

## Preliminary Status and Distribution of Indian Grey Wolf (*Canis lupus pallipes*) in the Bhal Region of Gujarat

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### ABSTRACT

The Indian grey wolf is a crucial apex predator in India's semi-arid region, but their wide range and elusive behavior make population estimation challenging. Accurate population estimation is essential for effective management and conservation efforts. Our study focused on the Bhal region of Gujarat and used local community information validated by ground surveys. Our estimates suggest a population of 64-88 wolves with a density of 0.021-0.029 wolf/km<sup>2</sup>. However, despite the region's continued distribution, it faces numerous threats. To protect the Indian wolf, compensation schemes, community participation, and protection of traditional breeding areas are necessary.

**Key words:** Indian wolf, status, distribution, Bhal region, conservation.

### INTRODUCTION

India is a mega diversity nation with a high degree of biogeographical diversity. Despite its modest size, it is home to 6 major predators, including the Indian grey wolf, and 23% of the world's carnivores (Srivathsa et al. 2020). The grey wolf is a globally distributed species with ten sub-species (Including Himalayan wolf and excluding Dingo) of which three exist in Asia (Boitani et al. 2020). The Himalayan wolf (*C.l. chanco*) and the Indian wolf (*C.l. pallipes*) are two allopatric subspecies of the Grey wolf that live in India. Those found in India's trans-Himalayan region are also referred to as Tibetan or Wolly wolves (Fox and Chundawat 1992, Werhahn et al. 2017a, b, Werhahn et al. 2018). Central Asia is home to the Tibetan wolf, whose territory includes Tibet, China, Manchurian, and magnolia. However, study based on genetic analyses suggest that the Tibetan wolf, which is a member of the Holarctic clade, and the Himalayan wolf are distinct species (Aggarwal et al. 2003, Sharma et al. 2004, Aggarwal et al. 2007, Shrotryia et al. 2012, Werhahn et al. 2018).

The semi-arid plains of peninsular India, Iran, and Israel are home to the Indian wolf, one of the tiniest wolves in the world (Shahi 1982, Jhala 1991). Nevertheless, a recent study by Hennesley et al. (2021) suggested that Indian wolves are among the earliest lineages of the wolf and that wolves from

the Arabian region form the wolf-dog clade. Moreover, Aggarwal et al. (2003) suggested that the Indian wolf and the Himalayan wolf should be recognized as distinct species or subspecies, *Canis Indica* and *Canis himalayensis*, respectively. Nevertheless, there is a lack of solid evidence to back up this assertion (Krofel et al. 2022).

Despite conservation efforts, several populations of grey wolves, including the Indian wolf, are in danger of going extinct. India's population of Indian wolves is between 2000 and 3100, and they are frequently persecuted because they prey on livestock (Shahi 1982, Jhala 2003, Singh and Kumara 2006, Maurya et al. 2011, Palei et al. 2013). Although being covered by the Wildlife Protection Act of 1972, the Indian wolf's protection is hampered by a lack of fundamental biology and extensive behavioral investigations (Jhala 2003, Krofel et al. 2022, Mahajan et al. 2022). In several investigations, ground surveys and local community knowledge were used to evaluate the status and range of the Indian grey wolf (Shahi 1982, Jhala and Giles 1991, Kumar and Rahmani 1997, Singh and Kumara 2006, Mahajan and Khandal 2021).

However, there has been no study to assess the status and distribution of the Indian grey wolf in Gujarat since 1991. This study aims to understand the current distribution, status, and threat to the Indian grey wolf in the Bhal region of Gujarat, India.

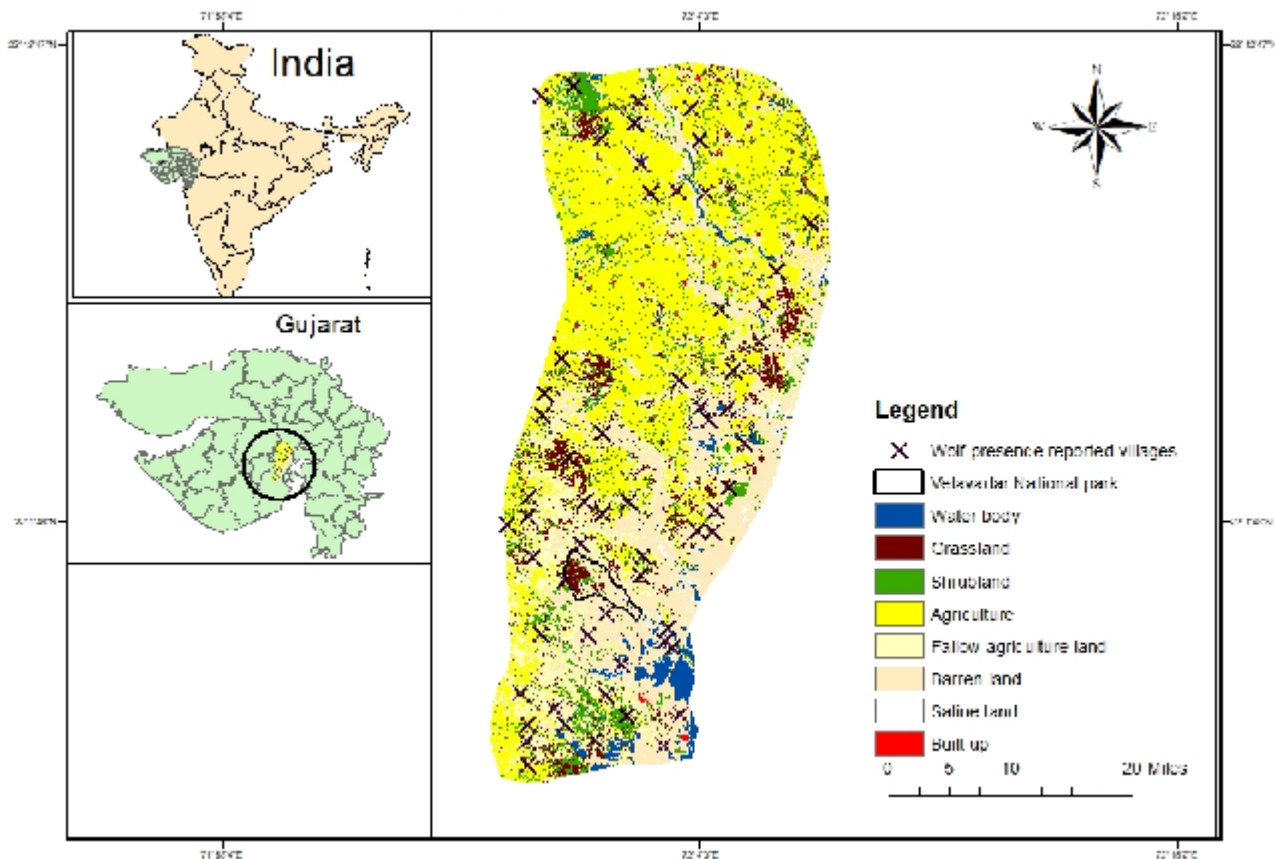


Figure 1 Map showing study area with land use and land cover of bhal region

## STUDY AREA

The study area is in the Bhal region of Saurashtra in the state of Gujarat, western India (Fig. 1). This region, which has a total size of 2940 km<sup>2</sup>, is distinguished by a flat alluvial plain with river silt deposits that run into the Gulf of Cambay (Khambhat) and the Arabian Sea. Cropland, salty land, marshy areas, grassland, and salt pans are all present in the area (Dharmakumarsinhji 1978). The Blackbuck National Park (BNP), which is well-known for its raptor diversity, lesser florican breeding grounds, large herds of blackbuck, and healthy populations of hyenas, Indian wolves, and other some small carnivore species as well as some floral diversity, is located in the Bhal region, which makes Bhal region more significant (Jhala 1991, Gadhvi 2002, Jethva and Jhala 2004a, Vyas and Joshi 2015, Prajapati et al. 2020, Desai et al. 2022). The region's climate is characterized by an average rainfall of 518 mm and summertime temperatures that range from

1 to 48°C. (Jhala 1991). Winter, monsoon, and summer are the three distinct seasons in the region. The Bhal region is prone to monsoon floods and summer droughts, which have an impact on the livelihoods of the people who depend mostly on agriculture and cattle rearing.

## METHODS

In order to ascertain the number and distribution of Indian wolves in the Bhal region of Saurashtra, Gujarat, the study involved a field survey carried out between April 2021 and May 2022. As monitoring large carnivores may be expensive and time-consuming, local people were considered as significant sources of information, especially for early status surveys (Singh and Kumara 2006, Ahmad et al. 2021). Group talks, individual interviews, and chance encounters with neighborhood farmers, shepherds, and nomads were used to collect information. Ground surveys were used to confirm

the data, utilizing data from direct sightings, scat, and pugmarks (Jhala and Giles 1991, Kumar and Rahmani 1997, Jhala 2003, Singh and Kumara 2006). Out of 112 villages, 102 viable villages were chosen for the survey based on their proximity to water bodies, open spaces, scrublands, and shrublands. In total, 1572 residents of the area were randomly questioned for the study. The survey was primarily carried out on motorcycles and on foot, looking for tracks and scat around ponds, unpaved trails, and agricultural berms. Packs of wolves were considered as those detected within a 10 km<sup>2</sup> region. Area size was determined using Google Earth and QGIS, and Shapefiles for the Bhal area were received upon special request from International Birdlife. We approximated the minimum and maximum pack size based on the respondent's consistent reporting of the number of wolves, and we divided the total area by wolf population size to determine the density. Between October and March 2021–2022, when everyone would be in packs and the area would be easier to access, hence the survey was intensified.

## RESULTS

To ascertain the distribution and status of the Indian grey wolf, the current investigation was carried out in the Bhal region (*Canis lupus pallipes*). The study's main objective, however, was to assess the wolf population's connectivity and habitat appropriateness in the Bhal region. We have so far counted 597 different carnivore signs, including those of wolves, hyenas (*Hyenas hyenas*), jungle cats (*F. chaus*), jackals (*Canis aureus*), and foxes (*Vulpes bengalensis*), among others among them, wolves appeared in 58.3% of the signs. The abundance of signs can be due to the suitable terrain (black clay, numerous paths, and unpaved roads) and thorough surveys. Due to their location in outlying regions, local groups including the Rabaris, Bharvaad, Devi-Pujak, and farmers, were an invaluable source of information.

According to our estimates, there are between 64 and 88 wolves still living in the Bhal region's various habitats (Table 1). Monpur in the Bhavnagar district

Table 1. Wolf population in Bhal region of Gujarat

Nos	Name of pack	District	Minimum number of individual	Maximum number of individual	Breeding reported	Direct sighting
1	Vegad (Sanej-Mevasa)	Bhavnagar	4	5	Yes	2 individual
2	Sanej (Ratibhet)	Bhavnagar	4	6	Yes	3 individual
3	Narmad	Bhavnagar	4	6	Yes	
4	Ganeshgadh	Bhavnagar	3	5	Yes	4 individual
5	Savainagar RF	Bhavnagar	4	5	Yes	0
6	Bhangadh-Rahtalav	Ahmedabad	4	5	Yes	0
7	Bavliayali	Ahmedabad	4	6	Yes	0
8	Adhelai	Bhavnagar	4	6	Yes	1 Individual
9	Monpur	Bhavnagar	6	7	Yes	6 individual
10	Naavagaam-Kamatalav	Ahmedabad	5	6	Yes	2 individual
11	Velavadar National Park	Bhavnagar	4	6	Yes	2+1 individual
12	Mithapur	Bhavnagar	4	6	Yes	0
13	Jansali	Ahmedabad	4	5	Yes	4+1 individual
14	Devaliya	Bhavnagar	4	6	Yes	0
15	Kharad	Ahmedabad	3	4	No	0
16	Navi Sodhi	Ahmedabad	3	4	No	0
			64	88	N+n indicate sighting incidence	

has the largest wolf pack, while Navi Sodhi in the Ahmedabad district had the smallest. Even without the Bhal region, the Bhavnagar district is home to a sizable wolf population. We discovered that there is a chance for 16 packs to remain in the Bhal area, and their dispersal is continuing to the north, west, and south sides of Bhal. Nonetheless, despite conducting a week-long field investigation, we discovered no indication of wolves in Kharad. In summer 2021 and during the monsoon, local people claimed to have seen a wolf, although sightings have become less common over the past two years. Moreover, In New Sodhi, sightings of wolves were less frequent, but we found evidence of their presence.

Blackbuck and wild boar are the main natural prey in these locations, whereas goats and sheep are the main livestock in the Indian wolf diet and were found all around the Bhal region. In contrast to Bhavnagar, the distribution of blackbuck is spotty in the Ahmedabad district. Given that wolves inhabit the surrounding area; we presume Velavadar National Park is a primary source of the Indian grey wolf population. Indian grey wolves' population appears to be dispersed along the rivers (Bhadar and Bhogawo) and other minor tributaries, as well as close to coastal regions. They are absent from areas with significant human populations and intensive agriculture, primarily in the Dhandhuka tehsils.

## DISCUSSION

The wolf population in the Bhal region is under several threats, including alterations in land use and land cover, conflicts between humans and wolves, intensive farming methods, the chopping of trees for fuel, poisoning the carcasses, the depletion of prey, poaching, sickness, and prey hunting (Jhala 1991, Jhala and Jethva 2004a, Ram et al. 2020). Unlike other accounts, we found no proof of wolf attacks on people (Kumar and Rahmani 1997, Jhala and Sharma 1997 Rajpurohit 1999). Nonetheless, there were a few instances of cattle depredation in Navagaam and Jansali as well as in the vicinity of Velavadar National Park, which may have been brought on by the scarcity of available wild prey.

The conservation of a species depends on having a grasp of its status and distribution (Buckland et al. 1993). It's crucial for managing any endangered

species to have accurate information on the condition, distribution, population size, extent, and habitat connectivity between populations (Sousa-Silva et al. 2014). Nonetheless, due to their elusiveness, low density, and widespread behavior, studying carnivore species is one of the most difficult undertakings (Garshelis 1992, Mech and Boitani 2003). The Indian wolf, which is the top predator in the semi-arid ecosystem of India, is being persecuted throughout its distribution range due to involvement in livestock depredation and historical child-lifting incidents (Shahi 1982, Jhala 2003, Habib 2007, Kumar and Rahmani 2000, Jhala et al. 2022). In this study, we looked at the distribution and preliminary status of the Indian grey wolf in Gujarat's Bhal region. The Bhal region may have 64–88 wolves with a density of 0.021–0.029 wolves/km<sup>2</sup>, whereas according to reports, Indian wolves can live in packs of 2 to 14 (Jhala and Giles 1991, Kumar and Rahmani 1997). According to our study, the largest pack lived in Monpur, where there was a lot of access to grassland, scrubland, and riverine habitat as well as a huge population of blackbuck, and even the number of packs and their size depend on the amount of available prey and the habitat (Jhala and Giles 1991, Grigione et al. 2002, Haskell et al. 2002). We believe that the plantation plot and scrubland along the coast act as a haven for the Naavagaam and Rahtalav packs. However, the proposed Dholera SIR airport and the Solar project next to the Kaamatalav regions represent an immediate threat to this pack, and demands long-term study. New Sodhi had the smallest packets, which may be related to their intense agriculture practices (Jhala and Giles 1991, Kumar and Rahmani 1997). In addition, the distribution of blackbuck appears to be more uneven in the Ahmedabad district than in the Bhavnagar district, which may result in a greater reliance on cattle, and lead to conflict, and persecution (Jhala 2003). The range of blackbuck is widespread in the Bhavnagar area, where we only surveyed a tiny portion of, thus that district has a bigger wolf population. Due to its protected status, which allows for less anthropogenic disruptions, the Velavadar National Park appears to serve as a source population, aiding in the repopulation of neighboring areas. The Vegad, Sanej, Narmbad, and Savainagar wolf packs could face severe difficulties due to ongoing building of a six-line, superfast motorway from Bhavnagar

to Bagodara and the anticipated construction of solar and salt pan projects. As a result, the National Park's capacity to be a source of population may be undermined. The survival of wolves in the Bhal region may be impacted by the conversion of scrubland and grassland to urban areas as well as intensive agricultural practices because, throughout their range, wolves mostly survive thanks to seasonal crop patterns that offer refuge (Majgaonkar et al. 2019). Moreover, the development of long-term irrigation systems and increased pesticide use could change the ecology. Some respondents noted that it is increasingly difficult to spot jackals and house crows (*C. splendens*), which may be related to the increased use of pesticides and vaccination of cattle. In addition, living with feral dogs puts wild animals at risk for disease. To comprehend the mechanism and causation, however, further research is required (Vanak and Gompper 2009).

A study by Jhala and Giles (1991) estimated that there were 190 to 270 wolves in the entire Gujarat and Rajasthan region. However, our recent population estimation in the Bhal region of Gujarat suggests resurgence in the wolf population, likely due to the Wildlife Protection Act of 1972 and better conservation efforts by the Gujarat Forest department. However, further studies are needed to understand the distribution and abundance of wolf prey and its impact on their diet, as well as to address conflicts with the shepherds' community who pose a threat to the wolves by smoking or blocking their dens, trapping the pups, and poisoning carcasses (Jhala 1991).

Due to landscape fragmentation and changes, it is difficult to conserve large carnivores like the grey wolf because their habitats are frequently dotted with agricultural and urban areas (Habib 2007, Habib et al. 2021). In addition, wolves' natural habitats, such as scrubland, grassland, and shrubland, are more susceptible to changes in an urban area (Vanak et al. 2017). When wolves dwell outside of protected regions, they frequently use cattle as food, which makes local community hostile to them (Jhala 1991, Maurya et al. 2011). As crop raiding has become more prevalent, compensating communities instead of creating new protected zones and restoring wolves to former distribution areas can help reduce crop raiding (Desai et al. 2021, Jhala et al. 2022). In order

to reliably assess wolf populations, non-invasive genetic sampling techniques and acoustic methods can be applied (Sadhukhan et al. 2019, López-Bao et al. 2018). Besides this, to comprehend how anthropogenic gradient affect wolf population and its parameter, long term study need to be undertaken.

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