

# MASS MORTALITY OF WILDLIFE DUE TO HAILSTORMS IN MAHARASHTRA, INDIA<sup>1</sup>

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*Abstract.* Owing to unusual hailstorms, 35 species of birds and 9 species of mammals were found dead, totalling at least 62,000 birds and hundreds of mammals, in the Marathwada and Vidarbha regions of Maharashtra, India, during 2014. Hail stones were up to 5 cm in diameter. We observed mass mortality at 26 sites with especially high mortality in 14 areas. These extreme climate events occurred from the end of February into May 2014. Mortality was especially high among roosting birds such as Rosy Starling *Pastor roseus*, House Sparrow *Passer domesticus* and Rose-ringed Parakeet *Psittacula krameri*. Mammals residing in open areas were also killed.

*Key words:* extreme climate event, Deccan plateau, hailstorm, India, Maharashtra, wildlife mortality

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## MORTALIDAD MASIVA DE LA VIDA SILVESTRE DEBIDO A TORMENTAS DE GRANIZO EN MAHARASHTRA, INDIA

*Resumen.* Debido a tormentas de granizo inusuales, un total de 62,000 aves de 35 especies y cientos de mamíferos de 9 especies fueron encontrados muertos en las regiones de Marathwada y Vidarbha de Maharashtra, India, durante 2014. Las bolas de granizo alcanzaron los 5 cm de diámetro. Observamos mortalidad masiva en 26 localidades, con mortalidad especialmente alta en 14 áreas. Estos acontecimientos climáticos extremos ocurrieron desde finales de febrero a mayo de 2014. La mortalidad fue especialmente alta en aves que se concentran en dormitorios como el estornino rosado *Pastor roseus*, gorrión común *Passer domesticus* y cotorra de Kramer *Psittacula krameri*. Los mamíferos en áreas abiertas también sufrieron bajas.

*Palabras clave:* clima extremo, meseta Deccan, granizo, India, Maharashtra, mortalidad de vida silvestre

## INTRODUCTION

A southern tropical thorn forest and associated habitats, rich in wildlife, exist in a portion of Vidarbha, Marathwada and the western part of Deccan plateau, Maharashtra, India (Fig. 1; see Champion and Seth 1978). During several months in 2014, from the end of February into May, a series of extreme weather events were reported across India, including this area but also Madhya Pradesh, Andhra Pradesh, and Punjab. According to the Indian Meteorological Department (IMD) these extreme weather events occurred due to western disturbances bringing an extra-tropical storm, originating in the Mediterranean, and characterized by sudden winter rain and snow.

Included in larger thunder storms that occurred during this unusual weather were a series of hail events. Major hailstorms occurred during 3 - 10 March 2014. Fruit orchards and cash crops, such as sugarcane, pomegranate and grapes, were destroyed. The severities of the hailstorms were so high that many domestic animals and a few humans died. Therefore, we decided to conduct a survey of wildlife impacts in hailstorm-affected areas and the results are discussed in this paper.

## METHODS

Surveys were conducted immediately after hailstorms at Pune, Solapur, Osmanabad and Washim districts to get first-hand information about wildlife mortality, followed by detailed surveys during the second week of March 2014. A Bombay Natural History Society (BNHS) team

also made ground searches in hailstorm-affected areas in the Marathwada and Vidarbha regions during 7-8 and 15-19 March, and 2-6 May (Fig. 1). Based on size of hailstones and damage that occurred to trees we surveyed sites where high bird mortality was reported (Table 1).

## RESULTS

A series of hailstorms, associated with the larger thunder storms, occurred in parts of Deccan plateau, especially Vidarbha and Marathwada of Maharashtra, India, from February to May 2014. Major events occurred especially during 3-10 March, resulting in a huge loss to the wildlife and agriculture sector. Vidarbha and Marathwada regions of Maharashtra (2,00,000 km<sup>2</sup>), which are rain-shadow areas, were the worst affected. Fruit orchards and cash crops including sugarcane, pomegranate and grapes were destroyed; many domestic animals and a few human lives were lost. Unseasonal rainfall, accompanied by hailstorms destroyed over 1.9 million hectares of standing crop causing distress among the farmers.

We found that wildlife was affected badly by hailstones, the hailstorms lasting for 20-30 minutes, especially within 25 km<sup>2</sup> blocks (3 km radius) surrounding 14 sites in Maharashtra (Fig. 1, Table 1). Hailstone size decreased outward from the center of the block. We also covered some sites having low mortality where hailstones were ~ 1-3 cm and the duration of the event was 4-5 minutes (Table 1). Hundreds of local people whom we interviewed provided useful information.

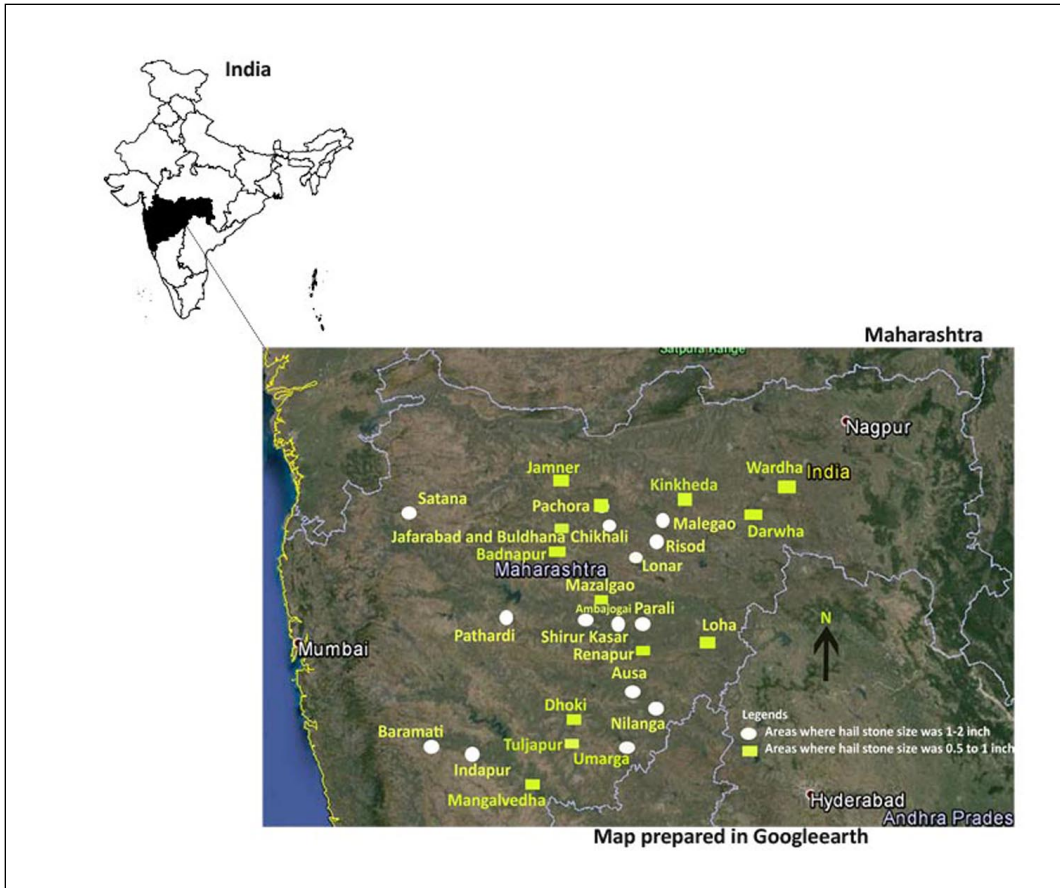


FIGURE 1. Study area in Maharashtra, India.

A total of 35 species of birds and the nine species of mammals were killed by the storm events (Figs. 2, 3). In total, about 62,250 birds and hundreds of mammals were reported dead, and several birds were reported to be injured.

#### AVIAN MORTALITY: RESIDENT SPECIES

The highest number of deaths occurred among birds that resided in large roosts near human habitation, for example, House Sparrow *Passer domesticus*, and Rose-ringed Parakeet *Psittacula krameri* (Fig. 4). The birds such as Southern Coucal *Centropus (sinensis) parroti*, Red-vented Bulbul *Pycnonotus cafer* (Fig. 4), Black Drongo *Dicrurus macrocercus*, Rose-ringed Parakeet *Psittacula krameri*, Syke's Lark *Galerida deva*, Cattle Egret *Bubulcus ibis* and Little Green Beeeater *Merops orientalis* were found dead

across the study area. We observed carcasses of more than 1,500 Rose-ringed Parakeets at Mandava village of Risod tehsil in Washim district (Fig. 4). These parakeets were roosting on a series of Teak *Tectona grandis* trees near a farmland, and after hailstorm their carcasses were seen lying over the area spread over one hectare.

Among water birds, egrets, cormorants, storks and ibises were the most affected species (Fig. 4). We visited a large heronry at Badalvadi village of Indapur tehsil, Pune district and found the understory full of broken eggs, dead chicks and juveniles and dead adults of Grey Heron *Ardea cinerea* and Little Cormorant *Microcarbo niger*. A group of bird-watchers from Indapur and Pune tried to rescue the birds and put the chicks back into the nests.

TABLE 1. Details of mass mortality of wildlife due to large hailstones reported in Maharashtra, India, during 2014 (data arranged in chronological order).

Sr. No.	Villages	Tehsil	District	Dates	Hailstone diameter (cm)	Coordinates of reference point
1.	Entire tehsil	Renapur	Latur	26 February	1-3	18°31'44.83"N 76°35'47.40"E
2.	Entire area	Shirur Kasar	Beed	3 March	2.5-5.0	18°57'28.34"N 75°39'27.41"E
3.	Pimpla Dhaiguda, Giruvali	Ambajogai	Beed	3 March	2.5-5.0	18°42'54.03"N 76°24'1.39"E
4.	Talegao, Kauthali, Sonpeth, Maralagwdi	Parali	Beed	3 March	2.5-5.0	18°51'25.55"N 76°30'44.27"E
5.	Nitur, Mugao, Shend, Muslga, Gaur, Valandi Dhobalewadi	Nilanga	Latur	3 March	2.5-5.0	18° 8'44.54"N 76°43'20.84"E
6.	Bhalgao, Kasalwadi, Midsangavi, Munguswadi, Kharwandi, Eknathwadi	Pathardi	Ahmednagar	3 March	2.5-5.0	19° 8'47.02"N 75°12'21.19"E
7.	Mangalvedha, Donaj, Talsangi	Mangalvedha	Solapur	3 March	1-3	17°30'43.35"N 75°27'1.05"E
8.	Kandhar	Loha	Nanded	3 March	1-3	18°56'50.59"N 77° 6'55.57"E
9.	Lamjana, Killari	Ausa	Latur	3 March	2.5-5.0	18°15'28.90"N 76°34'57.90"E
10.	Dahi, Irala, Malegao	Malegao	Washim	6-7 March	2.5-5.0	20°11'38.81"N 77°16'52.28"E
11.	Mandava, Kurha, Wadi Wakad, Borkhedi, Mozabandi	Risod	Washim	6-7 March	2.5-5.0	19°52'32.30"N 76°51'7.09"E
12.	Dhoki, Ter	Osmanabad	Osmanabad	6-7 March	1-3	18°20'3.28"N 76° 7'43.17"E
13.	Darvha, Arni, Painganga Wildlife Sanctuary	Arni, Digras	Yawatmal	6-7 March	1-3	20° 4'9.77"N 77°56'42.31"E
14.	Wardha town	Wardha	Wardha	6-7 March	1-3	20°43'8.14"N 78°36'1.97"E
15.	Shara, Dhavale	Lonar	Buldana	8 March	2.5-5.0	20° 0'40.10"N 76°31'59.15"E
16.	Sanjulina	Jafarabad	Jalna	8 March	1-3	20°11'56.58"N 76° 3'15.31"E
17.	Anvi, Bhakarwadi	Badnapur	Jalna	8 March	1-3	19°55'32.28"N 75°46'59.33"E
18.	Bhamrud	Pachora	Jalgao	8 March	1-3	20°39'30.72"N 75°21'7.58"E
19.	Entire tehsil	Jamner	Jalgao	8 March	1-3	20°46'13.22"N 75°40'33.82"E
20.	Entire tehsil	Buldhana	Buldhana	8 March	1-3	20°27'21.95"N 76°21'49.42"E

TABLE 1. Continued.

Sr. No.	Villages	Tehsil	District	Dates	Hailstone diameter (cm)	Coordinates of reference point
21.	Bhokar, Godri, Khor, Bhalkhed	Chikhali	Buldana	8 March	2.5-5.0	20° 0'18.85"N 75°53'50.46"E
22.	Shripurwarde, Shirpurwade, Wagale, Bhatkheda, Gorana, Pofir, Avandane	Satana	Nashik	9 March	2.5-5.0	20°34'49.83"N 74°12'54.65"E
23.	Baramati, Murti, Katewadi,	Baramati	Pune	9-10 March	2.5-5.0	18°8'31.18"N 74°34'20.97"E
24.	Parts of Bhigvan, Nimgao, Bhadalwadi, Bori, Bhavani Nagar, Sansar	Indapur	Pune	9-10 March	2.5-5.0	18°15'41.00"N 74°48'7.93"E
25.	Entire tehsil	Tuljapur	Osmanabad	1 May	1-3	17°58'55.79"N 76° 3'38.78"E
26.	Motala	Umarga,	Osmanabad	4 May	2.5-5.0	17°51'16.45"N 76°37'0.56"E

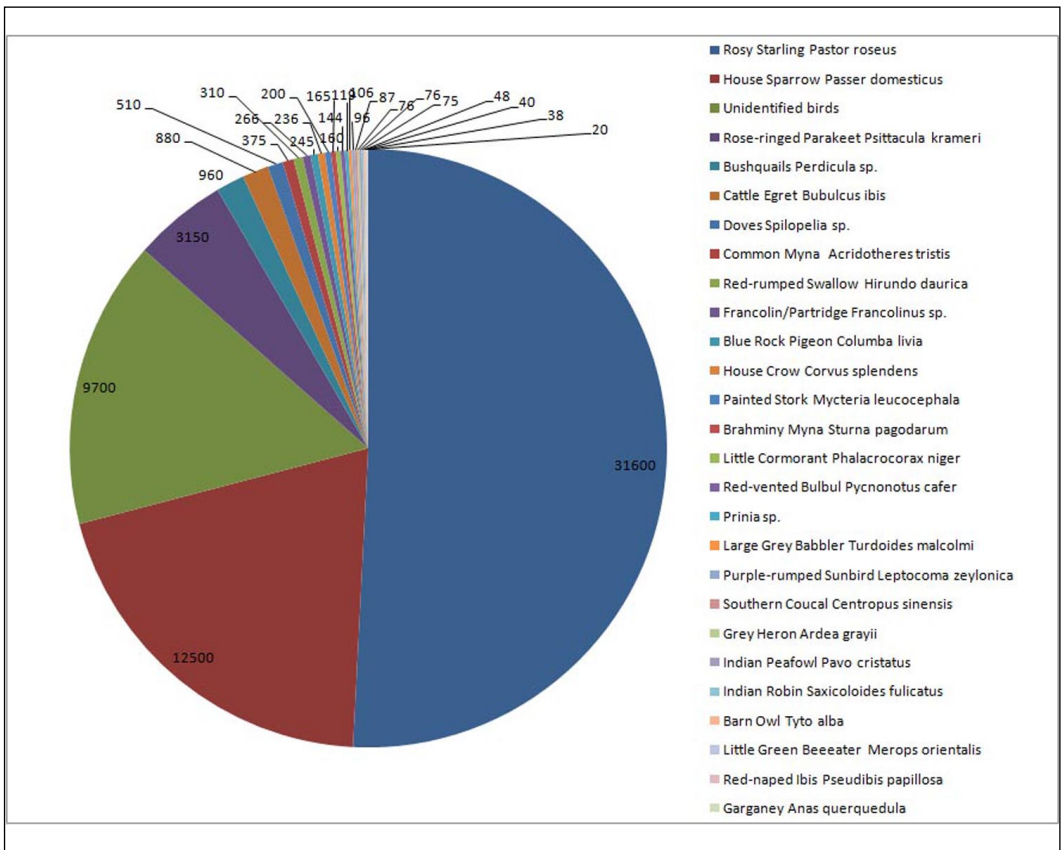


FIGURE 2. Summary of the mortality of birds observed in study area.

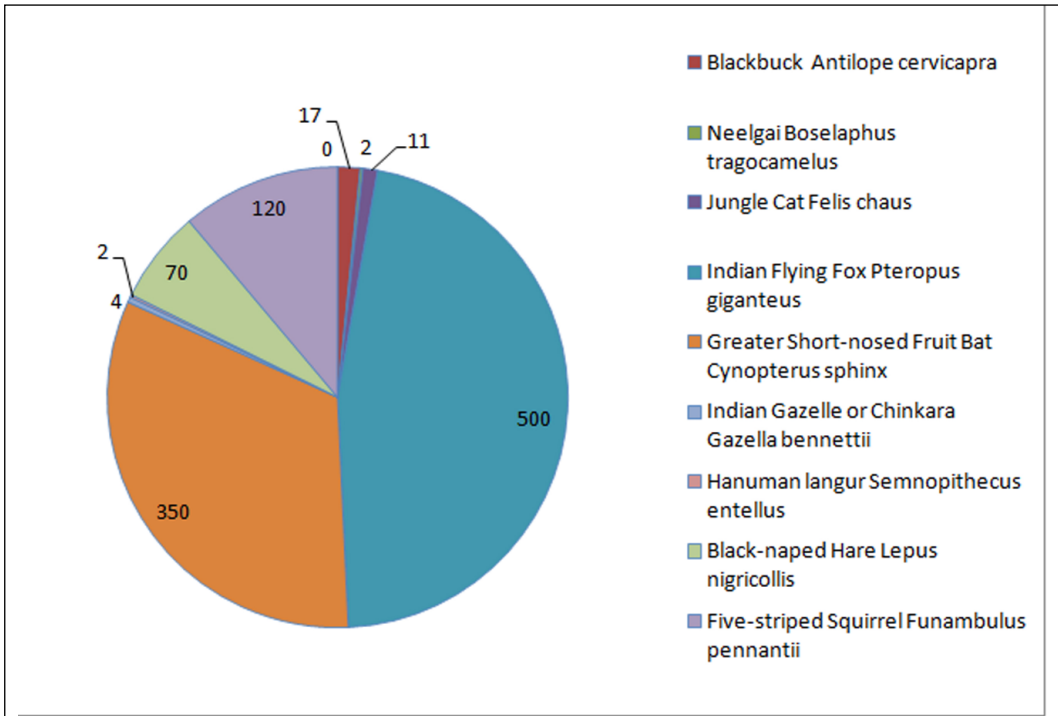


FIGURE 3. Summary of the mortality of mammals observed in study area.

**AVIAN MORTALITY: THREATENED AND MIGRATORY SPECIES**

Severe damage to many nests, and carcasses of a few chicks and juveniles of Painted Stork *Mycteria leucocephala*, and Black-headed Ibis *Threskiornis melanocephalus* – both Near Threatened species listed by International Union of Conservation of Nature (IUCN) – were observed in the study areas. We also observed mortality in Black-tailed Godwit *Limosa limosa*, a migratory and near threatened species, at one of the sites. Another migratory species, Rosy Starling *Pastor roseus* also suffered high mortality (Fig.4). In fact the death of >30,000 of these birds at various roost sites amounted to 50% of the total avian mortality (Fig. 2).

An injured Greater Flamingo *Phoenicopterus roseus* was rescued by some bird-watchers of Baramati from the Bhigwan area, in the back-water area of Ujani Dam in Solapur, Maharashtra. The bird was treated and kept at Baramati for a week and later was shifted to Katraj Zoo, Pune, where it died within a few

days. A few deaths and injuries among migratory ducks such as Ruddy Shelduck *Tadorna ferruginea*, Northern Shoveller *Anas clypeata*, Common Teal *Anas crecca* and Garganey *Anas querquedula* were reported from Ujani dam area.

**MAMMALIAN MORTALITY**

Based on the mortality at known bat roosts, we assumed that 50% of the population of tree dwelling bats including Flying Fox *Pteropus giganteus* and Short-nosed Fruit Bat *Cynopterus sphinx* was killed due to this hailstorm. Ungulates such as Chinkara *Gazella benne*, Indian Blackbuck *Antilope cervicapra* and Neelgai *Boselaphus tragocamelus* were found dead in some areas. In a couple of cases, these animals jumped into nearby water bodies or into the thick bushes to take shelter from the hailstones. Other smaller mammals such as Black-naped Hare *Lepus nigricollis*, Jungle Cat *Felis chaus*, and squirrels, were also found dead (Fig. 3). Stray dogs were seen eating the carcasses.



FIGURE 4. Carcasses of: top left, Rosy Starling found lying under many trees at Baramati Pune, 14 March 2014 (photo: Mahesh Gaikwad); top right, Rose-ringed Parakeets at Mandava, Risod, 4 March 2014 (photo: Santosh Gomase); bottom left, Red-vented Bulbul at Motala, Umarga, Osmanabad, 5 May 2014 (photo: Bhimashankar Waghmare); bottom right, ducks, terns, shorebirds and waders at Bhigvan, 4 March 2014 (photo: Sandeep Nagare).

## DISCUSSION

### HISTORICAL REPORTS OF MASS MORTALITY IN BIRDS DUE TO HAILSTORMS

Mortality of people and wildlife due to intense hailstorms is not a new phenomenon, though the incidence may be growing in new areas ([http://en.wikipedia.org/wiki/List\\_of\\_costly\\_or\\_deadly\\_hailstorms](http://en.wikipedia.org/wiki/List_of_costly_or_deadly_hailstorms)). This website lists 46 events beginning in the 9th century up to the present (see also Orr 2004). As examples particularly involving birds, seven Sandhill Cranes *Grus canadensis*, 151 American White Pelicans *Pelecanus erythrorhynchos* (142 immature), plus individuals of 12 other species were found dead due to a hailstorm in September 1977 at Chase Lake National Wildlife Refuge, South Dakota (Higgins and

Johnson 1978). Sarasola et al. (2005) described mass mortality of 158 birds, including 113 Swainson's Hawks *Buteo swainsoni* due to a hailstorm in central Argentina in 2003. Mortality in night roosts of the Great-tailed Grackle *Quiscalus mexicanus* and European Starling *Sturnus vulgaris* was reported because of a 6-minute hailstorm at Austin, Texas in March 2005 (Hall and Harvey 2007). Between October 2009 and March 2010 Carnaby's Black Cockatoo *Calyptorhynchus latirostris* was exposed to severe localized hailstorms; 51 birds were killed and 24 were badly injured (Saunders et al. 2011).

### REPORTED CASES OF MASS MORTALITY OF WILDLIFE DUE TO HAILSTORMS IN INDIA

About 2,000 water birds were found dead at the Diyala Jheel area of Karera Bustard Sanctuary in

Shivpuri district of Madhya Pradesh in February 1986 because of a hailstorm that lasted ~25 minutes. A Sarus Crane *Grus antigone*, Demoiselle Crane *Anthropoides virgo* and three White-rumped Vultures *Gyps bengalensis* were also found dead along with two individuals of Balckbuck *Antilope cervicapra* (D'Cunha and Akhtar 1987). As case of mortality of Barn Owl *Tyto alba* during a cyclone was reported for Pichavaram mangroves, South India (Thiyagesan and Nagarajan 1997).

### CONCLUSION

According to IUCN classification of direct threats in section 11.4, entitled "storms and flooding," hailstorms are classified as threats arising from long-term climatic changes and other severe climatic/weather events that are outside of the natural range of variation, and potentially can wipe out a vulnerable species or a habitat (BirdLife International 2014). From the information collected during our surveys, we observed that the mass mortality was recorded much higher in the areas where data from a avid, experienced birdwatchers were verified. There could have been many more unreported cases. Though we learned about a number of rescue operations from many areas, because of lack of experience and technical guidance, only about 20% of the injured wildlife could be recovered. Documentation of the results from extreme climate events is important as we assess the implications of our changing climate.

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