x
  18. Visconti P, Bakkenes M, Baisero D, Brooks T, Butchart SHM, Joppa L. Projecting global biodiversity indicators under future development scenarios. *Conserv. Lett.* 2016; 9:5-13. doi: 10.1111/conl.
  19. Wake DB, Vredenburg VT Colloquium paper: are we in the midst of the sixth mass extinction? A view from the world of amphibians *Proc. Natl. Acad. Sci. U.S.A.* 2008; 105 (1):11466-11473, 10.1073/pnas.08019 21105, 2008.
  20. Watson FGR, Becker MS, Milanzi J, Nyirenda M. Human encroachment into protected area networks in Zambia: implications for large carnivore conservation. *Reg. Environ. Chang.* 2015; 15:415-429. doi: 10.1007/s10113-014-0629-5
  21. Williams J. "Human population and the hotspots revisited: a 2010 assessment," in *Biodiversity Hotspots: Distribution and Protection of Conservation Priority Areas*, eds F. E. Zachos and J. C. Habel (Berlin; Heidelberg: Springer), 2011, 61-81.
  22. WII Report Management Plan for National Chambal Sanctuary, Madhya Pradesh – 2018-19 to 2027-28, 2016.
  23. Zhang W, Ricketts TH, Kremen C, Carney K, Swinton SM. Ecosystem services and dis-services to agriculture. *Ecological Economics*. 2007; 64:253-260.