

Anthropogenic Mortality of Wildlife: A Case Study

Demonstrating Free Ranging Dogs Emerging as the only Predator in Thar Desert

Based on the catalogue data of Jodhpur wildlife rescue center it was observed that rescuing injured wild animals especially small antelopes is inefficient practice. Among the different factors responsible for injuring wild animals in the region, stray dog has been observed as a main factor responsible for their injury and mortality. Status survey of antelopes in whole Thar region using latest techniques, attempting possibilities of mobile rescue platforms, establishing rescue centers at field level to avoid trauma to wild animals, dealing with populations of dogs is needed and maximizing urban forestry programs to maintain escape habitats for wildlife are suggested.

Key words: Thar Desert wildlife mortality stray dog rescue.

Introduction

Anthropogenic activities leave an irreversible damage to the ecosystem and especially on the native species. Many significant immediate and long-term threats, including habitat loss, infectious disease, and non-native species have been studied worldwide, among them free ranging dogs were ranked high (Hughes and Macdonald, 2013). Domestic dogs have negative impact on wildlife through direct predation, fear-mediated behavioural changes, direct food competition, hybridisation and disease transmission (Ritchie *et al.*, 2014; Banks and Bryant, 2007; Zapata-Ríos and Branch, 2016; Vanak *et al.*, 2014; Bassi *et al.*, 2017; Bergman and Bender, 2009; Furtado *et al.*, 2016; Doherty *et al.*, 2017). Domestic dogs have contributed to 11 vertebrate extinctions and are a known or potential threat to 188 threatened species worldwide (Doherty *et al.*, 2017).

Rural environments are where dog-wildlife interactions are most likely to occur. However, not all rural dogs are similar, but almost all dog populations are highly dependent on human-provided food, in other words, they are subsidized by humans (Vanak, 2008). The World Health Organization estimates that India alone is home to more than 25-30 million domestic dogs, which makes a matter of serious concern, as even such high numbers of dogs include even a small amount of wildlife in their diet, collectively they can have a serious impact. In India, now a day, dogs are sharing habitat with almost all wildlife, and few of them are critically endangered. There have been unconfirmed reports that dogs are consuming eggs of ground nesting birds and even if a domestic dog were to eat just one egg or chick of the Great Indian Bustard *Ardeotis nigriceps* in its breeding range, can leave a highly negative impact on the breeding success of this critically endangered bird (Vanak, 2008).

Since ages, western Rajasthan has set emulative example of wildlife conservation by local communities. The saga of Amrita Devi and dedication of Bishnoi community towards protecting the wildlife of Marwar region is well known all over the world. Due to a high sensitivity of the Bishnoi community towards wildlife protection and their intolerance of wildlife crime, there are few and occasional incidences of wildlife poaching in the region. It was believed that there is only one prima facie culprit for wildlife crime; humans. The present study highlights that free ranging dogs are a major

While observing the increasing trend in wildlife mortality in Thar desert with free ranging dogs as one of the major factor, the present study suggests developing rescue centers at field level, dealing with such dogs and maximizing urban forestry programs to maintain escape refuges for the wildlife.

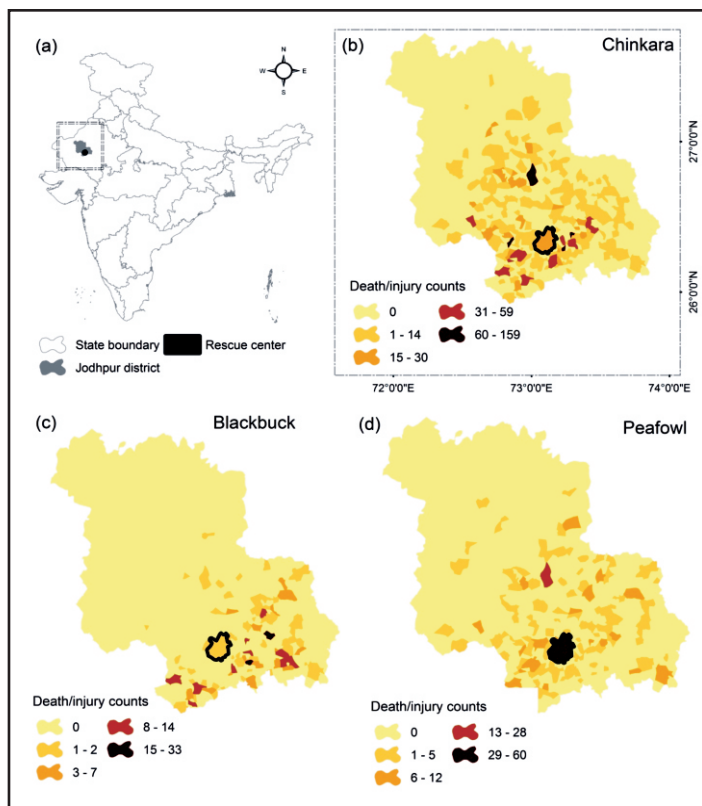
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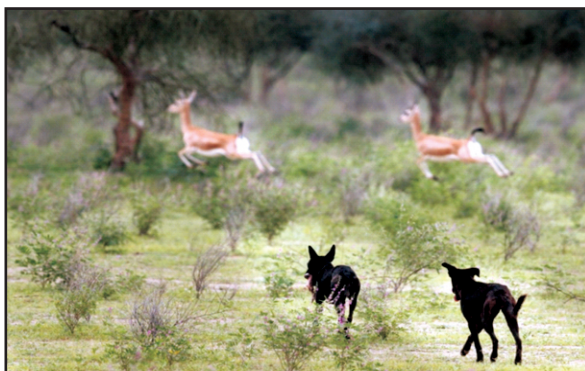
Map showing Jodhpur rescue center



Pic. 1 : Farming in pastures result in crop depredation



Pic. 3 : Crop protection fence becomes a trap for escaping antelope



Pic. 2 : Dog chasing antelopes



Pic. 3 : Becomes prey to chasing predator. Dog with Chinkara head

predator of many wild animals, and are responsible for more killings of chinkara (Indian Gazelle) *Gazella bennettii*, the state animal of Rajasthan, than any other agent. Human-wildlife conflict results from the interface of wild animals and humans. It is a function of the population sizes of humans and wild animals. Given the rapidly increasing population of human in India, it is certain that this interface will expand in future; exposing wild animals to newer risks. The landscape has a relatively large dog population that depends on village resources, tourist resorts, livestock, and native wildlife (Dutta *pers. communication* and Hiby *et al.*, 2016).

Therefore, assessing and mitigating these risks become crucial for wildlife management and conservation in the shared habitats. Expanses of the Thar desert in Jodhpur District (Rajasthan, India), dominated by barren, grassland and scrub habitats interspersed with agriculture, support a unique biodiversity alongside the highest human density in any desert. Many of these desert-adapted species, notably the Critically Endangered Great Indian Bustard *Ardeotis nigriceps*, chinkara *Gazella bennetti*, Desert Fox *Vulpes vulpes pusilla* and Spiny-tailed Lizard *Saara hardwickii*, are affected by anthropogenic disturbances such as hunting, habitat loss and/or introduced predators. The State Forest Department, custodian of wildlife conservation in Rajasthan, receives reports of animal injuries/deaths through a network of frontline staff and local communities. Most of the time local communities, including *Bishnois*, initiate the information of injured wild animals especially chinkara. The department responds to this crisis by transporting these individuals, often across large distances, for their treatment in different

rescue centers run by the forest department. The present study is based on the data of one rescue center, established in the heart of the city Jodhpur. The center maintains a catalogue of all rescued animals, inclusive of the date, location (village), condition, and cause of injuries/deaths. This report analyzes a 7-year catalogue data (2009-16) of this wildlife rescue center, with the objectives of assessing the extent of injury/death suffered by various species, understanding the factors responsible for these injuries/death, assessing the success rate of rescue operations and finally recommending strategies for reducing the detrimental effects of human-animal interface on wildlife and improving the effectiveness of future rescue operations. The present study is an assessment of various anthropogenic pressures on wildlife of Thar Desert, where dog came up as major cause of concern and turned to become largest predator for many wildlife species. Considering how free ranging dogs have become inimical in India, there are limited studies on their impact on wildlife (Vanak *et al.*, 2007; Bhardwaj and Dutta, 2015); the present study will help in making managerial strategies to deal with the problem.

Material and Methods

Data was collected from the existing records of Jodhpur Wildlife Rescue Center and arranged in MS excel and simple statistical calculations and analysis was done. Field trips were also conducted in the area for verification and photographic evidences. BioDiversity Pro (McAleece *et al.*, 1997) software was used for computing the diversity indices with respect to different taxa recovered from different landscapes.

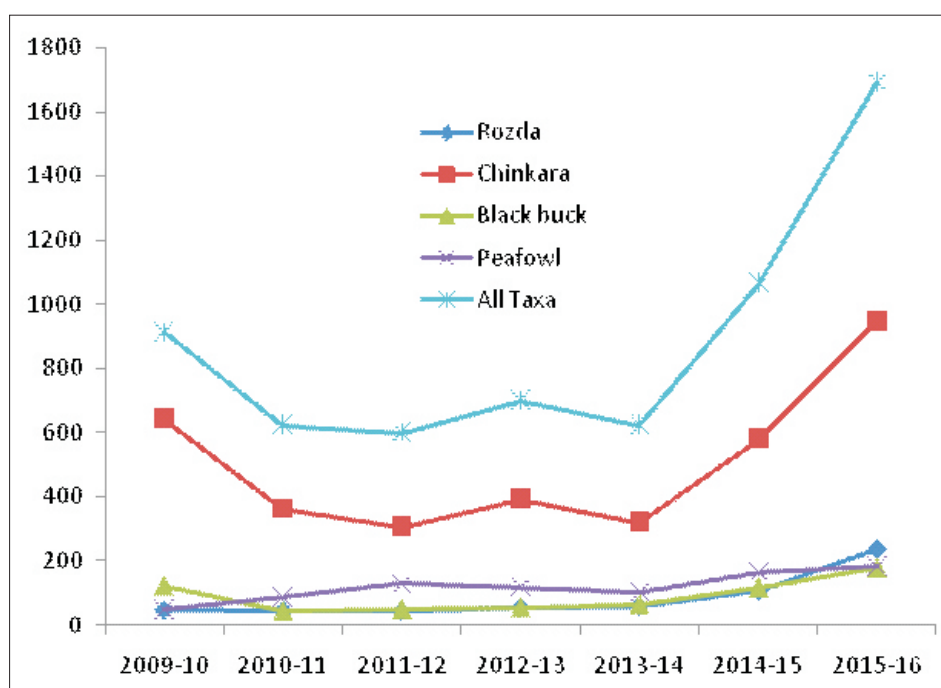


Fig 1: Line chart showing trend in the no. of injuries animals brought to JRC (n=6304) in different years.

Results and Discussion

Between 2009 and 2016, a total of 6304 cases of injured wild animals belonging to >51 species were reported injured/dead and treated in the Jodhpur Wildlife Rescue Center (Table 1). Animal injury/death reports varied between years and showed increasing trend after 2014 (Fig. 1). The fluctuating erratic trend till 2014 can be attributed to less report of the animal injury cases to the

department. Majority of these rescues (97.95%) were from Jodhpur district, while a small number of cases (129) were reported from neighboring districts, it may be largely due the far away distances and lack of rescue facilities in these districts, hence forth that were eliminated from the subsequent analyses (Table 2).

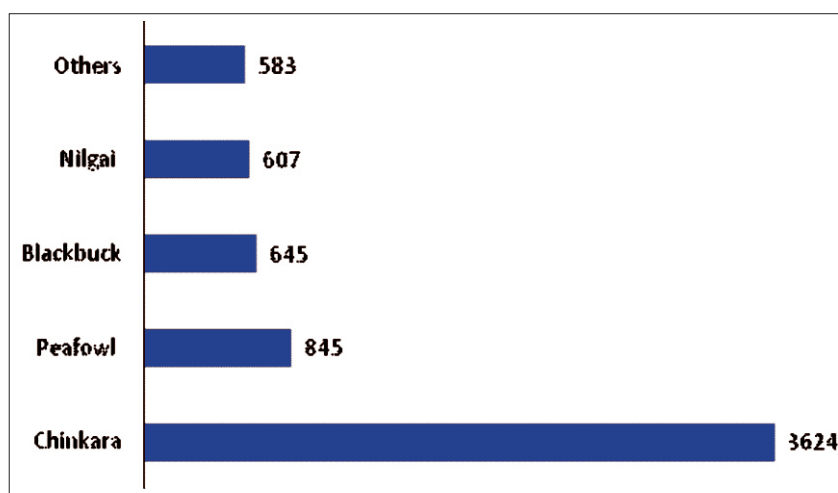
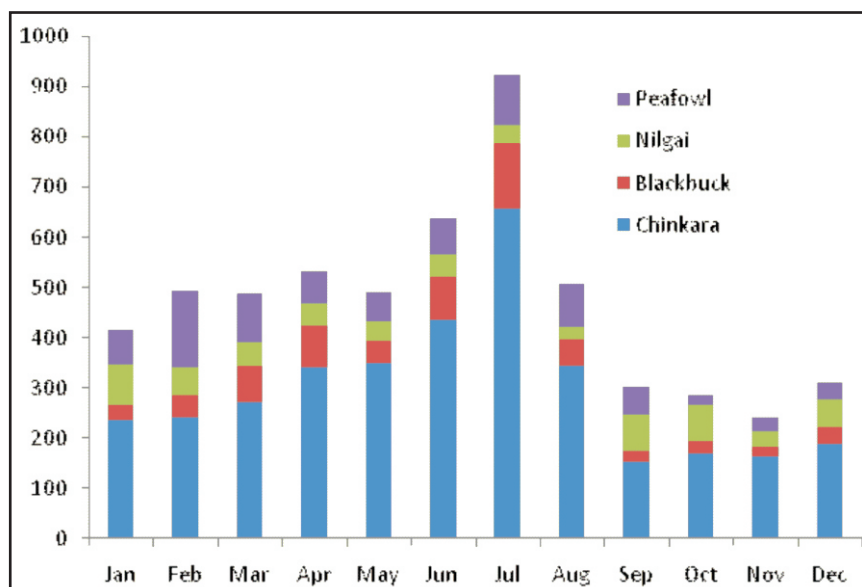
Among the various taxa reported injured/dead, Indian gazelle Chinkara *Gazelle bennettii* contributed the most

Table No. 1: Number of cases of different species registered in Jodhpur Rescue center from July 2009 to July 2016

Sl. No.	Name of the Species	No. of Cases
1	Chinkara <i>Gazella bennettii</i>	3624
2	Peafowl <i>Pavo cristatus</i>	845
3	Blackbuck <i>Antelope cervicapra</i>	645
4	Nilgai <i>Boselaphus tragocamelus</i>	607
5	Hanuman Langur <i>Semnopithecus entellus</i>	86
6	Indian Hare <i>Lepus nigricollis</i>	62
7	Pariah Kite <i>Milvus migrans</i>	56
8	Owl <i>sps</i>	47
9	Indian Flapshell Turtle <i>Lissemys punctata</i>	46
10	Demoiselle Crane <i>Grus virgo</i>	42
11	Rhesus monkey <i>Macaca mulata</i>	39
12	Raptor uid	34
13	Snake uid	20
14	Star Tortoise <i>Geochelone elegans</i>	13
15	Vulture <i>sps</i>	13
16	Duck <i>sps</i>	12
17	Cattle Egret <i>Bubulcus ibis</i>	11
18	Common Leopard <i>Panthera pardus</i>	10
19	Asian Koel <i>Eudynamis scolopaceus</i>	10
20	Parakeet <i>sps</i>	10
21	Indian Jackal <i>Canis aureus indicus</i>	7
22	Monitor Lizard <i>Varanus sp</i>	7
23	Ave <i>sps</i>	5
24	Grey Francolin <i>Francolinus pondicerianus</i>	5
25	Rock Pigeon <i>Columbus livia</i>	4
26	Emu <i>sp</i>	3
27	Porcupine <i>Antherurus sp</i>	3
28	Water Bird uid	3
29	Indian Grey Wolf <i>Canis lupus</i>	3
30	Bat <i>sp</i>	2
31	Asian Palm Civet <i>Paradoxurus hermaphroditus</i>	2
32	Desert Fox (White-footed Fox) <i>Vulpes vulpes pusilla</i>	2
33	Indian Pangolin <i>Maniscrassi caudata</i>	2
34	Long eared Hedgehog <i>Hemiechinus auritus</i>	2
35	Indian Grey Mongoose <i>Herpestes edwardsii</i>	2
36	Rock Python <i>Python molurus</i>	2
37	Shikra <i>Accipiter badius</i>	2
38	Sloth Bear <i>Melursus ursinus</i>	2
39	Little Cormorant <i>Micro carboniger</i>	2
40	Wolf (hybridized)	2
41	Coppersmith Barbet <i>Megalaima haemacephala</i>	1
42	Desert Cat <i>Felis silvestrisornate</i>	1
43	Eurasian Collared Dove <i>Streptopelia decaoto</i>	1
44	Laughing Dove <i>Spilopelia senegalensis</i>	1
45	Spotted owl <i>Athene brama</i>	1
46	Sand Boa <i>Eryx johnii</i>	1
47	Striped Hyena <i>Hyaena hyaena</i>	2
48	UID	2
Total Cases registered in Jhodhpur rescue center		6304

Table 2: Number of injured animals brought from different districts during the period of observation.

Sl. No.	District	No. of cases	%age
1	Jodhpur	6175	97.95368
2	Pali	52	0.824873
3	Barmer	47	0.745558
4	Jalore	11	0.174492
5	Jaisalmer	9	0.142766
6	Nagore	7	0.111041
7	Sirohi	2	0.031726
8	Nagour	1	0.015863
Grand Count		6304	100

**Fig 2:** Bar Chart showing number of different injured animals brought to JRC (n=6304) during the period.**Fig. 3:** Monthly distribution of animal death/injuries reported to the Rescue Center in Jodhpur during 2009-16 segregated by the major species.

(57.48%), followed by Indian peafowl *Pavo cristatus* (13.40%), blackbuck *Antelope cervicapra* (10.23%) and blue bull (*nilgai*) *Boselaphus tragocamelus* (9.63%), while other taxa contributed a relatively small fraction

(cumulatively 9.25%) of the injury/death reports (Fig. 2). It is interesting to note that high mortality/injury rate among Chinkara in comparison to another sympatric wild ungulates like Blackbuck and Nilgai in Thar Desert.

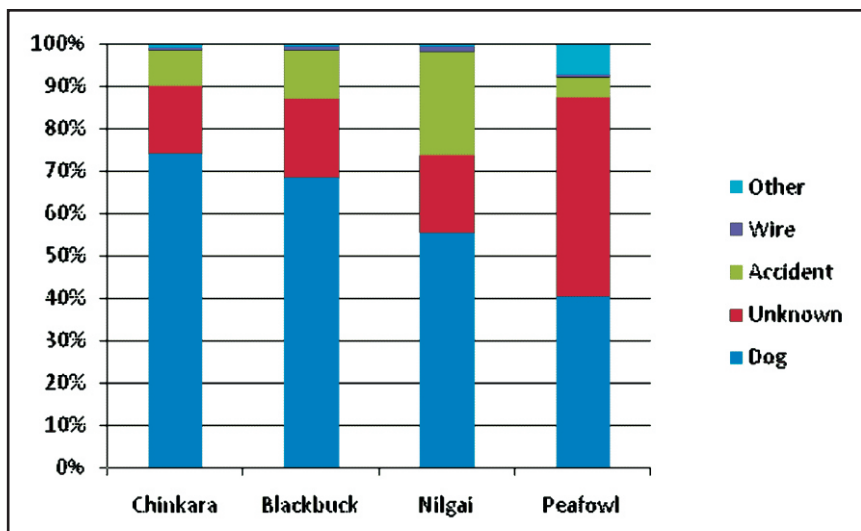


Fig. 4: Column Chart showing percent comparison of injury to different animals due to different factors.

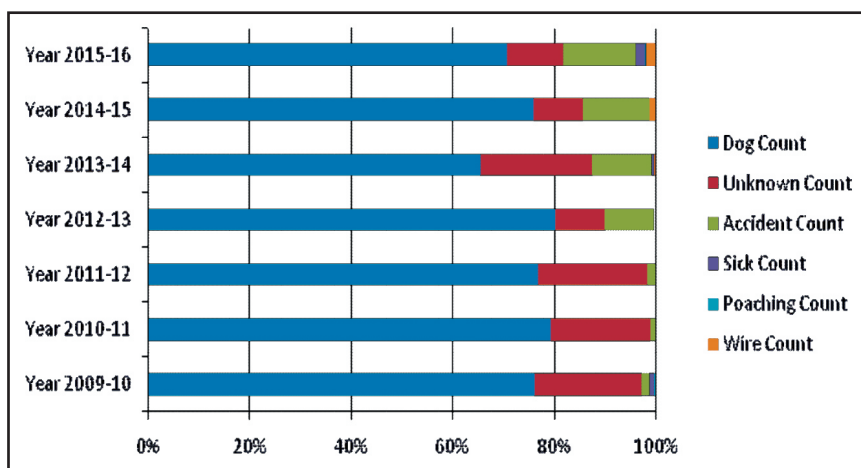


Fig. 5: Bar chart showing the trend of different injury causes to wildlife from 2009 to 2016.

Chinkara is small in size, remains in small herds and widely distributed in this region (Dookia and Jakher, 2007), where as Blackbuck is comparatively large bodied antelope, found in large herds and sparsely distributed in Thar Desert (Dookia, 2002; Dookia and Jakher, 2013). Nilgai or blue bull is Asia's largest antelope and adults were seldom approached by dogs. Therefore, the chances of encounter of Chinkara with dog are quite common and at the same time, injury caused by dogs leaves a high trauma on them, which was the main cause of death in Chinkara (Dookia, 2016). Among the commonly reported species, *chinkara* and blackbuck injuries/deaths increased during monsoon (June-August), while that of *nilgai* and peafowl were distributed uniformly across seasons (Fig. 3). This is probably because accumulation of rainwater in agriculture fields and ploughed land make it difficult for the small antelopes to evade chasing dogs.

Causes of injuries/deaths differed between taxa (Fig. 4) and were known in 78.92% cases for all the species. For

the commonly reported species, majority of injuries/deaths with known causes was due to free ranging dogs, with 74.28% for chinkara, to 68.68% for blackbuck, 55.68% for nilgai and 40.35% for peafowl. Road accidents, electrocution, pitfall or other accidents related to infrastructure remained next factor responsible for injury/death of the wild animals with 24.38% for Nilgai, 11.32% for Blackbuck, for 8.47% chinkara and 4.85% for peafowl. Natural ailments and reported poaching of cases constituted a small fraction (<1%) of cases reported across all taxa. 21.08% were those cases where cause of injury was not ascertained in the major taxa. Thus, the recent increase in number of cases of injured *chinkaras* brought to JRC by the forest department with the help of *Bishnois* of Jodhpur can clearly be attributed to stray dogs which have emerged as a new threat to the wilderness of this area. In last 7 years, an approximate number of 3624 injured *chinkaras* were brought to JRC and 74.28% per cent of the cases were due to dog chase and predation (fig 4). However the per cent of chinkara injury due to dog to all did not show any significant

Table 3: Number of Chinkara injury/mortality due to different factors between Aug1, 2009 to July 31, 2016.

Year	Dog	Unknown	Accident	Sick	Poaching	Wire	Total
Year 2009-10	490	136	10	5	1	1	643
Year 2010-11	288	72	3	0	0	0	363
Year 2011-12	235	66	5	0	0	0	306
Year 2012-13	316	39	38	0	0	1	394
Year 2013-14	211	71	38	1	0	1	322
Year 2014-15	440	57	76	0	0	7	580
Year 2015-16	673	107	136	17	1	18	952
Total	2653	548	306	23	2	28	3560

Table 4: Table showing the extent of mortality and after treatment recovery among different taxa.

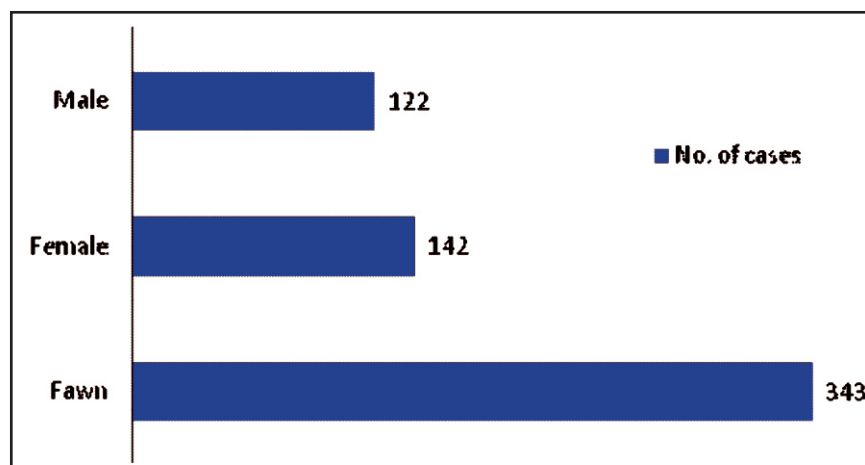
	Mammal	Aves	Reptile	Total
Recovery	285	597	81	963
Mortality	4820	513	8	5341
Total	5105	1110	89	6304

Table 5: Table showing extent of injury and post treatment recovery among different mammals.

	Antelopes	Carnivores	Lagomorphs	Primates	Others	Total
Recovery	160	21	37	60	7	285
Mortality	4716	10	25	65	4	4820
Total	4876	31	62	125	11	5105

Table 6: Comparison of biodiversity indices among the animals recovered in different areas.

Index	Urban	Mandor	Osian	Baori	Bilara
Shannon H' Log Base 10.	1.215	0.471	0.461	0.615	0.651
Shannon Hmax Log Base 10.	1.568	1.398	1.041	1.079	1.079
Shannon J'	0.775	0.337	0.443	0.57	0.603
Alpha	9.165	4.115	1.879	2.527	2.529
Simpsons Diversity (D)	0.084	0.529	0.476	0.297	0.286
Simpsons Diversity (1/D)	11.908	1.89	2.103	3.367	3.498
Hill's Number H0	37	25	11	12	12
Hill's Number H1	81.645	6.892	6.675	11.145	12.527
Hill's Number H2	0	0	0	0	0

**Fig. 6:** Bar chart showing the number of cases of blue bull *Boselaphus tragocamelus* injury.

increasing trend (Fig. 5) and remained above 70% in all the assessment years {76.2% (2009-10), 79.34% (2010-11), 76.8% (2011-12), 65.52% (2012-13), 75.86% (2013-

14), 70.69% (2014-15) and 74.52% (2015-16)}. The road accidents were observed to be responsible for 8.39% of total chinkara injury. It has also been observed that most

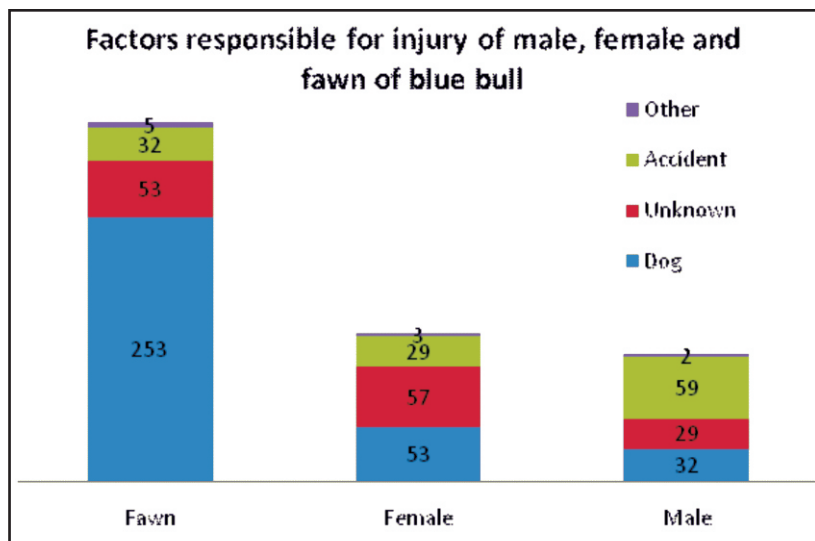


Fig. 7: Column chart showing the factors responsible for the injury of Blue bull.

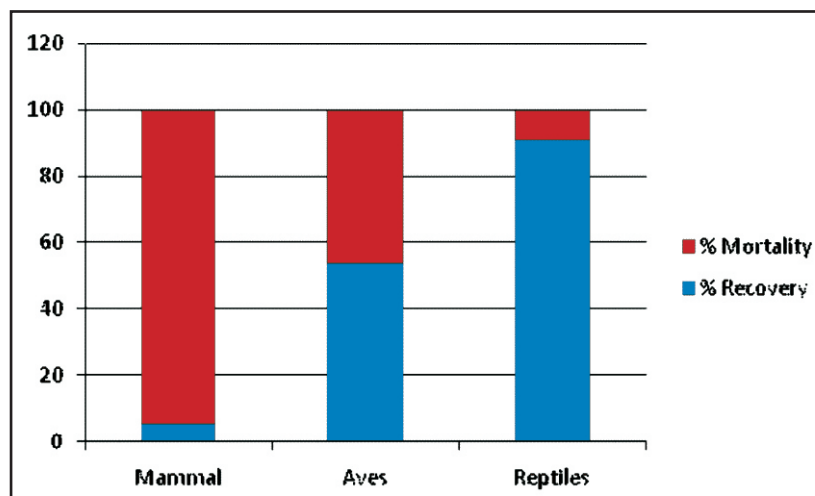


Fig. 8: Post treatment percent mortality and recovery among different classes.

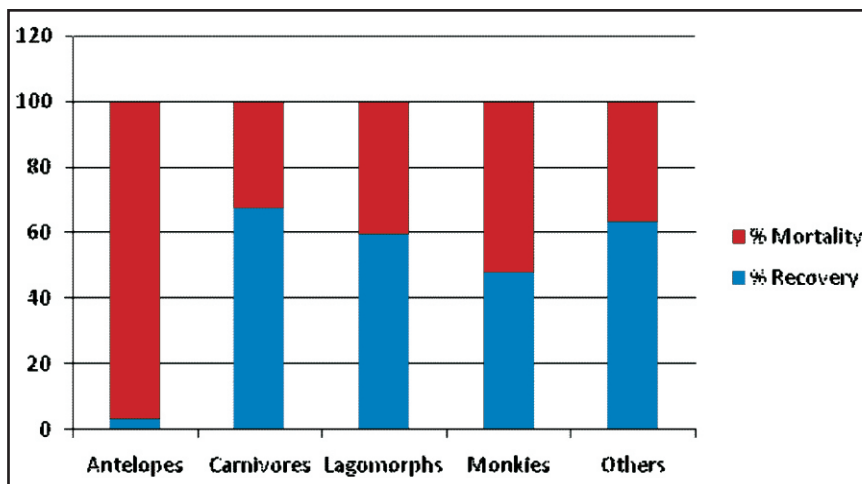


Fig. 9: Post treatment percent mortality among different taxa of class Mammalia.

of chinkara casualty due to road accidents was again because of chasing dogs, as it was reported by community wildlife volunteers, who helped in the rescue operation. The conversion of village pastures into agriculture fields and the raised fences (against crop depredation from antelopes) are the major hindrances for the escaping antelopes against the approaching predator, here free ranging dogs. Among blue bull maximum number of cases observed were those of fawn/infants (56.51%) followed by female (23.39%) and males (20.10%) (Fig. 6). Fawn of the blue bull remained most susceptible to dogs as 73.76% of the total injury of blue bull fawn was due to dogs. Road accident was observed to be the major factor (48.36%) responsible for mortality of adult blue bull. As discussed above, dogs seldom pose any threat to the adult blue bulls, where as they were successful in causing harm to the young ones. Fig. 7 shows a bar chart about different factors responsible for the mortality/injury of blue bull. Most of these dogs belong to local communities of villages and *dhanis* (village helmets) who keep these dogs as watch and ward for their crops and are never leashed, hence free ranging dogs. However, due to availability of human derived food near villages, dog populations have increased, and comprise of many individuals that are not owned by villagers.

Analysis of post-treatment status showed (Table 4) that recovery rates differed largely between different classes (Fig. 8) and even between taxa of same class (Fig. 9); ranging from extremely low success rates for mammals (<6% recovery) and moderate success rates for birds (54% recovery) to very high success rates for reptiles (>90% recovery). Among mammals the recovery ranges between < 4% (antelopes) to >65% among carnivores including common leopard. Table 5 shows the post

treatment recovery/mortality percentage in JRC. This indicates that the prevalent strategy of transporting antelopes across large distances for rescue efforts is not an effective strategy and needs to be revised.

Attempt was made to compare the diversity of the wild animals brought from different *panchayat samities* (blocks of Jodhpur district). Among four selected samples (*panchayat samities*), maximum diversity was observed in urban area of Jodhpur city (Table 6) followed by Mandor block and least in Baori and Bilara areas (Fig. 10 to 13). Maximum observed diversity in urban area may be attributed to less available escape area for different wild animals.

Study estimates the extent of wildlife injury/death in Jodhpur, largely caused by anthropogenic factors in habitats shared between humans and wildlife. Considering that a substantial yet unknown proportion of deaths would go undetected, estimates of wildlife injury/death in the present study should be considered as underestimates of the actual mortality rates operating in human dominated landscapes. Chinkara *Gazella bennettii* was identified as the most commonly reported species in rescue cases, amounting to 57.49% of all taxa ($n=6304$). It was observed that 931 cases of chinkara were brought from different areas of Jodhpur district in the last year of observation viz. August 2015 to July 2016, amounting to detection of distressed 4.074/year/100 km² per year. Given the fact that there are other wildlife rescue centers are also operating in different areas like Phalodi, Lohawat, etc. and the reported cases are far less than the actual in the field, the actual injuries/deaths are manifold higher (as discussed above) and the existing species' density in these landscapes are low, it is predicted that anthropogenic factors might bear serious consequences

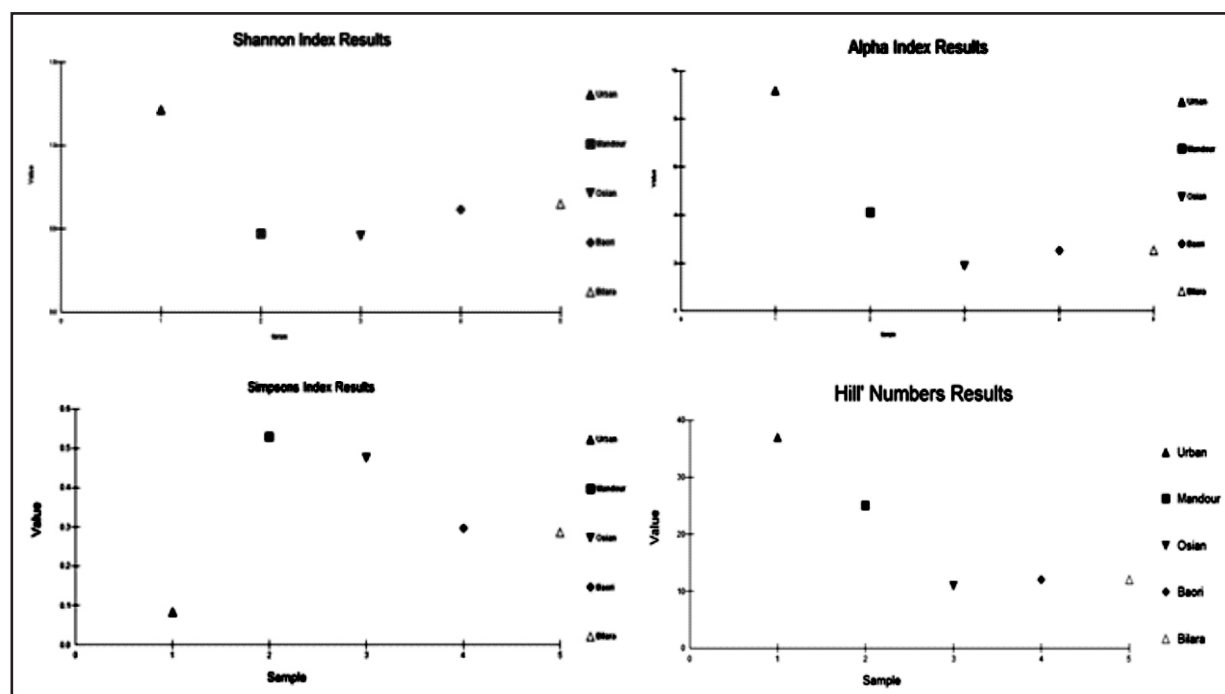


Fig. 10 to 13: Scatter charts showing different diversity indices for different wild animals recovered in different areas as computed with BiodiversityPro.

on the population of this antelope. Free ranging dogs remained dominant factor (74.28%) among all the known causes of chinkara injury/mortality (n=3560) which depends partially on local communities as well on wild resources. Past studies also shows that free-ranging dogs act as the apex predator in the Thar landscape. Compared to other apex predators, they occur at much higher densities, to the tune of 1.79 ± 0.46 individuals per km^2 , resulting in 1804 dogs in 1008 km^2 (Mohandas, 2017). It has already recommended in past about managerial interventions such as a sustained sterilization program at settlement level, constant removal of dogs from wildlife rich areas to resolve the growing free-ranging dog crisis in this landscape. This step can help in bridging the gap between conservation agencies and local communities, who want the dogs in their settlement to be, relocated (Mohandas, 2017), the present study also recommends for making a provision in the existing wildlife laws regarding dealing with stray dogs in wildlife rich areas.

Most of the rescue operation for chinkara is a futile exercise as post treatment recovery of injured chinkara is negligible (2.65%) because of unprofessional handling and distant transportation to rescue center subjecting the animal to trauma. Although the local wildlife authorities have already initiated a process of treating the animals without transportation to long distances by raising wildlife rescue wards in 17 different localities in Jodhpur district, these are not suffice for the sustainable management of wildlife populations. It is recommended to undertake a population monitoring comprehensive study on the status of antelopes and associated taxa and their interaction with dogs in Marwar region of Thar using latest scientific techniques. The study would yield information on the former's mortality rates and population viability, as well as develop measures to monitor/control dog populations if required. We recommend developing of mobile rescue platforms, running wildlife rescue centers at Block level (*Panchayat Samiti*) and treating animals in field to avoid the trauma and delay during transportation, which was the major cause of concern for conservation of wild ungulates. Authors suggest the improvement in treatment procedures through advanced infrastructure with the development of standard protocol for handling such animals and capacity building of frontline staff as well as local communities for the handling and treating wild animals with the help of subject experts.

Maximum observed diversity of wild animals in distress ($H^* = 1.21$, $\alpha = 9.16$, $1/D = 11.91$) in urban area (Jodhpur city) and semi urban areas (Mandor block) as compared to Osian rural area ($H^* = 0.46$, $\alpha = 1.88$, $1/D = 2.10$) may be attributed to less available escape areas (natural habitats) for different wild animals. Need of creating green patches under urban forestry schemes in all of urban areas and semi urban areas is highly recommended as these green patches will serve as wildlife refuges and escape habitats for the wild animals in distress. Given that a spectrum of wildlife with unique desert-adaptations are restricted to Thar alongside a relatively high human density, these findings and recommendations would help wildlife managers and decision-makers in acknowledging the human-induced mortality risks to these wildlife and developing mitigation measures for their conservation.

Conclusion

Looking at the increasing trend in wildlife mortality in Thar Desert, there is urgent need in dealing with the stray free ranging dogs, developing rescue centers at field level and maximizing urban forestry programs to maintain escape habitats for wildlife.

वन्यजीव की मानवोद्भव मर्त्यता: थार रेगिस्तान में एकमात्र परभक्षी के रूप में उभरे फ्री रेंजिंग कुत्तों का प्रदर्शन करते हुए एक केश अध्ययन

जी.एस. भारद्वाज, एस. दूकिया एवं एस. दत्ता

सारांश

जोधपुर वन्यजीव उद्धार केन्द्र के सूची आँकड़ों के आधार पर यह प्रेक्षित किया गया कि घायल जंगली पशुओं विशेषकर छोटे हिरणों को बचाना अक्षम पद्धति है। क्षेत्र में जंगली पशुओं को घायल करने के लिए उत्तरदायी विभिन्न कारकों में, इनकी चोट और मर्त्यता के लिए उत्तरदायी एक मुख्य कारक के रूप में आवाजा कुत्तों को प्रेक्षित किया गया। नवीनतम तकनीकों का उपयोग करके, गतिशील बचाव प्लेटफार्मों की संभावनाओं को तलाशकर, जंगली पशुओं के अभिघात से बचने के लिए क्षेत्र स्तर पर उद्धार केन्द्रों की स्थापना करके, कुत्तों की आबादी पर विचार करके सम्पूर्ण थार क्षेत्र में हिरणों के स्तर सर्वेक्षण की आवश्यकता है तथा वन्यजीव के लिए बचाव आवासों का अनुरक्षण करने हेतु शहरी वानिकी कार्यक्रमों को बढ़ाने का सुझाव दिया गया है।

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