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## Study to assess the lockdown impact on the biodiversity with main emphasis on Birds around the World Heritage Site-Keoladeo National Park, Bharatpur (Rajasthan, India)

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### Abstract

COVID-19 was first noticed in Wuhan, China and started spreading throughout the world gradually. Being a LETHAL IMPACT for human beings declared pandemic. With the signal of alert to save the human lives, lockdown process was imposed as one of the preventive measures to maintain the social distancing. The lockdown implementation checked the anthropogenic activities specially the transportation. Due to restricted or very less movement of humans in avifauna biodiversity, it came to observe a positive and healthy sign regarding their daily working activities and their way of living standards and management respectively which are good signs and indicators in improvement of avifauna biodiversity and their conservation.

In our study we attempted to assess the impact of the lockdown on the biodiversity with main emphasis on birds in human habitations which witnessed the revival of avifaunal diversity. For this purpose two type of assessments were carried out *viz*: Assessment of habitats around Keoladeo National Park with special reference to avifauna and Assessment of the avifaunal diversity around KNP in the pre- and post-lockdown period. The area undertaken for the study includes the urban, suburban and rural environs around Keoladeo National Park (KNP), Bharatpur, Rajasthan, India. The stakeholders from the human habitation with the aerial distance of 2-5 kilometres from the KNP boundaries were considered for the sampling studies.

**Keywords:** KNP, avifauna, lockdown, satellite wetlands, biodiversity etc.

### Introduction

Lockdown proved to be a boon for birds and animals and bane for people as there was less interference of human beings. Birds and other faunal species felt a feeling of relax. Recently, a study (Bilal *et al.*, 2018) [1] discussed perception of people towards influence of climate change on human health and the environment. One could hear more singing, chirping, and chattering of birds due to less noise in the environment as a result of lockdown (Harekrishna Bar *et al.*, 2020) [2] India is a country blessed with huge biodiversity among top most 17 nations on the globe. Approximately 1250 avifaunal species are found in India. In India 12-13% of avian species of total world are found in the country. Both seasonally and annually migration are undertaken by avifauna species. There is lot of variation in behavioural ecology of birds, some avian prefer to live territorial, in small family, and some prefer to live in large flocks. Many bird species prefer monogamous society for pairing at least for breeding season. There is vast future role of behavioural ecology of avifauna in Population study and ecological dynamics in Rajasthan (Gordo *et al.*, 2020) [8]. According to the report of IBA about 80 bird species are threatened globally. According of survey by IBA most prolific reason behind this that natural landscape have been converting into semi natural landscapes leads to loss of habitat producing edge effect, result in loss of connectivity among suitable habitats.

In Rajasthan more than 500 species can be seen in this state. Most important striking feature of birds is migration through which there is availability of food sources, breeding habitat with advantage of seasonal variations globally. Both seasonally and annually migration are undertaken by avifauna species.

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Keoladeo National Park aka 'Bird Paradise' is staging ground for migratory waterfowl arriving in the Indian subcontinent along the Central Asian flyway before dispersing to various regions and about 374 species of avifauna (Grebes, Pelicans, Cormorants, Snakebirds, Herons, Egrets, Storks, Kingfishers, Spoonbill etc.) 27 species of mammals, 13 types of reptiles, 7 amphibians and 43 fishes are recorded in satellite wetland area around park. In the period of lockdown avifauna species can be sighted and observed easily in and around the Keoladeo National Park because human confliction and disturbance was dropped and movements/ migration of avifauna increased and improved around KNP. As many as 34 wetlands around KNP hold high conservation value for waterfowl species, both migratory and resident by enabling them to have wintering, staging, and roosting grounds.

The lockdown during Covid-19 proved a boon for the welfare of Biodiversity and wildlife in Asian countries which is a great point of view regarding their protection & conservation. Non-interference of human activities during pandemic period reflected behavioural changes in wild animals, avian, pets, and butterflies and has also improved their living standards and ecosystems, and habitats to which they belong.

Our Forests found a sense of contentment during the lockdown, with animals' movements seen out of their Home Range because of less vehicle movement. Animals wandered uninhibitedly since they didn't detect vibrations from vehicles on the road. Unusual and rare sightings such as shy jungle fowl, sighting of which generally requires luck was witnessed by many wildlife staff (Manenti *et al.*, 2020) [10]. Avifauna like wood pigeons has plucked up the courage to roam freely around the forest. A shy creature like a hare which usually prefers to venture out when there are no people around was also seen in the forest roads, all this implying that animals are at ease. Elephants and gaur are also moving freely and

without any fear now. No significant scenes of tiger, panther, and elephant poaching have been recorded during the covid-19 lockdown time frame but at the same time it was found in a survey that poaching became a Lucrative Business and Peoples took advantage of the carelessness, indiscipline of the wildlife department.

Lockdown implementation checked the anthropogenic activities, especially transportation. Tourism sledged at a minimum bare level all around the world including the states of India. The eastern gate of Rajasthan – Bharatpur, a pride destination of wintering migratory bird ground in form of the Keoladeo National Park (KNP) witnessed the impact of the lockdown.

The reports stated longer stay of migratory birds such as Grey Leg Goose, Bar Headed Goose, Open Bill Stork, Painted Stork, Spoonbill, Ibis, and Pelican, etc. during the lockdown period near the area.

### The Proposed research work was planned with following Objectives

1. To study the effect of lockdown on avifauna biodiversity in positive and negative sense.
2. To study the impact of lockdown on avifauna habitats and conservation.
3. To explore the Possibility of bird species in new distributional ranges in proposed study area.
4. To assess the current status of avifauna species in region in general.

### Materials and Methods

Our Study area of research was villages that lie around KNP that has an amazing diversity of both plant and animal species.

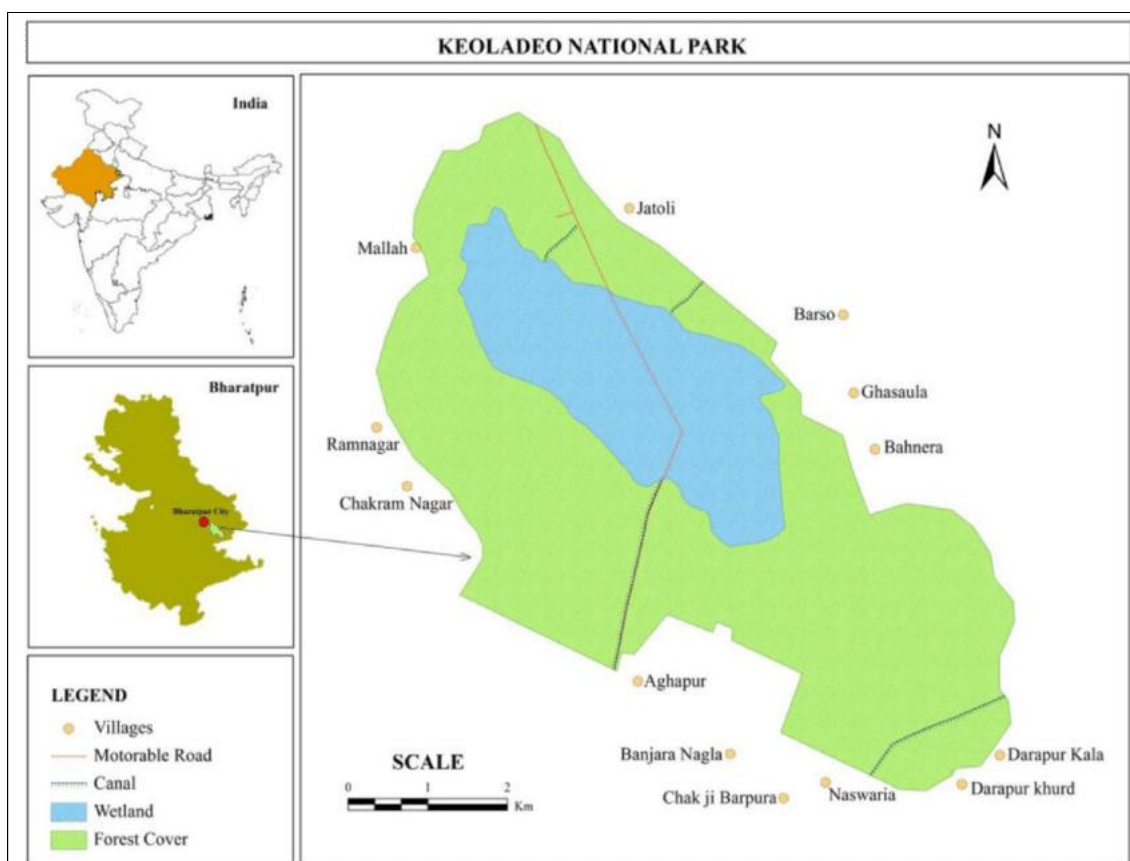


Fig 1: Nearby satellite wetlands of Keoladeo National Park, Bharatpur

There are small Diggi, Ponds, and Shallows pockets in Bharatpur city via Heera das Kunda, Atal band area, and 2-3 old diggies in Krishna Nagar habitation. During Monsoon these are all filled with water having plenty of food for water-birds which attracts the bird's species and due to the presence of certain local tree species, water birds nest in these areas. Visiting the villages' areas and agricultural fields all along the boundary wall of Keoladeo National Park, it was noticed that during the day period there was a large number of birds especially land birds, Arboreal birds, and birds of Prey species are present for feeding and roosting.

Satellite wetlands have a high significance value to both migratory and resident water birds. These are a prime source and largely meet the food requirement from the aquatic habitat scattered around them. The Satellite Wetlands surveyed during the research were *Ajan Bundh, Tehrah Mori dam, Chiksana bundh, Moti Jheel, Nonera, Bundh Baretha, Bhandor, Babula & Bhatawali, Pichuna canal & Rupvas bundh*.

### The Methodology used in our research included

1. General Survey (Encountered Method)
  - a. Around Keoladeo National Park
  - b. Satellite wetland areas.
2. Questionnaire Survey

### General Survey

**(a) Around Keoladeo National Park:** We carried out a general survey of the bird's species around the water bodies near residential areas where birds generally came for feeding and nesting purpose (which is also termed as "Encountered Method"). The survey was done by simply observing the birds and noting down the species seen. As a residential area was chosen for the survey so we noticed common birds like House sparrow, Common Myna, Red Vented Bulbul, House Crow, White Egret, Jungle Babbler, Cattle Egret, Kingfisher, etc. Visiting wetland areas in Bharatpur and in village areas around Keoladeo National Park. This method is carried out about an hour after sunrise in clear weather in person. Each area was survey including the nesting population of heronry species. Birds either incubating or roosting on each tree were taken into account. Birds on trees, water, and in-flight while collecting nesting material and roosting in the area in a small wetland in city area and in agriculture fields in villages around Keoladeo National Park were observed.

**(b) Satellite wetland survey:** A field survey was carried out around Keoladeo National Park of some important Satellite wetlands of significance to ascertain the Biodiversity and Habitat around Keoladeo National Park. Local residents and Migratory bird's activities were observed to estimate the lockdown impact on each site. Information was collected regarding bird's species composition and abundance. Important Satellite wetlands such as Ajan dam, Bandh Baretha, Nonera are most significant, where local and migratory waterfowl species are in large number including arboreal species and Predator bird's species. Some of the significant satellite wetlands are very good destinations for waterfowl due to the presence of water around the year or monsoon to the winter season. Apart from it due to

Freshwater bodies food remains in abundance for avifauna species. Major bird species seen here were Cormorant, Darter, Egrets, Pond Heron, Grey Heron, Open bill stork, lesser whistling teal, Black winged stilt, Pochards etc.

### Questionnaire survey

The aim of our research was to find out the views of local people towards climate change, COVID-19, and their impact on biodiversity with special emphasis on avifauna (Mendiratta *et al.*, 2021) <sup>[3]</sup> The data collected from the survey was analyzed and the results were interpreted to show the impact. The finding of our study revealed from people's perception that an increase in temperature, unpredictable precipitation, a spike in the frequency of disaster, and a decrease in food production has a direct impact on birds. Further, the study showed that local people have developed an interest in birds, nature, and wildlife preservation. The surveyors in the majority reported the sudden increase in bird sightings during COVID-19 lockdown (Rahil Madhok *et al.*, 2020) <sup>[5]</sup>.

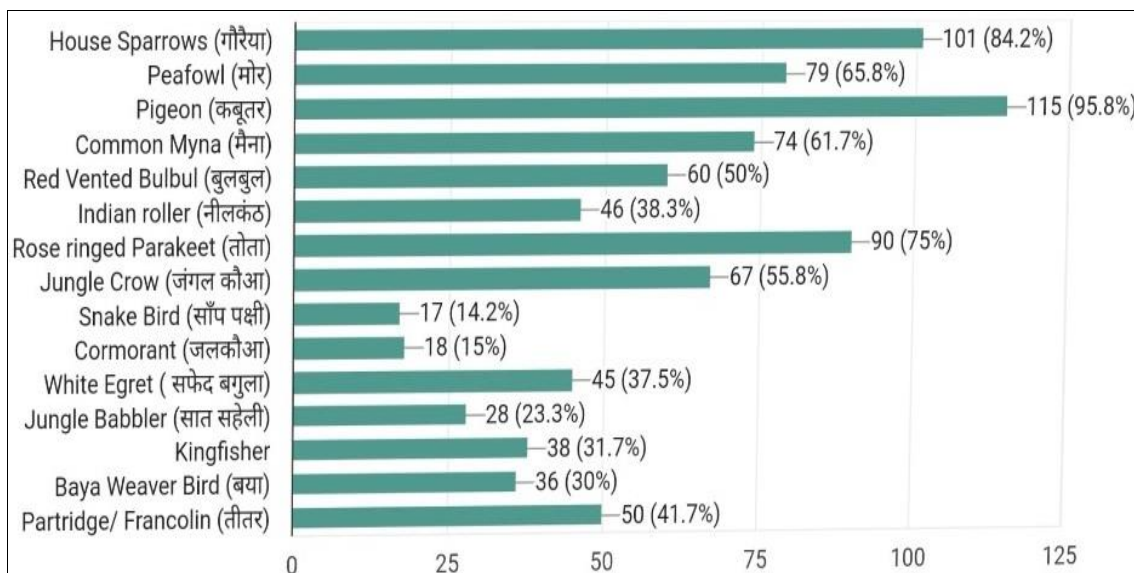
A set of questionnaire was prepared and a total of 600 respondents above age 25 years were interviewed (personally as well as online) in the rural area surrounding Keoladeo national park during the survey period January 2020 to December 2020 to find out the impact of Covid-19 lockdown of avifauna in satellite wetlands nearby the national park. Here we are mentioning some of the questions that we prepared for the survey:

1. Did you ever hear the term "Biodiversity"?
2. Does lockdown proved a boon or bane to biodiversity?
3. Human behavior affects Bird Communities in residential areas?
4. Has the Lockdown phase improved Biodiversity around your residential area?
5. Bird sighting increased during the COVID-19 lockdown phase?
6. Did COVID -19 change your birding activity?
7. Impact of Lockdown during COVID-19 on Birds & Biodiversity?

### Observations

The study to find out the impact of lockdown on biodiversity with main focus on avifauna in satellite wetlands around Keoladeo national park, Bharatpur was carried out through general survey, Field survey (which was done by field observations carried out via field visits), mapping (which was done through GIS in purview of the habitat diversity) and Questionnaire survey which was done via both offline mode and online mode (due to restrictions imposed by government due to Covid-19 pandemic) aimed to assess the local people's perception towards wildlife and biodiversity. The data collected from surveys and media reports was analysed to find out the impacts of Covid-19 pandemic on biodiversity with special emphasis on avifauna.

We were amused to see the result as majority of the respondents mentioned "House Sparrow" whose species were declining over the past few years, so lockdown brought with it good news for such type of species to revive their population (Marco Basile *et al.*, 2021) <sup>[6]</sup>. The figure below represents the list of birds observed by local community:



**Fig 2:** Species of Bird's seen by local community during the survey

General Survey was carried out in four phases from January 2020 to December 2020 in our study area. The phases are numbered as Visits.

**Visit 1:** January 2020 to early march 2020

**Visit 2:** Mid march 2020 to early June 2020

**Visit 3:** Mid June to Early October 2020

**Visit 4:** October 2020 to December 2020

We prepared three tables from the data collected through our

survey. Table-1 represented "Avifauna encountered in the General Survey" and almost 66 species were recorded by us. Table-2 represented "Common key species observed during the general survey" which were around 30. Finally we prepared a Table-2 by comparing Table-1 & Table-2. This Table-2 helped us to observe the percent increase/decrease in sighting of Common key species observed in the general survey. Here we are mentioning the findings through Table-2 which are as follows:

**Table 1:** Represented "Avifauna encountered in the General Survey" and almost 66 species were recorded

S. No	Number of Species	Sighting After lockdown
1	Little Grebe (Dabchick)	Increased
2	Little cormorant	Increased
3	Darter	Increased
4	Little Egret	Increased
5	Grey Heron	Increased
6	Purple Heron	Decreased
7	Large Egret	Increased
8	Cattle Egret	Increased
9	Pond Heron	Decreased
10	Painted Stork	Increased
11	Open-bill Stork	Increased
12	Black-headed Ibis	Almost same
13	Glossy Ibis	Almost same
14	Spoon bill	Almost same
15	Lesser whistling duck	Increased
16	Comb Duck	Decreased
17	Black – shoulder kite	Increased
18	Shikra	Almost same
19	Common krestel	Almost same
20	White-breasted water-hen	Increased
21	Purple Moorhen	Increased
22	Common Moorhen	Decreased
23	Common Coot	Increased
24	Red –Wattled Lapwing	Increased
25	Black –winged Stilt	Increased
26	House sparrow	Increased
27	Common myna	Increased
28	Jungle Babbler	Increased
29	Rose ringed parakeet	Increased
30	Red Vented Bulbul	Increased

**Some Key observations from questionnaire survey**

- A very good response showing peoples interest towards nature and wildlife (more than 96% of the respondents).
- Variety of understanding about the Biodiversity among people.
- People believe in Biodiversity values as health & well being.
- People are so keen to maintain healthy habitat.
- Human behaviour affects avifauna communities in different areas.
- Impact of Covid-19 lockdown was very positive for the improvement of Biodiversity in all areas.

**Results and Discussion**

The purpose is to assess the lockdown impact on the Biodiversity with main emphasis of birds around the World Heritage Site – Keoladeo National Park, Bharatpur (Rajasthan, India).

Findings through General Survey: During this general survey we noticed several faunal species in satellite wetland areas around Keoladeo National Park. KNP and its surrounding comprises as 400 species of birds, 29 Mammals (Sambhar, Spotted Deer, Jungle Cat, Fishing Cat, Jackals etc), 13 reptiles and 7 amphibians species (Turtles, Frogs, Monitor Lizards, Snakes, Python, Porcupine) and 43 fish species (*Labeo Species*, *Cirrhinus* sp., *Heteropneus* sp., *Clarias* sp.) Macro invertebrates such as worm, insects and molluscs were in abundance, more than 50 species of butterflies and around 15 species of odonates (flying Insects) were also found in this area.

Findings through Satellite Wetland Survey: Important Satellite wetlands such as Ajan dam, Bandh Baretha, Nonera are most significant, where local and migratory waterfowl species are in large number including arboreal species and Predator bird’s species. More or less the same species with variable number were observed in Moti Jheel, Nonera, Bundh Baretha, Pichuna Canal & Rupvas bundh wetlands.

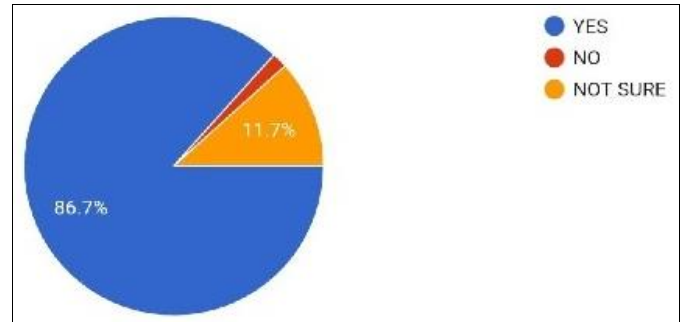
**Findings through Questionnaire Survey**

The data collected from the survey was analyzed and the results were interpreted to show the impact. The finding of our study revealed from people’s perception that an increase in temperature, unpredictable precipitation, a spike in the frequency of disaster, and a decrease in food production has a direct impact on birds. Further, the study showed that local people have developed an interest in birds, nature, and wildlife preservation. The surveyors in the majority reported the sudden increase in bird sightings during COVID-19 lockdown.

We analysed the responses and made some indicators to find out the impact of Lockdown on avifauna in satellite wetlands near Keoladeo National Park. The data observed from the questionnaire survey was analysed with the help of these indicators as mentioned below (we are mentioning here few indicators of our survey):

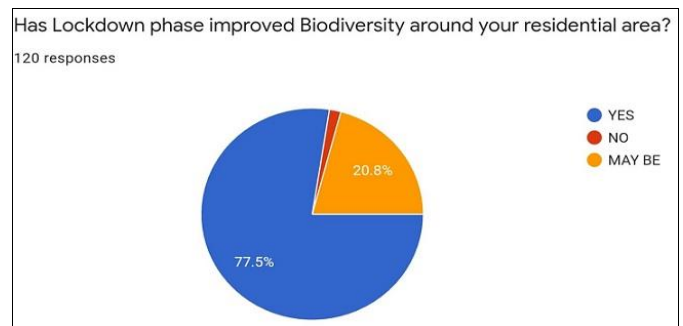
**Birds Sighting and People’s Birding Activities**

Near about 87% of local people observed increased birds sighting in their residential areas.



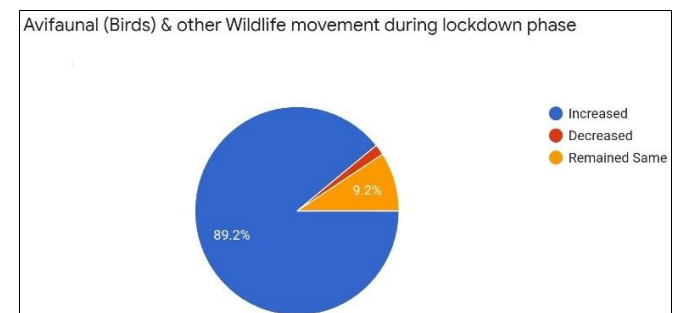
**Fig 3:** Sighting of birds improved

**Lockdown Impact on Biodiversity:** Covid-19 induced Lockdown helped biodiversity to gloom, to revive itself and had positive impact on environment and their related species with their habitats, movements, and roosting, feeding behaviour was also seen being impacted positively.



**Fig 4:** Improvement in biodiversity

**Movement of avifauna during lockdown:** The graphs from the survey represents an increased movement of avifauna and other wildlife.



**Fig 5:** Movement of avifauna and other wildlife

**Sighting of Some new species and rare species:** Rare sighting were also observed by the people as lockdown gave space to Biodiversity to gloom and improve itself.

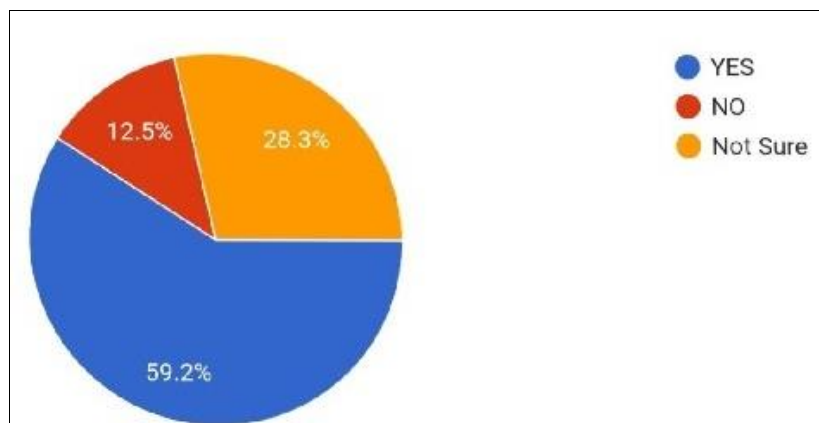


Fig 6: Sighting of rare species

**Impact of lockdown on pollution levels:** Our respondents told us that they were able to hear more chirping of birds in morning again a positive sign for glooming of biodiversity.

news for all of us to see the results as 100% of them believed that YES it is our moral duty to preserve our environment so as to make our future generations have a comfortable life ahead and through this we can also achieve one of our “Sustainable development goals” and lockdown has proved a boon with respect to the conservation of wildlife & its habitat.

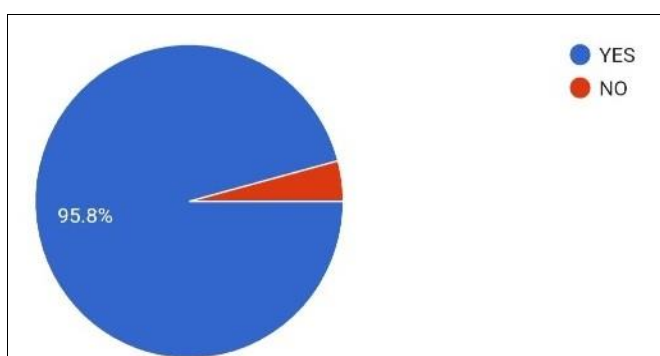


Fig 7: Reduction in noise pollution levels affected biodiversity positively

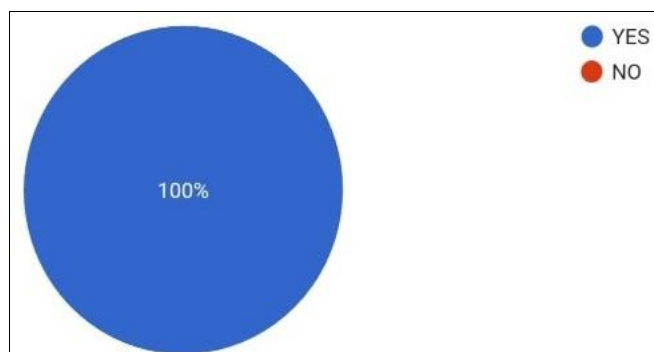


Fig 8: Overall impact of lockdown on biodiversity and its conservation

Summarizing our survey we tried to find out that whether this lockdown period proved a boon or bane to biodiversity, we asked our respondents about the same and it was a positive

Table 2: Respondents behaviour analysis

S. No	Parameters	Yes	Maybe	No
1	Awareness with the term- Biodiversity?	95.8%	-	4.2%
2	Avifaunal Sighting during Covid-19 increased?	86.7%	11.7%	1.6%
3	Biodiversity conservation needed for healthy habitat?	99.2%	-	0.8%
4	Does Lockdown improved biodiversity?	77.5%	20.8%	2.7%
5	Spread of covid-19 from wildlife to humans?	25.8%	37.5%	36.7%
6	Increased avifaunal & other fauna movement during lockdown?	89.2%	2.6%	9.2%
7	Rare species sighted during lockdown?	59.2%	28.3%	12.5%
8	Increase in poaching activities during lockdown phase?	30.8%	50.8%	18.3%
9	Reduction in pollution during covid phase	98.3%	-	1.7%
10	Change in birding activity	60.8%	28.3%	10.8%

The table shown above summarizes the findings of our dissertation in various aspects and we found that this lockdown imposed due to covid-19 proved to be a boon for the biodiversity; it gloomed and revived in its natural form to some extent and it has also given an indication for human beings that to reduce the negative impact on biodiversity only efforts made by government are not sufficient but common people should also try to devote themselves to improve biodiversity and surrounding habitat in best possible manner so that our upcoming generations can also enjoy the benefits.

**Conclusion**

The aim of this research was to find out views of local people towards climate change, COVID-19, and their impact on biodiversity with special emphasis on avifauna. The data

collected from the survey was analyzed and the results were interpreted to show the impact. The finding of our study revealed from people's perception that an increase in temperature, unpredictable precipitation, a spike in the frequency of disaster, and a decrease in food production has a direct impact on birds. Further, the study showed that local people have developed an interest in birds, nature, and wildlife preservation. The surveyors in the majority reported the sudden increase in bird sightings during COVID-19 lockdown.

Reduced mobility of both automobiles and human beings made a way for fauna to move freely in inside as well as outside their habitat, reduced pollution level (air pollution, noise pollution, water pollution) helped in increased sighting of faunal diversity (Bashir 2020 *et al*)<sup>[7]</sup>, people were able to

see the fauna very close to their residential areas including sighting of rare species also. Wildlife accidents also showed a decrease in trend as there were minimal vehicles seen on roads. This lockdown taught us a lesson on how we can contribute towards improving nature and fulfilling the goal of sustainable development

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