



# ZOO'S PRINT

**Communicating Science for Conservation**

Magazine of Zoo Outreach Organization  
[www.zoosprint.zooreach.org](http://www.zoosprint.zooreach.org)

ISSN 0971-6378 (Print); 0973-2543 (Online)  
Vol. XXXV, No. 12, December 2020



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## Contents

### Highlight

Analysis of news reports of road accidents from in and around Bhagwan Mahavir Wildlife Sanctuary and Mollem National Park, Goa's largest protected area

-- Rohan Menezes & Lisann Dias, Pp. 1–24

### Bird-o-soar

Interesting foraging behaviour of Crab Plover in Manali Island, Gulf of Mannar, India

-- H. Byju, Pp. 25–28

A preliminary study on avifauna of three sacred groves of Radhanagri Tehsil, Maharashtra, India

-- V.M. Lagade, S.V. Lagade, R.D. Kamble & S.E. Kamble, Pp. 29–37

### Bugs R All

First record of the Common Tinsel from the hilly state of Himachal Pradesh, India

-- Praveen Kumar, Jitender Kumar & Rajesh Kumar, Pp. 38–40

## Analysis of news reports of road accidents from in and around Bhagwan Mahavir Wildlife Sanctuary and Mollem National Park, Goa's largest protected area

### Abstract

Within Goa's largest protected area forest a proposal for widening the NH4A highway (running from Panaji in Goa to Belgavi in Karnataka) was given clearance virtually amidst the pandemic. A significant portion of this highway (13km) falls within the Bhagwan Mahavir Wildlife Sanctuary and the Mollem National Park (BMWS and MNP). It will involve the cutting of 12,097 trees and diversion of approximately 31.015ha of forest. The BMWS and MNP fall within the Western Ghats which is one of the four biodiversity hotspots in India. As per the Traffic Department of Goa, there have been 216 accidents on the Anmod-Mollem Ghat section of the highway causing 84 deaths. The Power Minister of Goa has attributed this to the narrowness of the highway and contends that the expansion of the highway in the protected area will reduce the number of accidents. In order to ascertain the proportion of the 216 accidents that occurred in the 13km-stretch running through the protected area, as well as to determine if the accidents were related to the narrowness of the roads, we analyzed news articles from roughly the same time period (2011 to 2019). The articles were analyzed for eight variables, i.e., area of accident, year of publication, date, deaths (number of people) caused by the accident, number of injuries caused by the accident, description, newspaper in which the article was published and cause of the accident. Our analyses found no significant relationship between the number of accidents and the narrowness of the road. In other words, the rationale for proposed expansion of the NH4A in BMWS and MNP can therefore not be tied to curbing accident rates and will have negative implications on this fragile ecosystem. The same highway is not being expanded in Kali Tiger Reserve in Karnataka which is contiguous with this forested landscape.

## Introduction

The Bhagwan Mahavir Wildlife Sanctuary (BMWS) and Mollem National Park (MNP) are threatened because of three large destructive projects, two of which were granted virtual clearances amidst a global pandemic.

The double tracking of the South Western Railway line from Castlerock to Vasco, the four lane-ing of the NH4A through 13km of the forest, and the laying of a 3.15km 400kv transmission line would considerably impact Goa's largest protected area. The three projects will collectively require the cutting of 59,000 trees in BMWS and MNP.

## Background of the region and the proposed expansion project

The National Highway 4A connects the state of Goa and Karnataka, running from Panaji to Belgavi, and is about 153km in total length. Of this, 83km falls within Karnataka and about 70.075km falls within Goa; 13km of the highway in Goa, beginning at the state border, falls within the BMWS and MNP.

In Karnataka, the work of widening the NH4A is being carried out by the National Highways Authority of India, but the road expansion does not include the stretch within Kali Tiger Reserve. This is specifically attributed to Kali Tiger Reserve being defined as a critical wildlife habitat under the Wild Life (Protection) Act of 1972. In Goa, however, the Public Works Department plans to include

the protected areas (BMWS and MNP) in the expansion despite these being critical wildlife habitats.

At present the road passing through the protected area is a double lane road having a carriageway of 7m, and right of way (RoW) of 12m. The proposal to widen the highway within the BMWS and MNP seeks to widen the existing double lane highway into a 4 lane highway with a total carriageway of 14m and RoW of 26m, largely by creating completely new roads held up on viaduct structures (Aarvee Associates 2016a).

The project would therefore involve not just widening of certain sections but creating new infrastructure in pristine and previously untouched parts of the BMWS and MNP. This proposal involves the cutting of 12,097 trees (Aarvee Associates 2018) and the diversion of about 31.015ha of protected forest area (6.75 in the BMWS and 24.265 in MNP). The estimated cost of the project is INR 59,400 lakhs (Aarvee Associates 2016b).

## Background of the biodiversity of the Bhagwan Mahavir Wildlife Sanctuary and Mollem National Park and the potential impact of a road widening project

The BMWS and MNP cover a combined area of 240km<sup>2</sup> of forests in Goa's Western Ghats. Both protected areas have been classified as Important Bird and Biodiversity Areas by the



Bombay Natural History Society as well as the UK's Birdlife International Society (Rahmani, A.R. et al. 2016).

The reasons for this are evident from the remarkable biodiversity of this region, which is also why the Western Ghats is one of only four biodiversity hotspots in India (Chandawarkar 2020). The BMWLS and MNP alone have 721 species of flowering plants, over 100 of which are endemic (Dinesh et al. 2020).

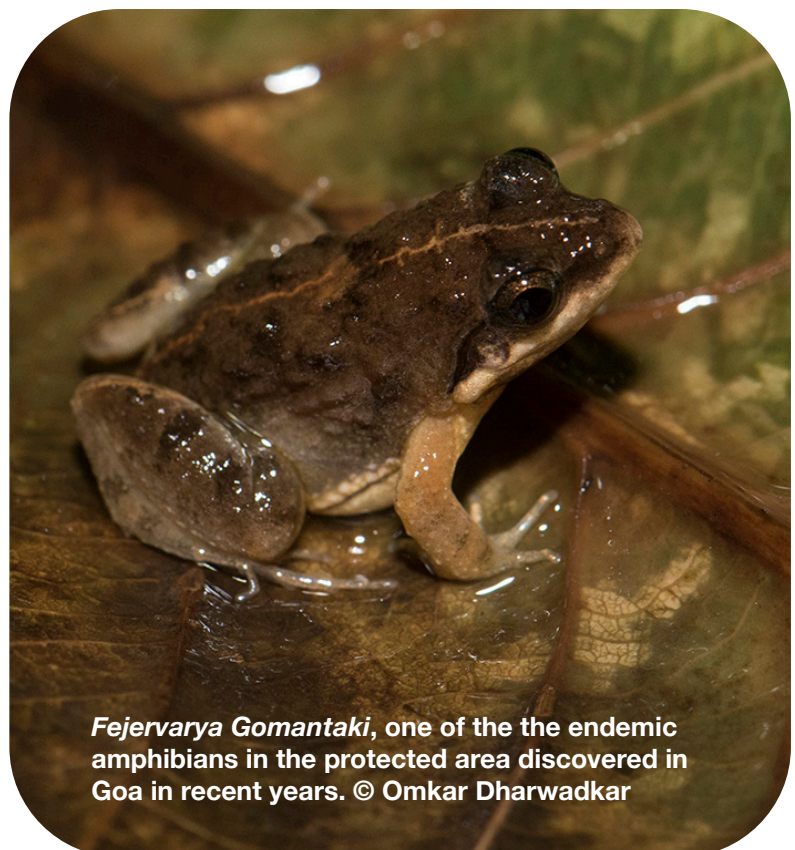
The protected regions also host at least 219 species of butterflies, 80 of odonates, 418 species of moths, 49 of fish, 36 of amphibians, 52 of reptiles, 60 of mammals, and an incredible 236 bird species.

Many of these species are endemic to the Western Ghats; these include 18 butterfly and odonate species, 18 fish species, and 18 bird species. Many of the species the BMWS and MNP hosts are also Schedule I protected species, including 11 mammal species such as Goa's state animal, the Gaur *Bos gaurus*, and 25 bird species such as the Critically Endangered Indian Vulture *Gyps indicus*.

Furthermore, new species endemic to the Western Ghats are constantly being discovered. In Goa alone,

seven new species of amphibians were found over the last 20 years (Dinesh et al. 2020). Thus, it is clear this region supports a biodiverse ecosystem and a number of important species that are conservation priorities, as well as likely undiscovered species valuable to science.

The potential expansion of the NH4A would pose a significant threat to these species through further habitat fragmentation. This is the process by which a large expanse of habitat (such as a forest) is carved up into several smaller patches of smaller areas, isolated them from each other. This can lead to habitat isolation and affect vital wildlife corridors for movement of species (Fahrig 2003).



*Fejervarya Gomantaki*, one of the the endemic amphibians in the protected area discovered in Goa in recent years. © Omkar Dharwadkar

One of the primary ways habitat fragmentation takes place is through linear infrastructure projects such as roads (Nayak et al. 2020). In fact, it has been estimated that each extra kilometer of road causes the loss of at least 10ha of habitat (Laurence et al. 2020).

The Western Ghats' closed canopy forests are particularly susceptible to being damaged by such projects due to the diversity of species that depend on the complex structure of these forests, which is altered by roads (Raman 2011). In such a biodiverse area such as the BMWS and MNP, this can have tremendous implications on the long-term survivability of numerous endemic and endangered species.

The risk to the complex ecosystems that sustains these forests is also a risk to the ecosystem services they provide to humans. These crucial services, the better supply of which is highly correlated to biodiversity richness, include the maintenance of water supply, water purification, and supporting populations of pollinator species (Brockerhoff et al. 2017).

Fragmentation of habitat also means that species become more vulnerable to becoming roadkill (Crooks et al. 2017), in particular reptiles and amphibians (Selvan 2012). Given that seven new species of amphibians have been discovered in Goa in recent years, it

can be surmised that such a project could negatively impact yet unknown species, which would be an irreversible loss to science. The threatened mammal and bird species in the BMWS and MNP are also susceptible to becoming roadkill (Selvan 2012).

The damage is not limited to fauna alone. Local flora become vulnerable in a more fragmented habitat, as invasive species of plant and animal make their way into newly disturbed forest land (Prasad 2009). Fragmentation also makes habitats prone to erosion, also contributing to extirpation of species (Prasad 2009).

Thus, if such a project could have significant implications to the long-term survivability of the local biodiversity (and thereby ecosystem services to human beings), the benefits of the project should also be clear and significant, and be put forth transparently to the general public.

## Rationale

According to the records of the Traffic Police Department of Goa, there have been 216 accidents on the Anmod-Mollem Ghat section of the NH4A between 2011 and 2019, causing 84 deaths (see appendix 1A). Now renamed NH748, this highway runs from Panjim in North Goa to Belgaum in Karnataka (National Highway 748 2019). The Power Minister of Goa claimed that the expansion of the highway in the BMWS and MNP would reduce



accidents, insinuating that these accidents were due to the narrowness of the road (Chandawarkar 2020). This analysis was conducted to ascertain what proportion of the 216 accidents occurred in the 13km stretch that runs through the protected area, as well as to determine whether the cause of these accidents was related to the narrowness of the road or other issues.

## Hypothesis

Upon analysis of the available data, we will determine that the accidents in Mollem are largely unrelated to the narrowness of the roads, so a road expansion project on the NH4A would not be useful to reduce accidents. Most of the accidents will also be determined to have occurred outside the BMWS and MNP such that a road expansion in the protected area of Mollem would be ineffective at curbing accidents along the NH4A.

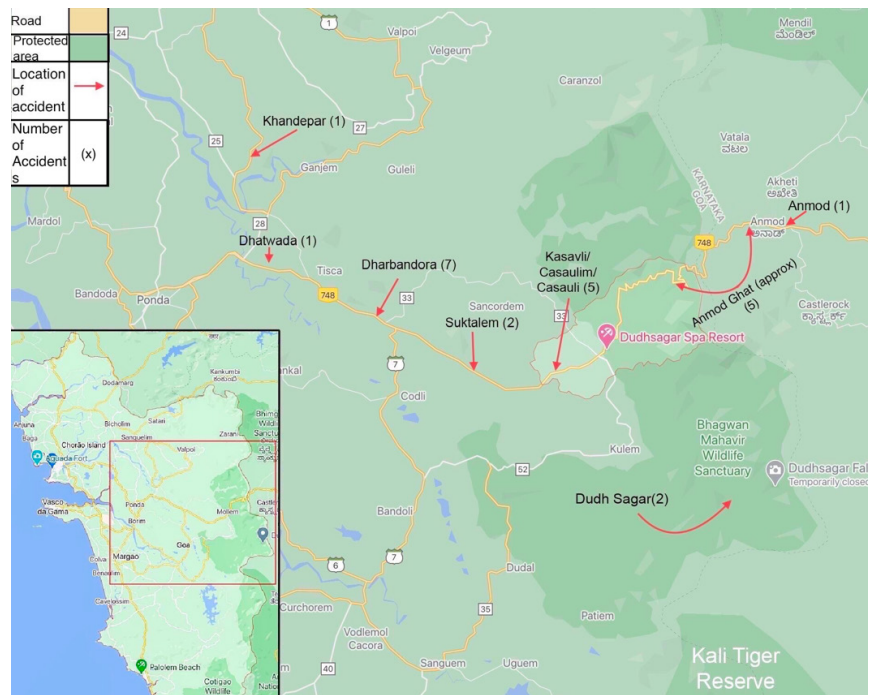
## Procedure

A database called Lexis Nexis was used to obtain the articles used in the analysis. First we searched “Bhagwan Mahavir (and Mahaveer) Wildlife Sanctuary” with keywords such as “dead”, “death”, “accident”, “fatal” and “vehicle crash”. The same procedure was repeated replacing Bhagwan Mahavir Wildlife Sanctuary with Mollem National Park.

Any articles which mentioned accidents between Belgaum and

Ponda/Mollem/Dudhsagar/ Anmod Ghat, were taken into consideration. Through this process, a total of 45 articles were identified for our research.

Upon analysis of the articles, it was determined that only 25 of the 45 articles discussed specific accidents on the Anmod-Mollem ghat section of the NH4A (and its vicinity) that occurred between 2011 and 2019. Each article in this set was analyzed for the following eight variables:



**Fig. 1. Map of locations with number of accidents at each, as determined via google maps.**

1. Area in which it took place.
2. Year in which the article was published.
3. Date.
4. Deaths (number of people) caused by the accident.
5. Injured (number of people) caused by the accident.
6. Description (brief) of the accident.
7. Newspaper in which the article was published and;
8. Cause of accident.

The analysis of this subset (termed subset A) was primarily drawn from the data recorded for variables 1, 2, 4, 5, and 8. Google mapping technology was also used after the initial analysis to determine which of these accidents occurred in the BMWS and MNP.

For those locations which could not be found via Google Maps, people familiar with the area, Omkar Dharwadkar (who has worked in the protected area) and Mangesh Gaonkar (from Dhargem, a village in Mollem), were consulted. In this way, the locations of 24 of the 25 accidents, in relation to the stretch of the NH4A crossing through the BMWS and MNP, were determined. One article did not specify the location of the accident within the Mollem region, so it was excluded from the location-based analysis.

The location-based analysis also revealed that two of the accidents we had articles for took place in the BMWS and MNP, but

not along the NH4A, so the data from those articles (and accidents) was removed from prior and subsequent analyses. As a result, Subset A was reduced to 23 articles for analysis (see the summary table in appendix **1B**).

Another seven of the total set of 45 discussed the general issue of accidents and road problems in Mollem and along the NH4A. The qualitative and quantitative data in these articles was deemed useful by the research team, and so were analyzed separately from the 25 related to specific accidents along the Anmod-Mollem Ghat section of the NH4A as subset B (see the summary table in appendix **1C**).

The five variables drawn from subset B for analysis were the same as variables 1, 2, 3, and 7 used for subset A, as well as one new variable; important information that the article contained (with regard to its relevance to road accidents in Mollem).

Of the remaining 13 articles (of the original 45), seven discussed accidents that did not take place along or in the vicinity of the Anmod-Mollem Ghat section of the NH4A; two involved Mollem residents, one involved a vehicle en route to Mollem, three occurred on the NH4A which runs through Mollem but not on the Mollem section, and one referenced an earlier similar accident in Mollem. Two others discussed accidents that



occurred prior to 2011. Another one was related to a likely homicide in Mollem. And, lastly, three articles were repeats. All of the 13 were therefore excluded from the analysis.

The 30 articles that ended up being analyzed as part of either subset A or B were primarily from the Times of India and Herald, but also included one from the Navhind Times, one from Diligent Media Ltd.'s Daily News and Analysis (DNA) and two from United News of India (UNI). Images of articles were placed in appendices to provide extra information. Where applicable, the reader is directed to view the relevant appendice(s) for reference, through brackets at the end of the appropriate sentence.

## Results

The 23 articles in subset A took place over an approximate seven year period, from January 10 2011 (when the earliest article was published), to 14 January 2018 (when the most recent article was published). Of the original set of 45, no articles from 2019 were determined to fit into subset A.

Collectively, the 23 accidents mentioned (representing approximately 10.65% of the total 216 accidents recorded on the road in this time frame) resulted in a total of 24 deaths (~28.6% of the total 84) and 52 people injured. For 12 of these accidents the cause is not mentioned.

However, for the remaining 11 accidents, representing 12 (50%) of the deaths in the subset, and 40 (~76.9%) of the injuries, 10 can be attributed to driver error.

Six (causing five deaths and 38 injuries) cite speeding as the cause for these accidents (see appendix **2A** for examples). Another four (causing five deaths and one injury) cite the driver losing control of the vehicle (see appendix **2B** for examples). Finally, one (causing one injury) cited as the cause that a driver was on the wrong side of the road.

Only one of the 11 accidents (causing two deaths) cites lack of road space as a reason for the accident. In this case, it was because the truck involved was making space for an oncoming car and fell into the ravine bordering that Anmod ghat road (see appendix **2C**).

Following this analysis, the location-based analysis of subset A using google maps was conducted, which further supported the hypothesis (see fig. **1** in the **Procedure** section).

Of the 22 accidents drawn from subset A for which the location along the Anmod-Mollem ghat stretch of the NH4A was provided (representing 21 deaths and 47 injured), only five (~22.7%) were found to have potentially taken place along the NH4A in the Mollem protected area.

These five accidents were responsible for six (~28.6% of the 21) deaths, and seven (~14.9% of the 47) injuries (see appendix **1B**). All five accidents occurred along the Anmod Ghat road, which extends outside of the protected area as well (see fig. **1** in the **Procedure** section).

For only one of these five accidents, the one taking place along a ravine as mentioned earlier, can the cause be deemed the narrowness of the road. Two of others can be attributed to driver error (one citing speeding and the other citing the driver losing control of the vehicle). The causes for the other two were not explicitly stated in their articles.

The other 17 accidents (~77.3% of the 22), responsible for the massive majority of deaths and injuries (~71.4% and ~85.1%, respectively) were confirmed to have not taken place on the stretch of the NH4A in the protected area.

The analysis of subset B indicated a number of other reasons for accidents other than narrowness. An article included in Subset B published in October 2011 stated that the NH4A road widening project was necessary to prevent accidents such as the 50 or 60 occurring annually at the time due to iron ore mining traffic (see appendix **2D**). MP Sardinha was cited making a similar claim in a Times of India article published in August

2020. However, in addition to the data in subset A suggesting that road-widening would not impact the rate of accidents and that most were not in the protected area, another article in subset B provides further insight into the cause of recent mining traffic related accidents along this road. An article published in June 2020 spoke of Usgao locals' concerns that ore transportation in the monsoon was leading to more accidents due to "poor visibility" coupled with spilled ore on the road, and truck drivers "dangerously" overtaking two-wheelers on the slippery roads putting the lives of riders "at risk" (see appendix **2D**).

Of the remaining four articles in subset B, two others that were published in 2019 and 2020 provide further evidence that other issues with the roads contributed to the accidents in the region. One points out the major pothole issue on the Mollem to Vasco road, with patchwork not even having begun as of September 2019. The other discusses how locals have noticed that speeding vehicles have resulted in accidents on NH4A. However, it should be noted that the locals requested a road expansion in the belief that such a project would solve the issue. Of the last two articles in the subset, one cited Chief Minister Sawant's claim in February that the NH4A widening project would be completed in a year, and the other pointed out that the project would "result in habitat loss and impact wildlife."



## Discussion

The results of the analysis based on cause of accidents showed that, of the 11 accidents included in the analysis, only one could be attributed to the narrowness of the road.

This seems to support the hypothesis, as the logical conclusion of these results is that a road expansion would not have prevented the vast majority (~91.7%) of the accidents we analyzed based on the causes mentioned in their articles. The location-based analysis indicates a similar conclusion, given that only a small minority of the accidents we analyzed (five of the 22, or ~22.7%) potentially took place in the protected area, with only one of those clearly attributable to road narrowness.

It should be noted that even the articles for the five accidents which potentially took place in the protected area, all of which were on the Anmod Ghat road, did not specify

which point on the Anmod Ghat road they took place. Given that that stretch of road extends outside of the protected area as well, it is possible that some or all of these accidents did not take place in the protected area either.

From the above analyses, it seems the road widening project on the NH4A in the Mollem protected area would not be effective at curbing the rates of accidents, and accident-related deaths and injuries along this road, or even target the area responsible for most incidents. Therefore, all the available data from subset A supports the hypothesis.

The results of the analysis of subset B also support the hypothesis. Of the reasons for accidents mentioned, such as iron ore transportation issues in monsoon, potholes and speeding, none would be solved or even mitigated by a road expansion.



Dead green vine snake that sadly became roadkill due to passing cars. This was on the 13km section of the NH4A in the Bhagwan Mahavir Wildlife Sanctuary and Mollem National Park. ©Omkar Dharwadkar.

In fact, in the article in which locals complained about iron ore transportation, it was also mentioned that several fatal accidents were caused by mining traffic in earlier years as well, but those were not monsoon-related. The article did not cite the reasons for those previous accidents. While we must admit that one of the articles cited Usgao

locals requesting an expansion of the NH4A, it is important to mention they did so because they believed it would curb the consequences of speeding. Evidence indicates this would not be effective, and in fact the contrary is often true i.e. wider roads are often correlated to higher rates of speeding (Noland 2003) (as will be discussed further in the conclusion).

However, the 23 accidents we have data for are only approximately 10.65% of the reported 216 accidents that occurred along the Anmod-Mollem section of the road between 2011 and 2019. And for 12 of those, we do not know the cause of the accidents (though at least eight of the 12 did not take place on the section of the NH4A in the protected area). These limits of our sample also limit the potential for extrapolation of our results, indicating a need for further research.

## Conclusion

The results of our analysis of the quantitative and qualitative data from the articles in subsets A and B show that, judging from the available data, there is no evidence to support the idea that a road widening project on the NH4A would reduce accidents in the region. That said, our analysis is only a starting point to provide information on all the accidents that occurred from 2011 to 2019 on the Anmod-Mollem ghat section of the NH4A. We were limited to using as our

sample the accidents reported on by the media, as the Public Works Department (the user agency) has no detailed information about these accidents publicly available.

There is a need for future research, as mentioned earlier. There is also a need for the government itself to release important information to facilitate such research before advancing these projects, and to demonstrate the reasoning behind them.

However, all available data supports the hypothesis, i.e., supports the conclusion that a road widening project on the NH4A in the Mollem protected area would not reduce accidents. There is no available data that does not support the hypothesis. In fact, given the evident issue of speeding that has been causing accidents, a road expansion could worsen the problem. A study by the Sam Higginbottom Institute of Agriculture, Technology and Sciences at Allahabad determined that the main cause of road accidents in India is speeding (Singh et al. 2015).

At least in the USA, wider lanes have been correlated to greater speeding and increased accidents, according to a study from Rutgers University (Noland 2003). The study puts forward that when there are wider lanes, “drivers may feel safer and reduce cautionary behaviour” leading to the increased rates of accidents seen on wider roads in America. It

was also posited that expanded roads led to up to an extra 900 accident-related fatalities per year in the USA (Noland 2003).

It is outside the scope of our research to propose any road related policy. But given that the project would cause significant ecological damage and risk the long-term survivability of numerous endemic and endangered species, and is based on an at best questionable claim, we must advise that it be put on hold at least until conclusive research proves its efficacy.

We must also advise that due diligence in procedure could be followed, such as in the case of the stretch of the NH4A in Karnataka. In Karnataka, the road passing through Kali Tiger Reserve is not being expanded, and that reserve is contiguous with the BMWS and MNP.

One possible alternative approach we recommend is for the state government to send representatives to the Ministry of Environment, Forests and Climate Change to re-evaluate these projects. They could also ask the Goa Forest Department to get the user agencies to rework their present proposals to put forth a working model (with livelihood and ecological tourism data) to show why an existing wide double road with 7m carriage needs to be made into a broader highway within a 13km segment of Goa's largest protected area.

There is also no data recorded on the intensity and volume of traffic through this protected area yet, which would be essential for proving the necessity (or lack thereof) of the NH4A expansion project in the protected area. Furthermore, the environmental impact assessment granted to the project has some serious issues, as identified by a detailed project report submitted by more than 30 scientists to the Central Empowered Committee of the Supreme Court (Punjabi et al. in press).

This report pointed out several problematic scientific statements in the Road EIA. For example, the EIA states that the road expansion will not affect faunal species, instead suggesting that species "may increase in number because of the road structures as the project will not obstruct their movement but rather can create new habitats for them" (Arvee Associates 2018).

As discussed in the **Background of the biodiversity of the Bhagwan Mahavir Wildlife Sanctuary and Mollem National Park and the potential impact of a road widening project** section of the paper, habitat fragmentation due to roads, which would become a worse issue with an expansion, is a major problem with severe impacts on the survivability of faunal species. There are also other concerns, as mentioned in the same section. We were unable to find a scientific basis for that statement in the EIA.



We would also advise research into alternate solutions directed at clearly identified accident-causing issues such as speeding, keeping in mind that wider roads could exacerbate the same.

It should also be noted that seasonal travellers that visit the area for nature-based tourism are unlikely to demand a highway, and when this route is blocked, they already access the border through other routes such as Chorla Ghat (Travel and Tourism Association of Goa 20 July 2020). This should be considered in any research into the necessity (or lack thereof) of the NH4A expansion project.

However, keeping all of the above in mind, the final result of our study is that, for the time being, our hypothesis seems proven.

## References

**Aarvee Associates (2016a).** Executive Summary. *Forestclearance.Nic*, [forestsclearance.nic.in/DownloadPdfFile.aspx?FileName=0\\_0\\_81191211291Projectdescription.pdf&FilePath=../writereaddata/Addinfo/](http://forestsclearance.nic.in/DownloadPdfFile.aspx?FileName=0_0_81191211291Projectdescription.pdf&FilePath=../writereaddata/Addinfo/).

**Aarvee Associates (2016b).** Wild Life Report. *ForestsClearance.Nic.In*, [forestsclearance.nic.in/admin/useragency\\_report\\_w.aspx?pid=FP/GA/ROAD/19978/2016](http://forestsclearance.nic.in/admin/useragency_report_w.aspx?pid=FP/GA/ROAD/19978/2016). Accessed 18 December 2020.

**Aarvee Associates (2018).** *Environmental Impact Assessment for the Wild Life Clearance for Four Laning of Existing Goa/Karnataka Border - Panaji-Goa Section of NH4A (New NH748) from Km 84.133 to Km 97.000 in the State of Goa on BOT (Toll) Basis under NHDP-III (Anmod-Mollem Section)*, 82pp.

**Brockerhoff, E.G., L. Barbaro, B. Castagneyrol, D.I. Forrester, B. Gardiner, J.R. Gonzalez-Olabarria, P.O.B. Lyver, N. Meurisse, A. Oxbrough, H. Taki, I.D. Thompson, F. van der Plas & H. Jactel (2017).** Forest biodiversity, ecosystem functioning and the provision of ecosystem services. *Biodiversity and Conservation* 26: 3005–3035. <https://doi.org/10.1007/s10531-017-1453-2>.

**Chandawarkar, R. (2020).** Infra Projects in Mollem Generate Heat at Virtual Debate. *OHerald*, Herald, [www.heraldgoa.in/Cafe/Infra-projects-in-Mollem-generate-heat-at-virtual-debate/16486](http://www.heraldgoa.in/Cafe/Infra-projects-in-Mollem-generate-heat-at-virtual-debate/16486). 03 September 2020.

**Crooks, K. R., C.L. Burdett, D.M. Theobald, S.R.B. King, M. Di Marco, C. Rondini & L. Boitani (2017).** Quantification of habitat fragmentation reveals extinction risk in terrestrial mammals. *Proceedings of the National Academy of Sciences* 114(29): 7635–7640. <https://doi.org/10.1073/pnas.1705769114>.

**Datar, M. & P. Lakshminarasimhan (2011).** Endemic plants of Bhagwan Mahaveer National Park, Goa-an analysis based on their habitat, phenology and life form types. *The Indian Forester* 137: 1451–1456.

**Dinesh, K.P., C. Radhakrishnan, B.H. Channakeshavamurthy, P. Deepak & N.U. Kulkarni (2020).** A Checklist of Amphibians of India with IUCN Conservation Status. Version 3.0. updated till April 2020. available at <http://zsi.gov.in> (online only).

**Fahrig, L. (2003).** Effects of Habitat Fragmentation on Biodiversity. *Annual Review of Ecology, Evolution, and Systematics* 34(1): 487–515. <https://doi.org/10.1146/annurev.ecolsys.34.011802.132419>.

**Fernandes, A.P., G. Punjabi, A. Jayadevan, A. Borker, D. Halali, E. Purdie, F.D. Patel, H. Gawas, H. Gawas, H. Gauns et al. (2020).** *Inadequacy of Environment Impact Assessment for Projects in Bhagwan Mahavir Wildlife Sanctuary and National Park A Peer Review*.

**Global Biodiversity Hotspots with Special Emphasis on Indian Hotspots.** *ENVIS Resource Partner on Biodiversity*, [http://www.bsienvnis.nic.in/Database/Biodiversity-Hotspots-in-India\\_20500.aspx](http://www.bsienvnis.nic.in/Database/Biodiversity-Hotspots-in-India_20500.aspx). Accessed 14 November 2020.

**Laurance, W. F., M.W. Goosem & S.G.W. Laurance (2009).** Impacts of Roads and Linear Clearings on Tropical Forests. *Trends in Ecology & Evolution* 24(12): 659–669. <https://doi.org/10.1016/j.tree.2009.06.009>.

National Highway 748 (India). *Wikipedia*, Wikimedia Foundation, [en.wikipedia.org/wiki/National\\_Highway\\_748\\_\(India\)](en.wikipedia.org/wiki/National_Highway_748_(India)).

**Nayak, R., K.K. Karanth, T. Dutta, R. Defries, K.U. Karanth & S. Vaidyanathan (2020).** Bits and pieces: forest fragmentation by linear intrusions in India. *Land Use Policy* 99: 104619. <https://doi.org/10.1016/j.landusepol.2020.104619>.

**Noland, R.B. (2003).** Traffic fatalities and injuries: the effect of changes in infrastructure and other trends. *Accident Analysis & Prevention* 35(4): 599–611. [https://doi.org/10.1016/s0001-4575\(02\)00040-4](https://doi.org/10.1016/s0001-4575(02)00040-4).

**Prasad, A.E. (2009).** Tree community change in a tropical dry forest: the role of roads and exotic plant invasion. *Environmental Conservation* 36(3): 201–207. <https://doi.org/10.1017/s0376892909990257>.

**Rahmani, A.R., Z. Islam & R. Kasambe (2016).** Important Bird and Biodiversity Areas in India - Priority Sites for Conservation (Revised and updated). Bombay Natural History Society, Indian Bird Conservation Network, Royal Society for the Protection of Birds and BirdLife International (U.K.).

**Rahman, T.R.S. (2011).** Nature Conservation Foundation, *Framing Ecologically Sound Policy on Linear Intrusions Affecting Wildlife Habitats: Background Paper for the National Board for Wildlife, Ministry of Environment and Forest, India*.

**Selvan, M. (2012).** Roadkill animals on national highways of Karnataka, India. *Journal of Ecology*

and *The Natural Environment* 4(14): 363–365. <https://doi.org/10.5897/jene11.068>.

**Singh, N., E. Ali, A.F. Denis, A. Herbert & F.E. Kujur (2015).** Identification and improvement of highway accident causes and safety management strategies. *Journal of Academia and Industrial Research* 3(8): 346–347.

**Travel and Tourism Association of Goa (20 July 2020).** Letter to Central Empowered Committee on Concerns regarding Forest Land Diversion for NH4A highway expansion, Railway double tracking, and laying of LIL0 transmission line through Bhagwan Mahaveer Wildlife Sanctuary and Mollem National Park.

## Acknowledgements

We thank Meghna Agarwala, Assistant Professor of Environmental Studies at Ashoka University and Nandini Velho, a faculty member of Srishti Institute of Art, Design and Technology for their insights on the manuscript. We would also like to thank Shashank Srinivasan and Arjun Menezes of Technology for Wildlife for their help in mapping the locations of the accidents via google maps. We thank Omkar Dharwadkar of the Goa Bird Conservation Network and Mangesh Gaonkar of Dhargem for their assistance in locating areas mentioned in the accident articles that we had trouble finding on Google Maps.

## Rohan Menezes<sup>1</sup> & Lisann Dias<sup>2</sup>

<sup>1</sup> Intern at MyMollem, Goa, India and BA candidate at Dartmouth College, Hanover, NH 03755, USA.

<sup>2</sup> Master's in Public Policy student, St. Xavier's College, Mumbai 400001, Maharashtra, India.

Emails: <sup>1</sup> rohan.a.menezes.23@dartmouth.edu,

<sup>2</sup> lisannnds@gmail.com (corresponding author).

## Appendix 1. Data Tables used for Analysis.

### Appendix 1A. Traffic Police Report on Accidents on Anmod-Mollem Ghat section of NH4A from 2011-19.

- Annexure - A. Colly -

#### Details of accidents in Anmod - Mollem Ghat section of NH-4A.

: Records maintained by Traffic Police Department, Goa.

Year	Total Accidents	Fatal		Grievuos		Slight		Minor
		Accidents	Killed	Accidents	Killed	Accidents	Killed	Accidents
2011	23	01	02	01	01	00	00	21
2012	32	01	01	00	00	04	20	27
2013	20	00	00	01	02	05	10	14
2014	20	01	01	00	00	03	03	16
2015	36	04	05	03	06	01	01	28
2016	38	03	03	01	01	02	04	32
2017	26	03	04	04	10	01	01	18
2018	18	01	02	00	00	01	06	16
2019	03	01	01	00	00	00	00	02

TOTAL 216 NOS.

Note: Anmod - Mollem Ghat section was closed for traffic after December 2018 because of upgradation and construction of NH-4A in the jurisdiction of Karnataka due to non availability of diversion roads.

  
E.L.XV (N\*)

Image 1. Number of accidents per year on Anmod-Mollem Ghat section of the road per gradation of seriousness.



Appendix 1B. Subset A Summary Tables (One Full, then one with only Accidents potentially in the Protected Area).

**Subset A: Accidents along the Anmod-Mollem Ghat section of the NH4A (/NH748)**

No.	Area	Year	Date	Deaths	Injured	Description	Newspaper Herald (H) Times of India (TOI)	Cause of Accident (NM=Not Mentioned)	Potentially In Protected Area? Y/N/U (Undetermined)
1	Anmod Ghat	2011	January 10	2	0	Truck fell into ravine while trying to make way for other car	TOI	Road narrowness	Y
2	Kasavali	2011	June 5	1	1	Truck collides with sumo jeep	H	NM	N
3	Dharbandora	2011	September 20	2	0	Duo crushed by falling truck when it skidded off road and they tried to jump out	TOI	Lost control of vehicle	N
4	Casaulim	2011	October 17	2	0	Truck hit car	UNI (United News of India)	NM	N
5	Suktollem	2011	October 18	2	0	Empty mining tipper truck rammmed into car	TOI	Speeding	N
6	Dharbandora	2011	October 21	1	0	Driver lost control of truck and hit tree	TOI	Lost control of vehicle	N
7	Dharbandora	2012	July 13	0	1	Car hits motorcycle	H	NM	N
8	Dharbandora	2012	August 30	1	0	Speeding tipper truck hit man	TOI	Speeding	N
9	Suktalem	2013	April 29	1	0	Man lost control of motorcycle	TOI	Lost control of vehicle	N
10	Cansaulim	2013	September 20	0	1	Collision between containers	H	Driving on wrong side of road	N
11	Dharbandora	2013	October 6	1	0	Hit-and-run	H	NM	N
12	Casauli	2013	October 12	0	2	Speeding tempo hits car	TOI	Speeding	N
13	Dharbandora	2013	December 13	0	2	Two trucks collided	H	NM	N
14	Usgao	2015	February 6	1	0	Hit-and-run (presumed), victim was also drunk	TOI	NM	N
15	Anmod Ghat	2015	February 19	1	0	Collision between truck and container trailer	TOI	NM	Y
16	Cansaulim	2015	February 19	1	3	Car hit tree	TOI	NM	N
17	Anmod Ghat	2015	August 10	1	1	Collision of bus and motorbike at curve	TOI	Lost control of vehicle	Y
18	Kerya, between Ponda bus stand and Shigao	2015	September 6	0	30	Speeding truck tried to overtake bus, saw oncoming truck so turned and hit bus	H	Speeding	N
19	Mollem	2016	March 12	3	5	Truck and land cruiser jeep collided	H	NM	U
20	Anmod	2016	April 10	1	0	Collision of tempo and two-wheeler	TOI	NM	N
21	Dharbandora	2017	April 5	1	0	Collision of bus and motorbike	H	NM	N
22	Between Mollem and Anmod Ghat	2017	June 22	0	0	Trailer carrying wheel loaders turned turtle	DNA (Diligent Media's Daily News Analysis)	NM	Y
23	Anmod Ghat	2018	January 14	2	6	Speeding truck hits car while attempting to overtake	UNI	Speeding	Y
				<b>Total</b>	<b>24</b>	<b>52</b>			

Image 2. Each article of Subset A with each of the eight variables recorded.

# Highlight

Subset A Subsection: Accidents potentially inside Protected Area								
No.	Area	Year	Date	Deaths	Injured	Description	Newspaper Times of India (TOI)	Cause of Accident (NM=Not Mentioned)
1	Anmod Ghat	2011	January 10	2	0	Truck fell into ravine while trying to make way for other car	TOI	NM
2	Anmod Ghat	2015	February 19	1	0	Collision between truck and container trailer	TOI	NM
3	Anmod Ghat	2015	August 10	1	1	Collision of bus and motorbike at curve	TOI	Lost control of vehicle
4	Between Mollem and Anmod Ghat	2017	June 22	0	0	Trailer carrying wheel loaders turned turtle	DNA (Diligent Media's Daily News Analysis)	NM
5	Anmod Ghat	2018	January 14	2	6	Speeding truck hits car while attempting to overtake	UNI (United News of India)	Speeding
<b>Total</b>				<b>6</b>	<b>7</b>			

**Image 3. Subsection with the five accidents that potentially took place in the protected area — all on the Anmod Ghat road, which extends outside of the protected area as well.**

## Appendix 1C. Subset B summary table.

Subset B: Articles related to the accident situation along the NH4A (/NH748)						
No.	Area	Year	Date	Imp. info	Newspaper Herald (H) Times of India (TOI)	
1	Mollem	2011	October 24	NH expansion in Mollem is needed quickly as it has been pending since 2006, and will stop 50-60 mining traffic accidents annually on that road	TOI	
2	Goa	2019	September 1	Bad pothole situation in many Goan roads, patchwork not yet begun on Mollem-Vasco road	H	
3	Bhoma-Farmagudi	2020	February 7	Locals want Bhoma-Farmagudi road widened to reduce accidents due to speeding on the road causing traffic for thousands of vehicles	H	
4	Dharbandora	2020	February 26	CM Sawant said four lane NH work from Belgaum to Mollem would be completed within a year	H	
5	Mollem	2020	June 11	Clearance granted to three projects in Bhagwan Mahavirand Mollem protected areas harming wildlife and causing habitat loss	Navhind Times	
6	Usagao, Mollem-Ponda road	2020	June 18	Usgao locals fear ore transportation during monsoon will cause accidents due to visibility issues, slippery roads and risky overtaking by ore trucks	H	
7	Mollem	2020	August 22	MP Sardinha says govt should acquire pvt forests to protect them, implement projects to prevent accidents, says govt can plant trees to replace ones cut	TOI	

**Image 4. Each article of subset B with each of the five variables recorded.**

## Appendix 2. Images of articles for examples and reference.

### Appendix 2A. Speeding accidents.

8/23/2020 Two crushed to death in Mollem car mishap

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### Two crushed to death in Mollem car mishap

[Export Citation](#)

The Times of India (TOI)

October 18, 2011 Tuesday

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**Section:** GOA

**Length:** 123 words

#### Body

Ponda: Two persons died on the spot in road mishap at Suktollem **Mollem** on the Goa-Karnataka national highway on Sunday afternoon. Both the driver and the occupant of the car were crushed to **death**.

Ajay Kumar, 28, a resident of Andhra Pradesh, who worked as an area sales manager of Maruti cars was returning to Karnataka in the official car driven by Chandu Chawhan, 35, a resident of Hubli, when an empty mining tipper truck rammed into them at Suktollem crushing the duo to **death**, police sources said.

The truck which was on its way to Dharbandora was speeding and did not see the oncoming car. The driver of the truck, Suraj Desai, a resident of Madhalawada Sancorda in Dharbandora, has been detained.

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Image 5. 2 killed as speeding mining truck hit car (TOI, October 18 2011).



8/23/2020

Driver held, released in hit-and-run

Document: Driver held, released in hit-and-...

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## Driver held, released in hit-and-run

Export Citation

The Times of India (TOI)

August 30, 2012 Thursday

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**Section:** GOA

**Length:** 168 words

### Body

PONDA: Ponda police arrested tipper truck driver Sagar Parulekar, 35, resident of Collem for knocking down pedestrian Sadanand Kerkar, 58, and killing him on Saturday.

Parulekar had fled from the accident site.

Kerkar was standing near Dharbandora panchayat office at **Mollem-Sancorda-Usgao** junction when he was hit by the speeding truck.

Kerkar was severely injured and was admitted to Goa medical college and hospital (GMC) at Bambolim, where he succumbed to injuries on Monday night. He had severe head injuries, police said.

Ponda police have registered a case under Sections 279 (rash and negligent driving), 304 - A (culpable homicide not amounting to murder) of Indian Penal Code (IPC) and Section 134 A & B (fleeing without providing medical aid and informing the police) of Motor Vehicle Act.

Soon after Kerkar's **death**, police picked up Parulekar from his home. He was later released on bail. Police have handed over body to Kerkar's family after an autopsy on Tuesday.

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### Classification



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Image 6. Speeding truck kills pedestrian (TOI, August 30 2012).

## Appendix 2B. Accident due to losing control of vehicle.

8/23/2020 Bogmalo youth dies in Mollem road accident

Document: Bogmalo youth dies in Mollem r... Actions Select Language Disclaimer

< 1 of 71 Results list >

### Bogmalo youth dies in Mollem road accident

[Export Citation](#)

The Times of India (TOI)

August 10, 2015 Monday

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**Section:** GOA

**Length:** 200 words

#### Body

PONDA: Kumar Nemappa Pawar, 21, of Bogmalo, Vasco, succumbed to grievous injuries that he had sustained in a hit-n-run case at Anmod Ghat in **Mollem**.

Pawar, a native of Bagalkot, Karnataka, was returning from his native place on a two-wheeler when a NEKSRTC passenger bus knocked him down.

Soon after the mishap, the bus driver, Rajkumar Lamani, 32, of Madinal, Muddebihal-Bijapur, Karnataka, fled from the spot without giving medical aid to the victim and informing the police.



He was later traced at Ponda by Ponda police and handed over to Collem police. The bus was proceeding to Karnataka, while

the victim was on his way to **Mollem**. On reaching a curve on the road at Anmod Ghat, the bus driver lost control over his vehicle and it dashed against Pawar's bike.

Pawar sustained grievous injuries and succumbed to them on the way to the Dharbandora primary health centre. Videsh Naik, a resident of Dabolim, who was riding pillion with Pawar, was also injured seriously and admitted to the Goa medical college and hospital, Bambolim, for treatment.

Collem police arrested the bus driver, Lamani, under several sections of the IPC and MV Act. He was later released on bail.

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Image 7. Bus drivers loses control of vehicle and hits bike, causing death of rider (TOI, August 10, 2015).

8/23/2020

Driver, cleaner crushed to death under toppled truck

Document: Driver, cleaner crushed to deat...

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## Driver, cleaner crushed to death under toppled truck

Export Citation

The Times of India (TOI)

September 20, 2011 Tuesday

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**Section:** GOA

**Length:** 211 words

### Body

<p>

PONDA: A driver and cleaner were crushed to **death** under their toppled truck at Dharbandora on Sunday.</p>

<p>

Police sources said the duo attempted to escape from the truck after they noticed it skidding off the road.</p>

<p>

The goods truck was proceeding from **Mollem** to Usgao. When it reached Durgini-Dharbandora, the 25-year-old driver, Umashankar, a resident of Bihar, lost control over the vehicle. He and the 22-year-old cleaner Manoj Singh, a resident of Jharkhand, immediately attempted to jump out of the vehicle to save their lives. However, the duo were crushed beneath the toppled truck.</p>

<p>

Other truck operators passing by summoned a JCB excavator and retrieved the vehicle. They tried to rescue the duo, but both had died on the spot, said police sources.</p>

<p>

Ponda police have retrieved the bodies and preserved them at the Goa Medical College (GMC) and hospital mortuary at Bambolim. They have also informed the respective families of the incident. After the victims' families come to Goa, autopsies will be conducted, police sources added.</p>

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**Image 8. Truck driver loses control of vehicle, he and passenger jump out but are crushed as truck falls (TOI, September 20 2011).**










## Appendix 2C. Accident related to road-narrowness.

8/23/2020 Two die as truck falls into Anmod ravine

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### Two die as truck falls into Anmod ravine

 [Export Citation](#)

The Times of India (TOI)

January 10, 2011 Monday

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**Section:** GOA

**Length:** 240 words

#### Body

PONDA: Two persons were killed on the spot when the truck in which they were proceeding to Belgaum fell into a 100 m-deep ravine along the Anmod ghat on the Goa-Karnataka highway.

Collem police said the accident occurred when the truck tried to make way for an oncoming vehicle on Friday night. It skidded off the edge of the road and plunged into the ravine.

The bodies of driver Jagdish Gurappa Goddi, 35, resident of Navalgond-Dharwad in Karnataka, and cleaner Basavraj Maruti Budnoor, 22, resident of Anandnagar, Hubli, were recovered on Saturday morning after a search was launched.

Collem PI Manoj Mardolkar said the empty national permit truck (KA 25 B 9967) was proceeding towards Belgaum when the fatal accident took place.

According to police, at the time of the mishap, the truck was on a sharp turn on Anmod ghat, about 12 km from **Mollem** check-post and 2 km from Dudhsagar.

Though the driver and cleaner jumped out of the vehicle they hit a sharp rocky cliff

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Image 9. Truck moved to make way for other vehicle and fell into ravine (pg.1, TOI, January 10 2011).

8/23/2020

Two die as truck falls into Anmod ravine

resulting in their immediate **death**. Mardolkar said the post mortem report confirmed that the **death** was due to multiple fractures and damage to the cervical bone and spinal cord.

The bodies have been handed over to the families of the deceased after autopsies conducted at Goa Medical College and Hospital at Bambolim on Saturday afternoon.

"The truck is damaged. A high-powered crane is required to pull it out of the ravine," Mardolkar said.

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## Classification

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**Language:** ENGLISH

**Publication-Type:** Newspaper

**Subject:** AUTOPSIES (78%); **DEATH & DYING** (78%); TRAFFIC ACCIDENTS (78%); ACCIDENTAL FATALITIES (78%); BONE FRACTURES (77%); SAFETY, ACCIDENTS & DISASTERS (77%)

**Industry:** TRAFFIC ACCIDENTS (78%)

**Geographic:** GOA, INDIA (89%); KARNATAKA, INDIA (73%); INDIA (90%)

**Load-Date:** January 9, 2011



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Image 10. Truck moved to make way for other vehicle and fell into ravine (pg.2, TOI, January 10 2011).

## Appendix 2D. Locals fear mining will cause accidents.

8/23/2020 Usgao locals fear ore transportation during monsoon will lead to accidents


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### Usgao locals fear ore transportation during monsoon will lead to accidents

 Export Citation

Herald (Goa) (India)

June 18, 2020 Thursday

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**Length:** 329 words

**Dateline:** PONDA


#### Body

PONDA, June 18 -- The mining transportation of royalty-paid ore may have provided employment to truck owners, truck drivers and other mining dependents, however, the locals in the Usgao-Dharbandora mining belt feel that the ore transportation during monsoon is dangerous and fear that this will lead to accidents.

Demanding control on the speed of trucks, they claimed that the drivers are often involved in overtaking dangerously to increase the number of trips.

They informed that earlier during the mining season, the ore transportation used to stop during monsoon.

They complained that several ore laden trucks are transporting ore from Dharbandora to the Usgao-Arona mining belt. Though there is gap maintained by trucks during transportation, the locals said during heavy rains on account of poor visibility it becomes difficult for other vehicles especially riders to give way. It has been raining heavily now and the monsoon will be at its peak in July.



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Image 11. Mining during monsoon causes accidents, locals say (pg.1, Herald, June 18 2020).



8/23/2020

**Usgao locals fear ore transportation during monsoon will lead to accidents**

They further complained that the truck drivers overtake dangerously on the slippery roads thereby putting the lives of two-wheeler riders at risk.

Chetan, who commutes on a two-wheeler from **Mollem** to Ponda, said the truck laden with ore is covered with plastic; however some of it spills on road and makes the road slippery.

Dharbandora resident Ankush Naik said, "This is first time mining has continued during the monsoon. Earlier, the ore transportation used to stop by May-end or in the first week of June. It is learnt that mining transportation will continue till July and this may make situation dangerous for riders. Though transportation is necessary, at the same time taking care of locals' lives is also important."

Few years ago, when mining was at its peak, several **fatal** accidents occurred in mining belt.

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## Classification

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**Language:** ENGLISH

**Publication-Type:** Newspaper

**Subject:** MONSOONS (90%); TRAFFIC ACCIDENTS (78%); ACCIDENTAL FATALITIES (72%); SAFETY, ACCIDENTS & DISASTERS (72%); WEATHER (72%)

**Industry:** TRUCK DRIVERS (90%); TRAFFIC ACCIDENTS (78%); MEDIA CONTENT (62%)

**Geographic:** GOA, INDIA (93%); INDIA (92%)

**Load-Date:** June 18, 2020



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Image 12. Mining during monsoon causes accidents, locals say (pg.2, Herald, June 18 2020).

## Interesting foraging behaviour of Crab Plover in Manali Island, Gulf of Mannar, India

The Crab Plover *Dromas ardeola*, the only member of the family Dromadidae, is an elegant and unmistakable species with the restricted range extension recorded from limited sites in India. Ali & Ripley (1983) mentioned that in India it winters in small numbers on the western coast and peninsular India. On the western coast, the beaches and the islands of the Gulf of Kutch and Saurashtra coasts are the most favoured haunts of this species, where it occurs in a few thousands.

On the eastern coast, it is presently seen only in Manali and Hare islands. The foraging observations were done during the coastal bird monitoring study done during the years 2018 and 2019 on the island of Manali in the Gulf of Mannar Biosphere Reserve.

The Crab Plovers look more like plovers but have very long grey legs and a strong heavy black bill similar to a



Crab Plover flight.



Feeding on elevated mudflats and in pools.

tern. Its black-and-white plumage and long-necked upright posture with a heavy bill make it distinctive and unmistakable. Its bill is unique among waders and specialized for eating crabs

(Hayman 1986). I found some interesting foraging behaviour of these birds during our recent field site visits. Crab Plovers forage using a distinct walk-stop-look method, obviously using their





Crab Plover maintaining distance while foraging.



Crab Plover flocks.

eyes to locate prey in the low tides in the intertidal zones of the Manali island. Foraging occurred in a small pool of water either on the edges or inside the pool where the depth was less. The birds also ran to the higher sand flat parts between the pools and continued foraging for some

time. The birds kept a distance between themselves (Soni & Bhuva 2007). During stops, the Crab Plover turned its head and looked for potential prey in the near vicinity. Prey was located by eye; however, during the observations, it was noted that whilst hunting in a pool a bird

regularly dipped its slightly open bill into the water. This action was repeatedly done and is similar to that found in many *Calidris* species (Swennan et al. 1987).

The prey was collected by chasing the bird while feeding and the leftovers were



identified. The smaller crabs were grabbed with the bill and swallowed whole, while larger crabs were stabbed with the bill, dismembered, and eaten. The foraging Crab Plover was seen moving around the prey in a circle with its head and neck facing the prey. The legs were rapidly lifted from the water and the bill simultaneously stabbing at the prey. When the prey was seized it was lifted immediately taken from the pool onto a higher area while being held by the legs. It was shaken and dropped, the legs being pulled or shaken off. The legs were always eaten first, then the body was eaten as a whole or broken up, by placing it on the sand and stabbing the underside. This method was always adopted for larger crabs. The prey species included crabs (*Thalamita crenata*, *Macrophthalmus depressus*, and mostly juveniles of *Portunus portunus* & Fiddler Crab *Uca* spp.), common burrowing crab *Macrophthalmus parvimanus*, and *M. telescopicus* (Penny 1971; Balachandran 1990).

## Crab species from Manali Island - Gulf of Mannar.



*Macrophthalmus* sp.



*Portunus pelagicus*.



*Uca annulipes*.





Crab Plover foraging.

#### References

- Ali, S. & S.D. Ripley (1983).** *Handbook of the Birds of India and Pakistan. Compact edition.* Oxford University Press, New Delhi.
- Balachandran, S. (1990).** Studies on the coastal birds of Mandapam and the neighbouring islands (Peninsular India). Ph.D. Thesis, Annamalai University, Annamalai Nagar, India.
- Hayman, P., J. Marchant & T. Prater (1986).** *Shorebirds.* Croom Helm.
- Penny, M.J. (1971).** Migrant waders at Aldabra, September 1967–March 1968. *Philosophical Transactions of the Royal Society of London* 260: 549–559.
- Soni, V.C. & V.J. Bhuva (2007).** Feeding ecology of Crab Plovers *Droma ardeola* in the Gulf of Kachchh, India. *Wader Study Group Bulletin* 113: 32–36.
- Swennan, C., N. Ruttanadake, S. Ardseugnusu & J.R. Howes (1987).** Foraging behaviour of the Crab Plover *Dromas ardeola* at Ko Liborg, southern Thailand. *Natural History Bulletin Siam Society* 35: 27–33.

**Acknowledgments:** I am grateful to Dr. Balachandran, Bombay Natural History Society for several discussions and insights of his experience in the landscape and shorebirds and the feeding habits. I also thank Dr. Ravichandran, S. from Marine Sciences, Annamalai University for helping in the identification of crabs species. My special thanks to S. Chandrashekar, Madras Natural Society for several trips to GoM and the islands. The former wildlife warden, Mr. Ashok Kumar, and DFO Mr. Arun Kumar for accompanying and facilitating our boat trips several times during the years. Special thanks to boatmen and the Gulf of Mannar Forest Department staff for all help during the field visits.

#### H. Byju

Independent Researcher, No. 35, Rakatchi Garden, Ganapathy P.O., Coimbatore, Tamil Nadu 641006, India. Email: byjuhi@gmail.com (corresponding author)

**Citation:** Byju, H. (2020). Interesting foraging behaviour of Crab Plover in Manali Island, Gulf of Mannar, India. *Bird-o-soar* #63, In: *Zoo's Print* 35(12): 25–28.

## A preliminary study on avifauna of three sacred groves of Radhanagri Tehsil, Maharashtra, India

Birds are one of the important species in animal groups and are ecologically extremely different and occupy a wide range of habitats. Literature reports that sacred groves are excellent and protective site for all diverse groups of birds species (Deb et al. 1997; Jyothi & Nameer 2015).

In India, sacred groves are remarkably spread with around 13,720 sacred groves distributed through 19 States (Malhotra et al. 2001). Maharashtra State has recorded total of 2,820 sacred groves by Gadgil & Vartak (1975) and Deshmukh (1999). According to Gadgil & Vartak (1975) this vegetation patches are preserved for deity instead of law or act imposed by government for the protection of forest. Communities believe that harming or destructing the flora and fauna of sacred groves leads to the wrath of the deity. Sacred groves are locally called 'Devrai' in Marathi and they are named according



**Image 1. Satellite map showing three sacred groves of Radhanagri Tehsil, Kolhapur, Maharashtra.**

to the god being worshiped. Presently, such diverse and biological heritage sites are least concern by researcher and these habitats are successively under stress of various detrimental human activities like increasing human interference, harming flora & fauna, and other developmental activities in sacred groves.

Human activities are relatively responsible for degrading the ecological quality of sacred groves. Hence, such biological heritage habitats are needed to evaluate the ecological condition using comprehensive study of

avifauna which is one of ecological indicator species. The present study was conducted at three sacred groves of Radhanagri Tehsil, Kolhapur District, Maharashtra, viz, Lingoba (16.36250°N & 74.03611°E), Gomata (16.35778°N & 74.04361°E) and Wakighol (16.28861°N & 74.00944°E) (Image 1).

Geographically, Lingoba sacred grove measured about 0.607ha, Gomata sacred grove is about 0.405ha while comparatively Wakighol Sacred Grove was larger than rest of them, it is measured around 1.092ha.





**Image 2. Sacred groves of study area.**

These sacred groves were named on the basis of deity being worshiped locally. The Lingoba and Gomata sacred groves of Aini Village are well known for gods Lingoba and Gomata while Wakighol Sacred Grove of Wakighol Village is famous for lord Wakoba (Image 2 a-c).

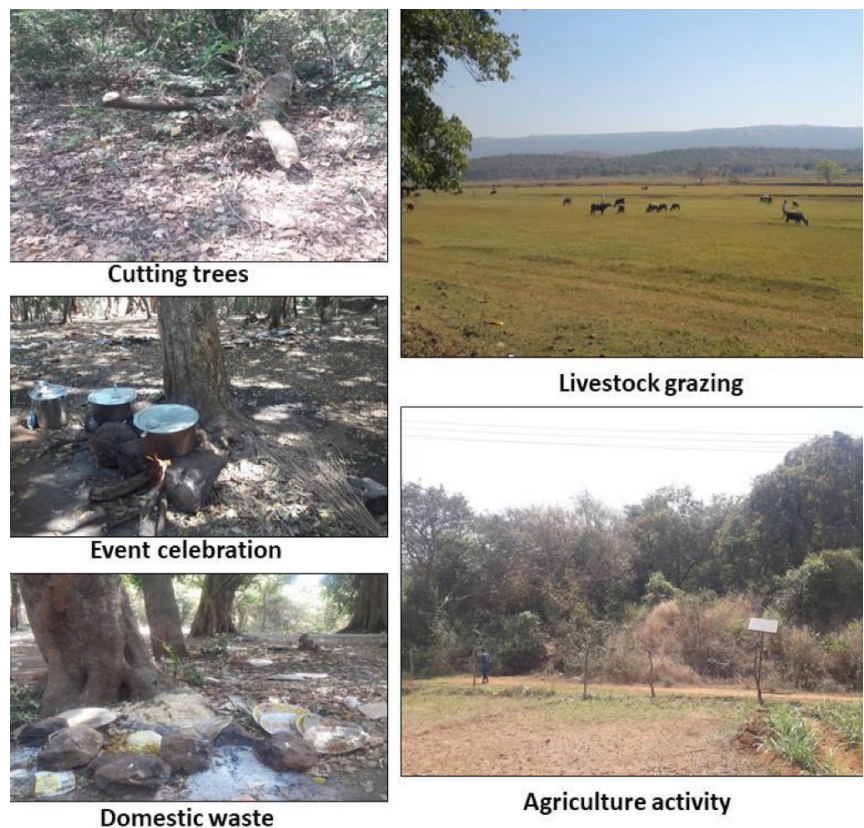
The birds were observed using binocular (10X5) and photographed (with Canon camera of 45X (Model-SX430 IS) and identified with the field guide of Ali (2002).

Present study was conducted from September 2018 to April 2019 to study the species composition and feeding habit by using point count method in three

sacred groves. In each sacred grove, the survey was conducted between 07.00–10.00 h and after noon

from 15.00 h to 17.00 h for observation and identification (using field guide of Ali 2002) of avifauna.

The birds are grouped under two categories namely R—Resident, M—Migrants depending on their timing and duration of occurrence (Ali 2002). The abundance status of birds are categorise into four groups, HA—Highly abundance (observed in all visits), A—Abundance (observed 5–6 times), M—Moderate (observed 3–4 times), L—Lesser (observed



**Image 3. Anthropogenic activities in and around sacred groves.**

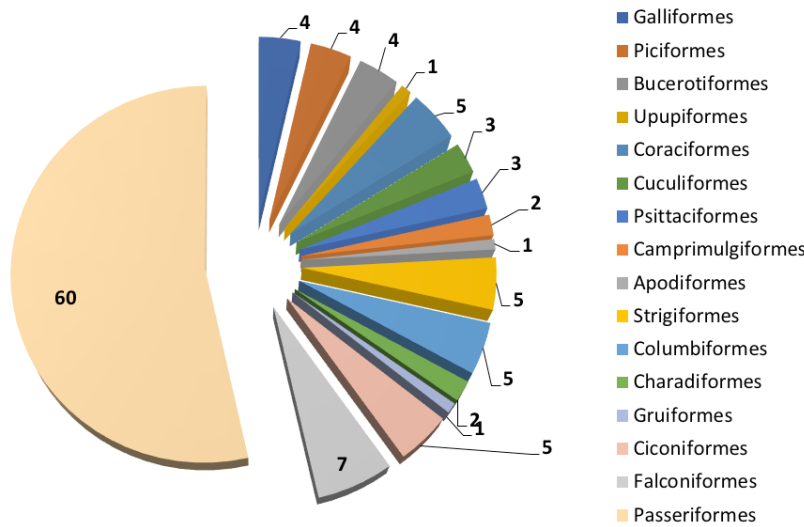


Fig. 1. Order wise distribution of birds in sacred groves.

only once). We have performed total of eight visits during the study period (September 2018–April 2019). Bird species were also assigned to a feeding guild following Salim Ali (2002), such as GV—granivorous, IV—insectivorous, CV—carnivorous, FV—frugivorous, OV—omnivorous, and PV—piscivorous.

A total of 108 bird species were observed belonging to 46 families and 16 orders (Tables 1). The order Passeriformes is dominated the list with 60 species, followed by Falconiformes with seven species and single species was recorded from order Upupiformes, Apodiformes,

and Gruiformes, respectively (Figure 1).

Among the 108 species recorded, 87.03% (94 species) were resident and 12.96% (14 species) were migratory (Figure 2). On the basis of the frequency

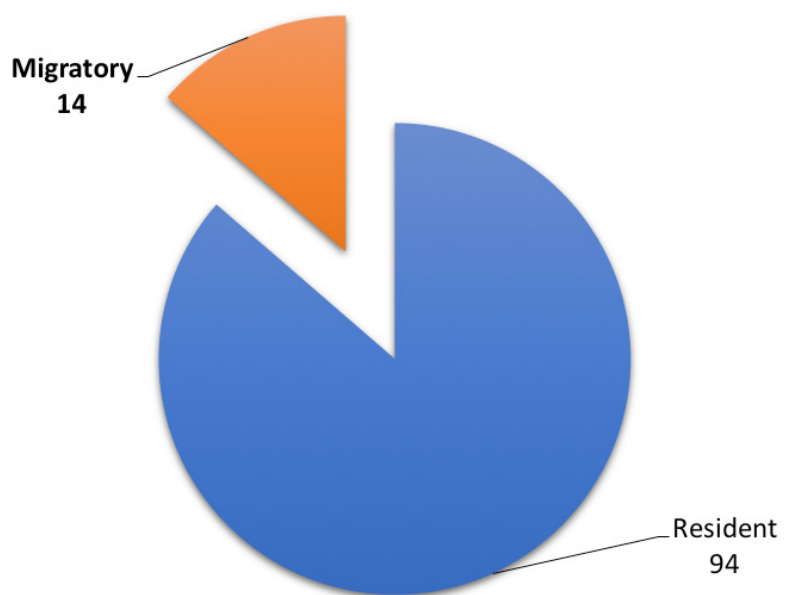


Fig. 2. Status of birds in sacred groves.

of occurrence of each bird species abundance, we calculated that 34 (31.48%) species were abundant followed by 31 (28.70%) moderate, 22 (20.37 %) highly abundant, and 21 (19.44%) lesser abundant respectively (Figure 3).

The data on feeding nature of bird species of scared groves were indicate that, the insectivorous and frugivorous birds were more positively associated with sacred grove than omnivorous, granivorous, carnivorous, and piscivorous (Figure 4).

Pradhan et al (2016) documented a total of 28 bird species from sacred groves

Table 1: Checklist, occurrence and distribution of birds at Sacred Groves of Radhanagari Teshii, Kolhapur.

Order	Families	Scientific Name	Common Name	Sacred Groves			Residency status	Abundance status	Feeding status
				LSG	GSG	WSG			
Galliformes	<b>Phasianidae</b>	<i>Coturnix coturnix</i>	Common Quail	+	+	+	M	A	GV
		<i>Perdica asiatica</i>	Jungle Bush-Quail	-	-	+	R	A	GV
		<i>Galliperdix spadicea</i>	Red Spurfowl	-	+	-	R	M	OV
		<i>Pavo cristatus</i>	Indian Peafowl	+	+	+	R	M	OV
Piciformes	<b>Picidae</b>	<i>Dinopium javanense</i>	Common Golden-backed Woodpecker	-	+	+	R	M	IV
		<i>Megalaima lineata</i>	Lineated Barbet	+	+	+	R	HA	FV
		<i>Megalaima haemacephala</i>	Coppersmith Barbet	+	+	+	R	HA	FV
		<i>Megalaima rubricapilla</i>	Crimson-throated Barbet	+	+	+	R	HA	FV
Bucerotiformes	<b>Bucerotidae</b>	<i>Ocyceros birostris</i>	Indian Grey Hornbill	+	+	+	R	M	FV
		<i>Anthracoceros coronatus</i>	Malabar Pied- Hornbill	-	-	+	R	M	FV
		<i>Ocyceros griseus</i>	Malabar Grey Hornbill	-	-	+	R	M	FV
		<i>Buceros bicornis</i>	Great Hornbill	-	-	+	R	M	FV
Coraciformes	<b>Upupidae</b>	<i>Upupa epops</i>	Common Hoopoe	+	+	+	M	M	IV
		<i>Coracias benghalensis</i>	Indian Roller	+	+	+	R	L	IV
		<i>Alcedo anthis</i>	Small Blue Kingfisher	-	-	+	M	L	PV
		<i>Halcyon smyrnensis</i>	White-breasted Kingfisher	-	+	+	R	L	PV
Cuculiformes	<b>Cerylidae</b>	<i>Ceryle rudis</i>	Lesser Pied Kingfisher	-	-	+	R	L	PV
		<i>Merops orientalis</i>	Small Bee-eater	+	+	+	R	HA	IV
		<i>Centropus bengalensis</i>	Lesser Coucal	+	+	+	R	HA	IV
		<i>Centropus sinensis</i>	Greater Coucal	+	+	+	R	HA	IV
Psittaciformes	<b>Cuculidae</b>	<i>Phaenicophaeus leschenaultii</i>	Sirkeer Malkoha	+	+	+	R	M	IV
		<i>Psittacula krameri</i>	Rose-ringed Parakeet	+	+	+	R	A	FV
		<i>Psittacula eupatria</i>	Alexandrine Parakeet	-	-	+	R	L	FV
		<i>Loriculus vernalis</i>	Indian Hanging-Parrot	-	-	+	R	M	FV
Apodiformes	<b>Apodidae</b>	<i>Apus affinis</i>	House Swift	+	+	-	M	HA	IV



Order	Families	Scientific Name	Common Name	Sacred Groves			Residency status	Abundance status	Feeding status
				LSG	GSG	WGS			
Caprimulgi-formes	Caprimulgidae	<i>Caprimulgus indicus</i>	Indian Jungle Nightjar	+	+	-	M	L	IV
		<i>Caprimulgus asiaticus</i>	Common Indian Nightjar	+	+	-	R	L	IV
Strigiformes	Tytonidae	<i>Ketupa zeylonensis</i>	Brown Fish-Owl	-	-	+	R	L	CV
		<i>Glaucidium radiatum</i>	Jungle Owlet	-	-	+	R	L	CV
	Strigidae	<i>Athene brama</i>	Spotted Owlet	+	+	+	R	M	CV
		<i>Treron phoenicoptera</i>	Yellow-footed Green-Pigeon	+	+	+	R	A	FV
Columbiformes	Columbidae	<i>Columba livia</i>	Blue Rock Pigeon	+	+	-	R	HA	GV
		<i>Streptopelia decaocto</i>	Eurasian Collared-Dove	+	+	-	R	A	GV
		<i>Streptopelia chinensis</i>	Spotted Dove	+	+	+	R	A	GV
		<i>Streptopelia senegalensis</i>	Little Brown Dove	+	+	+	R	A	GV
		<i>Amaurornis phoenicurus</i>	White-breasted Waterhen	-	-	+	R	M	IV
		<i>Vanellus indicus</i>	Red-wattled Lapwing	-	-	+	R	M	IV
Charadriiformes	Charadriidae	<i>Vanellus malabaricus</i>	Yellow-wattled Lapwing	-	-	+	R	L	IV
		<i>Ciconia episcopus</i>	White-necked Stork	+	-	-	R	L	PV
Ciconiiformes	Ciconiidae	<i>Ephippiorhynchus asiaticus</i>	Black-necked Stork	+	-	-	R	L	PV
		<i>Pseudibis papillosa</i>	Black Ibis	+	-	-	R	L	PV
Falconiformes	Threskiornithidae	<i>Elanus caeruleus</i>	Black-shouldered Kite	-	-	+	R	HA	CV
		<i>Milvus migrans</i>	Black Kite	-	-	+	R	HA	CV
		<i>Haliastur indus</i>	Brahminy Kite	-	-	+	R	HA	CV
		<i>Accipiter badius</i>	Shikra	-	-	+	R	A	CV
		<i>Accipiter virgatus</i>	Eurasian Sparrowhawk	-	-	+	M	M	CV
		<i>Circus macrourus</i>	Pallid Harrier	-	-	+	R	M	CV
		<i>Nisaea cirrhatia</i>	Crested Hawk- Eagle	-	-	+	R	L	CV

Order	Families	Scientific Name	Common Name	Sacred Groves			Residency status	Abundance status	Feeding status
				LSG	GSG	WGS			
Passeriformes	<b>Lanidae</b>	<i>Lanius excubitor</i>	Great Grey Shrike	+	+	+	M	A	IV
		<i>Lanius vittatus</i>	Bay-backed Shrike	-	+	+	R	A	IV
		<i>Lanius schach</i>	Rufous-backed Shrike	+	+	+	R	A	IV
	<b>Corvidae</b>	<i>Dendrocitta vagabunda</i>	Indian Treepie	-	-	+	R	M	OV
		<i>Corvus splendens</i>	House Crow	+	-	+	R	A	OV
		<i>Corvus macrorhynchos</i>	Jungle Crow	-	+	+	R	A	OV
		<i>Pericrocotus flammeus</i>	Orange Minivet	-	-	+	R	M	IV
	<b>Campephagidae</b>	<i>Pericrocotus cinnamomeus</i>	Small Minivet	-	-	+	R	M	IV
		<i>Rhipidura aureola</i>	White-browed Fantail Flycatcher	+	+	-	R	M	IV
	<b>Rhipiduridae</b>	<i>Aegithina tiphia</i>	Commom Iora	-	-	+	R	M	IV
		<i>Aegithina nigrolutea</i>	Marshall's Iora	-	-	+	R	M	IV
	<b>Dicruridae</b>	<i>Dicrurus macrocerus</i>	Black Drongo	+	+	-	R	A	IV
		<i>Dicrurus caerulescens</i>	White-bellied Drongo	+	+	-	R	A	IV
	<b>Oriolidae</b>	<i>Oriolus oriolus</i>	Eurasian Golden Oriole	-	+	+	M	M	IV
		<i>Oriolus xanthornus</i>	Black-headed Oriole	-	+	-	R	M	IV
		<i>Copsychus saularis</i>	Oriental Magpie-Robin	+	+	+	R	HA	IV
		<i>Saxicoloides fulicata</i>	Indian Robin	+	+	+	R	HA	IV
	<b>Muscicapidae</b>	<i>Monticola cinclorhynchus</i>	Blue-headed Rock-Thrush	+	-	+	M	L	IV
		<i>Myiophonus horsfieldii</i>	Malabar Whistling-Thrush	-	-	+	R	L	IV
		<i>Turdus merula</i>	Eurasian Blackbird	-	-	+	M	L	IV
<b>Paridae</b>	<i>Parus major</i>	Great Tit	+	-	+	R	M	IV	
	<i>Hirundo rustica</i>	Common Swallow	+	+	-	M	A	IV	
<b>Hirundinidae</b>	<i>Hirundo smithii</i>	Wire-tailed Swallow	+	+	-	R	AH	IV	
	<i>Hirundo daurica</i>	Red-rumped Swallow	+	+	-	M	AH	IV	

Order	Families	Scientific Name	Common Name	Sacred Groves			Residency status	Abundance status	Feeding status
				LSG	GSG	WGS			
Passeriformes	<b>Pycnonotidae</b>	<i>Pycnonotus cafer</i>	Red-vented Bulbul	+	+	+	R	AH	IV
		<i>Pycnonotus jacosus</i>	Red-whiskered Bulbul	+	+	+	R	AH	IV
		<i>Iole indica</i>	Yellow-browed Bulbul	-	-	+	R	L	OV
	<b>Silvidae</b>	<i>Hypsipetes leucocephalus</i>	Black Bulbul	-	-	+	R	L	OV
		<i>Chrysomma sinense</i>	Yellow-eyed Babbler	-	+	+	R	HA	IV
		<i>Turdoides caudatus</i>	Common Babbler	-	-	+	R	HA	IV
	<b>leiotrichidae</b>	<i>Turdoides malcoMi</i>	Large Grey Babbler	+	+	-	R	A	IV
		<i>Turdoides subrufus</i>	Indian Rufous Babbler	+	+	-	R	A	IV
		<i>Turdoides striatus</i>	Jungle Babbler	-	+	-	R	M	IV
	<b>Alaudidae</b>	<i>Galerida cristata</i>	Common Crested Lark	-	-	+	R	A	IV
		<i>Galerida deva</i>	Sykes's Crested Lark	-	-	+	R	M	IV
	<b>Zosteropidae</b>	<i>Nectarinia zeylonica</i>	Purple-rumped Sunbird	+	+	+	R	AH	FV
		<i>Zosterops palpebrosus</i>	Oriental White-eye	-	+	+	R	M	IV
		<i>Nectarinia minima</i>	Small Sunbird	-	-	+	R	M	FV
		<i>Nectarinia asiatica</i>	Purple Sunbird	+	+	+	R	HA	FV
<i>Dicaeum erythrorhynchos</i>		Tickell's Flowerpecker	-	+	+	R	M	FV	
<b>Passeridae</b>	<i>Passer domesticus</i>	House Sparrow	+	+	-	R	M	OV	
	<i>Dendronanthus indicus</i>	Forest Wagtail	+	+	+	M	A	IV	
<b>Motacillidae</b>	<i>Motacilla flava</i>	Yellow Wagtail	+	+	+	M	A	IV	
	<i>Motacilla alba</i>	White Wagtail	+	+	+	M	A	IV	
	<i>Motacilla maderaspatensis</i>	Large Pied Wagtail	-	-	+	R	A	IV	
<b>Ploceidae</b>	<i>Ploceus philippinus</i>	Baya Weaver	+	-	+	R	M	GV	
	<i>Amandava amandava</i>	Red Munia	+	-	-	R	L	GV	
<b>Estrildinae</b>	<i>Lonchura punctulata</i>	Spotted Munia	+	+	-	R	A	GV	
	<i>Lonchura malacca</i>	Black-headed Munia	-	+	-	R	A	GV	
	<i>Lonchura malabarica</i>	White-throated Munia	+	-	-	R	A	GV	



Order	Families	Scientific Name	Common Name	Sacred Groves			Residency status	Abundance status	Feeding status
				LSG	GSG	WGS			
Passeriformes	<b>Fringillidae</b>	<i>Melophus lathami</i>	Crested Bunting	-	+	+	R	M	IV
		<i>Sturnus pagodarum</i>	Brahminy Starling	+	+	-	R	M	IV
	<b>Sturnidae</b>	<i>Acridotheres tristis</i>	Common Myna	+	+	-	R	A	OV
		<i>Acridotheres fuscus</i>	Jungle Myna	+	-	+	R	M	OV
		<i>Acridotheres ginginianus</i>	Bank Myna	-	-	+	R	M	OV
		<i>Prinia hodgsonii</i>	Franklin's Prinia	-	-	+	R	M	IV
		<i>Prinia inornata</i>	Plain Prinia	-	+	-	R	A	IV
		<i>Prinia socialis</i>	Ashy Prinia	+	+	+	R	A	IV
	<b>Cisticolidae</b>	<i>Prinia sylvatica</i>	Jungle Prinia	-	-	+	R	L	IV
		<i>Orthotomus sutorius</i>	Common Tailorbird	+	+	+	R	A	IV
<b>Total = 16</b>	<b>46</b>	108		57	60	80			

**Abbreviations:**

Sacred Groves: LSG = Lingoba Sacred Grove, GSG = Gomata Sacred Grove, WSC = Wakighol Scared Grove  
Occurrence: + indicate = Occurrence of birds species, - indicate = absence of bird species.

Status: Residential = R, Migratory = M

Abundance: Highly Abundance = HA, Abundance = A, Moderate = M, Lesser = L.

Feeding nature: Granivorous = GV, omnivorous = OV, Insectivorous = IV, Piscivorous = PV, Carnivorous = CV, Frugivorous = FV.

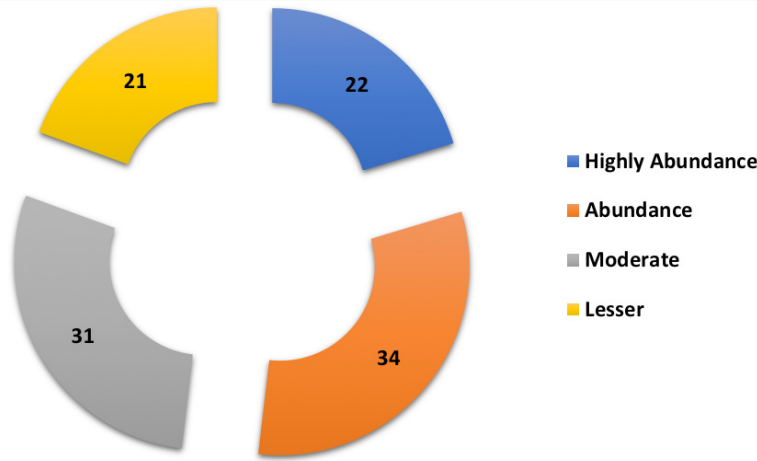


Fig. 3. Abundance of birds in sacred groves.

Figure 4. Feeding nature of birds in sacred groves

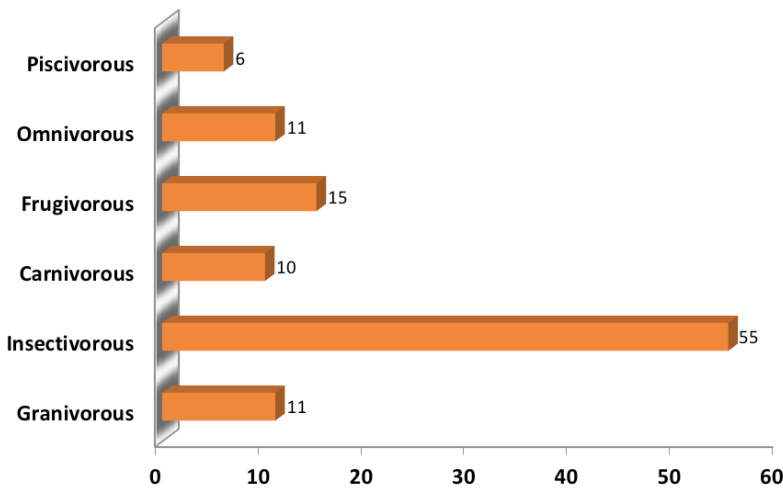


Fig. 4. Feeding nature of birds in sacred groves.

of Odisha, according to the birds' feeding habit they reported more insectivorous bird species from the study area. In tropical region, the insectivorous birds are dominant group (Harisha & Hosetti 2009). Katherina et al. (2019) also worked on different feeding guilds on their primary feeding behaviour from sacred groves of Afrotropical savanna.

References

**Ali, S. (2002).** *The Book of Indian Birds*. 13<sup>th</sup> revised edition. Bombay Natural History Society, Mumbai.

**Deb, D., K. Deuti & K.C. Malhotra (1997).** Sacred grove relics as bird refugia. *Current Science*. 73(10): 815–817.

**Deshmukh, S. (1999).** *Conservation and Development of Sacred Groves in Maharashtra – Final Report of the world Bank Aided Maharashtra Forestry Project*, BNHS, Mumbai, 289pp.

**Gadgil, M. & V.D. Vartak (1975).** Sacred Groves of India: a plea for continued conservation. *Journal of the Bombay Natural History Society* 72: 314–320.

**Harisha, M.N. & B.B. Hosetti (2009).** Diversity and Distribution of Avifauna of Lakkavalli Range forest, Bhadra wildlife sanctuary, Western Ghat, India. *Ecoprint. An International Journal of Ecology* 16: 21–27. <https://doi.org/10.3126/eco.v16i0.3469>

**Jyothi, K.M. & P.O. Nameer (2015).** Birds of sacred groves of northern Kerala, India. *Journal of Threatened Taxa* 7(15): 8226–8236. <http://dx.doi.org/10.11609/jott.2463.7.15.8226-8236>

**Katherina, K., I. Grass & M. Waltert (2019).** Sacred groves hold distinct bird assemblages within an Afrotropical savannah. *Global Ecology and Conservation*, 18: e00656. <https://doi.org/10.1016/j.gecco.2019.e00656>

**Malhotra, K.C., Y. Gokhale, S. Chatterjee & S. Srivastava (2001).** *Cultural and ecological dimensions of sacred groves in India*. Indian National Science Academy, New Delhi and Indra Gandhi Rashtriya Manav Sangrahalay, Bhopal, 16–17pp.

**Pradhan, A., S.P. Mishra & N. Behera (2016).** Avian diversity in sacred natural forest site in Odisha. *The Ecoscan* 10(1&2): 91–95.

**V.M. Lagade<sup>1</sup>, S.V. Lagade<sup>2</sup>, R.D. Kamble<sup>3</sup> & S.E. Kamble<sup>4</sup>**

<sup>1,3&4</sup> Department of Zoology, Shri Yashwantrao Patil Science College, Solankur, Kolhapur, Maharashtra 416212, India.

<sup>2</sup> Department of Zoology, Rajarshi Chhatrapati Shahu College, Kolhapur Maharashtra 416005, India.

Emails: <sup>1</sup>drvmlagade@gmail.com (corresponding author),

<sup>2</sup>kamble.swapnaja@rediffmail.com, <sup>3</sup>kamblerajvardhan929@gmail.com,

<sup>4</sup>kamblesumit103@gmail.com

**Citation:** Lagade, V.M., S.V. Lagade, R.D. Kamble & S.E. Kamble (2020). A preliminary study on avifauna of three sacred groves of Radhanagri Tehsil, Maharashtra, India. *Bird-o-soar* #64, In: *Zoo's Print* 35(12): 29–37.

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## First record of the Common Tinsel from the hilly state of Himachal Pradesh, India



**Image 1. Underside of the *Catapaecilma major* Druce, 1895 from surrounding hilly terrain of Balh Valley, Himachal Pradesh, India (©Jitender Kumar).**

The butterfly diversity is one of the indicators for monitoring health of the ecosystem. As the butterflies are very sensitive to the changing environment, this makes them a subject of interest among the scientific community and researchers to study their relationship with the environment. There are several studies and the historical records (de RhePhilippe1931; Wynter-Blyth 1941–1947) and numerous recent publications on butterflies diversity and distribution in the Himalayan region (Kumar & Juneja 1977; Saini et al. 2009; Singh & Banya 2013; Chandel et al. 2014; Sharma & Sharma 2017; Sodhi et al. 2017; Kunte et al. 2020).

The Himalayan region is characterized by the unique geobotanical landscape that inhabits rich biological diversity. The mountainous habitat provides a wide scope for the ecological study of the butterfly species. The present record of the butterfly species is the part of long term monitoring of butterfly diversity in the surrounding hills of the Balh Valley, Himachal Pradesh, India. The valley is characterized by a flat area extending from Gutkar (near Mandi City) to Sundernagar, surrounded by a hilly area with moderate topography (Fig. 1). The region is characterized by sub-temperate, sub-humid mid-hill agro-climatic conditions.



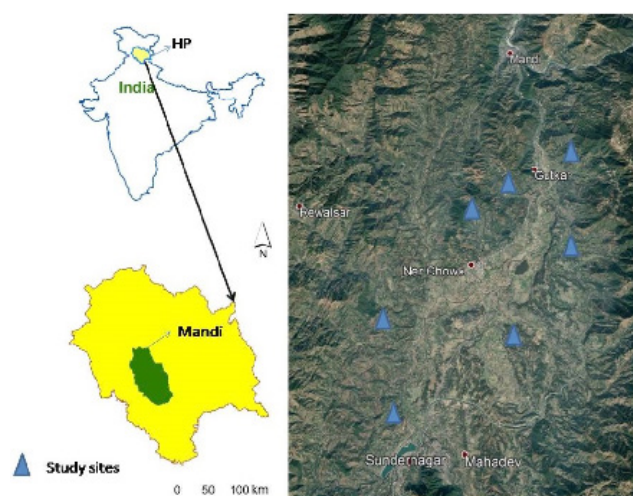
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The hills are dissected by the perennial or seasonal drainage system, which carries the sediment to the lowland area. The flat area is either extensively cultivated or facing enormous modernization that is even spreading to the fringes of mountain ranges. So, the surrounding hilly region was extensively studied to check the butterfly diversity. The Common Tinsel Butterfly *Catapaecilma major* Druce, 1895 was noticed in the Balh Valley, Himachal Pradesh, India. This is the first records of the butterfly in the hilly state, which was recorded earlier in eastern, western India and some recent sighting from the hilly state of Uttarakhand (Fig. 2).

This butterfly species was noticed many times in the month of July 2020 near Ner Chowk. The available literature was studied including the online resources, and



**Fig. 1.** Map showing location of study sites with respect to India.



**Fig. 2.** Map showing distribution of *Catapaecilma major* Common Tinsel in India (adapted from Kunte 2020).

the species has no record in the past. The study area is also characterized by diverse vegetation including; *Terminalia chebula*, *Terminalia bellirica*, *Berberis asiatica*, *Carissa congesta*, *Pistacia integerrima* and *Tinospora cordifolia*. The butterfly mainly wanders on the top canopy where *Terminalia* sp. can be the host plant.

The present record of *Catapaecilma major* Druce, 1895 Common Tinsel in Himachal Pradesh shows the distribution of the butterfly species is slightly towards the northern side. The successive encounter of this species in the area confirms the existence of the butterfly species in Himachal Pradesh, India.



# Bugs R All

Invertebrate Conservation & Information Network of South Asia (ICINSA)

Newsletter of the

## References

**Chandel, S., V. Kumar, B.P. Sharma & R. Patyal (2014).** Butterfly fauna of shivalik hills areas of Kangra and Hamirpur districts of Himachal Pradesh in India. *Life Sciences Leaflets* 55: 25–38.

**deRhe-Philipe, G.W.V. (1931).** The butterflies of the Simla Hills. *Journal of the Bombay Natural History Society* 35: 172–184, 415–429, 620–634.

**Kumar, A. & D.P. Juneja (1977).** Some distributional records of butterflies (Lepidoptera: Rhopalocera) from Himachal Pradesh (Western Himalayas). *Newsletter Zoological Survey of India* 3(6): 410–415.

**Kunte, K., S. Sondhi, & P. Roy (eds.) (2020).** Butterflies of India, v.2.90. Indian Foundation for Butterflies. <https://www.ifoundbutterflies.org/sp/631/Catapaecilma-major>.

**Saini, K., A.K. Sidhu & H.S. Mehta (2009).** Insecta: Lepidoptera: Rhopalocera 12:21–41; in faunal diversity of Pong Dam and its catchment area. Wetland Ecosystem Series, 12: 1-138+8 plates Zoological Survey of India, Kolkata.

**Sharma, S. & N. Sharma (2017).** New butterfly records from the Jammu Shiwaliks, Jammu & Kashmir, India. *Journal of Threatened Taxa* 9(10): 10856–10859. <http://doi.org/10.11609/jott.3180.9.10.10856-10859>.

**Singh, V. & H.S. Banyal (2013).** Insect fauna of Khajjiar Lake of Chamba District, Himachal Pradesh, India. *Pakistan Journal of Zoology* 45: 1053–1061.

**Sondhi, S., B. Valappil, Y. Sondhi & A. Sondhi (2017).** A report on some butterflies (Lepidoptera) from Ladakh in Jammu & Kashmir and Lahaul in Himachal Pradesh, India. *Journal of Threatened Taxa* 9(3): 9971–9987. <http://doi.org/10.11609/jott.3024.9.3.9971-9987>.

**Wynter-Blyth, M.A. (1940–1947).** A list of the butterflies of the Shimla Hills. *Journal of the Bombay Natural History Society* 41: 719–741; 42: 448; 43: 672–673; 45: 256–257; 46: 735–736.

## Praveen Kumar<sup>1</sup>, Jitender Kumar<sup>2</sup> & Rajesh Kumar<sup>3</sup>

<sup>1</sup> Research Associate, Department of Soil Science, CSKHPKV, Palampur, Himachal Pradesh 176062, India.

<sup>2</sup> Distributor, M/S Dinesh Associate Village-Amargarh, PO Ponta Shahib, Sirmor, Himachal Pradesh 173025, India.

<sup>3</sup> Student, Vallabh Govt. Collage Mandi, Himachal Pradesh 175001, India.

Email: <sup>1</sup>pk.hpkv@gmail.com (corresponding author), <sup>2</sup>jitenderkumarj999@gmail.com, <sup>3</sup>rajeshkumar82591@gmail.com

**Citation:** Kumar, P., J. Kumar & R. Kumar (2020). First record of the Common Tinsel from the hilly state of Himachal Pradesh, India. *Bugs R All* #190, In: *Zoo's Print* 35(12): 38–40.

Bugs R All is a newsletter of the Invertebrate Conservation and Information Network of South Asia (ICINSA) edited by B.A. Daniel, published with the financial support of Zoological Society of London.

For communication, Email: [daniel@zooreach.org](mailto:daniel@zooreach.org)





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Communicating science for conservation

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## Publication Information

### ZOO'S PRINT, ISSN 0973-2543

Published at: Coimbatore

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Owner: Zoo Outreach Organisation, 12, Thiruvannamalai Nagar, Saravanampatti - Kalapatti Road, Saravanampatti, Coimbatore, Tamil Nadu 641035, India.

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E-mail: [zooreach@zooreach.org](mailto:zooreach@zooreach.org)

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