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COVER : **Crab Spider**
Thomisidae species
by Girish Gowda

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Editorial...

December 2020, as I was getting ready to translocate myself from Dehradun to Mumbai, another translocation was going on in my vicinity in full scale. Tigers were being translocated to Rajaji Tiger Reserve from Corbett Tiger Reserve in order to supplement a dwindling population of two females in the western part of Rajaji. A male and a female were captured from Corbett and were released in Rajaji. It took me a couple of months to settle down in Mumbai. Both the tigers took even more time to settle down in their new home. By the time I gained a somewhat good understanding of BNHS, the tigers were well settled in their new home in western part of Rajaji Tiger Reserve. After several months of exploring the forest at a time when the entire world was on its knees due to the COVID pandemic, the two tigers met each other. A year has passed since then and we are patiently waiting to hear the good news about tiger cubs from Western Rajaji.

To set a new goal or to dream a new dream does not always come easily. Many of us feel too pressured at the workplace or stressed out at home to do this. But there are a few among us who allow nothing to dampen their zest, not even a COVID pandemic. They make the time to go out into the field, to travel to faraway places, and to share their experiences with our readers. The articles published in 2021 come from such brave-hearts. We have had some remarkable contributions to *Hornbill* since its inception, each adding to our knowledge of nature, and our present authors have continued this tradition with their informative and thought-provoking writings and unique images.

Environmental sustainability is a phrase commonly used in discussions on nature conservation and climate change. For those who believe that sustainability has become an overused, hackneyed term, an article on the effects of the 2004 tsunami is a must read. The waves that hit the Nicobar Islands during this disaster thrashed everything that came in their way, submerging most of the beaches and coastal villages. The devastation was enormous, but what followed was far more detrimental than the tsunami itself, which may be called an act of nature. Over the past two decades since 2004, the lifestyle of the Nicobarese moved away from their pre-tsunami self-sustaining systems, and now the negative impacts of this change have begun to show. Read more about it in this volume.

Invasive plants and animals have long been a cause for concern, as they threaten not just economic growth, but also disturb the ecological balance in natural habitats. Invasive species are now perhaps a far bigger threat to wildlife, more than illegal hunting or trapping. The world has recognised the urgent need to tackle invasive fauna and flora, and there is a whole science that is trying to tackle this insidious problem. Physical removal of invasives is sometimes the only remedy, but it cannot be done on a continental scale. Besides, it provides no long-term solution, as can be seen in the persistent invasion by Water Hyacinth, that chokes and destroys our waterbodies. Yet, though failure to eradicate them is not uncommon, success is possible if there is timely intervention by governments to initiate the prevention, control, and eradication of aggressive exotic invaders, at least from protected areas. This volume of *Hornbill* has two articles on invasives; I hope you enjoy reading them.

Bird migration studies is one of the longest running projects of BNHS, the earliest record dating back to 1927. Our researchers have generated a large amount of data on both land birds and water birds, and now we have many bird enthusiasts contributing too, as they have realized the significance of Citizen Science in reporting colour banded/tagged birds along migrant flyways. For those who are new to birdwatching, please visit our website to know more about BNHS bird migration studies, and when you go into the field, do look out for interesting sightings. Please share your sightings of birds, especially tagged birds, with us at bands@bnhs.org. By reporting such sightings, you contribute crucial details that help to map the migration routes between breeding grounds, stopover points, and wintering grounds, as well as help our researchers to understand avian behaviour like mate pairing and family structure.

Many of the contributions to *Hornbill* are from participants in BNHS camps, who travelled to diverse wildlife destinations of their choice with our experts. An article on the quest for *Bugun liocichla* in Arunachal Pradesh is one such. The Northeast remains a lesser-known area for the vast majority of us, and until you can visit this paradise and see for yourself its unique biodiversity, do leaf through the article and enjoy the visuals. For the last many months, our Programmes department was not able to organize such camps as often as earlier. But in the words of Confucius, "It does not matter how slowly you go as long as you do not stop." We have begun conducting our trails and camps, with due precautions during the travel, and hope to resume their pre-pandemic frequency soon.

Would you like to see your written words and your photographs of Indian biodiversity find space in the *Hornbill*, your companion of the last many decades. Now is that time, as *Hornbill* edges towards its fiftieth birthday; let us all, researchers and nature enthusiasts, pledge that we will pen our experiences and share them, making this magazine a truly participative link with fellow BNHS members.

Bivash Pandav

Mangroves, People, and Tsunami:
The Nicobar paradigm

Text and Photographs: **Nehru Prabakaran**

Uprooted mangrove trees and snags – a familiar post-tsunami sight in the Nicobar Islands

Tsunami, a word nearly unheard by the people of the Nicobar archipelago, has become a benchmark to denote their lives – before and after – since December 26, 2004. The havoc created by the 2004 Indian Ocean tsunami on the Nicobar archipelago of India was unimaginable. The waves thrashed anything that came their way, and land submergence buried most of the beaches and coastal villages under the sprawling ocean waters. The tsunami changed not only the lives of the people in the archipelago, but also the boundaries of all its 23 islands.

The mangroves – a unique vegetation type that occupies land and sea interface – were an inseparable part of the lives of the indigenous Nicobarese community, coastal dwellers that reside on the 12 inhabited islands in this remote archipelago. From food to shelter, the Nicobarese heavily relied on the mangroves that were brimming with bountiful natural resources. The delicious mangrove crabs, oysters, mussels, and a variety of fish were harvested daily from the mangrove swamps for household consumption. Some Nicobarese still fondly remember their patient wait for hours on the mangrove trees, to spear big fish as they moved back at low tide into the ocean with the retreating tidal water. The leaves of mangrove palm *Nypa fruticans* were invariably used to thatch the roofs of their comfortable huts, and the strong poles of *Bruguiera gymnorhiza* and other mangrove trees kept the houses firm and strong for years. All these were no longer available in life after the tsunami.

The initial stages of restoration were not very successful (L: photographed on January 29, 2011).
Efforts by the Forest Department succeeded in establishing patches of *Rhizophora mucronata* and *Ceriops tagal*
(R: photographed on April 19, 2019) at Marine Katchall Bay in Katchall Island

The pristine mangrove forests of Nicobar Islands were severely impacted by the 2004 tsunami. Land submergence due to tectonic subsidence made sure that any tree that successfully defended the land mass against the force of the tsunami would no longer survive. Permanent waterlogging created hypoxic or oxygen-free environmental conditions under the soil substrate that choked the trees to death. A recent study indicated that the mega-disturbance caused a loss of 97% mangrove forests in Nicobar Islands. This severe loss has had a cascading effect on all biodiversity, as well as the indigenous Nicobarese community. The endemic Nicobar Flying Fox, which primarily depends on mangrove swamps for roosting and feeding, is just one example of species severely impacted by the loss of mangrove habitat.

Mangrove natural recovery and restoration – a post-tsunami challenge

The geographical positioning of mangroves at the land and sea interface has evolutionarily provided them with resilience to natural disturbances, as they frequently face cyclones, storm surges, tidal erosion, and rise in sea level. However, the natural recovery of mangroves in the Nicobar Islands was much restricted due to two significant reasons: (i) Availability of local seed sources is crucial for post-disturbance recovery of mangroves. In the Nicobars, the complete devastation of mangrove vegetation at the majority of the sites destroyed the seed source for recolonization. Therefore, recovery relied heavily on the mangrove trees that somehow managed to get established after the tsunami. Further colonization was possible only after these rare trees attained reproductive maturity. (ii) Most of the potential areas for mangrove re-establishment now available were previously terrestrial forests; therefore, the soil condition and other environmental factors were initially not conducive to mangrove establishment. In the

15 years of recovery, the mangroves appear to be re-establishing at several sites, primarily facilitated by the local seed source from first generation colonizers, and the gradual transformation towards favourable soil conditions. The mangrove patches restored by the Forest Department at a few sites also played a crucial role in the natural colonization.

The initial efforts to restore mangroves by the Forest Department were not fruitful, as the seedlings found it difficult to grow in affected sites, where inundation related changes in coastal line had altered the water currents and soil. Additionally, the viability of the seed material that was primarily transported from the Andaman Islands was also questionable. It is likely that the majority of the seeds lost their viability in the two to three weeks of transit since their collection till they reached the planting sites in the Nicobar Islands. Limitations in infrastructure, such as local transport and man-power in remote islands, made matters worse, and implementation of the restoration projects was a challenge. Despite this, persistent efforts by the Forest Department resulted in gradual success at a few select sites across the Nicobar archipelago. Some of these were Maggar Nallah in Great Nicobar, two locations in Kamorta Island, three locations in Katchall Island, Safed Balu creek in Trinket Island, Champin at Nancowrie, and Kimios Bay in Car Nicobar. All these sites now have a small but well-established patch of mangrove forest that will eventually promote the natural succession leading to faster recovery of the mangroves. Restoration efforts by ANET (a local NGO) also proved to be successful at some sites in Little Nicobar Island.

Why the post-tsunami recovery was hard for the Nicobarese

Over the past 15 years since the tsunami, livelihood of the Nicobarese remains unsettled and unstable. The mangroves provided bountiful food and other resources, while the sale of *copra* (dried coconut) provided them with money to access products from the market. In the aftermath of the tsunami, most of the coconut trees were lost, either directly to the tsunami or to land submergence. A significant challenge awaited the Nicobarese trying to earn a livelihood from coconuts for two reasons. Firstly, most of the flat coastal areas suitable for coconut cultivation were lost to land submergence. Secondly, the social structure, e.g., living as extended families that often exceeded 20 persons per household, and cooperation within the community had been the main reason for their self-sufficiency in these small islands before the tsunami. With most of the elders, who made the rules and drove the actions in families or hamlets, lost during the tsunami, the younger generation took the lead. Their inexperience, coupled with increased

The first post-tsunami house built in the Ookchuaka village of Trinket Island was in 2010 made entirely of tin-sheets (L: photographed on November 28, 2010). Now it has a new shade roofing of mangrove palm leaves (R: photographed on April 25, 2019)

interaction with the outside world, government, and excessive external aid (e.g., free ration, cash compensation for tsunami loss, and free housing), disallowed them from visualizing a future similar to their pre-tsunami self-sustainable past. With time, family structure and communal living have also changed, resulting in dwindling cooperation among the community members and disputes over resource use (e.g., land rights). Therefore, despite the availability of abundant natural resources and the passage of 15 years since the tsunami, neither have the coconut plantations recovered, nor have the pre-tsunami social structures that would have ensured a self-sustainable future.

Returning to the Nicobarese way of life

Trinket Island remains an unforgettable example of the impacts of the tsunami. The mostly flat terrain of the island with its sandy soil was overrun by the deluge. At two places – one in the centre and another in the north, each having a major Nicobarese village – the tsunami waves completely crossed west to east, which broke the island into three pieces. Almost one-fourth of the inhabitants of Trinket Island were lost to the tsunami. The island was administratively abandoned by the government, and the entire population was provided relief and free housing at the nearby Kamorta Island. Although they were bound to be restricted in the permanent housing at

A view of Ookchuaka village in Trinket Island before the tsunami

Kamorta, their heart stayed with Trinket and after three or four years, few families began visiting the island to re-establish their homes. By 2011, three huts had been built in the central part of Trinket, where the main hamlet Ookchuaka existed before the tsunami. Initially, only the men stayed back in the huts; the rest of the family would come but seldom stay on. But by 2019, the number of houses increased to six, and the families appear to have taken permanent shelter on the island again.

Meanwhile, the two sites where the island had broken gradually reconnected due to continuous deposition of sand. Vegetation colonized over the sand deposits and ensured that the island became continuous again. It was exciting for a mangrove researcher to notice the new shade roofing made of the Mangrove Palm *Nypa fruticans*, just the way it used to be before the tsunami. Likewise, a house under

A house under construction in Ookchuaka village of Trinket Island was built entirely of mangrove material: poles from *Lumnitzera racemosa* and thatch (for roofing) from *Nypa fruticans* (L: photographed on April 25, 2019)

A successful mangrove restoration site of the Forest Department at Kamorta Island (L: photographed on March 11, 2010) is a prime target of local communities for poles used in house construction (R: photographed on May 01, 2019)

construction used only poles of *Lumnitzera racemosa*, a mangrove tree, and *Nypa* to thatch the roof – just like before the tsunami. These mangrove resources are sourced from the naturally recovering mangrove patches behind the village. A similar recovery and utilization of mangrove resources were observed in two other islands – Katchall and Little Nicobar. All this points to the fact that be it the mangroves or the Nicobarese people, they will recover on their own and support each other's existence.

Challenges of mangrove conservation

Tsunamis and submergence of land are not rare for the Andaman and Nicobar Islands, which experienced three major earthquakes above 7 Mw (Movement magnitude) in 1847, 1881, and 1941, before the 2004 earthquake. These three earthquakes had also caused land submergence and tsunamis, but of lesser intensity than in 2004. The mangroves in the Nicobars have been known to recover after sudden changes, but after the last tsunami recovery may not be as easy. In earlier times, humans barely populated these islands, but ever-increasing anthropogenic pressure now impacts the recovery process. For example, harvesting of first-generation mangrove trees – on which the entire future mangrove colonization depends – would significantly reduce the chance of expansion or make it impossible. Such a situation was encountered in Kamorta Island, where rampant harvesting of *Rhizophora apiculata* and *R. mucronata* was observed in a mangrove restoration site established by the Forest Department. Straight poles, which are used for house construction, were unavailable since the tsunami; so, the local extracted poles from these decade-old stands that have reached a canopy height of nearly 15 m. Such clear-felling of first-generation mangroves will destroy this resource for the future. Unfortunately, *Rhizophora* species do not coppice if the main trunk is cut. Continued harvesting will have a detrimental effect on mangrove recovery in the Nicobar Islands. Therefore, the local community must support the efforts of the forest managers, and conservationists must also invest in engaging with the community, to make them understand the importance of such first-generation trees not only for the future of mangroves, but also for their own sustainability. ■

Nehru Prabakaran is a DST-INSPIRE Faculty at the Wildlife Institute of India.

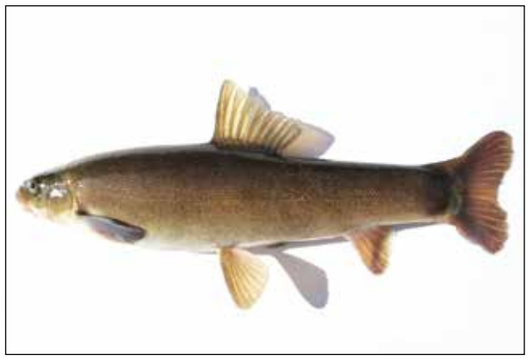
Sport Fishing in BHUTAN

Text: **A.J.T. Johnsingh and Sonam Wangchuk**

Beautiful Bhutan is known for its sparkling clean perennial rivers that in winter reflect the colour of the cloudless blue sky. This small mountainous nation also has numerous clear and clean, small to large water bodies. The total length of the rivers and their tributaries in Bhutan is estimated to be about 7,200 km, and the number of natural lakes, most of them above 2,200 m, is reported to be 590. These water sources are now, however, subject to various development activities, ranging from fish production to hydel power.

A.J.T. JOHNSINGH

Manas river in Bhutan, with deep pools where mahseer aggregate in winter



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Snowtrouts are native to most of the high altitude rivers in the Himalaya

SHIVAKUMAR

Brown Trout is one of the introduced species in the Himalaya

A.J.T. JOHNSINGH

Sikkim is successful in raising Rainbow Trout in its rivers and farms

MISTY DILLON

Chocolate Mahseer caught by Stuart Walker from Dibang River, Arunachal Pradesh

Although documentation of the fish fauna in Bhutan is in its nascent stage, the richness of this faunal group can be seen from the information available in the recently published book FIELD GUIDE TO FISHES OF WESTERN BHUTAN by The National Research Centre for Riverine and Lake Fisheries (NRCR&LF). This book documents 104 species of fish from three major river systems in Western Bhutan: the Amochhu/Torsa, the Wangchhu, and the Punatsangchhu/Sunkosh. The number of fish species in all of Bhutan will likely be much higher when the central and eastern regions of Bhutan are surveyed, which is scheduled to be done in the next few years.

The three most important sport fish species found in the waters of Bhutan are the legendary Golden Mahseer *Tor putitora* and the Chocolate Mahseer *Neolissochilus hexagonolepis*, (both native to Bhutan), and the exotic Brown Trout *Salmo trutta* (introduced in the 1930). Until the early 1980, the Brown Trout was raised in two hatcheries to stock the rivers and streams. This practice was discontinued in 1983, because there were reports of locals complaining that it had reduced the populations of two species of snowtrout, Dinnawah Snowtrout *Schizothorax progastus* and Common Snowtrout *S. richardsonii*, which the Bhutanese like very much. But the competition with Brown Trout may not have been serious, as snowtrouts are primarily bottom feeders. The abovementioned book suggests that there could be three more snowtrout species in the waters of Bhutan. When several such closely related species occur in an area then they should have a fine mechanism of ecological and behavioural isolation, which would enable them to co-exist.

Rainbow Trout *Oncorhynchus mykiss* is another excellent sport fish, but currently, it is being raised only for commercial food production, in the trout farm in Haa, which is managed by NRCR&LF under the Department of Livestock (DOL). Because it is a predatory fish, Rainbow Trout is prevented from escaping into natural waters, being well contained in the trout farm. A native species that could be caught using rod and reel in Bhutan waters is the Trout Barb *Raiamas bola* (= *Barilius bola*), also called Indian Trout (though it does not belong to the trout family). Trout Barb occurs at lower altitudes than the non-native Brown Trout and Rainbow Trout. A native species that could be caught using rod and reel in Bhutan waters is the Trout Barb *Raiamas bola* (= *Barilius bola*), also called Indian Trout (though it does not belong to the trout family). Trout Barb occurs at lower altitudes than the non-native Brown Trout and Rainbow Trout.

KUSCHEL GURUNG

Tsomgo lake in East Sikkim has an introduced population of Brown Trout

International Mahseer Conference

Our interest in the sport fishes of Bhutan was ignited when we attended the extremely valuable International Mahseer Conference in Paro, December 3–5, 2018. This conference was organized, funded, and hosted by the Bhutan Ministry of Agriculture and Forests, World Wildlife Fund−Bhutan, and the Fisheries Conservation Foundation (USA), with additional sponsorships from the Bhutan Trust Fund for Environmental Conservation, Druk Green Power Corporation, the Mahseer Trust, the International Finance Corporation, Kenauk Nature-Canada, Sigma Eight, and the International Section of the American Fisheries Society.

At Paro, winter had set in, and the landscape looked brown, the harvested rice fields were bare, apple trees *Malus pumila* with all their leaves shed looked stark and dry, and even the abundant Blue Pine *Pinus wallichiana* on the hills lacked their sheen. The only tree that looked attractive was the Himalayan Flowering Dogwood *Benthomidia capitata* (= *Cornus capitata*), as it bore colourful red fruit. The conference was held in the picturesque Zhiwa Ling resort. There were nearly 50 participants from the USA, UK, Canada, Holland, Pakistan, Nepal, India, Venezuela, Brazil, and Thailand among others, as well as an equal number of participants from Bhutan.

With mahseer being a group of freshwater species, most of the presentations focused on freshwater fishes, emphasizing their value in human welfare and highlighting the threats faced by the fishes and their habitats. Some startling facts emerged from the conference. Freshwater ecosystems occupy less than 1% of earth's surface, yet they are home to 10% (126,000 species) of the world's wildlife. Even in the vast North American continent with numerous large rivers and extensive lakes, and relatively low human population density, freshwater biota continues to decline. Throughout the world, a major problem faced by freshwater habitats, particularly rivers, is the extraction

of sand and gravel, which affects the quality of fish habitats. It was reported that China used more sand in 2011–2013 than the United States had extracted in the entire 20th century! One reason for the extinction of Yangtze River Dolphin *Lipotes vexillifer* in China, the first global extinction of megafauna (over 100 kg) in the last 50 years, was the massive extraction of sand and gravel from the Yangtze river basin.

Golden Mahseer conservation in Bhutan

The most important presentation relating to Golden Mahseer was made by Karma Wangchuk, David Philipp, and Julie Claussen, who radio-tracked 64 Golden and 43 Chocolate mahseer for a period of four years in the Manas river watershed. The fish were caught by angling, transmitters were surgically implanted, and data were collected and periodically downloaded from the receiver stations placed at intervals along the stretch of the Manas river and its two major tributaries, Drangme Chhu and Mangde Chhu. The Manas river exits Bhutan, flowing into India through Royal Manas National Park. Even though fishing for consumption through capture and sale is not legal in Bhutan, the local Bhutanese do fish for consumption by the family, and the four-year monitoring of radio-tagged fish revealed a minimum human-induced mortality of 26% (with a possible maximum of 66%) for the Golden Mahseer, and a slightly higher mortality for the Chocolate Mahseer.

One interesting observation recorded in the book MY KUMAON: UNCOLLECTED WRITINGS by Jim Corbett is that shoals of mahseer, some as big as a human, were seen swimming up the Ganges near Rudraprayag with the rush of the first snowmelt water that usually occurs in April. The Bhutanese telemetry study similarly reported that mahseer went up the rivers before the rains began (June-July), returning to the lower reaches only after the monsoonal high water levels subsided. In addition, movement data indicate that mahseer do not swim up rivers or tributaries to altitudes above 1,000 m. This finding has two relevant points for mahseer conservation. Firstly, if a hydel dam is built above 1,000 m, it would not impede the upward and/or downward migration of mahseer. Secondly, if a dam is built below 1,000 m, then workable fish ladders should be built to allow fish passage. Unfortunately, to date, fish ladders that work for mahseer have not been perfected, even in Bhutan where fish ladders have been constructed for dams across the Kurichhu and Dagachhu. Furthermore, because Brown Trout largely occur above 1,000 m, trout anglers should be prohibited from fishing in the lower stretches of rivers, which are inhabited by mahseer, where they would be hooking only mahseer, not trout. In plain words, attempts to fish for mahseer by using permission to 'fish trout' should be made illegal.

Genetic studies based on tissue samples collected from the fins of the radio-tagged mahseer showed that the fish returned to their natal rivers to spawn, much like the Atlantic Salmon *Salmo salar* and other salmonids. This interesting aspect of their life history precludes the use of hatchery-bred mahseer to stock streams and rivers, because they will not have the homing instinct of wild-spawned mahseer. We are not sure how or where the hatchery-bred mahseer would try to spawn, nor how the young of these individuals would in turn select their spawning sites.

One interesting but questionable conclusion of the telemetry study was that in winter most of the mahseer gathered along the border of Bhutan and did not enter Manas Tiger Reserve in India, even though the river continues to flow into Indian territory. It may be that after flowing out of the hilly terrain of Royal Manas National Park, the river on the Indian side becomes too shallow and braided, with only a few deep pools needed for overwintering, which are present within Royal Manas National Park. Extension of the telemetry study on the Indian side would provide extremely valuable information on this assumption.

Based on the above findings, mahseer conservationists have proposed a programme to initiate community-based conservation by promoting high-end catch-and-release recreational angling, coupled with increased enforcement and a public education programme to make locals realize that a live fish in the river that can attract well-paying anglers is much more valuable than a fish killed for food. Once it is killed, a mahseer's value is lost forever, but a live fish will continue to attract more and more anglers, bringing in more revenue for the locals.

The proposed recreational fishing programme outlined during the conference by David Philipp, Fisheries Conservation Foundation, recommended that angling be permitted from 1st October to 15th May, and only in the daytime. The fee would differ for foreign and Bhutanese anglers, and also vary depending upon the stretch of the river where the anglers would be fishing. Fees would cover various components such as a Bhutan Fishing Permit, a valid Mahseer Stamp, a Mahseer Conservation Support Fund and a Community Economics Support Fund. The locals would provide camping facilities, rafts, and food, and would be trained to serve as rafters, fishing guides, and trail guides. Such a programme could gain the support of the locals in mahseer conservation and would make them refrain from killing the mahseer. Bryant Dunn (Himalayan Adventures), a tour operator who takes adventure tourists and anglers to different parts of the world and who was attending the conference, opined that it would not be difficult to bring in a good number of anglers to fish in Bhutan, because such an expedition would give them opportunities not just for fishing but also to see other charming wildlife such as hornbills, Golden Langur, Goral, Serow, Barking Deer, Sambar, and maybe even Tiger or Leopard.

A.J.T. JOHNSINGH

Avalanche reservoir in the Nilgiris has an introduced population of Rainbow Trout

Visit to the Rainbow Trout hatchery

On 6th December, after the conference, we made a day visit to Haa (*c.* 3,000 m above msl) to see the Rainbow Trout hatchery and the farm where the fish are cultured for sale in Bhutan at a price of Rs 450/- per kg. The fish feed is procured from Mangaluru in Karnataka, India, and fertilized eggs (for producing sterile adults) from Himachal Pradesh in India, and from other countries such as Denmark. Fishes grown from these eggs are unable to breed and establish a population, even if they escape into the natural waters.

We were immensely impressed by the orderliness and cleanliness of the hatchery, and one of us (A.J.T. Johnsingh) lamented the way the trout hatchery in Avalanche in the Nilgiris, that had been established by Henry Charlton Wilson in the early 1900s, has been allowed to go to ruin. Yet, the staff there continue to catch the trout that come up along the Avalanche stream for spawning, keep them in a tank, and when sufficient numbers are caught, sell them to one of the hotels or resorts, where there is a great demand for Rainbow Trout, which is a delicacy.

In the trout hatchery in Haa, Richard Williams, an instructor experienced in fly-fishing, demonstrated how to cast and fish using a fly rod, and he and others caught some trout to be photographed and then released back

ANAND KUMAR

Golden Mahseer is found in most of the Himalayan rivers

into the water. Our lunch too included an excellent preparation of trout. We drove back to Paro across the 3,988 m Chelela Pass, which in the morning stood covered by frost in many places.

Lessons for India

The conference brought to light several problems associated with sport fish conservation in India. We have allowed the iconic Orange-finned Mahseer of Cauvery river, *Tor remadevii*, to become Critically Endangered, by the thoughtless introduction of the Blue-finned Mahseer *Tor khudree*. No one is to be blamed for this disaster, because back when it was done, we had no idea of the ill effects of such introductions. People then simply thought that they were adding more fish for angling in the Cauvery river, and that it was a good thing. Unfortunately, for years our hatcheries have mixed up the genomes of various mahseer species by crossbreeding and hybridization, creating a genetically compromised hatchery product. In addition, there was no hesitation to introduce a species into an area where it does not belong.

Furthermore, our Government does not understand that catch-and-release angling involving the local people, as is planned in Bhutan, is one feasible way to save the iconic Golden Mahseer and other mahseer in their range in India. Now most of the Golden Mahseer that leave their feeding grounds in summer to breed, either from Corbett Tiger Reserve or from the mighty Sharada river, do not come back because almost all get killed along their journey by local people using a variety of destructive means. Pakistan, on the other hand, has set aside a 104 km length of the Poonch river as Mahseer National Park, a great model for others. Although we have fabulous rivers in Uttarakhand and Arunachal, no such protected area has been set aside exclusively to protect mahseer.

During the British period, Rainbow Trout was introduced into all the streams in the Upper Nilgiris, which colonized most of the reservoirs in later years. As a result, Rainbow Trout cannot be eliminated from the Upper Nilgiris, and whatever harm they caused to the small local fish in the Nilgiri streams would likely have occurred a long time ago, even eliminating some species. In such a situation, it may be prudent to activate the trout hatchery at Avalanche, stock the Avalanche Reservoir, and permit and promote angling as part of the Toda Ecotourism Programme being carried out there. An angler could be charged a minimum of Rs 1,000/- per day, a bag limit of six fish fixed, and the money thus collected could go to the local Toda Ecodevelopment Committee. If we cannot implement such a programme, then we should demolish the trout breeding centre and prohibit the illegal capture of trout from the Avalanche stream for sale. A.J.T. Johnsingh has learnt that although the trout hatchery is in a dismal state there is enormous corruption in its maintenance. It appears that little Bhutan is showing the rest of Asia a new and practical way to conserve sport fish and aquatic biodiversity. ■

A.J.T. JOHNSINGH

Well-maintained pools for rearing Rainbow Trout in Haa

A.J.T. JOHNSINGH

The trout hatchery in the Nilgiris is in a dismal state

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Marg
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Fruit Stall, Frans Snyders, ca. 1620. Oil on canvas; 206 x 342 cm. Collection of Hermitage Museum, Russia. Courtesy Wikimedia Commons. https://commons.wikimedia.org/wiki/File:Frans_Snyders_-_Fruit_Stall_-_WGA21518.jpg

Nandu Tambe's Forest

Konkan is well-known for its fascinating seashore, ancient temples, and forts. The rich floral and faunal diversity of the tropical semi-evergreen forests and mangroves of Konkan is why eco-tourism is proliferating here. I am a nature lover and I like to travel and explore new places. An article that I found on the internet, describing Nandu Tambe's Forest, situated in Shiravali village in Ratnagiri district of Konkan, prompted me to make a visit.

This privately-owned forest, spread over 36 acres, has a known history of 300–400 years. Nandu Tambe's Forest is famous for the Oriental Dwarf Kingfisher, though in this dense forest one can see a variety of birds, insects, and mammals. The forest is a treat for nature lovers and wildlife photographers. Nandu Tambe has set a great example of successful biodiversity conservation by maintaining the forest in its pristine form.

While walking along a trail in the jungle, we saw on a tree a female of the rare and beautiful Ornamental Tree Trunk Spider *Herennia multipuncta*. This species belongs to the Araneidae family and is found in India, Malaysia, China, and New Guinea. It is said to be invasive and synanthropic. The female is reddish-brown with a yellowish U-shaped patch on the cephalic region and multiple markings further back on its carapace; its long, slender, hairy, and spiny legs are mostly brown; underside of abdomen is red with a large black spot at the centre. The male is reddish-brown with dark legs, and body length of 5–7 mm, which is about half that of the female, which is 10–14 mm.

The forests of Konkan are home to many endemic species of reptiles, amphibians, birds, animals, and plants. The forested areas, grassy plateaus, mangroves, wetlands of this paradise should be conserved, else it will disappear, along with the treasures it holds. ■

– Kritalee Chindarkar
Mumbai

ABOUT THE POSTER

The Asian Elephant is presently distributed in the Indian subcontinent, Myanmar, Thailand, Cambodia, Laos, Vietnam, China, Malaysia, Borneo, Brunei, India, and Indonesia.

The Asian Elephant is the largest terrestrial mammal from the Asian continent, with males averaging 3.2 m at the shoulder and weighing over 5 tonnes (5,000 kg); the female is smaller at 2.6 m and weighs over 3 tonnes. Unlike African elephants (namely the African Bush Elephant and the African Forest Elephant), only the males carry tusks; some males are tuskless, and are called *makhnas*. The females are tuskless, some bear small tusks (called tushes) that seldom protrude much from the lip line. An elephant's most distinctive feature is its trunk, formed by an extension of the nose and upper lip. Multifunctional, the trunk enables it to breathe, smell, drink, access and handle food, communicate among its kin, and even serves as a snorkel while swimming.

Elephants are extremely intelligent and social animals, and form groups of 6 to 8, led by an older female called a matriarch. Adult males are mostly solitary, coming to the herd only for mating. They communicate in many ways, by visual signals, smell, touch, and sounds (trumpeting, squeaks, and rumbles), and over long distances, via low-pitched sounds that are barely audible to humans. Elephants have poor eyesight, and rely more on smell and hearing. They may live as long as 60 years.

Asian Elephant *Elephas maximus*

The main threats facing the Asian Elephant are habitat loss and fragmentation because of increasing human populations, and poaching for their tusks. Though most illegal ivory today comes from African elephants, the Asian Elephant still faces the threat of poaching. Their local and migratory movements, loss of habitat, and absence of corridors (connecting links) among forests lead to conflict with humans due to crop-raiding. A Schedule I species under WPA, 1972, this magnificent mammal is listed as Endangered under IUCN. It is estimated that around 40,000 individuals remain in the wild, half of which are in India. ■

Asian Elephant *Elephas maximus*

BIVASH PANDAV

Lockdown Window Birding

Text: **Shameera and Rafiq Somani**
Photographs: **Rafiq Somani**

"*Listen to the chirping of the birds without the chirping of the mind!*" – Osho

The Indian summer, when most people crave for a break, is the perfect time to set off for nature trails and treks for birdwatching. But the unprecedented and unexpected lockdown due to the Covid-19 pandemic in 2020 made it next to impossible to venture outdoors.

Stress levels were at an all-time high due to the uncertainty and anxiety that the contagion had posed. *Work from home* was the new norm, but not without its set of challenges. In such times, we seek instant gratification through the internet or social media, or by surfing TV channels. However, we end up spending most of our time on things that don't leave us feeling happier, contented, or rejuvenated. At such times, the only solace is the windows and balcony of our home, which provide a glimpse of the outside world.

The Aga Khan Palace grounds have a rich green canopy

One of the best parts of birdwatching is that it makes us look at the world differently. It is about focusing on just one thing – a bird – and admiring nature. The whole practice of mindful birdwatching focuses your attention to any one thing, be it the colours, behaviour, or the song of the bird. Whatever you choose, it can help root you in the present moment.

It helped that we stay close to the Aga Khan Palace in Pune, whose gardens and backyard have great potential for birding. We had spotted several birds here, even before the lockdown. But the lockdown seemed to have brought about a frenzy of bird activity. The bird calls were louder; there was a flurry of movement, almost as if they had gone wild and were rejoicing at freedom from human interference. Nature had finally reclaimed its spaces. The earth doesn't belong to man alone, and we must share it with other creatures.

With his DSLR camera in hand, at the end of his workday, my husband Rafiq would strategically park himself near the kitchen window to look out for birds. Evenings were the best time for photography for two reasons, the obvious one being that business and meeting calls were over. The second and more important one was that it was the golden hour when sunlight from the west provided ideal lighting conditions for photography.

Rose-ringed Parakeet mother (below) feeding her juvenile (male)

He was suitably rewarded with numerous bird sightings, which were beautifully captured in his camera. As a trained birder, the golden rule that he always asks a novice to follow is: "Look for the sound before the sight." We could hear the *tuk, tuk, tuk* call and knew it was a Coppersmith Barbet. Its green body with a red and yellow band near the neck, and a dash of the same on the head, was its distinguishing feature. He even spotted a juvenile in one of his sightings.

Our kitchen windowsill has some potted plants with colourful flowers. Mynas and bulbuls occasionally perch on them, but this time around, there were more frequent sightings. From the window, a Rose-ringed Parakeet mother and a juvenile were spotted on a tree. Typical of maternal instinct to nourish the young, the mother fed the juvenile some wild berries and other fruits. As the juvenile lapped up the food offered, the Indian Grey Hornbill, on an adjacent tree, started competing for my attention. The distinctive feature of this grey bird with a white belly is its prominent casque or horny helmet above the bill.

One lazy summer afternoon, the silence was disrupted by the persistent chattering of a Large Grey Babbler in our balcony. This bird is gregarious and always found in

Red-whiskered Bulbul is a common garden bird

Coppersmith Barbet makes a distinct *tuk tuk* call

Western Koel female is heavily speckled with creamy white

The electric-blue and brown White-throated Kingfisher

flocks, which gives it the name of Saat Bhai in Marathi. They are like the chatterboxes in the classroom, forever being reprimanded by the teacher to keep silent.

Kites frequently hover over the grounds, but now in the lockdown, they seemed to be swooping down lower than usual. One afternoon, we found a feather of a kite in our balcony. We soon realized that kites had begun perching on the terraces of the buildings – a departure from the usual, when they preferred the trees. Another raptor that we spotted was the Shikra, almost camouflaged in its dry surroundings. It surprises its prey from a hidden perch, streaking through the air at high speed, and catches it unawares. The prey are usually lizards, dragonflies, or small birds and mammals.

The Greater Coucal, with its long black tail and copper brown wings, is usually found in the undergrowth, but now it walked unabashed on some blue asbestos sheets in the backyard. Bharadwaj, as it is called in Marathi, is considered a good omen and a herald of good luck. The only thing on everyone's mind was a stroke of luck that would lead to the discovery of a vaccine for the virus, which was then far from reality.

Birds in laymen's terms can be classified based on size, by comparing them to common birds like crows or sparrows. For example, to describe a munia which is smaller than a sparrow, one says "sparrow minus", while a slightly larger one is "sparrow plus". The Cinereous Tit, which is about the size of a sparrow, could be heard from the window, going *whee-chichi*. A lot of these tiny birds were now seen in the surroundings, like the Purple Sunbird with its iridescent feathers, sucking nectar from flowers with its down-curved beak. The hyperactive Indian White-eye, with yellowish olive feathers and white eye-ring, was another wonderful sighting. These are social birds, and one can see them congregating in flocks of five to ten. They travel in mixed flocks, and birdwatchers refer to these as 'mixed-hunting parties'. Such flocking improves their feeding efficiency and provides them with better protection from predators. Sunbirds and white-eyes, being essential pollinators, are

The greenish-yellow Common Iora

Indian Golden Oriole perched on a branch

Indian White-eye is named after its white eye-ring

Purple-rumped Sunbird has a down-curved beak

often seen hovering around flowers in their quest for nectar and insects.

The Western Koel, with its melodious call of *kuuu kuuu*, wafted through the air. Almost the size of a House Crow, the male has bluish-black plumage and greenish-grey beak. The female, by contrast, has brown upperparts, heavily speckled with creamy white. Another melodious singer was the Oriental Magpie-Robin, which even imitates other bird calls.

Birds in various colours like the electric-blue and brown White-throated Kingfisher, the bright yellow Indian Golden Oriole, and the greenish-yellow Common Iora made their appearances, and delighted us with their calls. A Common Tailorbird with its bright green upperparts and white underparts was also spotted. It gets its name from its ability to sew leaves together to make a nest.

For us, the green cover of the Aga Khan Palace gardens and the surroundings was a saviour during the lockdown. It made us realize the importance of having an ecosystem where not just humans, but diverse flora and fauna mutually coexist and thrive. Plants, animals, mountains, rivers, and all of nature are a legacy to us humans, and it becomes our responsibility not only to admire but also to protect them. ■

Shameera Somani is a content writer and keen birdwatcher. She enjoys visiting UNESCO World Heritage Sites.

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Curious Case of the Cypress Tree

Text: **Zainab Khan and Paul Antony B.**

In 1956, a young trainee mathematician, Robert MacArthur, was observing warblers in a coniferous forest in north-eastern United States. The warblers (of a number of species) were living in such close proximity that one would assume they were sharing the same niches for foraging, nesting, and mating. However, MacArthur observed how different species of warblers divided the space among themselves on the same tree. For example, the Cape May Warbler *Setophaga tigrina* would spend most of its time around the tips of branches at the top of spruce trees *Picea* sp. Another, the Bay-breasted Warbler *Setophaga castanea* would feed mainly around the mid-interior of the same tree. His observations were what we now term resource partitioning.

Fast-forward to 2020, to the Sálim Ali Centre for Ornithology and Natural History (SACON). Nestled in the foothills of the Nilgiris, adjacent to a highway connecting Coimbatore city and Anaikatty in Tamil Nadu, SACON is situated in a region of rich biodiversity and almost unparalleled beauty. Funded by the Ministry of Environment, Forest & Climate Change, Govt of India, SACON is an important institution for research and education on various conservation issues in India, contributing majorly towards ornithological studies. The campus, true to the nature of the Western Ghats, has a hilly terrain surrounded by large hillocks clad in moist deciduous forest. The pathway connecting the main office buildings to the highway is lined with a few ornamental trees and shrubs. Around 402 species of flowering plants are found on the campus, and 186 species of birds, including many regional endemics like Malabar Parakeet, Nilgiri Flowerpecker, and Grey-fronted Green-Pigeon. Asian Elephant, Gaur, Wild Dog, and Spotted Deer are among the mammals that frequent the campus during the drier seasons.

PAUL ANTONY B.

Cypress tree in the Library Atrium hosting three nests of different bird species

SACON has an interesting architecture, wherein at least one or two atriums, designed to provide ventilation and adequate sunlight, have been constructed inside all the main buildings. An atrium is a large open space with a sky view surrounded by a building, usually after the main entrance. SACON has four main blocks, the Library, Administrative Building, Avian Forensic Laboratory, and the EIA Block, all of which have at least one atrium within. All the atriums are planted with ornamental trees, some with a small pool of water at the centre, or bird feeders attached to a tree trunk. Birds like Yellow-billed Babbler, Indian Peafowl, White-browed Bulbul, Red-vented Bulbul, and sunbirds are regular visitors to these spaces.

The atrium in the Library block has a small artificial pond and about 10 ornamental trees, which attract birds. It was around the end of July 2019, when we were on the terrace of the block from where one can get a fine aerial view of the central atrium. Suddenly, like two darts, two little birds flew past the tall Christmas Tree *Araucaria heterophylla* at the centre of the lawn. The birds were small, with a prominent, shiny, finch-like bill, white underparts, and brown head, tail, and wings. Munias perhaps, but which one? Fortunately, we were lucky to sight them again and confirm that they were White-rumped Munia *Lonchura striata*.

Subsequently, we often saw them flying in, perching on a guava tree, looking around, and then heading straight into a short Cypress *Cupressus* sp. tree. Soon we realized that they were rearing chicks and meticulously working to provide food and protection to their young. White-rumped Munia typically feed on grass seeds. They are also reported to feed on algae, while the young are fed on insects. The nest, a dome-shaped grass structure, is placed in trees, bushes, or even in tall grass. They are also known to occupy abandoned nests of Baya Weaver *Ploceus philippinus*. But what we did not know then was that "our" pair of White-rumped Munia also had busy breeding neighbours.

PAUL ANTONY B.

Scaly-breasted Munia with nest material at the Library Atrium

About a week after our observation on the munias, we saw a chick perched on a nearby Bougainvillea vine. It was too large to be a munia, and we did not have to wait much longer to see a Red-whiskered Bulbul carrying some berries to feed this fledgling. Later, we realized that these bulbuls had also nested on another Cypress tree adjacent to the munia's nesting tree. As their activity grew, so did the fights between the pairs of White-rumped Munia and Red-whiskered Bulbul parents. To further complicate matters, we soon observed a pair of Scaly-breasted Munia *Lonchura punctulata* frequenting the tree used by the White-rumped Munia. They would carry nesting material like blades of grass, making it evident that they were building a nest. Judiciously, they had placed themselves in the lower middle canopy of the tree while the upper canopy was used by the White-rumped Munia. We were fortunate to see the White-rumped Munia chicks taking flight lessons, and returning to the safety of their nest. But the icing on the cake came in the third week of our observations. We noticed a pair of Red-vented Bulbuls methodically carry food in their bills, perch on a partly bare guava tree, look around, and then swiftly disappear into the Cypress tree. They weren't feeding the munia chicks, of course! We noticed that the pair would enter only through the back and top east side of the tree into the canopy.

To sum it up, there were three pairs of different bird species – White-rumped Munia, Red-vented Bulbul, and Scaly-breasted Munia, all nesting at different sites in the same tree. The Red-whiskered Bulbul in the nearby Cypress, however, would stand no intruder and had disputes with all its neighbours, especially with the Red-vented Bulbul, sparing not even a perch. This was possibly because the Red-whiskered Bulbul strongly

defends its territory during the breeding season. However, it is known that other species benefit from this aggressive behaviour, as they also get protection from predators and competitors. By the beginning of October, we saw two Scaly-breasted Munia juveniles returning to roost in the same Cypress, and the Red-whiskered Bulbul, perched on a Guava tree nearby, trying to chase them off.

All these species are not social breeders, so we were curious to know what was driving them to breed at such close quarters, irrespective of the interspecific competition created for food, nesting sites, and avoidance of predators. A perusal of literature revealed that Scaly-breasted Munia use various species of Cypress for nesting in urban gardens in northern India. The foliage of this tree is so thick that we were unable to see the nests or the breeding pairs once they were inside the foliage. Other bird species may also do so, benefiting from the Total Foliage Hypothesis, which states that greater foliage density inhibits the transmission of visual, chemical, and auditory cues given by the prey.

We have observed a pair of Large-billed Crows perched at the top of a large Christmas Tree, and a Shikra and Black-winged Kite on a leafless tree just 25–30 m away from the nesting Cypress tree. They are regular visitors to this patch, and there is no dense canopy to conceal the nesting birds, yet these predators seem to be oblivious of their presence. This may also be due to us humans, the true "noisy neighbours" who can create an intermediate level of disturbance, which ultimately keeps out predators. The atrium also provides much needed safety from other large predators, keeping the fledglings safe while they are still learning to fly. It is interesting to note that a Crape Jasmine *Tabernaemontana divaricata*, which is at a distance of 10 m from the Cypress tree has Pagoda Ant *Crematogaster* sp. nests. We never saw birds on this tree, nonetheless it is unclear whether the presence of the ants affects the breeding birds or not.

All these factors do not precisely explain the coexistence of these nesting birds, or why they would nest on the same species of tree. The campus has numerous other trees and open spaces; however, these birds prefer to nest inside the confined walls of the atrium. It can be said that they prefer an optimal nesting site, even when other nesting sites may actually be abundant. We say this as we also found an active nest with three Red-vented Bulbul chicks, built on a Dwarf Dracaena *Dracaena terniflora* at the tip of a low branch, hanging just two metres above the ground and exposed from all sides. This is inside the atrium of another building, the Administration block. The nest is well within hand's reach as we walk past through the corridors to the Administration office. One of the parent bulbuls is always on guard, keeping a watchful eye on the nest from a distance, although they seem to be undisturbed by the constant sounds or movement of

ZAINAB KHAN

Red-whiskered Bulbul bringing feed for its chick

PAUL ANTONY B.

White-rumped Munia perched on the Guava tree

PAUL ANTONY B.

Scaly-breasted Munia juvenile would take flight lessons and return to the Cypress, its nesting tree

people around the corridor. Outdoors, such a nesting site would have been an easy target for predators, as it is constructed on a rather open tree with little foliage; it is much safer inside the atrium.

It is known that Red-vented Bulbuls live in close association with humans and benefit from this relationship, making them synanthropic species. Munias are also considered to be synanthropic at times, to the point of becoming pests as they forage on cultivated crops. Since both species of birds benefit from this association and choose optimal sites for nesting, they seem to have created a trade-off amongst themselves by acquiring different niches within the same tree. This lets a total of four species (Red-vented Bulbul, Red-whiskered Bulbul, White-rumped Munia, and Scaly-breasted Munia) coexist while they exploit the same resources at the same time, even at the cost of frequent fights.

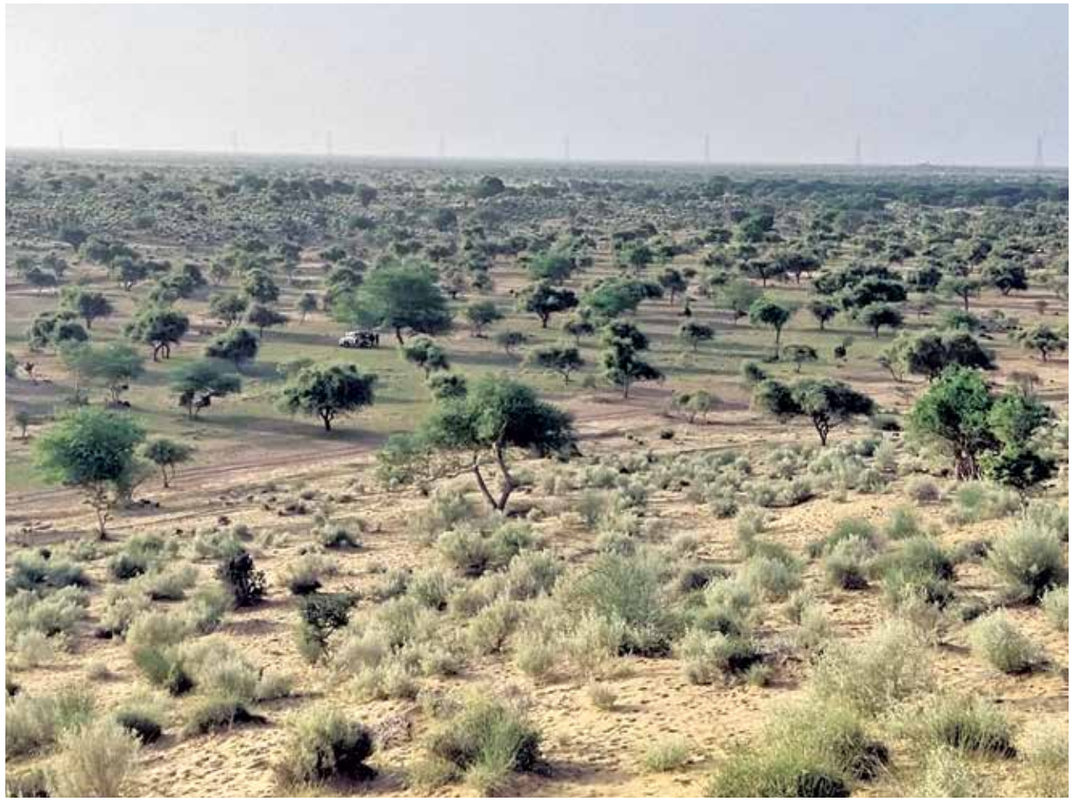
Nature is ingenious when it comes to resolving problems. Our small, opportunistic observations have opened windows into the intricate design of survival strategies in nature. Although it isn't surprising that humans, as a species with an ever-growing population, invariably cause drastic alterations to nature's pristine setup, implementing smart architectural design (like atriums) and taking simple steps like planting beneficial trees (or maintaining gardens) on a small or even large scale, go a long way in maintaining a healthy coexistence between man and the wild. To what extent do human disturbances affect species, and how do species develop such relationships, will always be debatable, considering how these relationships change over time. However, be it the 1950s or 2020, what remain constant are the intriguing marvels of nature that can sometimes be explained by ecological study. ■

Zainab Khan is a wildlife researcher and has worked at SACON. When not observing animals in the wild, she's probably bringing them to life through art.

Paul Antony B. is an avid birder, amateur photographer, and a footballer. He has worked as a Junior Research Biologist on the Forest Owlet project at SACON.

Challenges to avert extinction of the Great Indian Bustard

Text: **Sujit Narwade**



SUJIT NARWADE

Undisturbed habitats are rapidly vanishing in Thar Desert; note the powerlines in the background

"I have never seen such lush grassland in Solapur in the last three decades," said Dr Asad R. Rahmani, former Director, BNHS, and my PhD guide, during his visit to the Great Indian Bustard Sanctuary in Solapur, Maharashtra, in October 2016. "Beautiful habitat, but no birds, and where have the bustards and blackbuck gone?" he asked. This is a question that has remained unanswered for decades, and especially troubled me, as I am a native of Solapur and a biologist in a number of BNHS projects on the Great Indian Bustard *Ardeotis nigriceps* (GIB).

Episodes of local extinction of Great Indian Bustard were first recorded in Karera, Madhya Pradesh, and then in Solapur, Maharashtra. We collectively failed to save the species; the reasons differ but bustards have disappeared all over their range in the last few decades. Dr Deepak Apte, former Director, BNHS felt that the Society should do something for the last remaining bustards in Thar Desert. In the editorial of *Buceros* Vol. 20, Nos. 2&3, 2015, newsletter of the BNHS-ENVIS Centre, he concluded, "This is our last chance to save this magnificent bird. It will be an absolute tragedy and shame if we lose this species, despite knowing well the problems associated with it and allowing the situation to spiral out of hand."

I had learnt from my experience in the Deccan Plateau that conservation projects are difficult to coordinate from headquarters, and therefore, I requested Dr Apte to allow me to shift to Rajasthan. Less than 150 individuals of the species were estimated to remain in 2018, and there was no scope for any mistakes (as had happened in the Deccan). Despite having a fair understanding of the GIB and its habitat from the experience of working in the Deccan Plateau, it took me two years to understand the difficulties involved in implementing conservation actions in the Thar.

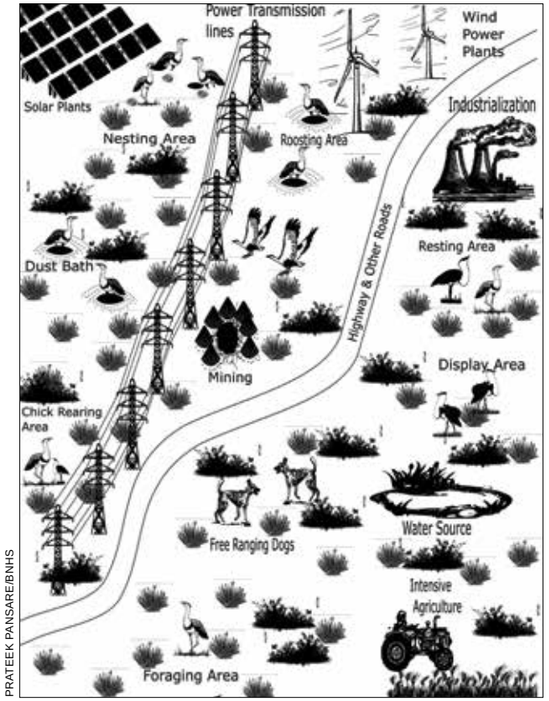
NAYAN KHANOLKAR

Last standing male of Nannaj, Solapur, Maharashtra, photographed in 2014

Since the 1970s, BNHS has been involved in conservation strategies for the GIB, especially during a pioneering, decade-long study on the GIB in the 1980s, sponsored by the US Fish & Wildlife Service, and thereafter in a number of research or conservation projects on or related to the species.

Management Complexities

Overall, addressing the conservation concerns of the GIB is not easy, as there is no single correlative factor, such as became evident for the vulture declines – diclofenac, a painkiller administered to cattle. Attempts to stop the sale of this drug saved vultures (and other birds of prey) from going extinct. The situation for GIB is complex, as it involves multiple issues, challenges, and stakeholders.



PRATEEK PANSARE/BNHS

Minimum habitat requirements of GIB and threats to birds and their habitat

GIB is a large bird and is considered 'extinction-prone' due to its slow life-history traits and struggle for survival in human dominated landscapes. It usually lays one egg, the male does not take responsibility of parental care, and the chick remains with the mother for at least a year to learn survival skills. To add to its extinction proneness, increasing human and livestock populations have been exerting immense pressures on its grassland habitat over the past 40–50 years, leaving only small, fragmented, and degraded patches for the bustard (and other grassland fauna) to survive. For more information on the ecology, habitat requirements, and decline of the species, please read "Great Indian Bustard – On the brink of extinction", *Buceros* Vol. 20, Nos 2&3, 2015, which is accessible online: http://bnhsenvis.nic.in/PublicationDetails.aspx?SubLinkId=222&LinkId=754&Year=2017

Grasslands are among the most neglected ecosystems, often treated as wasteland or pasture. India's Protected Area network covers only a miniscule expanse of our grasslands (<1% are officially protected). Vanishing grasslands, habitat destruction and deterioration, fodder shortage and over-grazing, infrastructural developments such as construction of roads, electric poles, and renewable energy projects like wind turbines and solar panels, mining, industrialization, threats from high tension power lines, and poaching are the major problems for GIB in the last remaining tracts of grassland, especially in non-protected areas (see figure alongside). Recent satellite-tracking studies in Maharashtra by Wildlife Institute of India (WII) and Government of Maharashtra revealed that birds (males) venture into non-breeding areas located 10–150 km away from breeding sites. Hence, instead of an approach focusing on the few protected areas of a region, it is essential to consider a wider, landscape-based outlook

SUJIT NARWADE

Habitat restoration carried out by Gram Panchayat Khetolai, with support from BNHS

DHARMENDRA PUNIYA

Bustards visit farmland and waterholes while foraging in villages outside Protected Areas

for the conservation of GIB. As happens in most places, villagers are turning against the conservation of GIB, as they feel that its presence on their lands would result in roadblocks to development in the area. Complicated landscape management systems in sanctuaries and land-use policies have led to delays in final notification of many sanctuaries, and settlement of land rights since the 1980s.

As a result of all these compounding factors, the population of GIB has declined from *c.* 1,000 in the 1980s, to *c.* 500 in 2000, to *c.* 150 in 2015. The current global population is probably less than 100 individuals. According to the information available, the species has reduced to 75 birds in the Thar Desert in Rajasthan; six or seven in Gujarat; no more than two to three in Maharashtra; 10 in Karnataka, and two to three in Andhra Pradesh. If the decline continues, and conservation initiatives are not implemented or turn out to be unsuccessful, this magnificent bustard which is already extinct in 90% of its former range, may become totally extinct in the wild within a decade or two.

Conservation initiatives by the Government of India

Four species of bustards are found in the Indian subcontinent, of which three (Bengal Florican *Houbaropsis bengalensis*, Lesser Florican *Sypheotides indicus*, and Great Indian Bustard *Ardeotis nigriceps*) are resident species. All three are listed under Schedule I of the Indian Wildlife (Protection) Act, 1972 and National Wildlife Action Plan 2002–2016. As per the National Forestry Commission's recommendation No. 172, and the resolution passed by IUCN in 2004 during the World Conservation Congress in Thailand, the Government of India is obliged to protect bustards as the flagship taxa for grassland flora and fauna through 'Project Bustards'. In CMS-COP 13 at Gandhinagar, Gujarat, Great Indian Bustard was included in Appendix I of the Convention on Migratory Species (CMS). In February 2020, the Ministry of Environment, Forest and Climate Change (MOEF&CC), under its centrally sponsored scheme, 'Integrated Development of Wildlife Habitats', initiated Species Recovery Plans for the bustards in India.

A conservation breeding programme for GIB was launched by Wildlife Institute of India (WII) in collaboration with Government of Rajasthan. Eggs were collected mainly from Desert National Park, Rajasthan, and at present 16 birds comprise the founder stock. The temporary conservation breeding centre is located in Sam and the main facility is being constructed at Ramdevra in Jaisalmer. The real challenge for this programme would be the successful release of captive-born birds into the wild, for which the availability of secure and optimal habitat would be essential. Judging from the developments over the decades in GIB country, and in India in general, the ground situation, especially in human-dominated landscapes, would be more hostile for wildlife in the future.

SUMER SINGH BHATI

Critically Endangered Great Indian Bustard *Ardeotis nigriceps* killed by collision with a power line in Degrai Mata Oran

BNHS approach to saving the GIB in Thar Desert

Presently, the only viable populations of GIB in Thar Desert are confined to four small pockets:

- Desert National Park: Since this site is a Protected Area and its management plan is in place, it does not have immediate threats from new renewable energy power projects, which are proliferating in non-protected areas in the Thar.
- Pokhran: Pokhran Field Firing Range and surrounding villages are the last refuge for the few remaining bustards found in non-protected areas of Thar Desert.
- Degrai Mata Oran: This was excellent habitat until a few years ago, but is now a death trap for the birds because of rampant mushrooming of high-tension power lines and renewable energy projects.
- Border areas between India and Pakistan under the control of Border Security Force (BSF).

Towards BNHS's goal of saving the GIB in Thar Desert, the strategy is to conduct landscape-level research and garner support from local people to conserve the birds in non-protected areas. This includes assessing the distribution of birds, and preparing site-wise conservation action plans using sensitivity mapping tool. At present, the following activities are being carried out to achieve this goal:

Community support: Thar Desert is well-known for the wildlife conservation efforts by the Bishnois. Using the examples of protection accorded to Khejri *Prosopis cineraria*, Blackbuck *Antilope cervicapra*, and Chinkara (or Indian Gazelle) *Gazella bennettii* by the Bishnois could help spread public awareness for wildlife conservation to other communities in the Thar.

Nature education programme in Pokhran: A customised nature education programme has been designed for students, who will get an opportunity to learn to identify the biodiversity present in their 'backyards' and understand their role in the ecosystem. Godawan (local name for GIB in Rajasthan) Fellowship will be given to students who would be brand ambassadors of our GIB conservation project.

SUJIT NARWADE

New high voltage power lines are coming up in the Thar area despite a stay order by National Green Tribunal

SUJIT NARWADE

Grass stunted because of overgrazing by free-ranging cattle, goats, and sheep in Thar Desert

Habitat Restoration: *Oran* or sacred groves are natural forest patches worshipped and conserved by locals. The *Oran* and revenue land which had been overrun by the exotic *Prosopis juliflora* was restored by planting native grasses with the help of Khetolai Village Gram Panchayat, Pokhran, Jaisalmer district and the Border Security Force (BSF).

Collaboration with Defence/Indian Army: BNHS has received strong support from the Indian Army for GIB conservation, especially in the Pokhran Field Firing Range (PFFR) area, which holds the largest extant global population of GIB.

Sensitivity mapping: Under sensitivity mapping, high scores were given to sites with presence of GIB and other obligate grassland birds, raptor congregations, comparatively minimum threats, and suitability of potential habitat. Polygons were drawn around these areas. The report on sensitivity mapping project has been submitted.

Advocacy for policy making (mitigating impacts from new renewable energy sector): New renewable energy (solar and windmills), and associated structures like power lines, spreading rapidly in prime GIB landscape are a matter of great concern for the survival of the species. BNHS, along with BirdLife International, Rajasthan Forest Department, MoEF&CC, Wildlife Institute of India (WII) and local people, is making concerted efforts to mitigate the threats to GIB (and other birds) from these energy projects through management initiatives and advocacy, and to advocate that sites where GIB is presently distributed should be free of such infrastructure development. Apart from core staff and volunteers, BNHS has developed a small network of like-minded local people by identifying them as *Godawan Mitra* (Friends of GIB), who are involved in project activities such as monitoring and awareness programmes. A group of such passionate conservationists under the leadership of Kamlesh Bishnoi from Khetolai village, Sumer Singh Bhati from Sanwata village and Musa Khan from village Neemba, Sam, Jaisalmer have come forward and taken ownership and responsibility of this conservation initiative. ■

Sujit Narwade is Project Scientist at the BNHS and he is currently in charge of the Great Indian Bustard Programme of the BNHS.

ERRATA: April-June, 2020; Pp: 23 and 24
For: Indian Moon Moth *Actias selene* | **Read**: Indian Moon Moth *Actias maenas*

Online Release of Publications

BNHS PHOTO LIBRARY

BNHS PHOTO LIBRARY

The Covid-19 pandemic slowed down many, but could not dampen the zest of three authors who came together on January 29, 2021 to release their publications online in the presence of family, friends, and supporters. The books, FLIGHT OF THE PINK-HEADED DUCKS AND OTHER STORIES by Ms Katie Bagli, a BNHS publication, and a Hindi e-book BHARAT KE SOU SAMANYA PAKSHI by Dr Raju Kasambe and Dr Satya Prakash Mehra, published by Wildlife and Environment Conservation Society, Amravati, were released by Ms Sree Nandy, CEO and Editor-in-Chief, Saevus Wildlife India and Member, IUCN Commission on Education and Communication.

Katie Bagli is an avid nature lover and she gives expression to her passion by writing for children. She has 25 published titles to her credit, nearly all of which are related to nature. Her latest work FLIGHT OF THE PINK-HEADED DUCKS AND OTHER STORIES, for which she appears in *Times of India's* Long List of Best Authors, 2021, is about the endangered birds and other animals of India, many of which may be unfamiliar to young readers. The stories are fast-paced and prod the reader to think through issues such as hunting, use of products made from animal parts, and human misconceptions that have rendered these animals vulnerable. The stories are simple, plausible, and engaging. An inspiring addition to a child's reading list, do write to cmd@bnhs.org to gift or buy your personal copy.

Dr Raju Kasambe has authored 19 books and 5 eBooks on birds and butterflies, and more than 150 research articles in various journals. He also writes articles and poems in Marathi and Hindi. Dr Satya Prakash Mehra is a trained Environmental cum Development Professional with 23 years' experience in conservation of natural resources and sustainable development through community mobilization. In BHARAT KE SOU SAMANYA PAKSHI, the authors describe 100 common birds of India with images, distribution maps, and information on birdwatching and bird migration studies in India. The book can be downloaded free from "Internet of Birds" a BNHS mobile app. The eBook can be accessed at: https://play.google.com/store/apps/details?id=com.internetofbirds&fbclid=IwAR0dZjAcPKMlCd6iSwmojpsPg5xutYaDYrwJ_D6Wth3BJhWZeG_GdesNbcE ■

Bharat Ka Amrit Mahotsav

The Government of India to commemorate 75 years of India's Independence has planned to showcase achievements of the last 75 years in all ministries, under the title 'Bharat ka Amrit Mahotsav'. The celebrations were flagged off by the Honorable Prime Minister of India on March 12, 2021.

Under this programme, the Central Zoo Authority of India (CZA), a statutory body of the Ministry of Environment, Forest and Climate Change (http://cza.nic.in/), along with BNHS, has launched a massive outreach campaign titled 'Conservation to co-existence: The people connect'. The campaign aims to generate awareness for 75 conservation priority species through continued public engagement in 75 Zoos across 75 weeks. One species will be celebrated each week showcasing its uniqueness, along with information on its conservation status. The awareness activities that will be conducted during the week will include expert talks, photography painting/poetry/quiz competitions, guided trips (in zoos in-person or via virtual mode in keeping with the COVID-19 guidelines.

SOURCED FROM: CENTRAL ZOO AUTHORITY

(L): Live portrait painting by art teachers and students; (R) Visually impaired students were introduced to the shape of an elephant through a life-sized model at the Veermata Jijabai Bhonsale Udyan and Zoo

SOURCED FROM: CENTRAL ZOO AUTHORITY

Public engagement of birdwatching participants at SGNP, Mumbai, during a session on Rusty-spotted Cat and Leopard

The species in focus for Week 1 and 2 of the programme were Asian Elephant (*Elephas maximus*) at Veermata Jijabai Bhonsale Udyan and Zoo and Rusty-spotted Cat (*Prionailurus rubiginosus*) at Sanjay Gandhi National Park and Zoo.

To know more about the activities being conducted around the species and zoo in focus, follow the facebook page and twitter handle (https://twitter.com/CZA_Delhi) and the YouTube channel (https://www.youtube.com/channel/UC9DQs7r_Ln34K5NdcFr0iBg) of Central Zoo Authority. ■

A Citizen Science Initiative by BNHS

BNHS PHOTO LIBRARY

Experts and volunteers for bird monitoring at Haathi Gate, SGNP

BNHS PHOTO LIBRARY

The concluding event for the count was held at Nature Information Centre

Bombay Natural History Society (BNHS) and Sanjay Gandhi National Park, Mumbai (SGNP) have initiated a a long term bird monitoring program (2021-25) in SGNP; CEC-Mumbai will coordinate this citizen science initiative. The first monthly bird monitoring under this programme was organized on February 28, 2021, where more than 70 people including BNHS scientists and members, bird experts, volunteers, and Forest Department staff participated. The monitoring was conducted on ten transects, of which four teams started from Haathi Gate (Goregaon East), three from Borivali, two in Tungareshwar Area, and one in the Nagla Block. COVID-19 guidelines were followed by all the participants involved in the count.

The count will help to document the distribution and abundance of birds in SGNP and help in understanding demographic changes in bird populations in the Park. The observations on birds across seasons and years, will help to better understand seasonal patterns of movement of birds, and monitor changes in distribution and abundance of birds over long periods.

The data collected from each transect will be compiled on https://birdcount.in/ – an eBird website. Bird Count India is an informal partnership of organizations and groups working together to increase collective knowledge about bird distributions and populations. ■

Is your pet on CITES list?

On June 16, 2020, the Ministry of Environment, Forest and Climate Change, Govt of India, issued an advisory to streamline the process for import and possession of exotic live species in India.

This process to be dealt strictly online through the Parivesh Portal (http://environmentclearance.nic.in/writereaddata/om/30052020 WildlifeAdvisorySpecies.pdf) came up with the following objectives:

- Developing an inventory of exotic live species in India through Voluntary Disclosure Scheme to streamline CITES compliance
- Procedure for import of exotic live species.
- Registration/Declaration of progenies of the imported exotic live species

It is stated in this advisory that the declarer would not be required to produce any documentation in relation to the exotic live species if the same has been declared within six months of the date of issue of the advisory, which was extended until March 15, 2021.

This declaration of exotic birds and animals will be applicable only to exotic animals listed under the Appendices I, II and III of CITES and does not include "native" species present in the Schedules of the Wildlife (Protection) Act 1972 (WPA). Over 38,700 species – including roughly 5,950 species of animals and 32,800 species of plants – are protected by CITES against over-exploitation through international trade.

BNHS in collaboration with Uttar Pradesh Forest Department conducted four workshops (virtual and offline) funded by BirdLife International between 8th February and 3rd March 2021.

FARMAN ALAM

BNHS conducted training on CITES in collaboration with Uttar Pradesh Forest Department

A total of 81 participants including two Chief Conservator of Forests, one Conservator of Forests, 19 District Forest Officers along with 59 Sub-divisional Officers, Rangers, Inspectors and Forest Guards from 20 districts of Uttar Pradesh attended the lecture by Dr Rajat Bhargava of BNHS.

The date and venue of these workshops were: Meerut (8th February 2021); Bareilly (15th February 2021); Hapur (27th February 2021) and Muzaffarnagar (3rd March 2021). Attended the training conducted by Dr Rajat Bhargava, BNHS Ornithologist. Several identification tips of species in the pet trade were shared among the participants – for instance, out of the 387 species of parrots found in the world, only four parrots are non-CITES.

Dr Bivash Pandav, Director, BNHS, said "We are working on a manual for easy identification of CITES listed species, and if any other state is interested and approaches us, we are more than ready to oblige." ■

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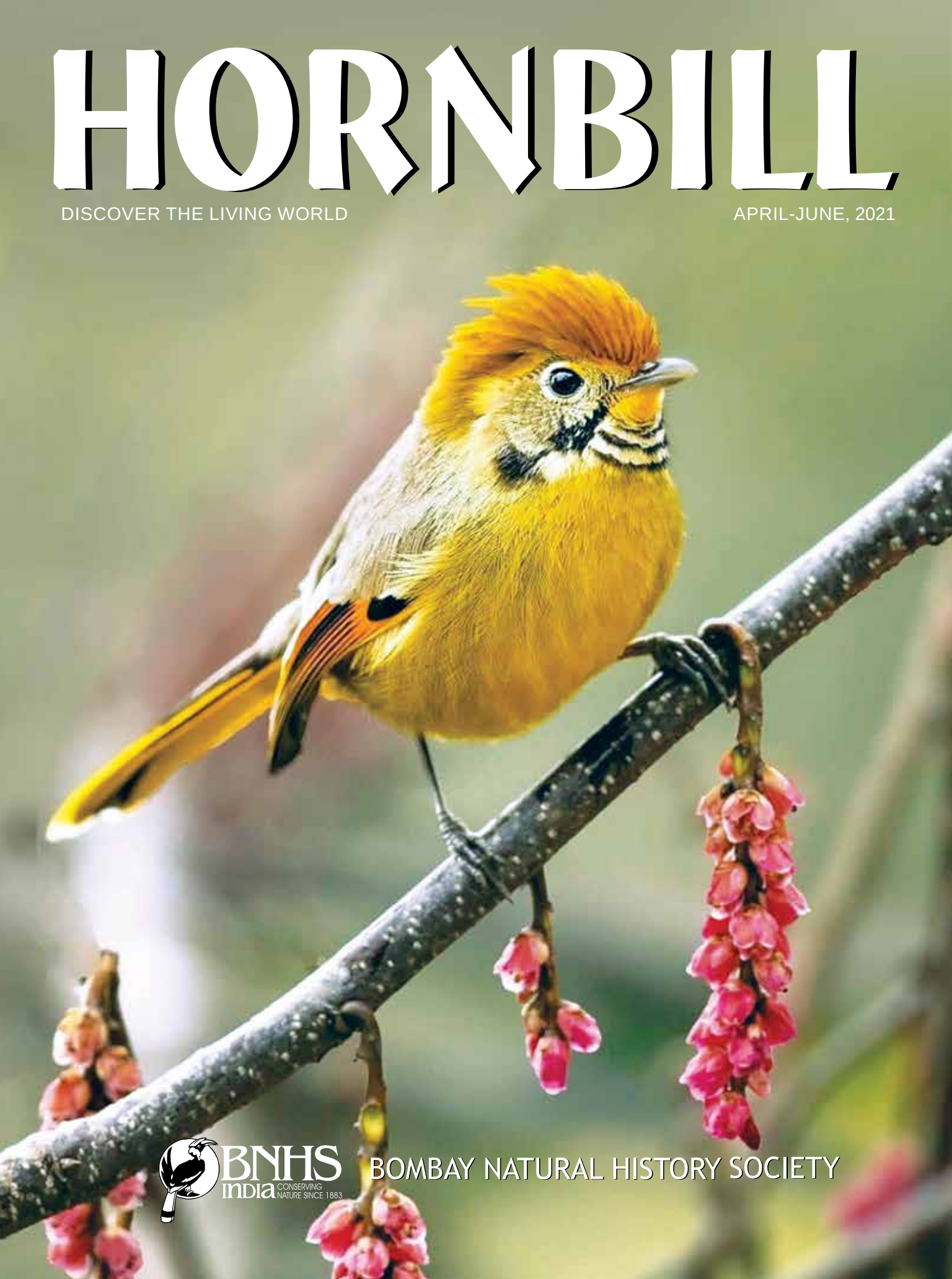

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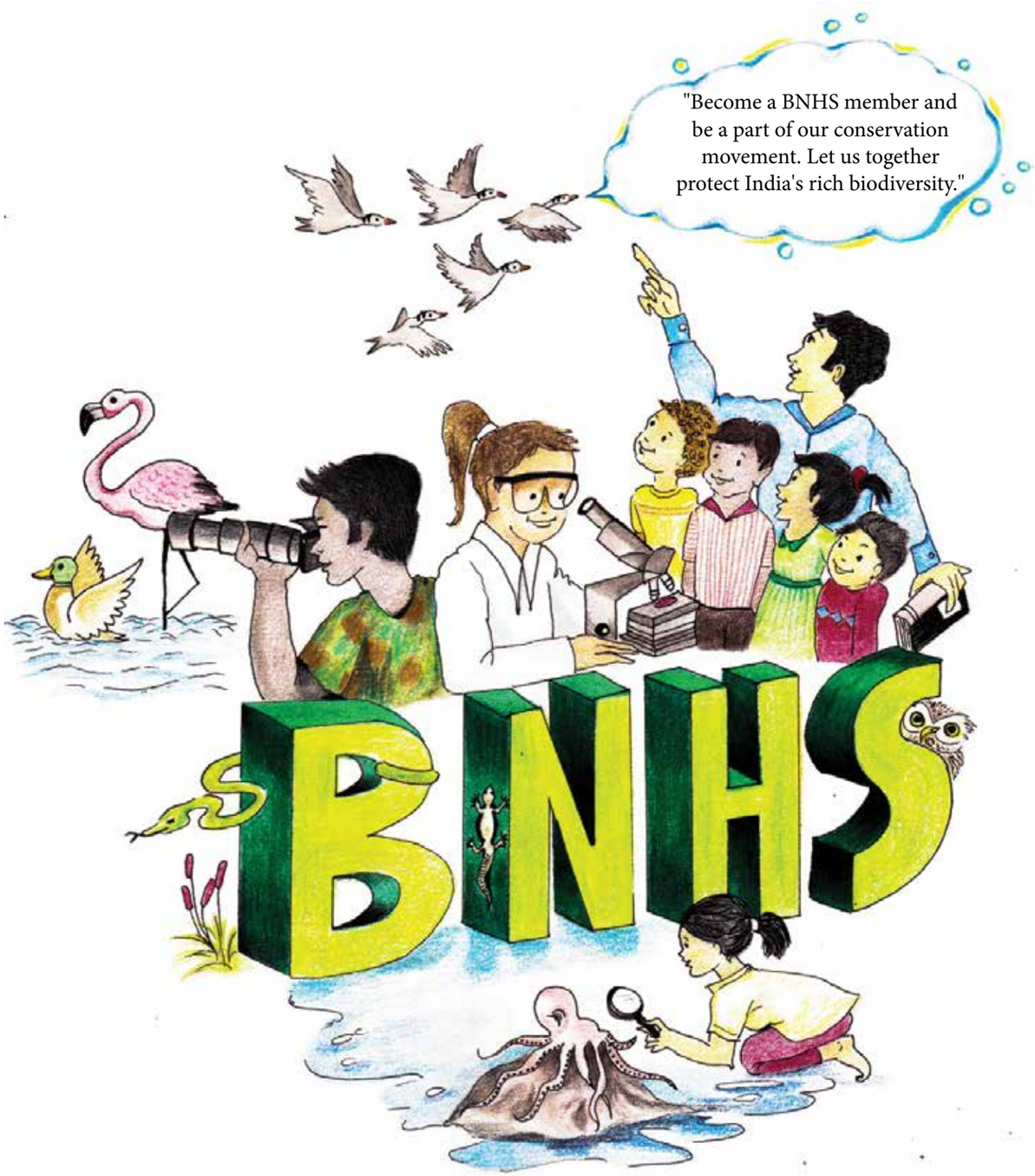

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HETALI SONEJI KARIA

Beautiful Sibia, pollen-faced from sipping nectar

A quest in Bugun Liocichla Country

Text: **Beena Menon**

It was March 25, 2019. Dawn was barely nudging out the chilly night when we hauled ourselves out of the wish-they-were-warmer blankets in our tent at 3:30 a.m. We trudged bleary-eyed towards the hot tea and biscuits in the dining room at Lama Camp. The Grey Nightjar kept up its dull, all-night cacophony from atop the tent. Clambering into our vehicles, we set off for what was the final day of a trip we had spent part-tramping, part-driving through the stony motorable paths that run around the deep, damp evergreen of Arunachal's Eaglenest Wildlife Sanctuary.

Now that sounds almost timid, uninteresting, and does little to convey the gravity of this event for a birdwatcher! Eaglenest, to begin with, is not, as one would believe, about eagles; it gets its name from the 4th Indian Army division, which has a red eagle as its symbol, stationed here many years ago. With its pristine and dense canopies, plunging valleys, and misty mountains, this forest-paradise in Arunachal's West Kameng district houses almost 50% of India's most stunning avifauna.

It was only five days ago that we had driven from Guwahati, as part of a BNHS tour group, and halted at the check post at Bhalukpong. As we idly watched Eurasian Tree Sparrows chasing each other in frantic mating games, we had little idea of what a rollercoaster of anticipation this trip would turn out to be!

The barricade swung up and we rolled on. The Jia Bhoreli, in its Arunchali avatar as River Kameng, rippled alongside, sparkling with promise. And we were not disappointed! Even before we got anywhere near Eaglenest, we made some casual pit-stops – to repair a deflated tyre or to get some fuel – and by the roadside we effortlessly sighted such gems as the Rufous-breasted Accentor, Daurian Redstart, and Goldcrest – for me these were all lifers (an obscure term used by birders for a species seen for the first time, an addition to what they call a life list!). However, in the coming days it was not so easy. The dense forest and vegetation of Eaglenest make bird-spotting a keen and intense affair, allowing at times only a glimpse at the end of a long wait, and at other times nothing.

The road winding around Eaglenest leads up from Tenga – a little town at the foothills of the Sanctuary and goes up to Lama Camp. Situated at an altitude of about 2,375 m, Lama is set in temperate broad-leaved forests that were ravaged for timber until the law finally called for a ban in 1996. Though the dining area of the camp offered spectacular views of the Gori-chen range, on most days, the mountains remained hidden behind thick, swirling morning mist. Birding in Eaglenest means being subjected to staccato visual treats from mixed-hunting parties – birds of different species that move together as they forage for food. This implies that you may, without warning, come across a quartet of Beautiful Sibias, restless Black-faced Warblers, mixed flocks of Yellow-cheeked Tits. You may also be assured of an "Oh My God!" moment when you come upon Chestnut-tailed Minla. Such moments, though, are fleeting, and leave you overwhelmed. Focus swings from branch to branch, cameras whir, and the mind scrambles to hoard information about tails, bills, and wings!

HETALI SONEJI KARIA

A solitary Yellow-rumped Honeyguide

KALPESH GAITONDE

A Eurasian Tree Sparrow near Bhalukpong checkpost

LOVESANG TSERING

Elusive and fragile – the Bugun Liocichla

Over the days, we moved further from Lama into the heart of Eaglenest WLS through Eaglenest Pass, the Sanctuary's highest point at 2,780 m. At the Pass, we had barely recovered from the spectacle of a Fire-tailed Myzornis whizzing past us, when the mystic charm of the dense woodlands and flowering rhododendrons consumed us. Mist moved in surreptitiously to adorn the luxuriant epiphytic mosses hanging from trees, like strands of silver, and in the gathering gloom, it almost appeared to be Harry Potter's Forbidden Forest!

We drove across the Pass, on towards the Sunderview open ground, and then descended to Bompu Camp – 'bompu' being the local name for bamboo. The entire stretch was surrounded by a tall temperate forest. Moving on towards the flourishing bamboo forest in the Camp's vicinity yielded a veritable treasure trove of birds like the Red-tailed Minla, Blue-winged Minla, Silver-eared Mesia, and Black-throated Sunbird. We got within deceptive arms-reach of playful Whiskered Yuhinas and White-naped Yuhinas. The riot of colours and patterns persisted as we carefully stepped around the Camp's kitchen, lest we disturb the Chestnut-crowned Laughingthrushes foraging there on the ground alongside Rusty-fronted Barwings.

We had, on another such morning as today, ventured even further from Bompu to the now-abandoned Sessni Camp where we tracked Black-chinned Yuhinas and a Blyth's Shrike-Babbler, and glimpsed the bright blue of a Beautiful Nuthatch. We sighted the Yellow-throated Fulvetta and a Rufous-winged Fulvetta shinning up tree-trunks, caught a long-distance view of a Rufous-necked Hornbill, stood enthralled in the company of a Yellow-rumped Honeyguide and admired the shades of daylight in the yellow crest of the regal Sultan Tit.

Yet, after several such fleeting though incessant displays, there remained that one last quest that we had set off for this morning. I snapped out of my reverie as we left the bumpy road and stepped down a narrow trail, gradually descending into specific, earmarked territory. The path was wet in places and we jumped lightly over stones to keep our shoes out of puddles. A restless Himalayan Bush-Robin (or Orange-flanked Bush-Robin) scampered into the brush and a pair of Striated Laughingthrushes clamoured in the crisp, bright summer morning. Bells rang all around us, as the domestic cattle fled with irritated moos, unhappy to be interrupted at their breakfast. We stopped and watched the resplendent Green-tailed Sunbird at its vantage point atop a bare tree, while the Lesser Yellownape restlessly hammered around the trunk. We enjoyed every spectacle but remained eager for the final prize.

Just then, our competent and highly resourceful guide Micah called our attention to a pair of beautiful Gold-naped Finches sourcing red berries from a clump of bushes. Glorious! The golden-yellow splash stood out at the back of the male's black head, while the females presented their own warm blends of brown and gold! The cameras worked frantically around my head as the finches stretched, flitted, and enjoyed their feed. We were

KALPESH GAITONDE

Luxuriant epiphytic moss covered the trees

HETALI SONEJI KARIA

Pleione formosana alba orchids growing wild in the forests

HETALI SONEJI KARIA

Bright blue and yellow splashes of the Blue-fronted Redstart

HETALI SONEJI KARIA

Rusty-fronted Barwing has a distinctive coloration

HETALI SONEJI KARIA

Chestnut-crowned Laughingthrush near Lama Camp

HETALI SONEJI KARIA

Commonly seen Striated Laughingthrush

soon distracted by yet another skulking charmer – the Streak-breasted Scimitar-Babbler, named for its scimitar-like down-curved beak. Eager video lenses captured every flap and twitch. In that moment, I felt it in my bones – this *will* be the morning for the prize we sought. There is never any explanation good enough for such feeling-in-the-bones. But there it was, and it was heart-warming.

Our primary target for that morning's quest was the Bugun Liocichla, first discovered by the astrophysicist Ramana Athreya, who spotted this *c.* 22 cm babbler-like bird in these very patches of Eaglenest in 1995. He established it as a new species in 2005 and bestowed it with the name Bugun Liocichla – a dedication to the Bugun people. The Buguns, approximately 3,000 in number, are one of the earliest recognized scheduled tribes of India, with the majority of them living in West Kameng District. The Bugun tribe from Singchung village, in collaboration with the Forest Department, look after a 17 sq. km hotspot, called the Singchung Bugun Community Reserve (SBVCR). In the forests they inhabit, apparently 10 village boys take turns every week to patrol the area. Their mission – forest conservation; supposedly, the state's first government-community collaboration in this respect.

Bugun Liocichla is endemic to a couple of specific locations in Eaglenest, and all reported sightings have been around altitudes of 2,000 m. Athreya's discovery played a significant role in establishing Eaglenest as one of the world's top-ranked birding spots for both researchers and serious wildlife photographers. Micah was constantly on the lookout for this coveted bird, and we picked up his excitement when he called our attention to a bunch

MICAH RAI

Fire-tailed Myzornis at Eaglenest Pass

of beauties, the White-breasted Parrotbill (or Greater Rufous-headed Parrotbill). That, he said, was the sign that liocichlas were sure to follow, and they did. There is nothing short of delirious happiness when you espy what you have been yearning for; I felt this when my binoculars finally zoomed onto the precious creature.

I am not sure how the rest of the group witnessed the spectacle; for me it began with the yellow and red patches on its wings, to the black tail (though I quite missed the red tip), and then to the face and prominent black cap that emerged from a clump of leaves. In beauty, its red-faced counterpart who sat alongside it, was not be outdone. The lone Red-faced Liocichla was missed by some, but for me, to catch a few glimpses of its burnt reddish-brown face and crimson ear-patch was as endearing as the sight of its olive-green friends.

In Arunachal, it is a given that unless a forest area has been marked as 'preserved' or 'notified' by the government, it is owned by different tribes. The Buguns, with their admirable conservation efforts, have created a triple-win situation – for themselves, for the verdant green forest, and for the Liocichla. Lama Camp and Bompu Camp now see an influx of serious birders from around the world, who brave the cold, make do with the simple vegetarian offerings, and contribute yet one more significant chunk to the conservation coffers. The employment generated for the local residents – camp managers, cooks, drivers, wildlife guides – ensures that the Liocichlas stay safe and protected. Laudable!

Sighting the Liocichla is extra-special, because it is rare, elusive almost. But now, as we watched it disappear among those moss-laden thickets, we were gently reminded of its fragility. A Striated Bulbul waved us off melodiously from atop its perch. Yet, it felt like a part of us lingered, entangled in the untamed beauty of that place. The untameable will endure though, and some day we know we will be back. We will retrace our footsteps on those stony paths, straining our eyes again for yet another tryst with the Bugun Liocichla! ■

Beena Menon is passionate about mountains, forests, and their treasures. In her spare time, she works as a Corporate Trainer and a Leadership Coach.

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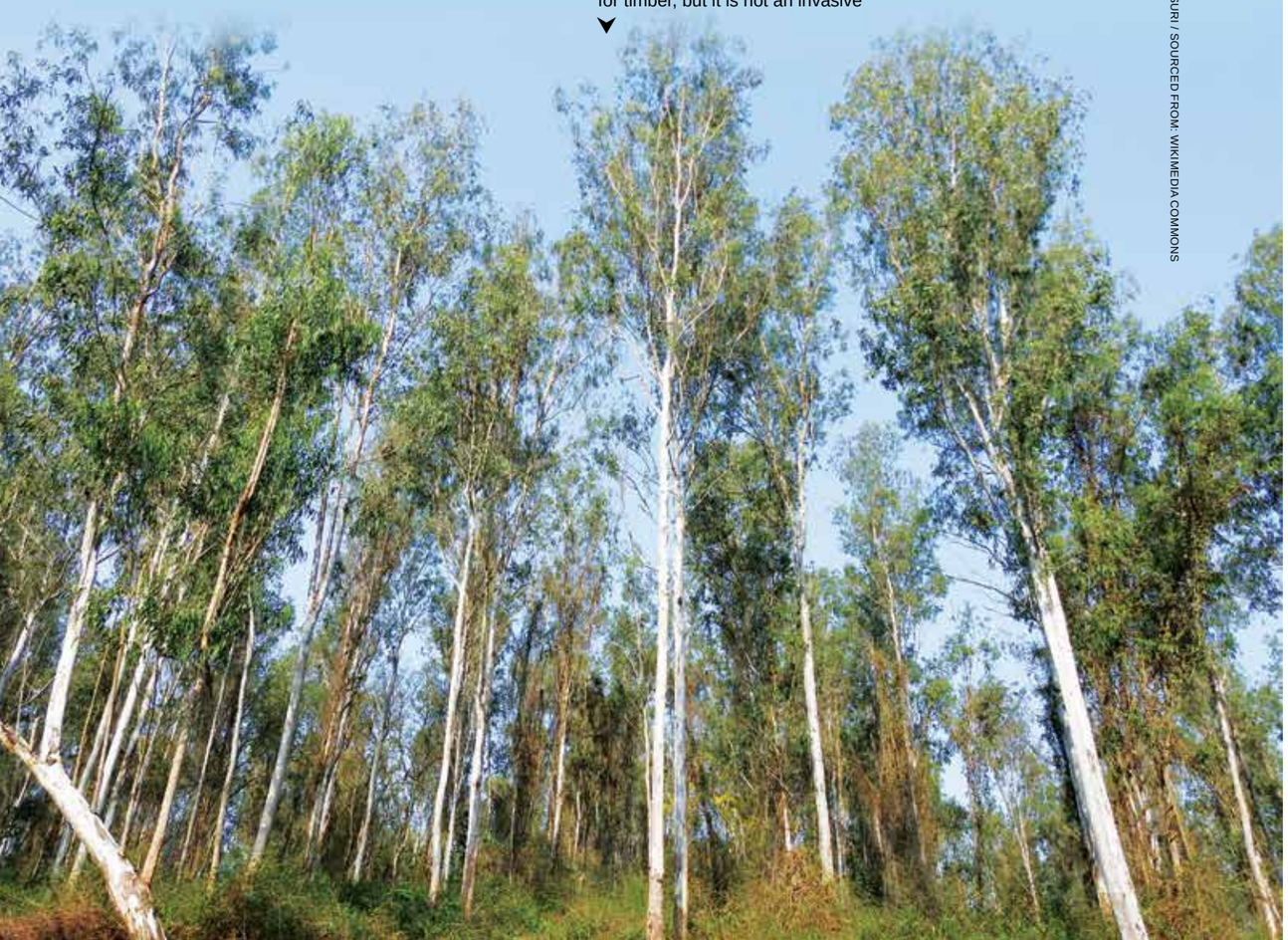
Judas and Mata Hari of the Animal World

Text: **Asad R. Rahmani**

The title may seem intriguing to you, but the subject that I am going to write about is not new: invasive species. Invasives are those species that are non-native, introduced by humans, or have come via human agencies to a new area or region or country, and proliferated out of control. Since time immemorial, humans have transported their animals and plants along with themselves, taking horses to America, Dingo to Australia, Sambar to New Zealand, and capsicum to India – the list is long. But, before I explain the title of my article, let us understand the difference between introduced species and invasives. All invasives are introduced species, but all introduced species need not be invasives. Here we must also differentiate between naturally dispersed species and those introduced by humans. More intrigued? Let me explain.



A native of Australia, eucalyptus was introduced into India for timber, but it is not an invasive

ANAND OSURI / SOURCED FROM: WIKIMEDIA COMMONS

Like cultural, literary, scientific and technological exchanges, biological specimen exchanges and species introductions have been going on for millennia. Discovery of new lands by travellers accelerate this process, as happened when America was 'discovered' by Christopher Columbus in 1492. Within no time, a large number of American species were brought, advertently or inadvertently, to Europe, and in return, many European species were taken to America. These exchanges included deadly diseases to which the natives had no immunity. It is a long story, which I will not go into here. Many vegetables, fruits, and flowers were brought from the Americas to India, and are now an integral part of our life. Most Indians do not know that our lowly *mirchi* (chilli pepper) was brought from Mexico to India in the 16th century by the Portuguese. Before that, we used black pepper in our cooking. Potato and tomato are other examples that were introduced to the Old World from the New World.

The Mesquite tree that has spread all over India was brought from America, so was Eucalyptus, a native of Australia, which was introduced into India for timber. But there is a classic difference between these two introduced trees – the first one is considered an invasive, while the other is not. The main dissimilarity is that an invasive species goes wild in its introduced land and starts growing where it is not required, sometimes at the cost of native flora. Lantana and Water Hyacinth are other examples of invasives in India, as any Protected Area manager will tell you. Eucalyptus has not (yet) become invasive, since it has to be planted (it does not grow on its own). Nor does it spread uncontrollably like Lantana or Mesquite, which are rampant all over India.

Besides habitat destruction, invasive species are now perhaps the second biggest threat to wildlife, much more than illegal hunting or trapping. This is particularly true for islands where native species have evolved in a comparatively insular environment, often with no defence against new predators such as cats, rats, mongoose, and dogs. Even non-predators such as goats, deer, and rabbits can become an invasive menace by overgrazing on native flora. There is a whole science of invasive studies that is trying to tackle this insidious problem. Most countries, including India, have introduced laws against bringing in new species. Most airports and seaports have quarantine cells to hold foreign animals/plants, to stop their spread or the diseases they can bring.

Removal of invasive species is sometimes the only remedy, but it cannot be done on a continental scale (e.g., failed attempts to eradicate Water Hyacinth in Asia and Africa). Incidentally,

J.M. GARG / SOURCED FROM: WIKIMEDIA COMMONS

JAYESH VISHWAKARMA

Mesquite *Prosopis juliflora* and Lantana are prominent examples of invasives in India

DHRITIMAN MUKHERJEE

Mikania micrantha is a widespread invasive in Assam. It is a vigorously growing (80 to 90 mm in 24 hours for a young plant) perennial creeper that covers other plants, shrubs, and even trees

the former is a native of South America. Removal of invasives has been tried on many remote islands with great success. These are islands where many endemics are found, sometimes in small numbers. It is estimated that out of the 100 odd bird species that became extinct in the last 400 years, 50% were island-endemics and were killed by invasive predators.

Total elimination of invasives is not easy, as they are 'smart' species – they know how to survive, which is why they flourish in new areas. We can eliminate 90 to 95% of the population of an invasive, but getting rid of the remaining 5 to 10% tends to be extremely difficult. They are the individuals that have learnt how to survive guns, traps, poison, and other predators. If they are not totally eliminated, they bounce back in no time, proving Darwin's theory that postulates "Survival of the fittest!"

Scientists and managers have found a solution to tackle the last few individuals – by using 'Judas and Mata Hari'! Judas Iscariot was one of the 12 disciples of Jesus Christ, but he betrayed Jesus, leading to his arrest. Since then, the very name of Judas is synonymous with betrayal or treason. Mata Hari's story is much more recent. Originally named Margaretha Geertruida MacLeod, this Dutch dancer, courtesan, seductress, and spy was born in 1876, and executed in 1917 in France during the First World War for being a German spy. In her short career, she befriended and honey-trapped many high-ranking military officers, politicians, and others, and passed on classified information to the Germans. Her stage name Mata Hari is now synonymous with eroticism and betrayal – a deadly but fascinating combination. The Judas and Mata Hari technique was effectively applied in that showcase of evolution made famous by Charles Darwin and his finches – Galapagos.

The Galapagos Islands are famous for their wildlife, with almost 80% of the land birds, 97% of the reptiles and land mammals, and more than 30% of the plants being endemic, making the archipelago a treasure trove of biodiversity and a laboratory of evolution. Unfortunately, these islands suffered the worst example of invasive species. Goats were introduced on many islands, not only in Galapagos, by whalers, fishermen, and pirates, for a constant supply of fresh meat, not realizing that these pestilential animals would soon

overrun the islands and eat anything, including rare island-endemic plants. In Galapagos, goats were in direct competition with the herbivorous giant tortoises – the most famous inhabitants of these islands. At one time, for example, there were nearly 250,000 feral and semi-feral goats on Isabel Island in the Galapagos group, jeopardizing the survival of local fauna and flora. The question was "What do we need, the native and endemic giant tortoises or the troublesome invasive goats?" To be fair to the goats, it was not their fault that they were present in Galapagos. They were brought in for animal husbandry by humans, but some escaped and became feral. Then the problem started.

In the 1990s, the government decided to eliminate the feral goats. In the beginning it was easy to shoot them, but soon the survivors learnt to avoid hunters. Even helicopters had to be used to reach inaccessible mountain tops, to kill the goats that had spread all over the islands. Killing 95% of the goats was relatively easy, but not the remaining ones that were thinly spread out in rugged and inaccessible mountain recesses. Someone had to betray their locations to hunters. So, Judas and Mata Hari goats were deployed. Sterile male goats fitted with radio-collars were released. As goats are herd animals, these Judas goats soon found the ferals, whose locations were constantly radio-signalled to hunters who quickly despatched the last few remaining animals. Fortunately, they spared the grateful Judas goats that had been marked with bright colours.

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Mata Hari on the day of her arrest on February 13, 1917

To con the adult male feral goats, Mata Hari goats in chemically induced oestrus were radio-collared and released. These irresistible damsels attracted the

PRUE SIMMONS / SOURCED FROM: WIKIMEDIA COMMONS

Raccoon Dog, a canid indigenous to East Asia, is playing havoc with the native wildlife in Europe

ASAD R. RAHMANI

An urban wetland choked with invasive Water Hyacinth

male feral goats, who fell prey to them, not knowing that they were being betrayed to the enemy. Unlike the original Mata Hari, these Mata Hari goats were spared the bullet after the job was done.

The story has a positive ending, at least for us humans. Many islands in the Galapagos have been rid of goats, bringing back the natural vegetation, at least in a few protected areas. The Judas-Mata Hari technique is now used in many islands, and even in countries like Sweden to eliminate the invasive Raccoon Dog *Nyctereutes procyonoides*, a canid indigenous to East Asia that is playing havoc with native wildlife, since its spread in Europe. Feral camels are also killed in Australia by the same technique. Some farmers use Judas goats for herding. These goats are trained to mingle with sheep or cattle, leading them to a specific destination, to pens and on to trucks. In stockyards, Judas goats lead sheep to the slaughterhouse, while their own life is spared.

I think Judas Iscariot and Margaretha Geertruida MacLeod could derive some satisfaction from knowing that their sins are being put to good use, to restore the ecological balance of the world! Who says that sinners cannot teach us lessons? ■

Asad R. Rahmani is a former Director of BNHS; he is now serving as a member of the BNHS Governing Council.

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Into the Lives of Frogs

Text: **Priya Warekar**

Frogs and toads! When you hear these words, what comes to mind immediately is the monsoon, and the sound of their croaking. The entire forest reverberates with calls of *drong drong…* or *treek treek* .... These are not just calls, these are in fact their love songs. Carl von Linné, the father of taxonomy, described reptiles and amphibians:

"These foul and loathsome animals are abhorrent because of their cold body, pale colour, cartilaginous skeleton, filthy skin, fierce aspect, calculating eye, offensive voice, squalid habitation, and terrible venom; and so their Creator has not exerted his powers to make many of them."

The reality is far different; amphibians and reptiles are among the most fascinating, yet misunderstood forms of life. Most of us have seen frogs hopping and leaping around our backyard or in forests, and many among us have possibly greeted these critters with cries of "Eeew"! ... Look at that frog – it is so slimy! See how ugly the toads look with those warts! This fear and disgust stems from ages of conditioning woven into the fairy tales and myths we have heard, wherein frogs and toads are associated with witches and black magic. Did you know that their slimy skin and warts protect frogs and toads from harsh weather conditions?

Frogs and toads are not genetically different from each other; nevertheless, the British, who were pioneers in the study of nature, separated them into these two groups due to the great variations in their physical characters. I got interested in studying these monsoon jewels when I joined BNHS as a volunteer. After studying specimens in the Society's Collections and referring to countless books and scientific

Dancing frogs use gestures in addition to calls to communicate

MANDAR SAWANT

SESHADRI K.S.

Amphibians and reptiles are among the most fascinating, yet misunderstood forms of life

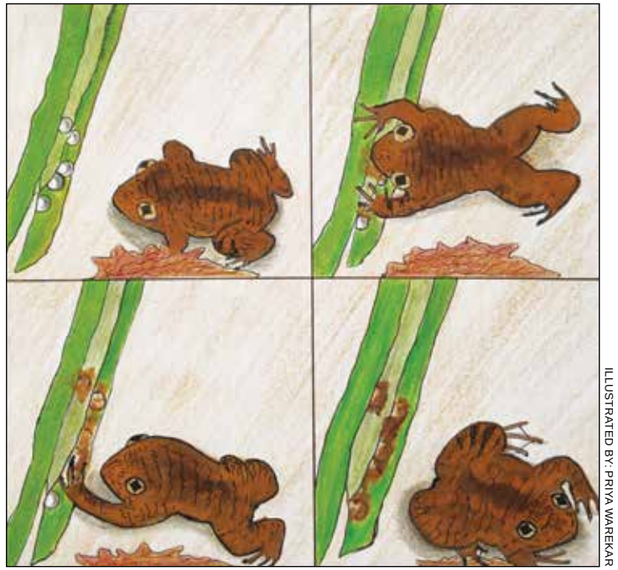
publications, especially THE BOOK OF INDIAN REPTILES AND AMPHIBIANS by J.C. Daniel, I learnt more about the survival techniques used by these lesser known but fascinating animals. Let me share my learnings as I take you through this journey into the world of frogs.

Can you imagine life without communication? Interaction among members of a species is an important feature of life. Frogs are the most vocal among all amphibians. Their calls are like birdsong, serving to attract a mate during the mating season. Frog calls are in fact like fingerprints, unique to each species. Like many in the animal kingdom, it is the female that chooses a male, and the male with the loudest and clearest call has the best chance of being chosen. We have been taught that a male calls out to females, but this does not mean that females never call. Females do call, though the call has been recorded only once. Female calls have earlier been reported in 25 anuran species, representing less than 0.5% of the 6,583 currently recognized species. Their calls are not as loud and continuous as those of males, but females do vocalize, especially when in distress. The female Bombay Night Frog *Nyctibatrachus humayunii* can be heard calling continuously, but this happens only when the male's call is not clearly heard. On hearing the female call, the male changes its calling position to be heard louder and to guide her towards him.

As we use gestures to communicate, frogs too use gestures in addition to calls, i.e., use audio and visual signals for communication. Some frog species extend their hind legs and spread their toes. This behaviour is aptly called foot-flagging. An example of such frogs is the Dancing Frogs of India, *Micrixalus* spp. These frogs were earlier believed to display foot-flagging behaviour to attract mates, but a new study by Doris Preninghar and Gururaja KV indicates that foot-flagging along with advertisement calls was used by males to attract females, though they have distinct calls of high frequency to overcome the noise of their stream or other habitats, and as a signal to other frogs that they are defending their territory.

We all know that frogs metamorphose from eggs to tadpoles and then to adults, but there are certain exceptions like bush frogs of the genus *Raorchestes*. This group does not have a tadpole stage; a miniature version of the adult, or froglet, emerges directly from the egg. This is a breeding strategy adopted to avoid competition in their breeding space. There are other ways in which bush frogs have evolved to avoid competition. In the forests of southern India, there are a few species that have innovative ways of breeding. Ochlandra Shrub Frog *Raorchestes ochlandrae* and Günther's Bush Frog *Raorchestes chalazodes* live and breed inside hollow bamboo stems. Being really tiny (no more than 28 mm from snout to vent), they can perch on your thumbnail, and reside in holes made by insects in the bamboo stem.

Tree frogs of the genus *Rhacophorus* (popularly called gliding frogs), practice polyandry. Here, many males mate with one female. Tree frogs also



ILLUSTRATED BY: PRIYA WAREKAR

Potter frogs apply mud to their eggs to save them from predation

SKETCH OR PIC: SESHADRI K.S.

Ochlandrae Shrub Frog with an egg clutch

PRANAD PATIL

The Amboli Bush Frog does not metamorphose through the tadpole phase; tiny froglets, encased in transparent egg cases, emerge from the eggs

DAVID RAJU

Leaping frogs like *Indirana* lay eggs in the crevices or depressions on rocks and on tree bark, far from any water body

build foam nests, using their hind legs to beat up the ejaculated sperm into foam. These foam nests are built directly above water bodies, so that once the eggs hatch the tadpoles fall directly into the water. A group of endemic frogs of the Western Ghats, called leaping frogs *Indirana* sp., have terrestrial tadpoles. These frogs lay eggs in the crevices or depressions on rocks and on tree bark, far from any water body. The eggs hatch into semi-terrestrial tadpoles, which feed on algae growing on the surface.

Frogs are generally accused of lacking parental care. This is not entirely true. The Kumbara Night Frog *Nyctibatrachus kumbara* uses mud to camouflage its eggs. After the female lays the eggs, the male returns to apply mud to the eggs to save them from predation.

There are any number of myths associated with frogs and toads. In India, it is believed that if two frogs are 'married' according to Vedic rites, the rain gods are appeased, and rain will follow. Another belief is that if a toad or frog urinates on a person, or simply by touching them, the person will develop warts. This, of course, is not true. You get warts from human viruses, not from frogs and toads! Frogs in India are not poisonous or venomous. The poison glands present in a toad's skin do not affect humans; they are a defence against its predators.

These are just a few of the facts that make a frog's life interesting. Next time you see a frog in the wild, forget the myths and just observe it. Frogs are fascinating just like any other animal. They are an integral part of the food web and thus of the ecosystem. Many species are endemic and cannot survive outside a particular region. Frogs are predators on many species of insects and are themselves prey for other animals. Sadly, these 'croakers' are declining, and some species are close to extinction due to habitat destruction and to an infectious fungal disease named chytridiomycosis, which is thought to be aggravated by climate change. We need to save these wonderful creatures that are friends of the farmers, before it is too late to reverse the damage. ■

Priya Warekar works with The Corbett Foundation in Kanha Tiger Reserve, Madhya Pradesh. She is researching aspects of human-wildlife conflict.

EDITORS' CHOICE

WHO RUNS THE SHOW?

Oohs and Aahs greet the magestic tiger
Wows serenade a lovely Bird of Paradise;
Eeeks and Eeew is the popular response
When an Insect crawls up before the eyes.

Pests and destoyers of crop we call them
A source of illness and disease;
But take some effort to find out more
And you will find their wonders never cease.

Without the intervention of an Insect
virtually nothing will grow;
From foodcrops, fruits and vegetables
down to cotton, coffee and tobacco.

And what a dull world this would be
Without the prospect of flowers;
Spring and Summer can burst in colours
For the Insect has magical powers.

And while scientists toil to unravel
how Glowworms create cold light;
The world would drown in decaying matter
Without the dung beetle and the termite.

For naturally effective forms of pest control
On the Dragonfly and Praying Mantis rely;
To cheer you up when you're feeling low
What more delightful than the Butterfly!

So, put away your list of the rich and famous
your awe for the tiger, elephant and rhino;
for it is the meek and little that matter most
It is the Insects that run the show.

– by **Mallika Iyer**

ABOUT THE POSTER

The moth family Limacodidae is best known for its slug-like caterpillars, which have a flattened body and possess suckers instead of prolegs, hence the alternative name slug caterpillar for these larvae. As the thoracic prolegs of the slug caterpillars are reduced, their movement is undulating. Many species of Limacodid larvae are brightly coloured and possess stinging nettle-like hairs that can cause profound irritation to the skin, leading to the name nettle caterpillar or stinging nettle caterpillar.

It is likely that you have experienced the potent sting of these caterpillars while moving through foliage during treks and trails. When the hairs of these caterpillars touch your bare skin, within no time you will suffer an unbearable hot jabbing pain, with a rash or urticaria. The pain eventually subsides, leaving an itchy red patch in the area of contact, for several hours.

RAHUL KHOT

Stinging Nettle Caterpillar *Miresa* sp.

Limacodid caterpillars are known to be defoliators, and hence pests, of many economically important crops including banana, cocoa, coconut, coffee, mango, oil palm, and tea. The caterpillar in the photograph belongs to genus *Miresa*, which is found from India to Sundaland. ■

Stinging Nettle Caterpillar *Miresa* sp.

RAHUL KHOT

Birdwatching in the HIMALAYA

Text and Photographs: **Yuvraj Patil**

Blue-throated Barbet

Birdwatching is not only a recreational exercise, it also helps us to understand and appreciate nature in all its wonderful colours. Moreover, it is an educational and uplifting activity. A fine destination for birdwatching is Chopta-Kedarnath Musk Deer Park, a wonder of nature hidden deep inside the mighty Himalaya. Travelling from the plains, and proceeding from Haridwar to Devprayag and Rudraprayag, we come upon a landscape surrounded by tall mountain ranges and bearing a rich diversity of flora and fauna. From Rudraprayag, one can feel the change in temperature as one approaches Chopta, as it gets colder, and the air becomes fresh and bracing.

Himalayan Tahr

Snow Partridge

Chopta lies in the lap of the Uttarakhand Himalaya and offers views of the imposing Himalayan peaks of Trishul, Nanda Devi, and Chaukhamba. It is located at an elevation of 2,680 m above sea level in Rudraprayag district. Chopta village is surrounded by forests of pine, deodar, and rhododendron; the fauna here includes rare species of birds and the elusive Musk Deer. We sighted a variety of birds like Himalayan Monal, Koklass Pheasant, Golden Bush-Robin, Scarlet Finch, accentors, wren-babblers and vultures, to name a few.

From the base point at Chopta, there is a path going towards a legendary Shiva temple named Tunganath. The trek to the temple, which is situated at *c.* 3,962 m above sea level, offers great opportunities for birdwatching and photography. Himalayan Monal, Chukar, Snow Partridge, and Golden Bush-robin inhabit the area, and are the main attractants for bird tourists. One can also chance upon Red Fox and Golden Jackal. It is quite amazing to see the Himalayan Tahr climbing easily up steep slopes and running nimbly over narrow trails. There are also many small and colourful birds, and it is a treat to watch these in flocks, as they restlessly flit from one bush to another.

The deodar forest around Chopta is dense and full of birds. From Tunganath temple, a trail goes towards Chandrashila peak. Chandrashila is a great spot from which to watch sunrise; one can also see Chaukhamba

Himalayan Monal

Black-throated Tit

Blue-fronted Redstart

Collared Owlet

White-capped Water-Redstart

Golden Bush-Robin

Red-billed Leiothrix

Rufous-bellied Woodpecker (female)

peak from this point. Deoria Tal in this area always attracts me. To reach, one needs to trek for two to three hours from Sari Village. In this area, you will get to see Black-throated Accentor, Mountain Finch, Snow Pigeon, and Mountain Hawk-Eagle, among other birds.

Of all the birds in the Himalaya, one of the most attractive is the Collared Owlet, Asia's smallest owl species. I was able capture it on camera after several visits to the Himalaya. I was the first to identify the Pygmy Cupwing (Pygmy Wren-Babbler) in Uttarakhand – a small bird, it is usually found by water around dense jungle.

While travelling in this region I marvel at its clean environment, pure air, and transparent water, all necessities for a healthy life. Which is why, when I get tired of working in the city, at least twice a year, I come here to relax, and to recharge myself by birdwatching. ■

Yuvraj Patil is a wildlife photographer based in Pune, Maharashtra. He is currently working with Thyssenkrupp. The Himalayan range is his favourite place for birding.

Conan Doyle's Inspiration?

Text: **Kumaran Sathasivam**

Round his brow he [Dr Grimesby Roylott] had a peculiar yellow band, with brownish speckles, which seemed to be bound tightly around his head. As we entered he made neither sound nor motion.
"The band! the speckled band!" whispered Holmes.
I took a step forward. In an instant his strange headgear began to move, and there reared itself from among his hair the squat diamond-shaped head and puffed neck of a loathsome serpent.

Thus do things come to a head in Arthur Conan Doyle's well-known short story, 'The Adventure of the Speckled Band', with the villain, Dr Roylott, falling into his own trap. Roylott, a widower, is given to violent rages, and he returns to England from India after serving a jail sentence for killing his butler in one of his bouts of temper. He lives with his two step-daughters in a run-down manor, all that remains of the vast estates of an aristocratic family. Roylott lives on an annuity arranged for by his late wife. The step-daughters are each entitled to claim a third of this annuity upon marriage. Roylott has a motive, therefore, to prevent the marriage of either step-daughter. He maintains exotic pets from India, including a cheetah and a 'baboon'. When one step-daughter gets engaged to be married, he introduces a venomous snake into her room when she is asleep – the snake bites her, killing her swiftly. Roylott has trained the snake to return to him when he whistles for it. The marks of the snake's fangs are not detected by the coroner, and the cause of the step-daughter's death remains an unsolved mystery. Two years later, when the second step-daughter gets engaged, Roylott attempts to kill her in the same manner. But Sherlock Holmes saves the day, and the serpent bites its 'master', as a result of which he dies very quickly. It is revealed that the snake is 'a swamp adder, the deadliest snake in India'.

'The Adventure of the Speckled Band' is only one among several stories by Arthur Conan Doyle that have references to India. Some of the Indian connections are trivial, whereas others are critical. For instance, in 'The Adventure of the Three Students', one of the students is Daulat Ras, a young Indian. And in 'The Five Orange Pips', Colonel Elias Openshaw, settled in West Sussex, receives a letter postmarked Pondicherry. Later in the story, Sherlock Holmes checks the sailing records of all the vessels that touched Pondicherry during January and February 1883. ('There were thirty-six ships of fair tonnage which were reported there during those months.') A third example is 'The Boscombe Valley Mystery', in which Holmes deduces that the murderer, *inter alia*, smokes Indian cigars.

Why does India feature in so many of Conan Doyle's stories that are set entirely in Britain? The fact is that by the time Conan Doyle began writing his stories, India was the 'jewel in the crown' and had a deep relationship with Britain. In the words of James Morris, 'If much of the Empire was a blank in British minds, India meant something to everybody, from the Queen herself with her Hindu men-servants to the humblest family whose ne'er-do-well brother, long before, had sailed away to lose himself in the barracks of Cawnpore. India was the brightest gem, the Raj, part of the order of things: to a people of the drizzly north, the possession of such a country was like some marvel in the house, a caged phoenix perhaps, or the portrait of some fabulously endowed if distant relative. India appealed to the British love of pageantry and fairy-tale, and to most people the destinies of the two countries seemed not merely intertwined, but indissoluble.'

Given this fascination with India, as we may expect, Conan Doyle was far from alone in bringing India into his works. Indeed, the branch of English literature dealing with or mentioning India is very vast. Back in 1973, one author listed 2,272 fictional works in this genre – many more have been published since then.

Most of these works are about the British community in India. The subset of authors who have introduced Indian *wildlife* into their fiction is relatively small. Arthur Conan Doyle, by bringing Indian animals into Speckled Band, which was published in 1892, was one of the earliest members of this select group.

Rudyard Kipling joined the club soon after, with the publication of JUNGLE BOOK and SECOND JUNGLE BOOK in 1894 and 1895. Subsequent works of the genre include 'Mrs Packletide's Tiger' by H.H. Munro ('Saki'), and 'Jungle Picture' by Norah Burke. One could also claim that George Orwell's 'Shooting an Elephant', set in Burma (now Myanmar), belongs to this category of literature, but there is a possibility that it is an autobiographical essay and not fiction.

It has been surmised that Conan Doyle was inspired to write Speckled Band after reading an article titled 'Called on by a Boa Constrictor: A West African Adventure' that appeared in *Cassell's Saturday Journal*. This article is reported to be an account by a captain of how a large snake descended into his cabin in the night through a ventilator. But one could offer other suggestions for the source.

KUMARAN SATHASIVAM

Did Indian wildlife inspire a subset of fiction authors and plant the seed of a story in their minds?

KUMARAN SATHASIVAM

Several books on natural history could have fed the minds of authors for the stories woven around Indian wildlife

K.R. Kirtikar's 20-part series in the *JBNHS* on 'Poisonous Plants of Bombay' (1892–1903) was possibly Conan Doyle's inspiration for 'The Adventure of the Devil's Foot'

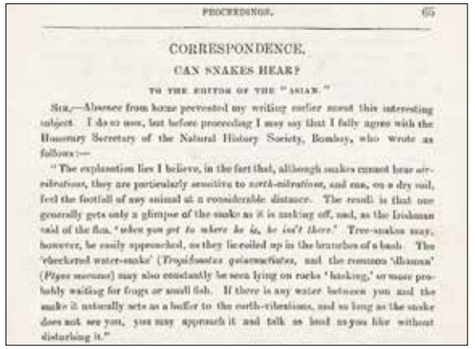
Conan Doyle could have obtained information about Indian wildlife from the natural history books available in his time – books such as those by T.C. Jerdon (THE BIRDS OF INDIA, THE MAMMALS OF INDIA), Albert Günther (THE REPTILES OF BRITISH INDIA), Robert Sterndale (THE NATURAL HISTORY OF THE MAMMALIA OF INDIA AND CEYLON), and Francis Day (THE FISHES OF INDIA, in the Fauna of British India series). Countless books on shikar had also been published. Another potential source was the technical journals that had been or were being published: *The Journal of the Asiatic Society of Bengal*, *The Madras Journal of Literature and Science*, *The Calcutta Journal of Natural History* and, significantly, *Journal of the Bombay Natural History Society* (*JBNHS* hereafter), the first volume of which appeared in 1886, just around the time that Conan Doyle says his 'brain quickened' and his 'imagination and range of expression were greatly improved'.

An examination of the contents of the *JBNHS* volumes published between 1886 and 1892 (the year of publication of Speckled Band) allows one to draw up a list of articles that, it could be argued, may have inspired Conan Doyle. No fewer than 91 articles published during this period in the *JBNHS* contain the word 'snake'. Eleven of these articles have 'snake' in the title. Among them are H.M. Phipson's *The Poisonous Snakes of the Bombay Presidency* [1887, Vol. 2(4)], Ghore Pore's *Can Snakes Hear?* [1888, Vol. 3(1)] and W.F. Sinclair's *How a Snake Climbs* [1889, Vol. 4(4)]. It may be recalled that in Conan Doyle's story, the swamp adder (1) is highly venomous, (2) climbs up and down a bell pull, and (3) has been trained to respond to a whistle. The coincidence, if that is what it is, is remarkable!

It could be argued that the *JBNHS* does not mention 'swamp adders' and that Ghore Pore's article does not claim that snakes can hear. But these articles, if Conan Doyle read them, probably served only to kindle his interest and plant the seed of a story in his mind. His imagination was fertile, as seen from his numerous stories, and he was not one to hesitate to invoke poetic licence. He writes in his autobiography, 'Sometimes I have got upon dangerous ground where I have taken risks through my own want of knowledge of the correct atmosphere.' He goes on to add, 'However, I have never been nervous about details, and one must be masterful sometimes … On the other hand, there are cases where accuracy is essential.' It is an intriguing idea that Speckled Band is the result of Conan Doyle having browsed through a set of *JBNHS* volumes, after which he exercised his literary skills, throwing in various imaginary details for dramatic effect.

Going through the body of his works (Conan's canon, as it were), one finds other tales in which there is an important natural history element. And when these are compared with the contents of the *JBNHS* volumes of the corresponding periods, the notion grows stronger that he had access to the journal and drew inspiration from it.

Consider first 'The Brazilian Cat', a non-Holmes story, from TALES OF TERROR AND MYSTERY. In this story, published in 1922, a man named Everard King has brought a number of creatures from Brazil to England, where he attempts to rear them. The pride of his collection is a 'monstrous cat'. This is 'a huge creature, as large as a tiger, but as black and sleek as ebony'. King explains, 'Some people call it a black puma, but really it is not a puma at all. That fellow is nearly eleven feet from tail to tip.'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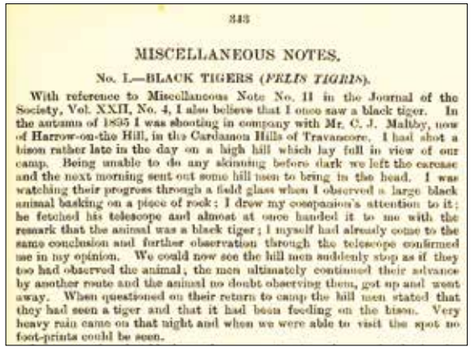
CORRESPONDENCE.

CAN SNAKES HEAR?

TO THE EDITOR OF THE "ASIAN."

SIR,—Absence from home prevented my writing earlier about this interesting subject. I do so now, but before proceeding I may say that I fully agree with the Honorary Secretary of the Natural History Society, Bombay, who wrote as follows:—

"The explanation lies I believe, in the fact that, although snakes cannot hear air-vibrations, they are particularly sensitive to earth-vibrations, and can, on a dry soil, feel the footfall of any animal at a considerable distance. The result is that one generally gets only a glimpse of the snake as it is making off, and, as the Irishman said of the flea, 'when you get to where he is, he isn't there.' Tree-snakes may, however, be easily approached, as they lie coiled up in the branches of a bush. The 'checkered water-snake' (*Tropidonotus quincunciatus*, and the common 'dhaman' (*Ptyas mucosus*) may also constantly be seen lying on rocks 'basking,' or more probably waiting for frogs or small fish. If there is any water between you and the snake it naturally acts as a buffer to the earth-vibrations, and so long as the snake does not see you, you may approach it and talk as loud as you like without disturbing it."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MISCELLANEOUS NOTES.

No. I.—BLACK TIGERS (*FELIS TIGRIS*).

With reference to Miscellaneous Note No. II in the Journal of the Society, Vol. XXII, No. 4, I also believe that I once saw a black tiger. In the autumn of 1895 I was shooting in company with Mr. C. J. Maltby, now of Harrow-on-the Hill, in the Cardamom Hills of Travancore. I had shot a bison rather late in the day on a high hill which lay full in view of our camp. Being unable to do any skinning before dark we left the carcase and the next morning sent out some hill men to bring in the head. I was watching their progress through a field glass when I observed a large black animal basking on a piece of rock; I drew my companion's attention to it; he fetched his telescope and almost at once handed it to me with the remark that the animal was a black tiger; I myself had already come to the same conclusion and further observation through the telescope confirmed me in my opinion. We could now see the hill men suddenly stop as if they too had observed the animal; the men ultimately continued their advance by another route and the animal no doubt observing them, got up and went away. When questioned on their return to camp the hill men stated that they had seen a tiger and that it had been feeding on the bison. Very heavy rain came on that night and when we were able to visit the spot no foot-prints could be seen.

As many as three articles on black tigers appeared in the *JBNHS* up to 1922, and innumerable articles on snakes

It happens that as many as three articles on black tigers appeared in the *JBNHS* up to 1922. The first of these articles was published in 1889, the other two in 1914. Further, in 1918, R.G. Burton wrote an article titled 'Panthers', in which there is a section on melanism and in which black tigers are mentioned repeatedly. Coincidence again? If yes, it is uncanny! On the other hand, if it is true that Conan Doyle did glance through the *JBNHS* occasionally, it is perfectly natural that he was fascinated by the idea of black tigers. His imagination would have conjured up the tale, and his story-telling skills would have introduced changes (India to Brazil, black tigers to 'Brazilian cats') for sheer "exoticness".

Consider next 'The Adventure of the Devil's Foot' (1917) – a poison named *Radix pedis diaboli* ('devil's foot root') is used in this tale. This poison has 'not yet found its way either into the pharmacopoeia or into the literature of toxicology. The root is shaped like a foot, half human, half goat like; hence the fanciful name given by a botanical missionary. It is used as an ordeal poison by the medicine-men in certain districts of West Africa and is kept as a secret among them.'

No deep search is needed to identify a possible source of inspiration – K.R. Kirtikar's 20-part 'Poisonous Plants of Bombay' (1892–1903) is immediately obvious. And if we wish to identify a particular plant that could have given rise to the idea of *Radix pedis diaboli*, we need not look further than Volume 1 of the *JBNHS*. Kirtikar's note on *Gloriosa superba* appears in the fourth issue of this volume. Kirtikar mentions reports about the poisonous nature of the roots of *Gloriosa superba* in the article. In the fourth part of his series, he describes the powerful emetic and purgative effects of the plant. He also describes the bulb of the plant as 'bilobed; vertical portion being half the shrivelled tuber of the current year; the horizontal portion being the new tuber…'. This is accompanied by an illustration of the said root. A bilobed root, with vertical and horizontal parts – the eyes of the imaginative writer could easily construe this as 'half human, half goat like'! And an artistic touch could convert India to West Africa. It must be admitted that the evidence for Arthur Conan Doyle's having been familiar with the *JBNHS* is entirely circumstantial, but nevertheless convincing.

There is a postscript to this examination. For many of the initial years, the *JBNHS* carried annually the list of members of the Bombay Natural History Society. In the lists of 1910, 1912, 1914, and 1915 appears the name of one James Doyle, from 'Balaghat, C.P.' Was this a relative of Arthur Conan Doyle? Did James Doyle send copies of the journal to a famous kinsman back in Britain? Considering the dates of James Doyle's membership and the year of publication of Speckled Band, this seems unlikely. *Au contraire*, maybe Arthur Conan Doyle, familiar with the *JBNHS*, suggested to a family member in India that he enroll as a member of the Society. ■

"First appeared in *Madras Musings* Vol. XXVI No. 05, June 16-30, 2016."

Kumaran Sathasivam is a writer with a wide-ranging interest in natural history.

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Conservation Setback:
The case of Lakshadweep

Text: **Neha Sinha**

SHWETHA NAIR

Lakshadweep is India's only coral atoll system, a group of picturesque islands that are extensions of coral reefs. Situated in oceanic waters, the atoll is rich in marine and coral diversity, and natural beauty; it is considered to be amongst the most beautiful spots in India. However, the recently proposed Lakshadweep Development Authority Regulation 2021 (LDAR, 2021) has upset local citizens and alarmed biologists. The draft that has been circulated indicates the intention to bring about far reaching changes to land use in the islands. This regulation is counter to existing regulations, and does not address issues of sustainability, climate, and conservation, and as such, does not have island-specific provisions.

Does Lakshadweep require sustainable development? Scientists and researchers working on the islands say it does. The area has witnessed several coral bleaching events. The entire island system depends on death and regrowth of corals, but climate change has disrupted these natural cycles. As one example, the reefs of the capital, Kavaratti, are eroding faster than they are growing. Therefore, scientists and conservationists say that all 'development' on the islands should include climate action and have an integrated approach. A climate action approach is one that addresses climate change. Construction, building and treatment of natural systems should be such that they do not add to impacts of climate change events. In the same vein, integrated approaches combine 'natural' and 'human-made' infrastructure to ensure they work well together, such as not interrupting natural drainage patterns or ecosystem services. For example, for a coral atoll, this would include preserving and augmenting freshwater, making sure the coral reefs get adequate sunlight, not endangering the reef system in any way, being mindful of the carrying capacity of the islands and preserving coastal and marine biodiversity, which is a natural livelihood source.

BNHS has written a letter to the President of India outlining its concerns with the LDAR, 2021. The letter states that in the case of Lakshadweep, whatever happens to the reefs would directly impact the islands. The islands are facing climate change impacts with mass coral bleaching events, and are extremely fragile in their present state. The Island Protection Zone Notification, 2011 regulates developmental activities in the Andaman &

MAHIMA JAINI

Lakshadweep is rich in marine diversity, but is being pushed to an extremely fragile ecological state

Nicobar and Lakshadweep archipelagoes; this must be adhered to and not sidelined by the proposed regulation.

The LDAR should also adhere to previous Supreme Court orders. In one such order dated 11th May, 2012 (in Civil Appeal No. 4625-4626 of 2012 filed by M/s Sea Shell Beach Resorts *vs* Union Territory of Lakshadweep and Others), the Supreme Court appointed an Expert Committee under the chairmanship of Justice R.V. Raveendran, Former Judge, Supreme Court of India, to provide recommendations for the islands. The idea was to create uniquely suited suggestions for these unique islands. The suggestions of this Committee were integrated into a Notification by the Government of India, Ministry of Environment and Forests, No. 19011/16/91-IA.III. Among several directions, the following are of particular interest:

a. That the Union Territory of Lakshadweep Administration shall take up an integrated approach involving all stakeholders in the islands to promote conservation of coral reefs and its biodiversity.
b. Detailed guidelines for the preservation and conservation of ecosystems provided in this report should be strictly adhered. Mapping of corals, sea grass, and distribution of rare, endangered organisms should be undertaken (in high resolution) to facilitate implementation of provisions specified for preservation and conservation of ecosystems. These maps may be periodically updated, say at least every five years.
c. It is highly essential to protect corals, sea grass, and other ecosystems from anthropogenic activities like waste disposal, port development, and associated activities like dredging of navigational channel and construction of breakwaters, tourism and related activities, sand mining, intensive fishing, etc.
d. All developments envisaged in the Integrated Island Management Plan shall be implemented in consultation with the elected local self-government bodies.

MAHIMA JAINI

Frequent mass coral bleaching events due to climate change have impacted islands greatly

Lakshadweep is a biologically unique area, hosting threatened giant clams (which BNHS has worked on for several years), living coral reefs, large colonies of seabirds, and migratory turtles. India is the current President of the Convention on Migratory Species and in a leadership position to show its commitment for Lakshadweep. As India shapes its National Biodiversity targets, we must also uphold our agreed commitments for both species protection and sustainable development.

BNHS is of the opinion that the framing of 'development' in the LDAR, 2021 does not adopt an integrated approach (as mandated by the orders of the Supreme Court), neither does it take a sustainable development approach (as agreed under our commitments to the Convention on Biological Diversity). It is to be noted that the way 'development' is framed by the LDAR is a view that considers building construction and concrete as analogous to development. It also enables the acquisition of anyone's land for 'development' purposes. The LDAR suggests development as follows: "development with its grammatical variations and cognate expressions, means the carrying out of building, engineering, mining, quarrying or other operations in, on, over or under, land, the cutting of a hill or any portion thereof or the making of any material change in any building or land, or in the use of any building or land, and includes sub-division of any land..."

MAHIMA JAINI

Protecting corals, sea grass, and other island ecosystems from anthropogenic activities like waste disposal and port development is the need of the hour

This view of development does not take into account nature-based systems or an integrated process combining built and natural systems. Any development plan for Lakshadweep must consider the unique ecological dimensions of the area, the threat of climate change, the carrying capacity of the islands, and the participation of local people.

Apart from the BNHS representation, a collective of scientists and citizens, and The Lakshadweep Research Collective (TLRC) have done a thorough review of the implications of the LDAR. TLRC finds that in enabling takeover of local land, this draft regulation is not in consonance with existing laws, such as the Land Acquisition, Rehabilitation and Resettlement Act, 2013, the Biological Diversity Act 2002, and The Environment (Protection) Act, 1986. The LDAR does not address India's commitments towards the Sustainable Development Goals, marine protection goals under the Convention on Biological Diversity, and the Ecotourism Guidelines 2019.

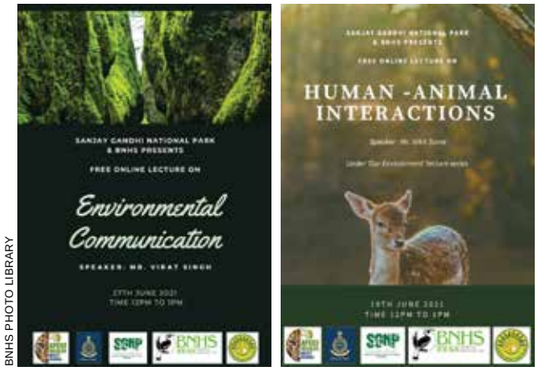
BNHS strongly feels that a far more comprehensive, integrated approach to development needs to be adopted in Lakshadweep, keeping climate security and ecological health in mind. ■

Neha Sinha heads Conservation and Policy at BNHS. She is the author of 'Wild and Wilful', Harper Collins India. She has a special interest in the intersection of politics with environment in India.

World Environment Day 2021

The United Nations has designated June 5 as World Environment Day to encourage individuals and NGOs to spread worldwide awareness and action to protect our environment. The BNHS-Conservation Education Centres (CEC) celebrated this day, as every year, with a range of educational programmes for nature enthusiasts.

@BNHS-CEC, Mumbai



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BNHS-CEC, Mumbai and SGNP conducted a series of webinars on weekends to celebrate World Environment Day

BNHS-CEC, Mumbai and Sanjay Gandhi National Park (SGNP), Mumbai conducted a series of webinars on weekends to celebrate World Environment Day. The webinar series was inaugurated on June 5, 2021, and 50 individuals attended the inaugural session. Mr Sunil Limaye, Additional Principal Chief Conservator of Forests (Wildlife West), Mumbai, addressed the participants and expressed his thoughts on the wildlife of Mumbai, and on conservation of flora and fauna. Dr Bivash Pandav, Director, BNHS, spoke about the commendable work done by SGNP and BNHS, future plans and the importance of wildlife conservation. He encouraged participants to join the webinar series, which were conducted weekly till June 27. Mr G. Mallikarjun, Director, SGNP, shared information about SGNP and their work.

The inaugural webinar was conducted by Professor Parvish Pandya on 'Environment of Mumbai'. On June 6, 2021, Rahul Khot, Assistant Director, Collections, BNHS, conducted a webinar on the importance of Citizen Science, and how to participate in its initiatives. He also presented a case study on the "e-mammal project" of BNHS, and how it had benefited young students and local people.

Other webinars in the series were 'Emergent Ecologies in SGNP and Water Ecosystems in Mumbai', 'Geology of Mumbai', 'Human-Animal Interactions', 'Restoration of Natural Habitat – A case study of Maharashtra Nature Park', 'Natural and Cultural Heritage of Mumbai', and 'Environmental Communication'. The weekend webinar series got a good response and positive feedback from the participants.

@BNHS-CEC, Delhi

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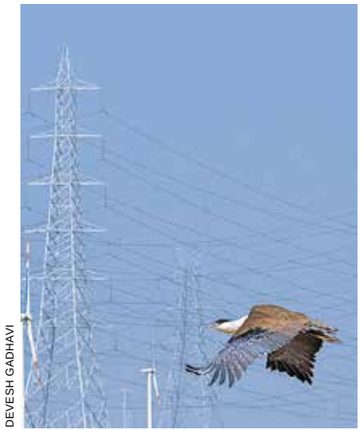
Painting competition and tree plantation drive was conducted by BNHS-CEC, Delhi this World Environment Day

BNHS-CEC, Delhi collaborated with the Department of Forests and Wildlife, Govt of NCT of Delhi (GNCT-Delhi) to celebrate World Environment Day from June 3 to 5, 2021, with the forest staff and their families and friends. On June 3, 2021 Sohail Madan, Centre Manager, CEC-Delhi, conducted a webinar on 'Ecosystem Restoration' and announced a painting competition for the Forest Department on 'How to Contribute for our Ecosystem' and 'Wildlife in my Balcony'. We received 25 entries from Delhi, Maharashtra, and Haryana.

On June 5, 2021, the BNHS-CEC, Delhi team organized a plantation drive at Asola Bhatti Wildlife Sanctuary (ABWS) in the presence of Shri Amit Anand, IFS, Deputy Conservator of Forests (South). More than 50 saplings of indigenous species of the Aravallis, including Ronjh *Vachellia leucophloea*, Kumtha *Senegalia senegal*, and Indian Bael *Aegle marmelos* were planted in the Aravalli Forest Centre of ABWS. These saplings were prepared in the Aravalli Native Plant Nursery of Asola, managed by the BNHS-CEC, Delhi team, in association with Department of Forests and Wildlife, GNCT of Delhi; 55 participants joined the programme. ■

Power lines to go underground in bustard habitat

DEVESH GADHAVI



DEVESH GADHAVI

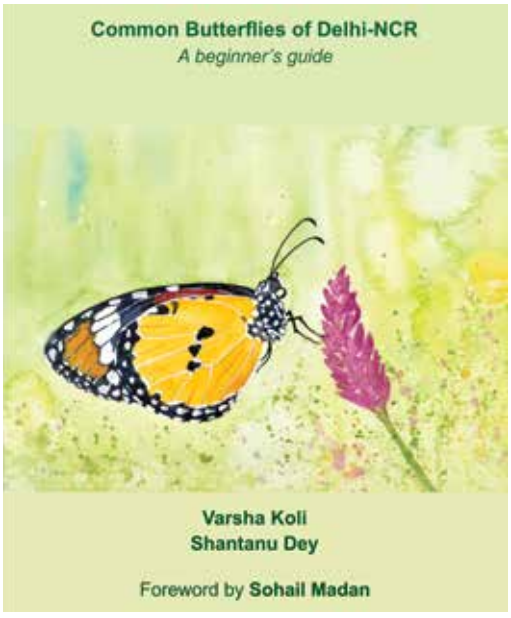
The critically endangered Great Indian Bustard population is now just about 100 birds in India

Over one lakh birds are killed annually in Thar, Rajasthan by power lines, according to Wildlife Institute of India (WII). The Corbett Foundation's (TCF) unpublished data reveals that nearly 30,000 birds die by collision with power lines annually in just one taluka, Abdasa in Kachchh, Gujarat. The critically endangered Great Indian Bustard (GIB) population is now at just about 100 birds in India. Though hunting, and habitat loss and degradation have contributed to its decline, collision with overhead power lines is presently the biggest threat. WII estimates that 18 GIB die each year from such collisions. GIB needs grasslands and semi-arid areas to survive, which are unfortunately categorized as 'revenue wastelands' in governmental records, and nowadays tend to be given away for solar and wind energy projects. Large renewable energy projects across GIB habitats, mainly in Rajasthan and Gujarat, have augmented this grave risk.

The Ministry of Environment, Forest, and Climate Change (MoEF&CC) has pioneered a Bustard Conservation Breeding Program in Rajasthan, being implemented by WII in collaboration with the Rajasthan Forest Department. Several chicks are being raised for release in the entire former GIB range, making it crucial to protect large swathes of habitat for them. And, very obviously, these areas would have to be free from the threat of power lines. In M.K. Ranjitsinh vs Union of India (W.P. 838 of 2019), of April 19, 2021, the Hon. Supreme Court directed that all power lines in both potential and priority bustard habitat be laid underground, prioritizing the safety of bustards irrespective of cost. The work is to be completed in one year from the date of the order, and renewable energy units in the area have been directed to install bird diverters (products like flaps designed to make overhead lines and gridded structures visible to birds and eliminate the risk of collision) in the interim. According to Kedar Gore, Director, TCF, "Overhead power lines continue to be installed in Rajasthan and Gujarat, without complying to the Supreme Court's directive. None of the existing power lines have been fitted with bird diverters, amounting to contempt of court. New renewable energy parks have been planned in Gujarat, Rajasthan, Maharashtra, and other states. It is hoped that the companies involved have planned to create infrastructure as mandated by the SC order on the power lines in GIB habitat."

"The charismatic Great Indian Bustard is undoubtedly standing at the doorstep of extinction," says Dr Bivash Pandav, Director, BNHS. "With a population of less than 100, the Thar desert is a unique Intensive Critical Care Unit for this species. BNHS lauds the Supreme Court judgement, and firmly believes in leaving no stone unturned in safeguarding the remaining bustard habitats in the Thar." For decades BNHS, and more recently TCF, has been working towards bustard conservation through monitoring, habitat improvement, community engagement, and in other ways with state forest departments and local people. The Government of India must formulate a policy to protect grassland species and the communities coexisting in agro-pastoral landscapes.

For further information, contact: Dr Bivash Pandav, Director, BNHS, director@bnhs.org and Kedar Gore, Director, The Corbett Foundation, kgore@corbettfoundation.org ■



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COMMON BUTTERFLIES OF DELHI-NCR was released online

Online Book Launch

On June 6, BNHS-CEC, Delhi in association with Delhi Bird Foundation, launched a free e-book online for beginners on COMMON BUTTERFLIES OF DELHI-NCR authored by Varsha Kohli and Shantanu Dey, with a foreword by Sohail Madan, Centre Manager, BNHS-CEC, Delhi. The programme started with a live interactive session with Mr Peter Smetacek of the Butterfly Research Centre-Bhimtal, hosted by Sohail Madan, which was attended by 95 participants from across the nation. This book is a great step towards creating synergies between researchers and citizens. This book covers the most commonly encountered butterfly species of Delhi, with identification keys, most likely habitats, and information on larval host plants. Butterfly enthusiasts, students, and readers wanting to enhance their knowledge on butterflies will find this book of great help.

The book can be downloaded from: <https://drive.google.com/file/d/1jZdIVWdMvWvkZA9tQG59RDU6s2ki49US/view?usp=sharing> ■

Birds Know No Boundaries

DEEPAK NALAWADE

A tagged Ruddy Turnstone

BNHS has been unravelling the mysteries of long-distance migration of birds for nearly a hundred years. Bird ringing, or banding, or tagging, and subsequent recapture or resighting, are robust means to study migration in birds. Based on these studies, the breeding zones, migratory routes, and stopover sites of more than 40 species have been well documented. The information obtained was pivotal in delineating the boundaries of major bird migration routes – the Central Asian Flyway (CAF) and its overlap with East Asian-Australasian and African-Eurasian flyways.

BNHS uses its wide network of citizens and scientists in India and in other countries, to reveal fascinating insights into migratory birds – the political boundaries they cross and the hurdles they conquer on the way. Recently, some tagged individuals were identified through high-resolution photographs. A Terek Sandpiper tagged in Gulf of Kachchh, Gujarat, in May 2017, was spotted in Jandola, Khyber, Pakistan in May 2021, while a Curlew Sandpiper tagged in March 2019 at Navi Mumbai was spotted this year in Tangu saltpans in Tainjin, China.

BNHS scientist Mrugank Prabhu and his team are studying migratory birds and their migration routes through Mumbai's wetlands since 2018, and have so far ringed and tagged 10,000 birds of 36 species. Resighting and recapture records of these marked birds provide insights into the migratory routes, site fidelity, and turnover rates of the different species, which would be useful in formulating species-specific conservation plans. Data from the project reveals that migratory birds wintering at Thane Creek use the adjacent wetlands as their high-tide roosts. These birds showed high fidelity to their traditional feeding and roosting sites, signifying the importance of the Creek area and the urgent need for its conservation.

With increased interest in birds among the general public, some popular citizen science programmes, and the use of social media, we expect to get more records of tagged birds, says Dr Bivash Pandav, Director, BNHS. We look forward to the active involvement of our members in reporting such valuable sightings from across India. ■

Published on June 30, 2021, by the Honorary Secretary for Bombay Natural History Society, Hornbill House, Dr Sálim Ali Chowk, Shaheed Bhagat Singh Road, Mumbai 400 001, Maharashtra, India.

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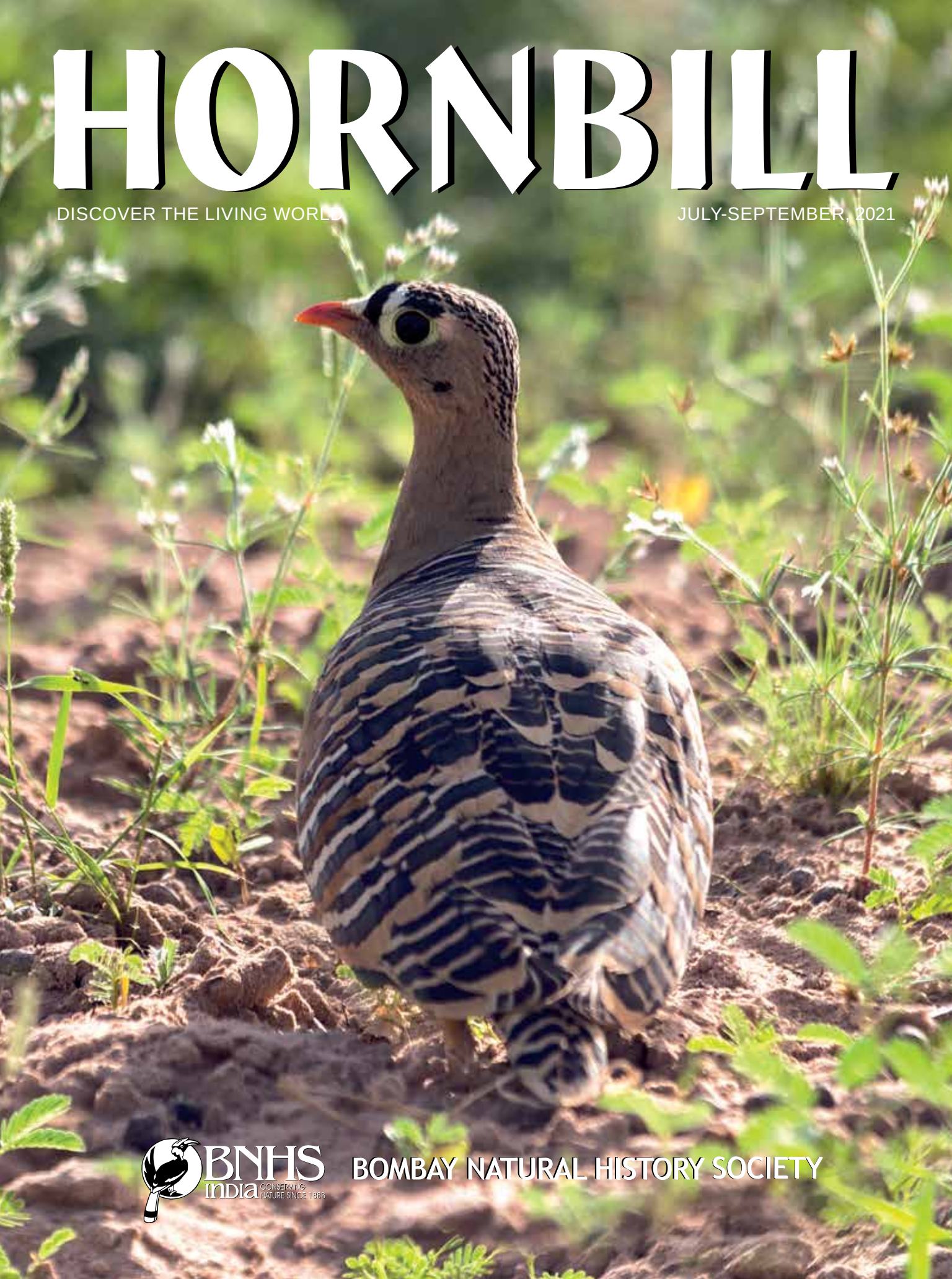

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COVER : **Painted Sandgrouse** ***Pterocles indicus*** by Badruddin Ali

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Kachchh – A Recall

Text and Photographs: **Badruddin Ali**

Kachchh has a very special place on the ornithological map of India. It is the entry and exit point, at the crossroads of major migratory routes for birds coming from Europe and northern West Asia into India, and also from Central Asia and passing on to Europe and Africa. Some will winter here, others disperse throughout the Subcontinent.

Our trip in September 2016 was a rerun of a trip we had undertaken in August 2010. It was especially targeted at land birds that pass through Kachchh in August-September en route to their wintering grounds in Africa, Europe, or the Gulf. These migrants take a different route on their return migration in spring to their breeding grounds. Some we had seen in 2010, but not all. The passage migrant land birds passing through this area listed by Dr Sálim Ali in his book BIRDS OF KUTCH are Rufous-tailed Scrub robin *Cercotrichas galactotes*, Common Whitethroat *Sylvia communis*, Eurasian Roller *Coracias garrulus*, European Nightjar *Caprimulgus europaeus*, Spotted Flycatcher *Muscicapa striata*, Blue-cheeked Bee-eater *Merops persicus*, and Red-backed Shrike *Lanius collurio*.

Our base camp in Kachchh was at the home-stay facility for birders at CEDO (Centre for Desert and Ocean), Moti Virani, about 50 km from Bhuj. On the first day, we explored the Nani Aral-Laiyari river area, which has thorn forests interspersed with dry sedimentary rock beds in hues of white, red, and purple. Water flowed in the river, interspersed with localized pools. Buffaloes, ducks, teals, and lapwings took advantage of these pools which had a few cormorants and an Oriental Darter *Anhinga melanogaster*. We were rewarded early by a pair of Marshall's Iora *Aegithina nigrolutea*, a speciality of thorn forest. Spotted Flycatchers were encountered in good numbers. The only Red-backed Shrike of the trip was seen on the first morning; we had a good sighting and enough time to ensure its identification. Later we found out that it was a 'front runner'. A few European Rollers were seen, though the numbers sighted were far fewer than in 2010. Another species of which we had good sightings was the Painted Sandgrouse *Pterocles indicus*. We followed a family of them for quite some time, initially over a bare rocky area and then into a gully surrounded by thorn forest, interspersed with grassland.

Driving around, we came across an albino Red-vented Bulbul *Pycnonotus cafer* that was busy building a nest, and this bird crossed the road several times in front of our vehicle. The albino stood out starkly in this arid landscape, which at that moment was verdant as the area had witnessed a good monsoon. Scampering up a slope to a pond through a narrow path, we found the burrows of Indian Desert Jird *Meriones hurrianae*. These sandy coloured mouse-like creatures with bushy tails live in small communities under the shade of the Acacia trees. They are easily spooked, but if you wait patiently, they can be viewed as they emerge from their burrows, curiously looking around.

That afternoon, we traversed the roads of the Nani Aral area. Stopping to check out the spot behind Sharan Nath Temple for birdlife, we stumbled upon a Banded Kukri Snake *Oligodon fasciolatus* that was trying to find refuge in the temple; fortunately the priest was not perturbed by its presence. We headed next to the Laiyari river where, after much waiting, we saw an Eurasian Eagle-owl *Bubo bubo* at a distance, perched on the ledges of the sedimentary rock formations making up the banks of the river. As dusk settled in, we came across many nightjars in flight. On the way back, we chanced upon a Saw-scaled Viper *Echis carinatus* crossing the road, and soon after, a Rufous-tailed Hare *Lepus nigricollis ruficaudatus*, which stood stunned in the glare of our headlights.

The second day was a 200 km round trip. First we drove towards Jara Jumara, diverting at Dayapur onto the Dayapur-Junachay road. During a breakfast stop, we saw our first of many Rufous-tailed Scrub-robin; it was amongst scrub at the edge of a field. It hopped around while foraging, would suddenly stop, stand tall on its feet and hold its wings out like an orchestra conductor, then get back to business. It did this repeatedly for all the time we watched. We also came across a pair of Yellow-crowned Woodpeckers *Leiopicus mahrattensis* that scaled up a concrete electricity post for want of a tree, and then perched on the wires. Bevies of Chestnut-bellied Sandgrouse *Pterocles exustus* were seen in flight, while Black Francolin *Francolinus francolinus* calls rang out loud and clear from fence posts in the fields.

Turning from Meghpur, we passed through fields where people were at work. We were discouraged from taking photographs, as the people do not take kindly to being photographed. The villages in the area had cement tanks outside the houses, as the area is extremely arid and water is brought in by tankers. It was here that we came across a lot of Singing Bushlark *Mirafra cantillans* (treated as conspecific with Horsfield's Bushlark *M. javanica* by BirdLife International). We watched as they took to

Sedimentary rock formations along the banks of Laiyari river are a unique feature of the Kachchh landscape

Painted Sandgrouse

Rufous-tailed Scrub-robin

Spotted Flycatcher

the air, singing loudly and slowly descending to the ground, only to repeat the performance.

Finally we reached the rock-strewn slopes of Jara Jumara, a fragile landscape in dire need of protection, which had many wild flowers in bloom. Highly windswept, it is a historical site with numerous stories of wars that have been fought here. We enjoyed the uninterrupted view of the Rann from the rocky outcrops, but birding was frugal.

Post lunch we drove to Lakhpat, stopping at the Siyot Caves, which were a refuge for Buddhist monks in a bygone era, but are now home to a mouse bat species. We also came across a field with many Hardwicke's Spiny-tailed Lizard *Saara hardwickii*; they were skittish to our approach and would immediately disappear into their burrows.

We passed a lake near a dilapidated cement factory where more than 50 Eurasian Spoonbill *Platalea leucorodia* had congregated. The wind here was so strong that we could barely hold our scope and binoculars steady, but we had good sightings of Small Minivet *Pericrocotus cinnamomeus* in an Acacia tree. The landscape was a mix of undulating grassland and wetland, with some human habitations bordering the Rann. A Nilgai *Boselaphus tragocamelus* appeared out of the grassy landscape but kept its distance from us. The road, as we approached Lakhpat, hugged the edge of the Rann. Here, we watched a Chinkara *Gazella bennettii* as it steadily made its way from the depths of the Rann, climbed onto the road, only to disappear into the grassland.

Spotted Sandgrouse

Crested Lark

Pallid Scops-Owl

Entering Lakhpat Fort, we found it inhabited by humans. There were large open areas within, where we came upon peacocks and some common birds associated with human habitation – swallows and martins swooped down from the skies. Climbing onto the ramparts, we came across a Crested Lark *Galerida cristata* with its beak full of seeds. In front of us lay the vast Rann, patterned in hues of beige broken by the stark white contrast of salt encrusted surfaces. In the distance shimmered large water bodies, and mounds that looked like stacks of harvested salt.

On the third day we went to Kala Dongar, driving over tarred roads through Banni grassland. We found a Rufous-fronted Prinia *Prinia buchanani* on the slopes of Kala Dongar. Having stayed at Kala Dongar in 2010 and seen White-bellied Minivet *Pericrocotus erythropygius* in a fossil-rich rocky area, and also reminiscing on witnessing the ritual evening feeding of jackals and porcupines by the locals, we thought of making this trip again. Sadly, we found the trip rather unproductive, more so considering the distance travelled and the compulsion of having to return by afternoon. It was extremely hot, and had it not been for the breeze, the trip would have been quite unbearable. We sighted some early migrant waders, but in low numbers.

That afternoon, we got news of a European Nightjar at a nearby farm, and rushed to see it settle on the ground. We kept our distance so as not to disturb the bird. We later visited an extremely interesting geographical formation, a mini gorge

Mouse-tailed Bat colony

cut by water exposing sedimentary layers, where we encountered Common Whitethroat, Marshall's Iora, Spotted Flycatcher, and Western Orphean Warbler *Sylvia hortensis*. From there, we drove on to spend a quiet evening on the Doramnath plateau. Kiro, an inactive volcano, stood in the distance, and it was here that an idea was spawned, of visiting Kachchh again in spring of the coming year, so that we could get to Chhari Dhand to watch the return migration of Common Crane *Grus grus*.

The last morning was spent at Fot Mahadeo that is approximately 19 km from our base at CEDO, an area of thorn forest with mythological pinnings about its formation. We had also been to this area in 2010, but had missed the White-naped Tit *Machlolophus nuchalis*, and this time too, Lady Luck was not shining on us. However, we had good sightings of a pair of White-bellied Minivet in courtship. As we followed the female's movements, the male approached, perching below the female, his orange breast fluffed, tail cocked to exaggerate the orange rump against a striking black back and wings, with contrasting white panels that shimmered in the sun. Then, he began to sing. The female, not convinced, moved on with the male in tow. The place was abuzz with many squabbling Spotted Flycatchers. With this, our autumn trip came to a close. In four action-packed days, we had seen 112 species of birds, seven species of mammals, and eleven species of reptiles.

We again returned to CEDO in the last week of February 2017, as planned. Chhari Dhand, as we were told, was accessible and the cranes were congregating, and so the excitement was palpable! After a quick breakfast to be in the field by 10:30 a.m., the idea was to do a short round through agricultural fields in the forenoon. An Indian Courser *Cursorius coromandelicus* in a fallow field held our attention, enacting a dance of arching its neck backward in an upright stance, and then bending in a peculiar manner to pick up food. Chestnut-bellied Sandgrouse made hasty flights and an Isabelline Shrike *Lanius isabellinus* hunted from a tree. We then we headed to Bhimsar lake, which we found was alive with eight species of ducks, Tufted Duck *Aythya fuligula* and Mallard *Anas platyrhynchos* among them, Eurasian Spoonbill *Platalea leucorodia*, Common Coot *Fulica atra*, Oriental Darter, besides a lone pelican which joined the party in its own clumsy style. A White-throated Kingfisher *Halcyon smyrnensis* welcomed us without interrupting his efforts to beat up a large non-cooperative fish he had been trying to convey down his gullet. The way back was made interesting by a squabble. A Long-legged Buzzard *Buteo rufinus* was chased by a Short-toed Snake-eagle *Circaetus gallicus* and a Steppe Eagle *Aquila nipalensis* in an attempt to make it drop food; after a bit of dodging and aerial display, the buzzard managed to keep its prize.

The afternoon session was on the shores of Chhari Dhand. This was the first time I was entering this area as it had been inaccessible in all my earlier visits to Kachchh. Banni, now devoid

Indian Desert Jird

Rufous-tailed Hare

of water except for lakes like Chhari Dhand, is a flat landscape of caked mud; when trodden or driven upon, it billows like talcum powder. We were greeted by flocks of larks that seemed to rise out of nowhere. We drove to a hillock where an Isabelline Wheatear *Oenanthe isabellina* was spotted by Chetan, our eagle-eyed driver. Kiro loomed in the distance, conical, poised, separated from us by the intervening dusty plain. We removed our gaze to the horizon towards Chhari Dhand and saw skeins of large birds in flight. The cranes were calling! Even the diversionary tactics of a Montagu's Harrier *Circus pygargus* could not hold us back.

As we drove towards Chhari Dhand, we encountered flocks of cranes varying in size from a couple to a few hundred individuals. They rose to flap away on mighty wings, maintaining their distance from us. We were told the birds were wary of vehicles and humans, due to poaching. There is a watchtower on the shores of Chhari Dhand; below it was a buffalo carcass, around which were three species of wagtails – Western Yellow *Motacilla flava*, Citrine *M. citreola* and White *M. alba* – picking on the bonanza of insects that buzzed around it. Chhari was alive with Dalmatian Pelican *Pelecanus crispus* and Great White Pelican *P. onocrotalus*, as well as cormorants and ducks. A Great Crested Grebe *Podiceps cristatus* paddled around, while a Pallid Harrier *Circus macrourus* quartered the grassy edges.

The sun began to set over Kiro, and the sky turned from pale blue to shades of delicate pink to orange and then red, the grasses on the shores of Chhari Dhand silhouetted against it. Buffaloes being driven home by the herdsmen kicked up dust in the distance that hung around in the still air. This theatre was completed by wave upon wave of Common Cranes patterning the sky as they flew over us. Their honking, a soothing *kraw kraw*, rent the air as they made way on great wings towards their roosting grounds. This magical sight left us wanting more. Suddenly it was pitch dark and stars filled the sky, revealing the grand spectacle of the Milky Way.

The following morning we left for Fulai village, where Grey Hypocolius *Hypocolius ampelinus* congregate for their return migration in April. Making our way into a castor field, led by our guide Mohammed, to bushes of *Prosopis* that are used as boundaries; this is where the birds were feeding on berries in mixed flocks. Large flocks of Rosy Starling *Pastor roseus* swooped through the sky. A few Oriental Honey-buzzard *Pernis ptilorhynchus* waited in the neighbouring trees for warmer currents before taking flight. Audible in the morning air was the honking of the cranes that flew past or roosted nearby. A sleepy Pallid Scops-owl *Otus brucei* hid in a large cactus – difficult to imagine how an owl can sit camouflaged in a cactus It would not have been seen but for industrious scouting by our guide, and prior knowledge of a sighting in the area.

The rest of the morning was a hard drive across Banni towards Vang and Nirona. The landscape

Western Marsh-Harrier (male)

White-naped Tit

changed from patches of low scrub to small thorny trees, and vast stretches of barren sandy plain. Our destination was the eastern part of the Banni, close to Epicenter Birding Resort near Lodai. The afternoon was spent looking out for Spotted Sandgrouse *Pterocles senegallus* that had been seen here after a hiatus of 19 years! After searching the area for well over an hour and on the verge of giving up, a sighting of some larks huddled under low bushes led us to spotting 14 birds. In the hot afternoon when not foraging, the birds seem to adopt this strategy. On being discovered, they marched away, feeding as they went; amongst the group was a laggard that seemed to have an injured leg. Dr Sálim Ali writes in his BIRDS OF KUTCH that Spotted Sandgrouse are mostly winter visitors to these parts, but there are records of them staying back. He adds that MKS Fatehsinghji had mentioned seeing them in the hot season, which is their nesting period. On the way back, we spent another evening on the shores of Chhari Dhand, absorbing the atmosphere in the company of two troops of camels that came by to drink. Buffaloes were being driven by herders across the plain in the fading light.

Waiting for the stars to adorn the sky before making our way back was fruitful, as we spotted a Jungle Cat *Felis chaus* in our headlights; it dodged in and out of a bush before disappearing into the dark. While searching for the cat, we chanced upon a Golden Jackal *Canis aureus*. Surprisingly, we did not encounter any nightjars or snakes this time.

The last morning was spent at Fot Mahadeo, which was dusty brown, contrasting with the verdant green of our earlier visits. The grass had dried and the Acacia trees too had dropped most of their leaves, but adding a spark of scarlet were a few Palash *Butea monosperma* in bloom. This time we were in luck with a strikingly beautiful bird that we had earlier pursued unsuccessfully in these thorn forests, the White-naped Tit. They seemed to be in the process of pairing with potential mates, as they called and sang in varied notes. We also had very good views of a Yellow-crowned Woodpecker and a pair of Common Woodshrike *Tephrodornis pondicerianus*. A point of note was the crops in the fields — major area was under castor, cotton, and wheat, and also *Psyllium* (Isabgul). Mango orchards were in blossom. Sadly, our short but power-packed trip ended here. On our way back, we were left thinking when the birds of Kachchh would beckon us next. ■

Badruddin Ali is a birdwatcher and photographer with a keen interest in all aspects of natural history.

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Combating Invasive Alien Plant Species in Protected Areas:
An Action Imperative

Text: **Gopal S. Rawat**

A.J.T. JOHNSINGH

Coral Creeper *Antigonon leptopus* has taken over much of the natural vegetation in the Andaman and Nicobar Islands

Invasive Alien Species

Invasive alien flora and fauna collectively rank among the top three threats to global biodiversity, the other two being unsustainable harvesting of various species from the wild, and habitat degradation and loss. In a recent assessment, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) concluded that invasive species, coupled with unsustainable resource use and climate change, have seriously impacted the livelihoods of indigenous and local communities in the Asia-Pacific region and that the oceanic islands, coastlines, inland wetlands, and agro-ecosystems are most vulnerable to the spread of invasive alien species (IAS).

It is estimated that Southeast Asia alone incurs an annual economic loss of about US$ 33.5 billion due to IAS. The Species Survival Commission (SSC) of the World Conservation Union (IUCN) has established the Invasive Species Specialist Group (ISSG) with headquarters in New Zealand. This agency aims to reduce threats to natural ecosystems and the native species they contain by increasing awareness of invasive species and of ways to prevent, control, or eradicate them. The Global Invasive Species Database, managed by ISSG, is freely available online at <www.issg.org/database>. IUCN has also issued guidelines for effective management of invasive species in natural areas. As part of the Post-2020 Global Biodiversity Framework, the UN Convention on Biological Diversity (CBD), under 2030 action target 6, has recommended that by 2030, invasive alien species and their pathways need to be identified, and that appropriate management strategies should be developed for priority species. As a signatory to CBD, India has aligned its national biodiversity targets to the Aichi Targets and set a similar goal for the management of invasive aliens. However, the task appears to be extremely daunting, as most of the natural areas, including well managed protected areas (PAs) are heavily infested with invasive species. Once the PAs and managed forests are infested with aggressive aliens, they become unsuitable for native biodiversity and eventually fail to achieve the conservation objectives for which they were established.

Invasive Aliens spread in India

It is estimated that more than 70% Indian PAs are infested with invasive alien plants (IAPs). Empirical evidences show that introduction of exotic species in natural forests, accidental garden escapes, improved transportation, fragmentation of forested habitats, and unregulated grazing in the forests by domestic livestock have led to rapid spread of IAPs. On an average, Indian PAs, especially those located in warmer regions, harbour 15–20 IAPs each. Although colonization of new areas by IAPs is a natural phenomenon, their rapid spread induced by humans leads to various environmental problems such as biotic homogenization,

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Spectacular Cassia *Senna spectabilis* is overtaking native tree species because of its ability to grow quickly

GOPAL S. RAWAT

Mesquite *Prosopis juliflora*, one of the most aggressive invasive alien plants in semi-arid grasslands of India

replacement of natural communities, changes in nutrient cycling and hydrology, disruption of ecosystem functioning, loss of native biodiversity, and degradation of wildlife habitats. Infestation of natural areas by opportunistic IAPs is more severe in tropical countries such as India, where the growing season is prolonged and most of the ecosystems are heavily influenced by humans and very little attention is paid to the upkeep of public land and natural areas.

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A waterbody along a highway in Assam covered by Water Hyacinth *Eichhornia crassipes* and Besharam *Ipomoea carnea*

It is estimated that nearly 1,600 species of vascular plants, including 140 aquatic species, have invaded Indian territory during the past hundred years from different regions of the world such as Tropical America, Africa, Southeast Asia, and Eurasia. Most obnoxious among these species are Lantana *Lantana camara*, Bitter Vine *Mikania micrantha*, Congress Weed or White Head *Parthenium hysterophorus*, Water Hyacinth *Eichhornia crassipes*, Scotch Broom *Cytisus scoparius*, Black Wattle *Acacia mearnsii*, Sticky Snakeroot *Ageratina adenophora*, Siam Weed or Bitter Bush *Eupatorium odoratum* (=*Chromolaena odorata*), Creeping Sensitive Plant *Mimosa invisa*, Mesquite *Prosopis juliflora*, Sickle Senna *Senna tora* (=*Cassia tora*), Prickly Pear *Opuntia stricta*, Besharam *Ipomoea carnea*, and Alligator Weed *Alternanthera philoxeroides*.

Invasive species can spread through the stages of introduction, establishment, and dispersal to a full range. They are highly adaptable, widespread, and can grow in a wide range of habitats. Ecologists have put forward several theories explaining successful invasions by exotic species. Some of these include: absence of predators in the new habitat; greater reproductive potential; poorly adapted native species; chemical change or allelopathy causing inhibition of growth of native plants; empty niche hypothesis, i.e. the absence of a particular component in the ecosystem which can be filled by an exotic; and disturbance-produced-gap hypothesis. Lantana, one of the most successful invaders in India, exhibits more than one trait, namely very little herbivory, efficient coppicing ability, extremely prolific flowering and seed production, and seed dispersal by birds and mammals. Of all the habitats, riparian zones, especially in dry deciduous forests, are particularly susceptible to plant invasion due to frequent disturbances and their functioning as dispersal corridors for many species, including invasives. Heavy infestation by IAPs leads to drastic decline in forage for wild herbivores and loss of habitat. Excessive growth of unpalatable species, especially around fringes of the PAs and human habitations, act as cover for Leopard, Wild Pig, and Indian Crested Porcupine, which are often seen as root causes of human-wildlife conflict.

Many species of exotic trees were introduced into Indian forests during the 1970s and 1980s to increase green cover, meet the demands of fuel wood, paper, and wood pulp industries, e.g., *Prosopis juliflora*, wattle *Acacia* spp., White Locust Tree *Robinia pseudoacacia*, exotic pines *Pinus* spp., Subabool *Leucaena leucocephala*, Chinese Tallow Tree *Sapium sebiferum*, Japanese Pencil Cedar *Cryptomeria japonica*, Paper Mulberry *Broussonetia papyrifera*, Tree of Heaven *Ailanthus excelsa*, Karen Wood

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Lantana *Lantana camara* in the process of invading hillside grasslands in Shivalik hills

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Scotch Broom *Cytisus scoparius* has invaded the open areas and forest lands in the Nilgiris

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Prickly Pear *Opuntia dillenii* with *Prosopis juliflora* in the background, Moyar Valley, Western Ghats

Haplophragma adenophylla, and *Eucalyptus* spp. Many of these species have now become invasive.

Impacts on PAs of India

Based on the data collected during the countrywide assessment of Tiger, associated prey and habitats, the Wildlife Institute of India (WII) has estimated that Lantana alone has infested nearly 44% of the tropical humid forests in the country, covering about 87,000 sq. km. Likewise, Mesquite has spread over millions of hectares in the semi-arid and arid regions of the country since its introduction as a fuel wood species during the 1950s. Presently, it is a major threat to arid and semi-arid grasslands and their obligate fauna. Among the aquatic IAPs, Water Hyacinth is said to be the most aggressive. According to an estimate, this species is spread over about 2,000 sq. km of inland freshwaters in the country, including several PAs. It is projected that Lantana, Mesquite, Congress Weed, Bitter Vine, Bitter Bush, and Water Hyacinth are spreading at an alarming rate, and it can be safely predicted that if left unchecked and unmanaged, these invasive plants may take over most of the biodiversity hotspots and tropical forests of India by 2030.

In many PAs, past plantation sites have been heavily infested by herbaceous and shrubby IAPs replacing the native vegetation and hampering the quality of wildlife habitats. This is evident in several PAs along the foothills of Himalaya and north-east India. Prominent IAPs in the PAs along eastern Himalayan foothills, (e.g., Jaldapara, Mahananda, Buxa, Pakhui and Namdapha) include Bitter Vine, Bitter Bush, and Sticky Snakeroot. These species are also prevalent in almost all the mid-elevation PAs of Western Ghats, while the low elevation PAs here are dominated by Lantana or Mesquite. Several natural grasslands in the plains of Tamil Nadu are infested by Prickly Pear. Village relocation sites in the PAs are mostly infested with *Parthenium*, *Xanthium strumarium*, *Sida cordifolia*, and *Senna tora*. Problems due to IAPs are more acute in the Andaman and Nicobar Islands, where *Lantana*, *Mikania micrantha*, *Antigonon leptopus*, *Chromolaena odorata*, *Eichhornia crassipes*, and *Wedelia trilobata* have taken over much of the natural vegetation. In our marine PAs, a recently introduced sea alga Elkhorn Sea Moss *Kappaphycus alvarezii* is reported to be a major threat to coral reefs and sea grass beds. It is well known that native fauna and flora of islands are sensitive to habitat changes and other perturbations, and have gone extinct due to invasive aliens. However, the impacts of IAPs on ecology and populations of rare endemic species in the Andaman and Nicobar Islands have not been assessed.

Combating the IAPs menace

Ecological impacts of IAPs on faunal communities, their habitats, and soil biota can be complex. Most importantly, IAPs alter the availability of forage for all groups of animals, namely insects, birds, and mammals, thus affecting the food chain, pollination, seed dispersal, and habitat structure. Several pertinent questions pertaining to impacts of individual IAPs, their dispersal pathways and invasibility, need to be addressed on priority. Similarly, predicting the patterns of invasion in new areas, under changing land use and climate in different biogeographic regions of the country, would be necessary so as to prevent, control, and manage such species.

So far, quite a few attempts have been made to control the spread of IAPs, and ecological restoration of invaded areas in protected areas of India has also been attempted. For example, Professor C.R. Babu of Delhi University developed a protocol for the successful eradication of Lantana within Corbett NP, Kalesar NP, and Satpura Tiger Reserve, and emphasized the need for similar model and management strategy to restore invaded sites across PAs. This could be achieved through focused and persistent efforts by the respective management authorities for a few consecutive years. Water Hyacinth has been successfully eradicated from a few wetlands such as Keoladeo Ghana National Park, Bharatpur, and some man-made water bodies. However, for large wetlands and natural lakes, removal of aquatic invasive species without affecting micro-habitats can be a major challenge. Likewise, prickly pear species have been successfully controlled from quite a few areas around the world. These restoration programmes need to be supported by ancillary scientific information on the variety of factors such as dispersal mechanism of the invaders, soil, climate, the present ecosystem condition, condition of neighbouring ecosystems, and the requirements of the stakeholders.

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Bitter Bush *Chromolaena odorata*, one of the common invasive alien plants along the Himalayan foothills and Western Ghats

Long-term strategies for the effective management of IAPs include development of a reliable screening system, as well as effective measures for the prevention, control, and eradication of such species. The screening systems help in predicting the patterns of alien plant invasion, possible source of introduction, and threats based on various biological attributes of invasive species, e.g., life history, biogeography, habitat, and general history of spread. Currently, the Government of India through the Ministry of Environment, Forest and Climate Change (MoEF&CC) is implementing the third National Wildlife Action Plan (2017–2031). One of the priority actions listed under this plan includes development of 'National Policy and Action Plan on Management of Alien Invasive Species' for terrestrial and aquatic ecosystems by 2019, so that it can be implemented during the rest of the plan period. It also recommends setting up of a mechanism for assessing, monitoring, and managing invasive species within PAs. It is,

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A mat comprising a mix of invasive alien species along the roadside in Kamorta Island, Nicobar

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Bitter Vine *Mikania micrantha* is a common invasive alien in moist evergreen forest edges

therefore, high time that conservation agencies gear up and develop a comprehensive policy and action plan to prevent introduction of invasives, to control or eradicate those alien species that threaten ecosystems, habitats, or native species within PAs and their surrounds in a time-bound manner, beginning with the priority species.

The policy and action plan must include the following components:

(i) Setting up Special Task Forces within the State Forest Departments to combat the invasive species of flora and fauna through networking, creation of Voluntary Action Groups and experts,

(ii) Comprehensive plans for prevention, control, and management of IAPs within PAs and species specific management plans,

(iii) Identification of invasion hotspots and vulnerable ecosystems, especially islands, freshwater lakes, estuaries, coasts, and mountains that need to be given the highest priority for prevention of new introductions,

(iv) Dovetail eco-development activities and green skill development programmes in and around PAs, following participatory approaches, so that heavily infested sites are managed and restored for sustaining ecosystem services, local livelihoods, and reducing human-wildlife conflicts, and

(v) Increasing regional cooperation for better surveillance and management of invasive alien species and coordinated knowledge-based system in the Indian subcontinent.

GOPAL S. RAWAT

Chinese Paper Mulberry *Broussonetia papyrifera* can readily colonize available habitat, particularly disturbed areas

Protected Areas (PAs) serve as cornerstones of *in situ* biodiversity conservation and ecological security. In the long run, they ensure a wide range of environmental, social, and economic benefits to society. Despite the burgeoning human and livestock populations and all the challenges, India has successfully set aside nearly 4.9% of its geographical area as PA in different biogeographic zones. However, given the eco-climatic variation in the country and distribution of a large number of rare and threatened species still lying outside the PA network, this is quite inadequate. The Government of India is also committed to implementing the National Wildlife Action Plan and to enhance management effectiveness of its PAs. However, dealing with aggressive invasives, the silent killers of India's native biodiversity, will require prompt and proactive action at the national level. In this regard, the role of the National Board for Wildlife could be very effective in prompting the national and state governments to initiate appropriate prevention, control, and eradication of aggressive exotic invaders from our PAs, before it is too late. ■

Gopal S. Rawat is the former Dean and presently Senior Research Affiliate at the Wildlife Institute of India, Dehradun. His areas of specialization include Plant Ecology and Himalayan Biodiversity.

ABOUT THE POSTER

The Western Ghats, besides being one of the biodiversity hotspots of the world, also has a unique forest subtype, the Myristica Swamp Forest. This primeval ecosystem gets its name from the dominance of two threatened tree species, *Myristica fatua* and *Gymnocranthera canarica*, both members of the primitive family Myristicaceae. These trees occur in valleys which are prone to inundation during the monsoon, and they can withstand waterlogging with the help of their aboveground stilt roots. The trees form a fairly dense forest with a closed canopy. The aroids and ferns that are abundant in such swamps have spongy rhizomes that also enable them to survive in waterlogged conditions. These swamps play a crucial role in sustaining water in the area by acting like a sponge, which could be valuable to the landscape during the dry season. With a higher ability to sequester carbon than non-swampy forests, these relict ecosystems play a crucial part against global warming.

Myristica Swamps are believed to have occupied large swathes of the thickly-wooded Western Ghats in the past, but now occur in small patches in southern Kerala, Uttara Kannada district of Karnataka, and Goa. Studies have shown that the swamps are restricted to less than 200 hectares in the country. A recently discovered patch of Myristica Swamp in the northern Western Ghats of Maharashtra, near Bambarde (from where this photo was taken) in Dodamarg taluka of Sindhudurg district, was recognized by the State Government as a biodiversity heritage site, as defined under the Biodiversity Act of 2002.

MANDAR SAWANT

Myristica Swamp Ecosystem

The rich biodiversity of Myristica Swamp Forests includes at least 79 tree species, 26 shrubs, 27 climbers, and 44 herbs. The future of many rare and threatened species is at stake if steps are not taken to preserve such a unique ecosystem. India's neglected Myristica Swamps need much more attention from researchers and conservationists. ■

For more information on the endangered Myristica Swamp Ecosystem, check the links below:

https://india.mongabay.com/2019/11/why-the-ancient-myristica-swamps-need-more-protection/

https://india.mongabay.com/2019/11/new-species-remain-hidden-in-the-myristica-swamps-of-the-western-ghats/

http://wgbis.ces.iisc.ernet.in/biodiversity/sahyadri_enews/newsletter/issue13/index.htm

https://en.wikipedia.org/wiki/Myristica_swamp

MANDAR SAWANT

Myristica Swamp Ecosystem

Nature Watch in Suburbia

V. GOPI NAIDU

Water flowed from an unknown source, creating a little wetland habitat, where birds and mammals came to feed upon lesser prey

Narrative: **V. Gopi Naidu**

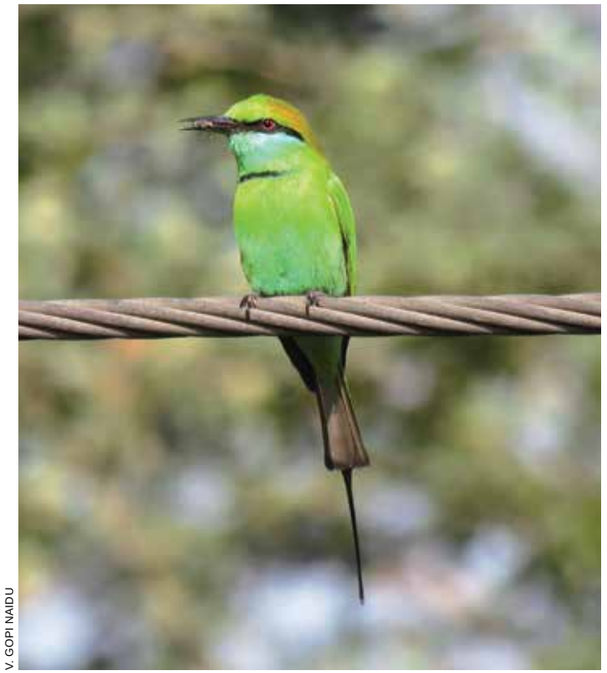
If one looks at the brighter side, the global pandemic of 2020 gave us many opportunities, with time on our hands to follow our passion. Working on BNHS publications constantly exposed and sensitized me to biodiversity, and so I began to notice the variety of birds and animals encountered during my morning walks. I would carry my camera along, to preserve these moments of joy around me. On one such walk, I first noticed an abundant flow of water near the railway track in Thakurli, a Mumbai suburb. The water appeared crystal clear, probably from a break in a distribution pipe, and its unregulated flow created a small wetland where one species after another appeared, to drink, feed, or bathe, or even to roost. Predators like Bengal Monitor and the Indian Grey Mongoose soon reached the spot, to prey upon the lesser species. The show went on, till one day the water source dried up, and all that remained of the species were the photographs I had captured, which I share here.

V. GOPI NAIDU

Green Sandpiper *Tringa ochropus* is a dark brown bird with white underparts, and long greenish bill. This small wader is seen singly or in small groups, and feeds on insects, which it probably found in abundance here

V. GOPI NAIDU

Black Drongo *Dicrurus macrocercus* primarily feeds on insects, which were present in large numbers around the waterfall. The shiny black plumage and forked tail easily identify this passerine bird, which is an aggressive hunter, feeding on termites and other insects, like a flycatcher



V. GOPI NAIDU

Asian Green Bee-eater *Merops orientalis* is an intensely bright green bird with a black gorget and eye mask. It flits about in the air, catching its prey in mid dive, then perches on a high spot to devour its meal of insects, mainly hymenopterans (bees and wasps), from which it gets its name

V. GOPI NAIDU

White-breasted Waterhen *Amaurornis phoenicurus* is often seen around marshy wet ground, where it picks its food, or swimming near the banks of water bodies. Here it fed on water plants, seeds, grasses, insects, snails, and worms

V. GOPI NAIDU

Purple Swamphen *Porphyrio porphyrio* is a common inhabitant of marshes and lakesides. The red bill and forehead shield, and red legs and feet are characteristic. It was seen stepping lightly over the ground with the help of its long toes

V. GOPI NAIDU

Yellow-eyed Babbler *Chrysomma sinense* is easily identified by its bright orange-red eye-ring. Described as "an odd-looking babbler which looks and behaves like a prinia on steroids", it was often seen near the water source

VIVEK NAIDU

Indian Grey Mongoose *Herpestes edwardsi* is the commonest of four species of mongoose found in India. It uses a diverse range of habitats, but in the urban setup, it is most likely to be seen around garbage, where it comes to feed

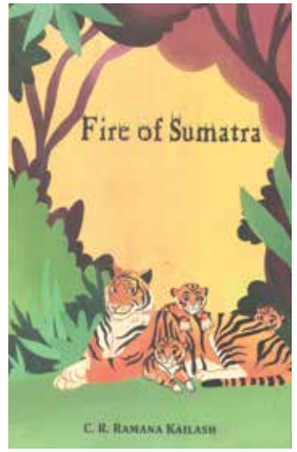
V. GOPI NAIDU

Bengal Monitor *Varanus bengalensis* is native to South and Southeast Asia. Here it came to hunt on the ground, feeding on small insects and other invertebrates, though it would be happy to find birds' eggs or young

Acknowledgements: *I thank Dr Gayatri Ugra, Senior Consultant Editor, BNHS, for the much needed support to put my narrative into words.*

V. Gopi Naidu is a Senior Design Consultant at Bombay Natural History Society. He is a keen nature watcher.

Fire of Sumatra
Author: C.R. Ramana Kailash
Published by: Kamarkat Publishing, 2021
Size: 21.5 x 14.5 cm
Pages: 198
Price: ₹ 250/-
Paperback



Reviewed by: **Maithreyi M.R.**

"… if something dies, it gives new life to another. Here, in our home, everyone is connected…" Zalim, the tiger dad, consoles his young cub Wagdoh who is feeling "slightly cruel" (p. 136) for killing a stag. It is the first big hunt for the siblings Wagdoh, Baachi, and Elsa, and their initiation into the "Circle of Life". *Fire of Sumatra*, C.R. Ramana Kailash's debut novel, takes us into this connected web of life through the gaze of its protagonists, the tigers, where, not surprisingly, the human is the only misfit.

The story takes off in the forests of Sumatra amidst a raging fire that tears through the landscape. Satra, the tiger mom, is one of the few survivors rescued and brought to a local tiger conservation centre. Her three hungry cubs lie waiting for her in their cave, unaware of the dangers closing in on them. Ramana Kailash manages to weave a perfect beginning that is at once gripping and soul-stirring. The 14-year-old author acknowledges that it was a photograph of a half-burnt orangutan he saw in a Tamil weekly article as an eight-year-old that stayed on to emerge as a story idea. His mother had then explained that oil palm industries looking to expand their plantations were behind these fires.

It is clear that Ramana Kailash has researched his setting, his subjects, and the issues that plague them. Linsang, bearcats, colugos, siamang, hog badger, tapir, argus, muntjac, serow, and many other wonderful creatures, big and small, crisscross our paths as we follow Zalim and his cubs through the forest. The author's attention to detail makes his characters well-rounded and believable. There is a part where Satra recounts to Wali, a tigress in her neighbouring cage in the rehabilitation centre, 'creatures' she had encountered near a biped's den: "…strange, muscular animals with two horns were sitting clumsily and chewing something …" (p. 141). Packed within this humorous perception of the cow is the hard truth of tigers seeking easy kill and falling prey to human wrath. For these wild animals, especially predators like the tiger, danger lurks everywhere in the form of forest fires, death traps, and retaliatory attacks. In their world of connectedness, the biped can only be this 'other' that is to be avoided, feared, and not to be trusted.

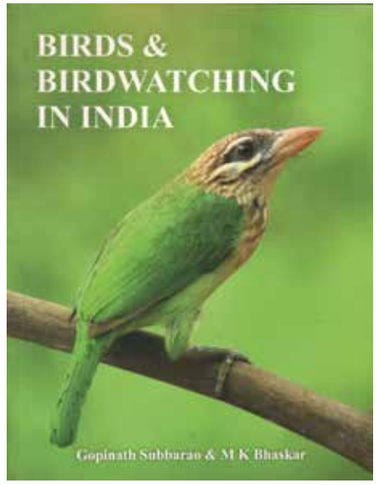
Fire of Sumatra may be located in Indonesia, but it is a familiar story of tigers like Satra, Zalim, their cubs; the human-animal conflicts; the conservation interventions; and our general disconnect with the 'circle of life'.

There are many takeaways in this book, especially for a young reader. The 'Names and Inspirations' section deserves special mention – it makes the characters in the story so much more endearing. If we were to wonder whether a male tiger would indulge in parental duties like Zalim does in the story, the section gives you a ready example. The name 'Zalim' stems from our construct of what a ferocious male tiger may be. The author brings out the irony of it effectively in his character sketch of Zalim.

It is remarkable how effortlessly Ramana Kailash swings from non-human narration to human, maintaining a clear difference in the two voices. He has a way with words that makes the narration simple and poignant. Like his description of the aftermath of the forest fire in the chapter 'Smouldered Jungle'. As we walk through the ash-laden forest with the conservationists and encounter an orangutan which "had been burnt completely" (p. 161), the scene he creates is heart-wrenching: ". . . its carcass was black and covered with ash. Its back faced the sky while its two arms were coiled as if hugging something. Sylvia then saw another pair of small, slim hands, tightly hugging the mother. The mother had tried to save the child from the fire." I recalled Ramana Kailash's account of the photo of the half-burnt orangutan he had seen as an eight year-old. It was clear how deeply it had impacted his young mind.

Fire of Sumatra has its shortfalls, though negligible. Like a misplaced or missing footnote (pp. 85–86) or a noun used wrongly as a verb (". . . they used to agony their mother while she hunted"; p. 129). There are places where the narration slackens, which can easily be fixed with a little tightening of the text.

As I read through the final 30th chapter, my eyes skipping many words and paras that formed conservationist Sylvia's speech – not because they were irrelevant but interrupted my journey with Satra and her cubs – I wished the last two chapters had been interchanged. Satra, who had opened the story, should have stayed to give it a close. ■



Birds and Birdwatching in India
Authors: Gopinath Subbarao and M.K. Bhaskar
Published by the Authors, 2019
Size: 23.5 x 18 cm
Pages: 314
Price: ₹ 1,100/-
Paperback

Reviewed by: **Asad R. Rahmani**

Amateur birdwatchers have always played a key role in the understanding of birds and the need for their conservation, and this is amply proved by the wonderful book under review. Gopinath Subbarao is an architect and M.K. Bhaskar a mechanical engineer by profession. Their respective professions and common amateur interests are reflected in the design of the book.

The book is divided into four chapters: Birdwatching Basics, Features of Birds, Species Information, and National Parks & Sanctuaries. The last two chapters make up the bulk of the book, and rightly so. Most bird books have a similar setup, starting with where to look for birds, how to watch birds, the morphology of a bird, and so on. However, what I like about this book is the way the authors have treated these mundane subjects. For example, to depict the size of a bird, the outline of the bird in question is given in comparison to the silhouette of a House Sparrow or House Crow – two birds that even a non-birder would know well (p. 13). On comparing the size with these two birds, we can easily assess how large a pelican or a stork is, or how small a warbler is. Another innovative idea is to show how some birds appear in different postures/stances, using the Indian Pond-Heron as an example.

To describe different body parts in technical terms (p. 20), a wonderful illustration of a typical bird with different colours is used. The wing and its component feathers are similarly explained. The different shapes of beaks are illustrated by paintings. But the most innovative part of this chapter is the nomenclature of leg bones – comparing the shape of bird bones with similar bones in human, like hip joint, thigh bone, knee joint, shin bone and ankle joints figure. Bird Trivia (pp. 32 and 194) is another section that will interest both ornithologists and birdwatchers.

The third chapter deals with species information, one species per page, with two illustrations. In each species, male and female (where dimorphic) are shown, and other details given. This is not a comprehensive field guide, so all 1,300 odd bird species of India are not included. Only those species that a beginner to birdwatching is likely to encounter are mentioned. A total of 160 species are profiled, covering almost all the families of birds found in India.

The fourth chapter deals with 17 protected areas (PAs) that are good for birdwatching. These PAs are representative of the habitats and avifauna from the whole country. Each PA account is profusely illustrated with the birds found there, and a very useful Trip Sheet that includes 'Other Places of Interest', 'Coordinates', 'Weather throughout the year', 'Distance from the nearest large cities', and 'Important address'. This chapter will help beginners immensely.

The only drawback – that can be improved in the second edition – is having two images of the same bird on the same page, often in similar stances. This is fine in dimorphic species where male and female have different plumages, but in monomorphic species it appears superfluous. Even in dimorphic species, such as Black Francolin, both the images provided are of the female. Similar is the case for Kalij Pheasant and Indian Peafowl, where only males are shown. In Black-necked Stork, where the only difference is in the colour of the iris (red in male and yellow in female), both the images are of a female. In many species, juveniles are quite different from adults. Adding images of juveniles would have enhanced the book.

Overall, the book is a good introduction to birdwatching for beginners. ■

A Serendipitous Encounter

Text: **Rakesh Vyas**

The Sightings

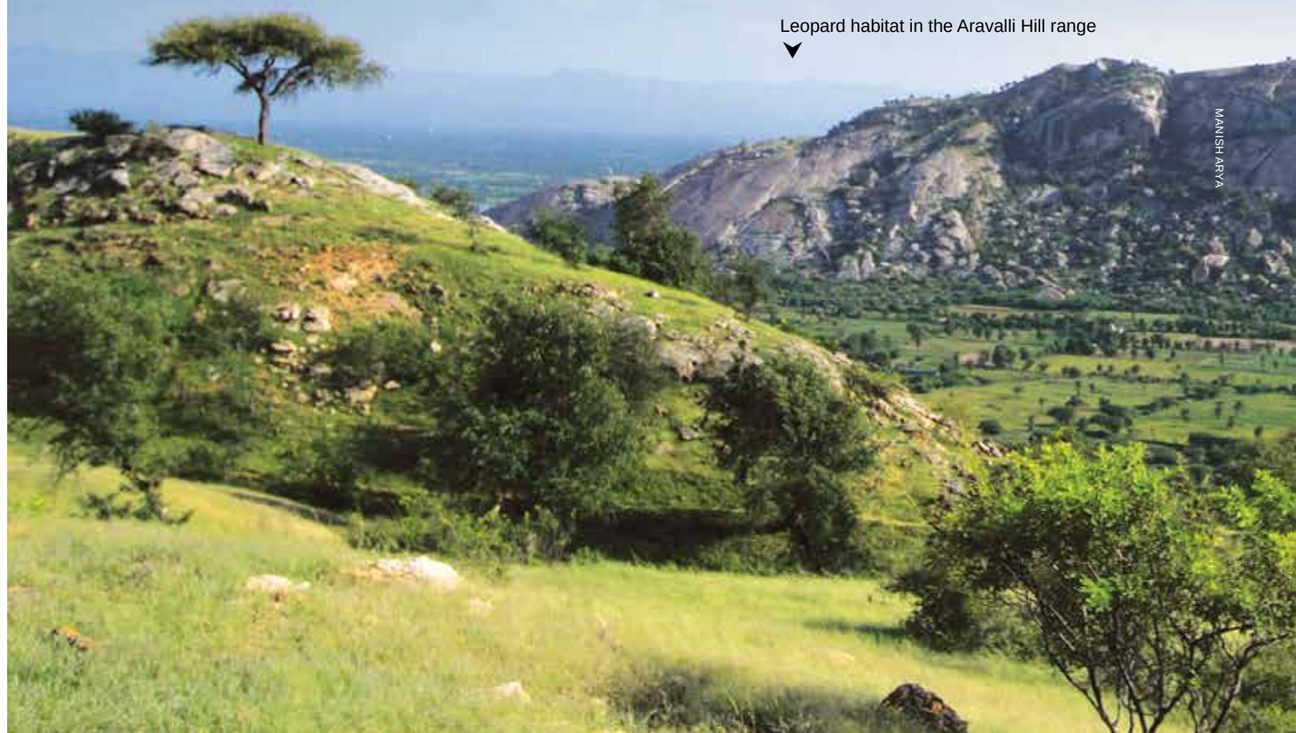
On that momentous evening, Viramdev Singh was forced to take shelter inside a temple to avoid a heavy downpour. As the rain turned into a drizzle, he stepped out onto the patio of the temple to assess his chances of commencing a homeward journey. He was looking towards the cloud-covered peak of a hill, when he observed a slight disturbance behind a rock. A leopard ventured out for about 10 to 15 seconds, sniffed the moist air, roared, and turned back to the safety of the rock cover.

Leopards inhabit almost all the hills in the vicinity, so Viramdev Singh was not surprised, but what struck him was the unique pelt colour of this animal. In the falling dusk, he perceived its pinkish coloration with henna-coloured (reddish-brown) rosettes. He immediately made inquiries with the caretaker of the temple and other villagers about the strange-coloured leopard, but did not get any satisfactory answer. Viramdev believed that his eyes had played tricks on him in the fading light.

However, the image of the unique leopard remained with him, and fortuitously it was not long that he had to wait for another sighting. While passing through a foliaged jungle path, Viramdev saw a leopard cub emerge from the bushes, followed by its mother. He stopped at a safe distance and watched in awe at the unique colour variation of the mother. The body hair was milky white, and the rosettes were reddish-brown. Now, he was sure that he had chanced upon something unique and worthy of an inquiry. Questioning his friend Hitesh Motwani in Udaipur yielded somewhat mixed opinions. Someone did mention seeing a 'strawberry' variant, but most believed that it was some form of albinism.

Still looking for a suitable answer, Viramdev kept pursuing the female and her cub in his leisure time, and over 15 months, collected valuable information about the strange leopardess, her normal coloured mate, and cubs from two litters. The cub from the last litter, now almost 18 months

Leopard habitat in the Aravalli Hill range



MANISH ARYA

Leopard with normal coloration in the same habitat

old, still follows her, and currently she is suckling an unweaned cub, which is confined in the den.

Viramdev Singh sought the support of his local friends Behar Singh and Chunnilal in observing the leopardess regularly, and to ensure her safety. In the meantime, the young conservationists Manish Arya and Hitesh Motwani, and researcher Ram Meghwal formed a team to study and photograph the leopardess and her habitat. One day, while Viramdev was passing through the jungle path alone, he saw the leopardess standing right in front of him. That day, and for the first time, he could photograph the elusive strawberry leopardess. This image from his mobile phone was the first and conclusive proof of the ultra-rare erythristic leopardess.

Indian leopards and colour variants

Indian leopards generally have an excellent coat of black rosettes on a variable pale yellow to yellowish-brown or golden background, with climatic and altitudinal variations. Leopards from the desert plains are paler, whereas individuals from high altitudes have a soft grey buff coat with small, thick-rimmed rosettes. Their coloration makes them blend with their natural environment, where variegated sunshine filters through trees and thick bushes. A leopard relaxing behind a bush during dusk and dawn, or perched on the fork of a tree during the day, is barely visible from a distance.

Among the uncommon colour variants of leopard, the melanistic form is encountered more frequently than albino, leucistic, or erythristic forms. Although black leopards are also not as common in the wild, still, they have been regularly recorded from the jungles of south India. Albinism among leopards is extremely rare, and besides a few historical records, there are no recent sightings of a white leopard in India. In his book THE LEOPARD IN INDIA: A NATURAL HISTORY, J.C. Daniel has quoted from the *Journal of the Bombay Natural History Society*, in which Divyabhanusinh (1993) collated data of nine recorded sightings of albino leopard in India. In 1965, a villager shot the last recorded albino leopard near Ajaigarh in Madhya Pradesh. Most of these records are from Bihar, Jharkhand, and Madhya Pradesh.

The ultra-rare colour variant among leopards is the erythristic form, caused by a recessive gene similar to the one causing albinism. In the case of erythrism in an animal, the red pigments are overproduced or dark pigments are underproduced. This phenomenon is frequently seen among invertebrates, but is extremely rare among vertebrates, particularly among mammals. Leopards with this colour mutation are called strawberry leopards.

The first strawberry leopard was reported from South Africa in 2012 from Madikwe Game Reserve, NW Province, South Africa. Yet another recent record (July 2019) is from Thaba Tholo Wilderness Reserve, South Africa, where the leopard was photographed feeding on a giraffe carcass. In reply to an inquiry posted in 1947 in *The Statesman*, Calcutta, regarding the sighting of an albino leopard, someone had replied in *The Field* magazine, describing a skin obtained from a leopard shot in a princely state near Patna. It said that the colouring was not due to albinism but due to lack of melanistic characters. There were no black markings, and the skin, being various shades of orange and cream, resembled that of a tortoiseshell cat. This incident is mentioned by E.P. Gee in his book THE WILDLIFE OF INDIA. If this posting is anything to go by, then it was probably a strawberry leopard, which was a curiosity in those days due to lack of clarity over erythrism.

Protection of the Queen of Kathaveshwar Temple Hill

The home range of the leopard-queen of Kathaveshwar Temple Hill lies within the sanctified area, which is protected by local sentiment. Viramdev and his friends keep a keen watch on the activities of the leopardess and see to it that she is safe and secure in her domain. The temple management, priests, and the devotees are equally involved in the protection of the forest and its flora and fauna. In a recent expedition, the conservationists photographed the leopardess peacefully resting on a ledge, undisturbed and secure in her habitat. The exact location has not been disclosed to protect the leopardess and her habitat, which she has ruled for almost six years. ■

VIRAMDEV SINGH

Strawberry leopard with its normal coloured cub

VIRAMDEV SINGH

Strawberry leopard resting on a ledge

MANISH ARYA

The strawberry leopard up close,
a rare shot caught on a mobile phone camera

Rakesh Vyas is a wildlife conservationist and author of many popular articles and books on wildlife and natural history.

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Prophecy of an Untreatable Future

Text and Illustrations: **Sushmita Karmakar**

If just a swish of a wand could clean every possible bit of dirt! Wouldn't that be wonderful? Life never seemed to be out of control for the Weasleys and Harry Potter, with their reparo spells. But the 'muggle world' is a lot more complex, isn't it?

Till date, issues pertaining to the deteriorating health of our planet are on an exponential rise. Special Protocols, Assemblies, Meets, and Committees have been established to tackle such situations. These targets are supposed to be achieved by all the organizations, irrespective of their governmental, private, or non-governmental status.

Yes, we know that this planet and her dwellers are suffering. The goliath of all troubles, of course, is none other than our very reliable, cheap, and easily available plastic. Its non-perishable character and low price has opened up Pandora's Box. This product has been nothing short of a boon, especially for developing nations. Even in the presence of eco-friendly alternatives, the poor economy and mindset of people has made plastic a necessity, and yet an endangerment to all.

News and infotainment channels, scientific journals and articles, and media coverage on the UN Climate Change Conference have made us all aware that plastic has irreparably damaged both terrestrial and marine fauna and flora. Micro plastics are like invisible predators and harm every living organism. We have already witnessed the occurrences of

Plastic pollution in Ghana, 2018

MUNAYA CHASANT / SOURCED FROM WIKIMEDIA COMMONS

ENGELBERGER / SOURCED FROM WIKIMEDIA COMMONS

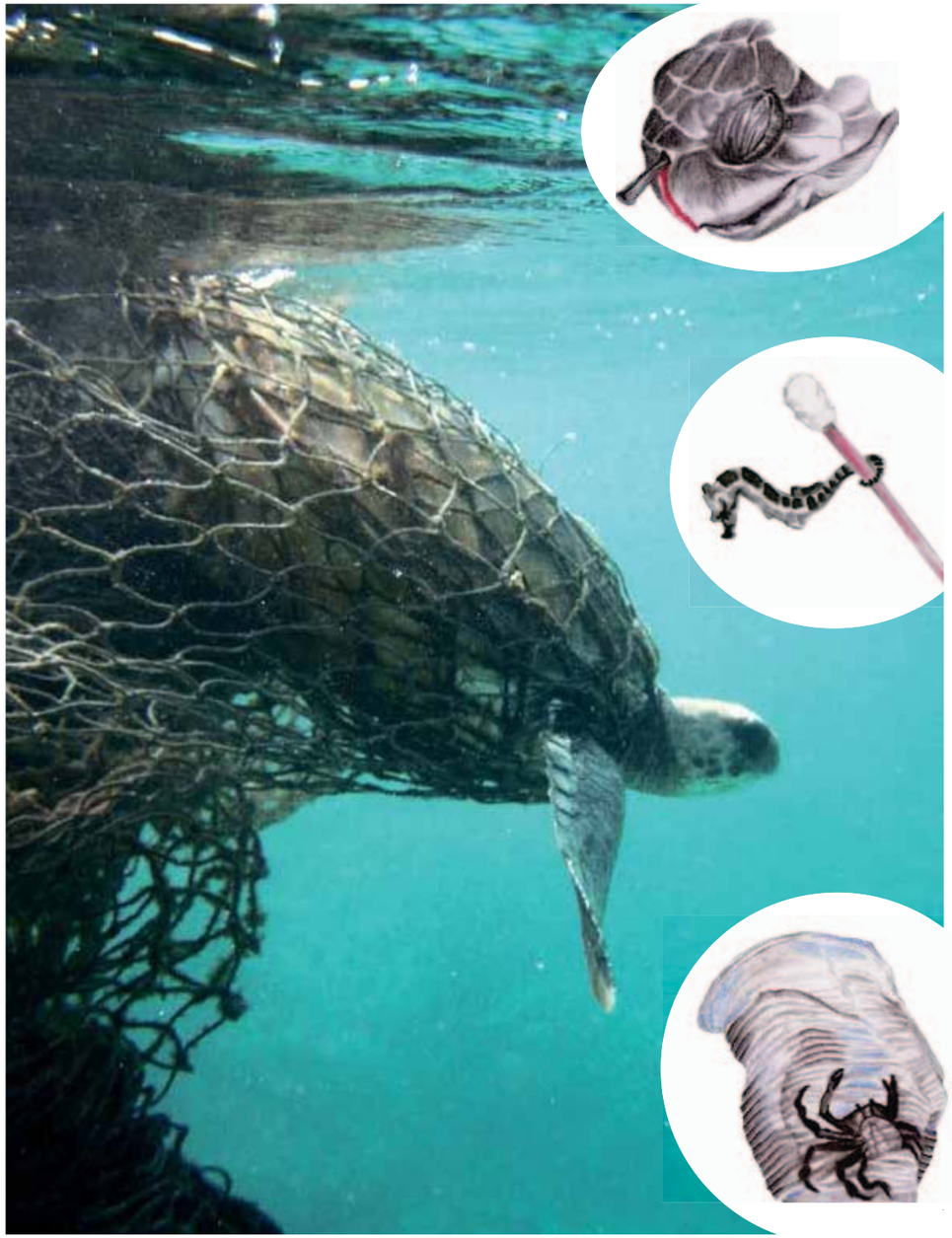
Northern Gannet in Helgoland, Germany, trapped in their own nests that are built only of old nets and other plastic waste

'The Great Pacific Garbage Patch', an Olive Ridley Turtle with a plastic straw stuck in its nostril, a whale washed ashore filled with plastic debris, the Small Estuary Seahorse with its tail coiled around a cotton bud, animals ingesting plastic garbage and later getting choked, release of toxic fumes from plastic incineration, lands getting saturated with plastic debris, drains and pipes blocked with plastic refuse leading to a flood-like situation, and many more disheartening incidents. In short, this synthetic polymer has mercilessly wreaked havoc on land, in the air, and in water.

Governments are trying to undo some of the damage by banning single-use items made of plastic. Stringent laws and penalties have been imposed on the same. But, we continue to contribute to polluting our planet with plastic. How?

For starters, while celebrating any event, workshop or special day, it is quite common for almost every organization to produce hoardings or banners, which might or might not be used ever again. These sheets are made up of PVC (polyvinyl chloride), which is the world's third most widely produced human-made polymer. Rigid and flexible are the two basic forms of PVC. The latter form, which is made so by incorporating plasticizers such as phthalates, is used in the making of banners, standees, hoardings, vinyl floorings, etc. Phthalates are linked with disruptions of the endocrine system and endocannabinoid system and are labelled as possible carcinogens by International Agency for Research on Cancer (IARC), European Commission (EC), and World Health Organization (WHO). Studies on rodents have inferred that phthalates also change hormone levels and cause birth defects. As phthalate plasticizers aren't chemically bound to vinyl, they can leach out, migrate, or evaporate into indoor air and concentrate within dust particles, in turn leading to dermal absorption. The physical and chemical presence of this form of PVC is hazardous for the health of both living organisms and the environment.

Huge stacks of unused or waste synthetic polymer sheets end up either in dump yards or in the oceans, indefinitely harming the habitats and their inhabitants. Long stretches of these sheets



DOUG HELTON / SOURCED FROM: WIKIMEDIA COMMONS

A sea turtle entangled in a ghost net, a plastic straw in a turtle's nostril, the seahorse with its tail coiled around a cotton bud, a crab trapped in a plastic bottle, are just a few examples of the extent of plastic pollution in our oceans

have ruined the fauna, especially in the marine ecosystem. Large fishes and turtles often end up ingesting these discarded floating sheets, leading to their untimely demise. Bits of plastic are mistaken for food or nest building materials by birds. This nuisance has steadily suffocated our planet and turned it into a health hazard-prone orb.

Yet, it will be inconvenient for us to entirely discard such a useful and low priced commodity. Also, its quality to last, withstand adverse weather

THARMAPALAN TILAXAN / SOURCED FROM: WIKIMEDIA COMMONS

A herd of 40 wild elephants at Ampara in east Sri Lanka is totally dependent on garbage dumped in tractor-loads
This causes serious health issues in the animals, some have even died

conditions, including pounding rain during monsoons, adds to the allure of using PVC sheets as a fabrication material.

Numerous protest marches, along with new initiatives, are mushrooming against the production and usage of various forms of synthetic polymers, but very little thought has been given towards this flexible form of PVC that poses a great risk to everyone's health. Its drawbacks and perils are enormities, enough to make this a matter of urgency, so that timely intervention might save innocent lives that are unaware of this growing threat.

Shouldn't each concerned individual and establishment grasp the reality, that to do justice to the national and international days/weeks celebrated for our planet or its dwellers, events must be organized in logical and environmentally appropriate ways that do not defeat their very purpose? Simple solutions, like using digital banners, cloth, fabric, or paper banners can initiate the end of the 'Flexible PVC' era. These options are more environment friendly and are biodegradable too.

Are the are high costs and less durability of such safe alternatives reasons enough to continue using the 'plastic dementor', which has already disrupted environmental health in almost every corner of this planet? Can't we make a small beginning for the benefit for our present and future? After all, no rules or penalties will curb this menace unless we get out of our make-believe comfort zone and fight for our home. This Earth is our only home. Since we have sullied it, it is our responsibility to clean it up.

Wealth or Health? I choose the latter. What's your choice? ■

Sushmita Karmakar loves petrichor. She has done her Masters in Biotechnology and Business Administration, and is currently employed as an Information Officer at BNHS-ENVIS.

Bird havens of Navi Mumbai

Text and Photographs: **Sarbasis Dutta**

In megacities like Mumbai, Kolkata, New Delhi, and Chennai, urbanization has taken a direct and indirect toll on the environment. Fortunately, these cities still have some extant green spaces amid their rapid sprawl for us to savour, and for the birds and other animals they support. However, we will have to learn from past mistakes committed in these cities to ensure that such environmental blunders are not repeated in small towns that are expanding, and in the new ones coming up, such as Navi Mumbai.

Navi Mumbai is a planned city on the west coast of the state of Maharashtra. This satellite city was developed in 1972; it has a population of 1,119,477 (2011 census) individuals and is currently considered one of the world's largest planned townships. It was conceptualized to decrease the population pressure on Mumbai and also to construct a new city on the mainland across the harbour. Navi Mumbai's landscape comprises diverse habitats, like urban areas, agriculture, mangroves, creeks, forests, wetlands, and also degraded sites. Each habitat is unique in its own way and is home to numerous birds and other creatures.

Floating vegetation in Lotus Lake after restorative measures were undertaken to mitigate the effects of encroachment

As part of the BNHS project 'Long-term bird monitoring programme in and around Navi Mumbai International Airport (NMIA) in its construction phase', I got to work on the birds of the area and know the Navi Mumbai landscape well. Birds are selected as indicator species for assessing habitat quality, as they are relatively conspicuous, mobile, and easier to survey than other fauna. Here I share my experiences in a few of my favourite bird havens of Navi Mumbai.

Tickell's Blue Flycatcher feeding on insects in thickets of Chapewadi Forest

Chapewadi

My favourite among the bird havens of Navi Mumbai is Chapewadi in Kharghar. This is a forested area with a variety of indigenous and exotic plants, and with rich faunal diversity. It has a refreshing and lively ambience, due to the constant chirping of bulbuls, sunbirds, coucals, ioras, and many others. During the pre-monsoon season, the loud celebration of a Tickell's Blue-flycatcher family on rocky patches is a delight to watch. While trekking through the forested path of Chapewadi, one can hear the sudden rustle of Red Spurfowl as they flee through the fallen leaves, and maybe catch a glimpse of the cryptic Common Quail lurking inside small, dense bushes. One must trek through the forest path to get to the top of a hillock to view the breathtaking cityscape, and also the unremitting hovering of Black-winged Kite looking for food.

Lotus Lake

Situated amid the suburb of Nerul, Lotus Lake is my next most favourite place in Navi Mumbai. It is located just behind the majestic corporation building of Nerul, Sector 27. It is a natural lake full of lotus and a variety of aquatic plant species, which grow in a crumpled mass completely covering the water. This lake supports local migrants and other waterbirds, even in the face of anthropogenic interference. During our wetland surveys, we observed foraging and roosting flocks of Purple Swamphen, intermingled with egrets, cormorants, and Indian Pond-Heron. Common Moorhen, Bronze-winged Jacana, and Pheasant-tailed Jacana, along with their young, were also a common sight. Lesser Whistling-duck and Indian Spot-billed Duck were always busy foraging in the shallow nutrient-rich waters of the lake. It was quite astonishing to watch the undisturbed nesting of Little Grebe on floating vegetation just beside a busy road with high-pitched vehicular traffic.

Green Valley Park

An ideal place in Belapur for birdwatching during the monsoon, Green Valley Park attracts enthusiasts who come here for wildlife photography. The trails connecting Chapewadi and

Little Grebe constructing a nest at the water's edge at Lotus Lake

The migratory Indian Paradise-Flycatcher occupies well-wooded habitats inside Green Valley Park

Green Valley Park with small rain-fed water bodies and the dense green tree cover are soothing and absolutely wonderful. Odd glimpses of the male Indian Paradise-Flycatcher are mesmerizing, as are the Red Spurfowl that camouflage themselves in the bushes. The Red Spurfowl's indecisiveness – whether to conceal itself or to come out – makes it visible to the discerning eye. One can also hear the signature calls of Malabar Whistling-thrush and the constant singing of the tiny Pale-billed Flowerpecker and Greenish Warbler. While watching a flock of Ashy Drongo, one may be lucky to also catch sight of Oriental Dwarf Kingfisher on shrubs near rain-fed water bodies, patiently waiting for a catch.

Kharghar Wetland

Kharghar Wetland is exceptional for its vast expanse, and the rich variety of migratory birds seen here in winter. Part of this wetland, Sector 17, is a continuation of Panvel Creek, with the eastern side bordered by a mangrove patch, and the western and southern sides surrounded by residential complexes. Another part, Sector 25, is a continuation of the inlet of Panvel Creek to the north. The bunds across this wetland divide it into four parts. Of the almost 70 species recorded here, quite a few are winter migrants. Flocks of sandpipers, stints, shanks, godwits, ducks, terns, and gulls – with special mention of Ruff, Eurasian Curlew, Black-tailed Godwit, Northern Pintail, and Gadwall – were observed during the morning and afternoon field surveys. The Near Threatened Painted Stork and Black-headed Ibis are plentiful in this wetland, which serves as their feeding and roosting grounds. The occasional jamborees of Blue-tailed Bee-eater in the adjacent mangroves are enthralling to watch.

Ulwe Mangroves

From Nhava Sheva port to Ulwe, there is a continuous stretch of mangroves surrounding

A flock of Black-tailed Godwit and Curlew Sandpiper at Kharghar Wetland

Intact mangrove habitat adjoins the creek area near Nhava Sheva Port at Ulwe

Communal roosting of Lesser Sandplover and Greater Sandplover at the NMIA construction site

Thane creek, along with some small, intervening wetlands, the Ulwe Mangroves. Many terrestrial and waterbird species were sighted in this area during our seasonal field sampling. There is an abundance of Red Avadavat, Tricolored Munia, and Scaly-breasted Munia in the associated scrub patches and aquatic vegetation of the mangrove area. One can also trail the murmuring of Rosy Starlings in the mangrove area near Nhava Sheva port in winter. Some migratory bird species like Pacific Golden Plover and Grey Plover were also seen in the small wetland patches surrounding the mangroves. Conservation of these areas is important to maintain the populations of mangrove-associated birds and the health of the ecosystem.

Navi Mumbai International Airport (NMIA) area

Last but not least is the proposed Navi Mumbai International Airport (NMIA). Originally, the area was an important green space, home to a myriad resident and migratory bird species. Currently, landfilling and construction work is underway, and the area is almost devoid of natural vegetation except for some remnant grassland patches, and also the mangroves along the Panvel Creek channel just beside the ongoing NMIA construction site. Common Stonechat, Ashy-crowned Sparrow-lark, Desert Wheatear, Isabelline Wheatear, Bluethroat, Blue Rock-Thrush, Black Redstart, and Rufous-tailed Lark still hold on in the remnant grassland patches. Godwits, stints, shanks,

Pacific Golden Plover in areas near Ulwe Mangroves

Land-filling and construction in the proposed NMIA area

curlews, sandpipers, plovers, terns, gulls, egrets, herons, storks, and bitterns are still plentiful in the mangrove associated creek area. Raptors like Black Kite, Black-winged Kite, Osprey, Western Marsh-harrier, Greater Spotted Eagle, and Indian Spotted Eagle were consistently sighted during our regular field surveys, indicating their site fidelity to the area.

REFLECTIONS

From my field experiences in all the bird havens of Navi Mumbai, it is very easy to comprehend the importance of green spaces in cities and towns. In all these bird havens, I observed species-specific traits of bird communities, with their habitat preferences, and also their ability to adapt their behaviour across various habitats. Urban green spaces in Navi Mumbai are of great importance for their social, economic, and ecological values, which include the provision of habitats for birds and other urban wildlife, and potential for community development. These urban spaces are also ideal ground for the development of conservation approaches through social integration by seeking the active participation of local residents and other stakeholders. During our field sampling in the NMIA construction site, we recorded 71 bird species. Our long-term studies on the NMIA site will help to understand the gradual ecological changes in the area and also the need to maintain a suitable habitat conducive to safe flight operations during landing and take-off of aircraft.

To end, a quote from Gifford Pinchot in THE FIGHT FOR CONSERVATION:

"*Unless we practice conservation, those who come after us will have to pay the price of misery, degradation, and failure for the progress and prosperity of our day.*" ■

Acknowledgements

I thank Mr Rahul Khot for his constant support and encouragement. I am grateful to my amazing team members Mahasweta Patnaik and Akshata Karnik for being so professional, and Ashok Pisal for cooperation during the field surveys.

Sarbasis Dutta is a Research Fellow at Bombay Natural History Society. His areas of interest include ornithology, particularly avian behaviour, urban ecology, and conservation biology.

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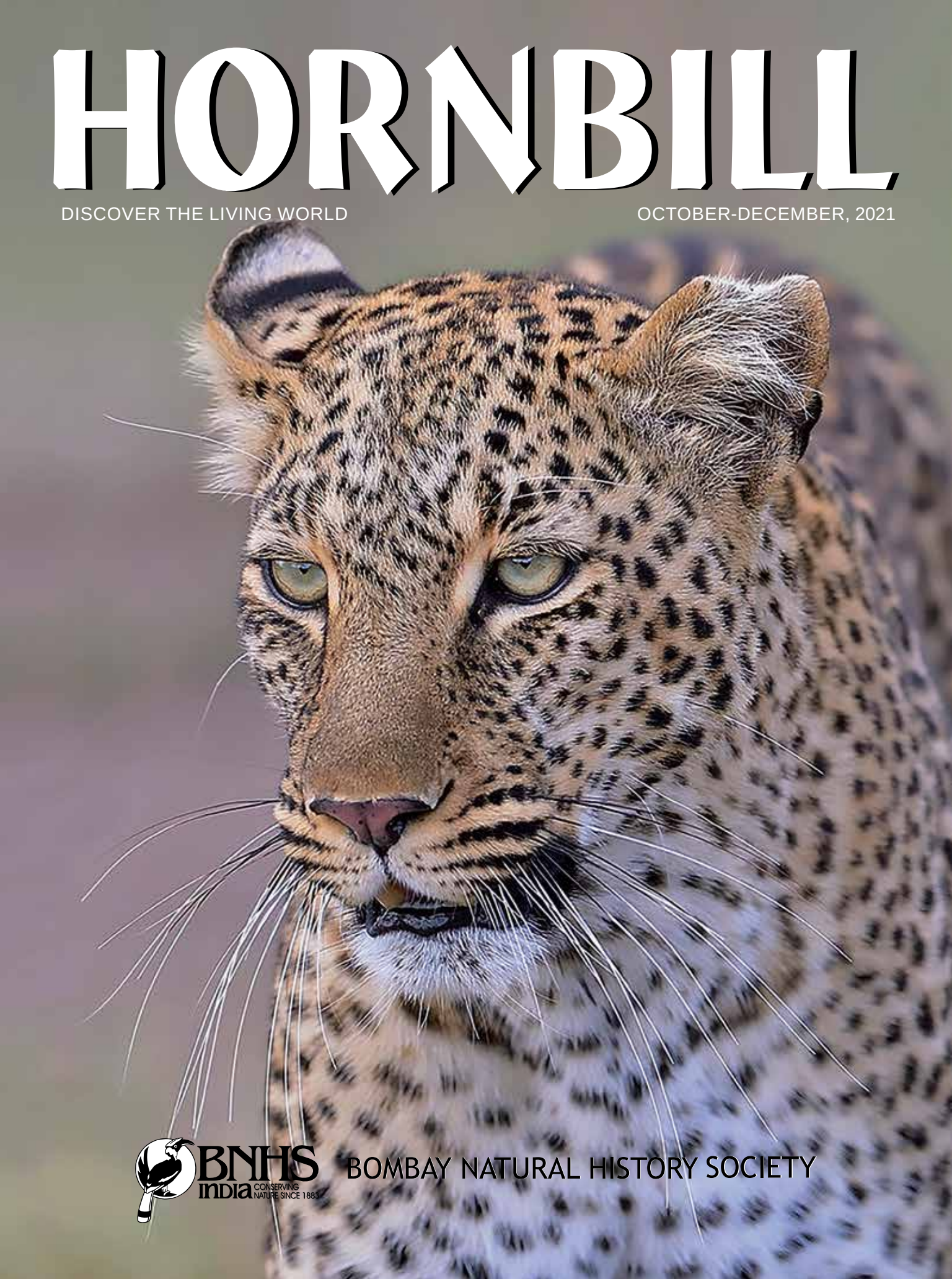

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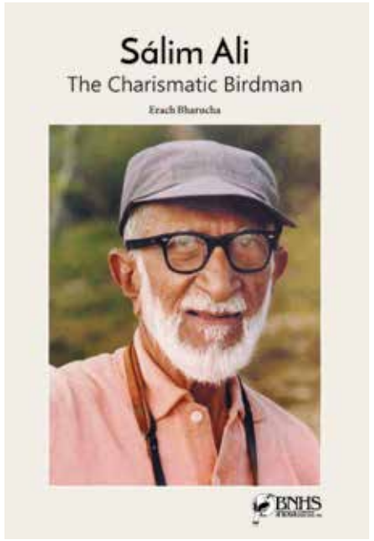

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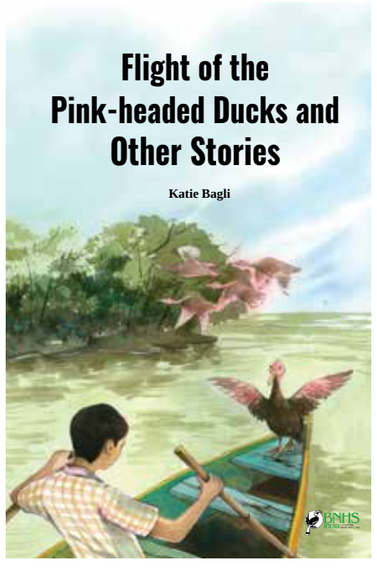

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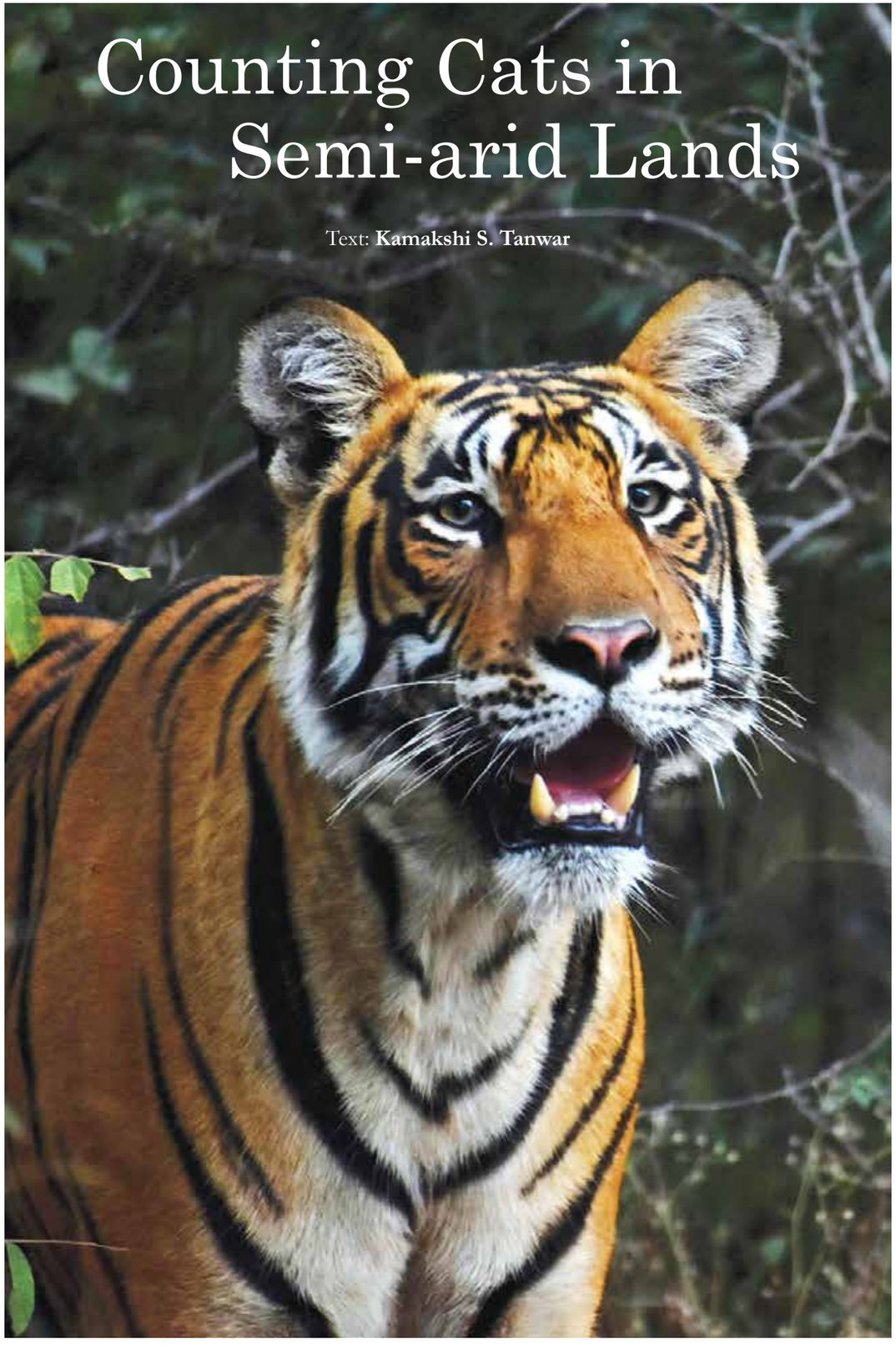
Counting Cats in Semi-arid Lands

Text: **Kamakshi S. Tanwar**



AYAN SADHU

Tigers walk with kingly glory in a land that was ruled by Rajputs and Mughals in the past

Those who are enthralled by the wilderness are, to me, unquestionable in their fervour. For the majority, however, the allure of the wilderness is short-lived, limited to brief trips. My connect with the wild was also limited to such trips, until I got involved in India's 'big cat' count exercise, the All India Tiger Estimation. Since 2006, India rigorously estimates its tiger and co-predator populations, and assesses their habitat status. Trained field biologists and foresters survey the remotest parts of the country to collect field data. The lay person rarely understands the importance of these top carnivores in the forest ecosystem, and the extent of the fallout if we were to lose them. Nevertheless, almost every Indian citizen felt proud when the world's largest camera-trap survey in 2019 reported a 33% increase in tiger numbers in our country. They lauded the efforts of approximately 44,000 foresters and 55 researchers who had just conservation in their hearts; I was one of them too, savouring the same passion.

Estimating the population of tigers and leopards at country-level is a herculean task, because both these felines are elusive, occurring in small numbers, and the estimation process involves studying the factors influencing their presence. This mountainous challenge is faced once every four years, by the National Tiger Conservation Authority and Wildlife Institute of India (WII), Dehradun, in collaboration with state forest departments and WWF. Years of research efforts have established that habitat, prey (food), and human disturbance are the most crucial factors in shaping large carnivore density and distribution.

After joining the project, we were trained at Rajaji Tiger Reserve, where we received in-depth knowledge about the estimation process directly in the field. Here, we were taught by the giants themselves – Dr Y.V. Jhala and Prof. Qamar Qureshi (Principal Investigators of the project), who had conceived this countrywide monitoring programme way back in 2005–2006. Walking through the *rao*s (dry riverbeds) with them, I felt like I was unravelling the mysteries of the jungle step by step, and peeping into the intricate balance of nature. It was here that I learned almost everything that I later applied when we were sent in teams to our respective field sites.

AYAN SADHU

Calm and clandestine, a leopard moves along the trunk of a tree in Ranthambore

Land of leopards awaiting lions

Our first field site was Kuno-Palpur Wildlife Sanctuary, in the remote areas of western Madhya Pradesh. This was the land of leopards, of golden grass and the scorching summer sun. These areas have been described thoroughly in the memoirs of the Mughals and the paintings commissioned by them, particularly Jahangir, an avid naturalist. He has written extensively about the many hunts undertaken by him, mainly of lions. Kuno has historically witnessed the cohabitation of all four big cats of India: tiger, lion, leopard, and cheetah.

The last remaining Asiatic Cheetah was unknowingly hunted to extinction in Madhya Pradesh, India by the Maharaja of Surguja in 1948. Now, only a small subpopulation of this beautiful animal clings to protected areas in Iran. The Asiatic Lion, which had also been subjected to extensive hunting, is now restricted to the Gir lion habitat in Gujarat, with a total estimated population of 600–650 individuals, according to the 2020 Census. Two detailed studies, conducted separately across states, to access suitable habitats for cheetah introduction and lion relocation, recommended Kuno and its environs as the best possible site for both the species. Interestingly, from 1904 to 1915, Maharaja Scindia of Gwalior State [starting in Shivpuri, the site of the present Madhav National Park, Shivpuri, Madhya Pradesh] had hosted a pride of the exotic African Lions on the urging of Lord Curzon. At present, Kuno has only a good population of leopards.

We reached Kuno on May 1, 2018, and spent a few days trying to understand the landscape better. Reconnaissance helped us plan and schedule our work. Our daily early morning ritual was to walk along the transects laid and maintained by the Forest Department to sample the prey abundance available for the big cats. Sampling was undertaken by two persons walking a distance of 2 km (or more) in each transect, and with the help of a range finder and compass, the perpendicular sighting distance and sighting angle of animals observed along the transect were recorded. This exercise required us to be extremely vigilant and silent, so that sauntering animals did not disperse on sensing our presence. Walking the line every dawn, when the jungle is vibrant with life, gives a bit of adventure and loads of learning opportunities. We learnt about the co-dependencies in the wild, the different calls of animals and birds, their behaviour, and how to safely wend our way through the forest. During the walk back, we would identify and count herbivore droppings in a 20 m linear stretch at every 500 m.

KAMAKSHI TANWAR

Once an abode of kings out to hunt them, this 19th century palace in Kuno now serves as a sanctuary for the very same animals

AYAN SADHU

After relocation of villages outside the park, the land once used for agriculture has turned into pristine grassland, with a thriving deer population

While our mornings were spent walking transects, our evenings were for deploying cameras. Broadly, two types of camera-traps are deployed for population estimation. One is for species that can be individually identified based on their unique body (coat) pattern, as in tiger, leopard, and hyena. These cameras are positioned on roads and trails which these animals frequent. Another method is adopted for individually unidentifiable species, such as the prey of these large cats. For this, cameras are placed randomly inside the forest. Camera trapping of prey species was done in India on such a large scale for the first time during the All India Tiger Estimation exercise. Camera-trapping complements the traditional line transect method of prey species estimation, and helps increase the precision of the estimates.

Siyaramji, our field assistant, would always accompany us during our field trips. Growing up in these woods, and having previously worked in conservation projects in the area, he had an excellent knowledge of the wilderness. His village was among the 24 villages that were relocated outside the Park, between 1996 and 2001, to prepare the area for the introduction of Asiatic Lions from Gujarat. The evicted villagers are from the Saharia tribe, one of the most vulnerable tribal groups of India. It has been 24 years since, but there is still no sign of lions on their land. This is because Gujarat, which is justifiably proud of having protected lions for half a century, refuses to part with a few prides to ensure a second population that will secure their future. Now, the villagers cannot help but wonder if they had been evicted from their well-drained, fertile low-lying land to unirrigated and rocky areas for nothing. The promises of lion tourism and the greater good have fallen flat.

Although the summer sun never went gentle on us, the nature of our work kept us motivated. Our base camp was an old forest rest house, perfectly nestled alongside river Kuno, the largest water source for the sanctuary. It was the perfect vantage point to see cheetal guzzling water, alert for looming danger with every gulp, alongside Indian Peafowl and Oriental Darter. In the evenings, we revelled as the leafless forest came alive with the echoing rutting call of the cheetals – love was in the air for them! At night, if one was lucky, one could hear the civets noisily nibbling on *Cassia fistula* pods that had fallen from a nearby tree. The dinner table was surrounded by our excited chitter-chatter, as we exchanged the day's experiences.

Where tigers roar

As soon as sampling in Kuno was completed, instructions came for us to head to Ranthambore National Park, a 6-hour drive from Kuno. Setting up the base camp, we zealously awaited our next escapade in the realm of the tiger. Networking connected to our colleagues, who were based as far away as Dibang in Arunachal Pradesh and as far south as Periyar in Kerala, providing us with an opportunity to share experiences from the various tiger habitats.

Tigers have been killed indiscriminately throughout history in India, and Ranthambore being a former royal hunting ground, has its fair share of killing of tigers. However, the real decline in their population occurred after the emergence of small monarchs. This opened the forests to hunting by the locals, who wanted a taste of this royal habit. During this time, it was customary for forest officials to shoot a tiger after being recruited, and before being promoted! Some of these officials later transformed into great tiger conservationists. Earnest efforts at conservation began in the 1970s with a ban on shooting with the passing of the Wildlife (Protection) Act, 1972 followed by the launching of Project Tiger, and demarcation of tiger reserves in 1973. These efforts bore fruit, and tiger number surged all over the country. But around 2004, it was revealed that parks such as Sariska and Panna were left with no tigers. Inadequate protection and management was identified as the reason for this tragedy. This led to the formation of the Tiger Task Force, and highlighted the need to estimate tiger populations scientifically and robustly. With reintroductions and good protection and management, tigers are now back in these two sanctuaries.

Although people flock to Ranthambore to see the tiger, there are other stunning species, like Striped Hyena, Wolf, and Caracal that call it their home. Interestingly, Colonel Kesri Singh mentions having hunted Dhole in Ranthambore in his book ONE MAN AND A THOUSAND TIGERS published in 1959, which are now mainly restricted to national parks in central and south India. In 2019, park officials were thrilled to sight and photo-capture an entire family of Smooth-coated Otter for the first time, increasing the known mammalian diversity of the park. And so, despite a lot of mismanagement in the past in Ranthambore, a lot has been done to recover the losses.

AYAN SADHU

Researchers calibrate the camouflaged camera-traps that are designed to automatically photograph any passing animal

On the first day, we rose at daybreak and headed for the forest. Once in its confines, we were compelled and charmed by the uniqueness of the place: Cheetal dawdling near the beautiful lake, Sambar wallowing, the craggy cliffs, and the huge fort silhouetted atop a hillock. The old ruins of a bygone era, scattered throughout the jungle and smothered with roots, add to the beauty of Ranthambore, a photographer's paradise. Capturing a tall sturdy tiger against the backdrop of a dome or arch in the glistening twilight, is every photographer's dream. After initial exploration, we dived into our carefully choreographed routine of walking transects in the morning and deploying cameras in the evening.

RAJPAL SINGH

Amidst the natural heritage, Ranthambore National Park has numerous architectural ruins that add to the picturesque views

Ending notes

Treading the trail in tiger country is very different, as had been told to us during our training. We slowly acquired this skill from the dedicated old forest guards and trackers who have spent most of their lives working and patrolling the forest on foot, a trait missing in the new recruits. Physical and mental endurance is not necessary to study science, but field biology requires both. Our daily challenges included negotiating with logistics and the arduous terrain, navigating safely through the forest, and a struggling vehicle on a muddy road. And after the field trips, back in WII, the researchers sort out and analyse the data to arrive at estimates of tigers, its co-predators, prey populations, and information related to forest cover and human disturbance. Family obligations come under strain and their concerns elevate during months spent apart without network.

In July 2020, India's All India Tiger Estimation project bagged the Guinness world record title for being the largest camera-trap wildlife survey ever conducted. The 2018-19 survey found that the tiger population had increased in India. In fact, India had managed to achieve the target set in 2010 by The Global Tiger Forum, an international collaboration of tiger-bearing countries, of doubling the number of wild tigers in the wild by 2022, four years earlier. But does that mean all is well? Do tigers need only numbers to survive? What will happen when larger numbers of tigers are pushed to occupy smaller spaces? ■

Kamakshi S. Tanwar is a wildlife conservation enthusiast who worked as a research biologist in the All India Tiger Estimation – 2018.

Big Cat Survey

Tigers wander over a large geographical expanse; therefore their habitats are divided into five major landscapes for the purpose of the survey: (i) Shivalik hills and Gangetic plains, (ii) Central India and Eastern Ghats, (iii) Western Ghats, (iv) North-eastern Hills and Brahmaputra Flood Plains, and (v) Sundarbans.

Phase 1: The Forest staff along with researchers and volunteers survey each beat over a few days, to collect data of carnivore signs, tiger prey abundance, dung counts, etc. This information is fed digitally into a specially designed application with the GPS locations of the observations.

Phase 2: All the data collected during Phase 1 is analysed to model the tiger occupancy within the habitat with the environment's characteristics and human impacts.

Phase 3: Camera traps are placed strategically in the sampling area to maximize the possibility of photo-capturing tigers and leopards. Cameras are installed in pairs to capture both sides of these carnivores, each of which have a unique pattern of stripes or rosettes. Scat samples are collected for genetic sampling simultaneously in areas where camera trapping is not feasible.

Phase 4: All the data collected during Phase 3 is analysed using an image processing software designed to organize and geo-tag the photo-capture. Pattern recognition programs are used to identify individual tigers and leopards. This method is highly credible, as each animal counted has been captured on the camera traps.

Challenges Confronting the Gentle Giants in NAGALAND

Text: **Prajna Paramita Panda**

Lying in the hills and mountains of the northeastern part of the country, Nagaland is home to diverse indigenous tribes and vibrant cultures. Spread across an area of 16,579 sq. km with 1,148 villages and a population of 19.76 lakhs, the state has a forest cover of 77.62%, of which 88% is owned by communities. The state harbours approximately 2,431 plant species, including 396 species of orchids, more than 490 species of birds, and a variety of other animals, including the largest mega herbivore, the Asian Elephant.

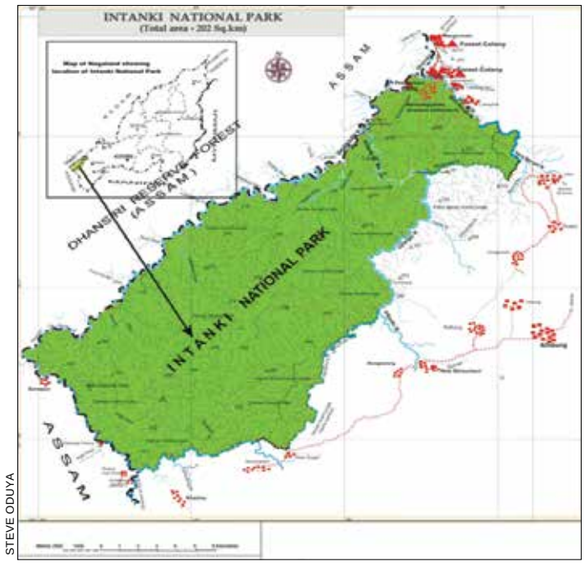
In the early 90s, Asian Elephant habitat in Nagaland stretched from Peren district in the south, all along the foothills to the northwest, till it entered Tirap district in Arunachal Pradesh. This traditional contiguous stretch is now heavily fragmented, with isolated pockets of elephant-bearing areas, which are no longer connected with each other through corridors. At present, the elephants are mostly distributed in six districts, namely Peren, Wokha, Zunhebeto, Mokokchung, Tuensang, and Mon, spread across an area of 2,047 sq. km. The average population of elephants in Nagaland was estimated at 169 individuals during censuses carried out from 1993 to 2012. However, in 2017, an all India synchronized Asian Elephant population count estimated a total of 446 elephants in Nagaland, with an elephant density/sq. km of 0.45, which is the second highest in India after Karnataka.

STEVE ODUYA

The traditional contiguous elephant habitat in Nagaland is now heavily fragmented, resulting in isolated pockets that are no longer connected with each other

PRAJNA PARAMITA PANDA

The Dhansiri river is a natural border between Intanki Elephant Reserve and Dhansiri Reserve Forest, which together provided a contiguous habitat for the migration of elephants



STEVE ODUYA

Intanki National Park is considered one of the best protected area in the North-east

The threats to elephant conservation in Nagaland are mainly habitat fragmentation, hydroelectric and irrigation dams, commercial plantations, customary rights regarding land ownership, crop raiding by elephants, poaching, insurgency, and lack of awareness among people. Besides the distribution of the elephants in the two elephant reserves of the State – Intanki and Singphan, the species is more abundantly found in the district of Wokha, which was once contiguous with the forests of Assam. The interface of humans and elephants in these three major habitats of Nagaland vary, so pragmatic planning and management strategies need to be adopted for the conservation of elephants in the state.

Intanki Elephant Reserve

In the late 1990s, the elephants in Nagaland were largely confined to Intanki Reserve Forest,

PRAJNA PARAMITA PANDA

Intanki Elephant Reserve holds a significant part of the elephant population of Nagaland

which is contiguous with Dhansiri Reserve Forest of Assam. The two reserve forests, separated by a natural border, the Dhansiri river, provided a contiguous habitat for the migration of elephants across the two states. Considering the long-term ecological importance of the area, the State Government declared the Intanki Reserve Forest (202 sq. km) a wildlife sanctuary in 1975 with the name Ntangki Wildlife Sanctuary, and subsequently as Intanki National Park in 1993. Having a significant threshold of the elephant population of the state, the state declared Intanki as its first Elephant Reserve in February 2005.

Intanki Elephant Reserve, due to its contiguity with Dhansiri RF, and being surrounded by the Tuilong and Intanki rivers, is one of the best habitats for elephants in Nagaland. The reserve not only boasts of good vegetation, but also maintains the traditional migratory routes of elephants towards Dhansiri RF. However, the Park has become disconnected with other elephant areas in Nagaland due to human disturbance and settlements. Due to increase in human population and shifting cultivation, and increase in area of cultivation in the fringe areas for the last few decades, this landscape is facing severe biotic interference, resulting in habitat fragmentation and loss, and increasing human-elephant conflict. The elephant habitat is now confined to a narrow strip along the north-western border at Intanki Elephant Reserve.

A major conservation challenge to this reserve is the demand of land by the insurgents of the Nationalist Socialist Council of Nagaland (NSCN) to set up their camp at Hembron that borders Intanki Wildlife Sanctuary. Once a residential colony of the Forest Department, the area is now occupied by the NSCN, which runs a parallel government from the offices at Hembron. As elephants disperse out of the reserve from time to time, sporadic incidents of damage to crop plantations and destruction of huts occur in the bordering villages of Khelma, Sailhem, New Nkio, Daniel, Jalukiekam, and Jalukie Zangdi.

Singphan Elephant Reserve

The only other protected area that lies contiguous with the forests of Assam is the Singphan Elephant Reserve, the smallest such reserve in India. Declared as the 30th elephant reserve of the country in August 2018, Singphan ER is situated in the Mon district of Nagaland. Spread across 23.57 sq. km, this reserve is strategically located in contiguity with the Abhaypur Reserve Forest of Assam, so it facilitates the movement of elephants across both the states. The Singphan ER is demarcated from the reserve forests of Assam by natural boundaries, and elephants are regularly known to migrate across the states.

PRAJNA PARAMITA PANDA

Singphan Elephant Reserve juxtaposed with a tea garden in Assam

PRAJNA PARAMITA PANDA

The strategic location of Singphan Elephant Reserve facilitates the movement of elephants across the states of Nagaland and Assam

The major threats faced in Singphan Elephant Reserve are illegal felling of trees, hunting, and illegal fishing. A 14 km road cuts across the reserve, but serves as a lifeline for the seven fringe villages (Lower Tiru, Upper Tiru, Oting, Namthai, Hotahoti, Maiching, and Vapnyu) located outside Singphan. This road also is used for transportation of coal from the mines located outside the Elephant Reserve in Lower Tiru and Vapnyu. The road, however, remains closed from 6:00 p.m. to 6:00 a.m. due to security reasons.

Wokha District

Wokha district, which holds more than 50% of Nagaland's elephant population, is known as the land of plenty. Baghty / Akuk-Mekokla elephant range in Nagaland was once an extension of the Kaziranga-Karbi Anglong foothills of Assam,

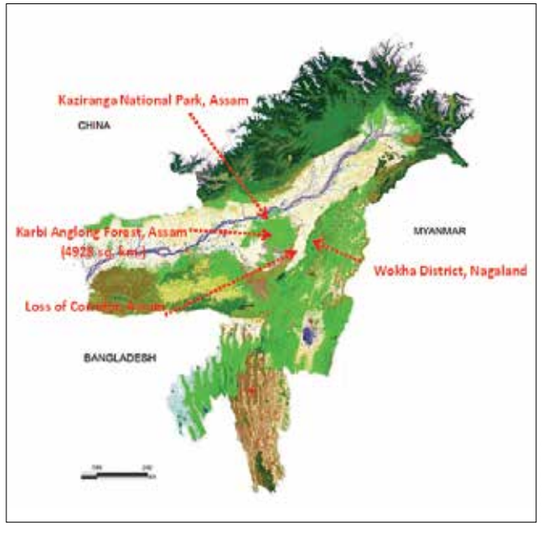
STEVE ODUYA

Since most of the forest wealth in Nagaland is not under the control of the government, the onus of conservation and protection of wildlife rests on the communities

PRAJNA PARAMITA PANDA

Wokha district is known as the land of plenty as it holds more than 50% of Nagaland's elephant population, and hence also the epicentre of intense human-elephant conflict

traditionally a habitat for migrating elephants. Intact forests are still found in Assam in Nambor Reserve Forest of Golaghat district, which shares its borders with the north-western part of Wokha district. In the past, elephants migrated across Wokha and Assam without any hindrance. But with increase in human settlements, tea estates, and other factors, elephants now cannot move back to Assam and remain trapped in Wokha. The elephants that were earlier confined to Baghty valley of Nagaland are at present in almost all areas of Wokha.



STEVE ODUYA

The Kaziranga-Karbi Anglong foothills of Assam were once a habitat for migrating elephants

Wokha is the epicentre of intense human-elephant conflict, with a total of 53 villages (covering more than 1,225 sq. km) severely affected. Traditionally, Nagas are hunters and gatherers. Besides rare instances of killing elephants in retaliation, with the meat shared among communities, poaching of elephants for tusks is uncommon in Nagaland.

Challenges to conservation of elephants are myriad in a state like Nagaland, with provisions of Article 371A upholding the Naga customary law and procedure. Though the state has a forest cover of 77.62%, 88% is owned by communities. With most of the forest wealth not under the control of the government, the onus of conservation and protection of wildlife rests on the communities. But in spite of the complexities of social and racial norms, all hope is not lost. The people in Nagaland are coming forward to get their lands declared as community reserves. There are 112 such community reserves in Nagaland, of which six are in Wokha district. Changpang Community Reserve of Wokha was declared this year. This perhaps reinforces my strong belief that living with elephants is not an impossibility in today's world. ■

Prajna Paramita Panda is the National Coordinator of the Elephant Cell, Project Elephant Division, at the MoEF&CC.

GENERAL BIPIN RAWAT

PVSM, UYSM, AVSM, YSM, SM, VSM,
ADC Chief of Defence Staff of India

BNHS has had a proud tradition of working alongside the Indian Army for biodiversity conservation and outreach. It was therefore a privileged moment for us when the Late General Bipin Rawat, PVSM, UYSM, AVSM, YSM, SM, VSM, ADC, Chief of Defence Staff, agreed to visit Hornbill House on November 14, 2021. The visit was yet another move towards cementing this collaboration.

During his address to the gathering at Hornbill House, General Rawat said "It is a privilege to be here today among the passionate ecological warriors and experts in this field, and of course we have the iconic Sálim Ali who was a bird conservationist, who did great wonders, and we need to pay tribute to him. I am honoured to be present here at a time when environmental concerns the world over are being looked at from a different prism." On the role of the Indian Army in conservation, he stated: "We have raised eight eco task force territorial battalions for preservation of the environment. Starting from 1982, we planted six crore saplings keeping local biodiversity in mind, and reclaimed 70,000 hectares of degraded land. Limestone quarrying had devastated the hills of Mussoorie in Uttarakhand, and these have been restored, along with places in Andaman Islands, Western Ghats, and Indo Gangetic Plains."

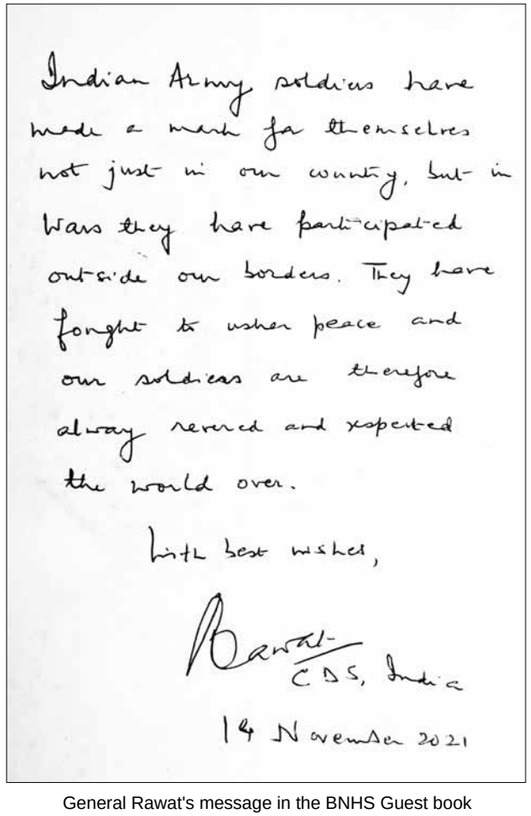
General Rawat elaborated further: "Security is not just about national security and security of our borders and hinterland, it is about security of our energy issues … If the environment degrades, you will run short of energy sources, your population, your food related issues, and

A memorable visit: Rawat addressed a gathering and saw the BNHS Collections during his visit to Hornbill House

of course, all that will affect your economy, and … will finally lead to civil strife. So to prevent civil strife in the country, we have to make sure that we ensure the safety and security of our environment. But in doing all this, we have a very long road ahead."

He spoke about the efforts being made by the Indian Army to put conservation into action in their own practices. This includes paperless e-office practices and reduction in the use of fossil fuels. DRDO (Defence Research and Development Organisation) is working on many projects, such as developing bio-digester technology-based toilets for the Metro, wherein the waste is completely recycled and there is no damage to the environment. In 2019, from the Siachen glacier alone, Indian Army personnel lifted 150 tons of trash, a lot of which could be recycled, like cardboard cartons and cans.

He spoke about Chilika, where the Olive Ridley Turtles come to breed. These are being protected by our Navy and the Army Air Defence Centre, based in Chilika, which helps the turtles to return to the waters.



Indian Army soldiers have made a mark for themselves not just in our country, but in wars they have participated outside our borders. They have fought to usher peace and our soldiers are therefore always revered and respected the world over.

With best wishes,

Rawat-
CDS, India

14 November 2021

General Rawat's message in the BNHS Guest book

In order to forge a working collaboration with BNHS, General Rawat said: "I am very happy to visit BNHS – we are committed to protecting environment and ecology. We will provide impetus to the project of Indian Armed Forces and BNHS. We will seek expertise from BNHS." He expressed his pleasure at being in a building called Hornbill House, and was reminded that during his posting in Nagaland, the hornbill was an iconic bird, but there were hardly any hornbills remaining, so he had called upon the local people to refrain from killing these birds.

He spoke about the migratory Amur Falcon, which stops over in Dimapur, on the way to South Africa from eastern Siberia. There was a time when the Nagas would kill these small birds, which came in flocks. But he saw a very happy situation later in 2015–16, when he found the Nagas protecting the Amur Falcons, and was glad to find that BNHS had been collaborating on the ground in the awareness campaign that brought about this change.

Extending an invitation to BNHS, he said: "Please visit our forward areas – we may even discover new species." Accepting this invitation, Dr Bivash Pandav, Director, BNHS said: "BNHS is famous for describing new species – through scientists and our journal, *JBNHS*. We heartily accept the invitation to survey remote areas. We would like to survey such remote corners and describe new species, and establish intellectual authority on our own land."

It was, therefore, with deepest regret that BNHS received the sad news of the passing away of General Bipin Rawat in a tragic helicopter crash on December 08, 2021. General Rawat was a true patriot, who occupied the highest position in the Indian Armed Forces as the first Chief of Defence Staff, in which capacity he greatly contributed to modernising our armed forces and security apparatus. The Society extends its heartfelt condolences to the Rawat family on the untimely demise of General Rawat and his wife Mrs Madhulika Rawat, and also to the families of the 14 other personnel who lost their lives.

It was well-known that General Rawat had a particular interest in wildlife and environmental conservation, which he so eloquently expressed when he was with us on November 14. We shall always remember his inspirational words: "Environmental conservation is patriotism in action." BNHS is determined to take General Rawat's ideas forward, to join hands with the Armed Forces for ecological patriotism and wildlife conservation, in the best traditions exemplified in him. ■

In the field with Dhanbad Birders

During my nature trips in Jharkhand, I noticed that areas on the outskirts of Dhanbad city would be of interest to upcoming birders. I spoke with the local people, and things started shaping up. I put together a group of passionate youngsters, who were excellent at bird identification, to help encourage other youngsters to watch birds and appreciate nature. We christened the group Dhanbad Birders; most of our members are former research biologists from Wildlife Institute of India. To accomplish the group's objective, I placed exhibits near schools with eye-catching images and thoughtful observations by well-known birders and naturalists like Carol Inskipp, Dhritiman Mukherjee, and Richard D'Souza (ex PCCF Goa). Next, I kept a lookout for suitable areas for birdwatching.

In the last one year, we have visited almost all the areas around Dhanbad for this. The habits of birds play a crucial role in identifying the habitat one should visit to see them. For example, Purple Swamphen loves to run on floating vegetation, while shallow wetlands attract ducks, egrets, and herons. This I have learnt from nature camps organized by BNHS, and by interacting with other nature enthusiasts.

At Bhelatand village, which is about 7 km from Dhanbad Railway Station, we spotted 24 species of birds in a short span, in a very small area with mixed vegetation. This number was far more than we had hoped for. Dhanbad Birders visit this area regularly. One can spot three species of doves and mynas, and Rose-ringed Parakeet at any time of the day, but to watch prinias, you need to be there in the early morning hours. We look for areas with mixed vegetation, as they would tend to have a greater variety of birds.

While travelling by train to Kolkata, I had seen one such site, near the Khodra railway halt, about 7 km by road from Dhanbad. It had small plants, creepers, and tall trees, like Kadam *Neolamarckia cadamba* and Peepal *Ficus religiosa*, and also a small grassy area that would be ideal for munias, since they feed on grass seeds. I decided to visit this place with my group. Before reaching the site, I had shared with the boys a list of the birds that we would probably encounter. We saw all of the likely sightings – 45 species in a 4 sq. km area, but the greatest sighting for me was that of a group of Yellow-wattled Lapwing, as in my 30 years of birding, I had never seen 12 birds together. I have seen hundreds of Red-wattled Lapwing, but the Yellow-wattled Lapwing only thrice in the last three decades; the highest count was seven birds seen from a distance on the outskirts of Vedanthangal Bird Sanctuary, Tamil Nadu during a BNHS trip.

So far, we have identified two sites for future birding adventures in the Dhanbad environs, but we are hopeful of discovering at least five more good birding sites in the area, which will be duly explored by Dhanbad Birders. ■

– A.K. Sahay
Dhanbad, Jharkhand

Acquaintance with a turtle

On the morning of June 14, 2021, I was walking, as usual, on a jogging track in the TIFR Campus in Mankhurd, Mumbai, when I noticed a shell that appeared much bigger than that of a snail. I stopped to observe it, and noticed a head and four legs coming out of the shell, and was extremely surprised and elated when I realized that it was a turtle! I had never seen a turtle in my colony, and most importantly, never one at such close quarters. I rushed home to get my camera. By the time I returned, the turtle had moved just a few steps. It had pulled its head and legs inside its shell, possibly because it heard my footsteps. I kept calm and photographed it.

The turtle was the size of my palm; it was possibly a juvenile. It appeared moist, though there was no rain at that time. The shell was dark brown with black hexagon-like patterns, and it looked like a leather pocket; its glossy olive-green head had straight black lines. The feet were blackish and had four sharp claws. The turtle's eyelids were turned outwards, and its snout appeared like the nose of a pig.

I had attended lectures by Dr Varad B. Giri on 'Understanding Snakes' and 'Taxonomy of Snakes' conducted by BNHS in May 2021. After I came home, I

wrote to him, asking for assistance to identify the turtle. He replied promptly and told me that I had seen the Indian Softshell Turtle that morning. He also shared a pdf file of Fahmeed Hanfee's A WWF-INDIA FIELD GUIDE TO FRESHWATER TURTLES AND TORTOISES OF INDIA, which has details about the different species of turtles and tortoises in India.

I searched for more information about the turtle on the internet and learnt that its food includes leaves, flowers, fruits, grasses, snails, insects, and fragments of dead animals. A vulnerable species, the Indian Softshell Turtle is poached for food and needs protection. I feel lucky to have such interesting biodiversity around my home. We visit so many places like zoos and national parks to see animals and birds, but if we start looking around, we will find them in our backyards. ■

– Sayuri B. Chandanshive (Std VIII)
Anushaktinagar, Mumbai

ABOUT THE POSTER

DHRITIMAN MUKHERJEE

Green Sea Turtle *Chelonia mydas*

Green Sea Turtles are the largest hard-shelled marine turtles in the world, growing up to 1.5 m in length, and tipping the scales over 300 kg. Their range extends throughout the tropical and subtropical seas, with two distinct populations in the Atlantic and Pacific oceans. They are also found in the Indian Ocean.

The upper side of the smooth, heart-shaped carapace varies in colour from brown to dark olive, grey, or black, depending on its habitat, while the underside is yellowish-white. Unlike most other sea turtles, adult Green Sea Turtles are herbivorous and prefer sea grasses and algae, resulting in the greenish colour of the fat beneath their skin, which lends them their name. Juveniles are omnivores, and feed on small invertebrates, algae, crustaceans, and molluscs, among other items.

Green Sea Turtles reach sexual maturity between 20 to 50 years of age. They are known to migrate long distances between their feeding and nesting sites, some swimming more than 2,600 km to reach their nesting grounds. To lay their eggs, they often return to the same beach where they hatched. In late spring and early summer, the males arrive at the breeding grounds – usually in shallow waters close to a sandy beach where the females will lay their eggs – and wait for the females to reach. While males are capable of mating every year, females mate only once every two to four years.

After mating in the water, the female moves to a sandy spot above the high tide line, where she digs a hole 28–56 cm deep with her hind flippers, deposits her eggs, and covers up the nest. Clutch size ranges between 85 and 200 eggs, depending on the age of the female. This process takes about an hour to an hour and a half. After the nest is completely covered, she returns to the sea. The female can lay eggs three to five times in one season. The eggs hatch after about two months. The hatchlings face a gauntlet of predators, including crabs and seagulls, as they make their way into the sea. If they can survive this dangerous run, Green Sea Turtles can live from 80 to 100 years.

Green Sea Turtles are listed as Endangered by IUCN, and their numbers are decreasing. They are protected by a variety of national and state laws and international treaties, but hunting of live turtles and harvesting of eggs remains a major threat as such legislations fail in implementation. Bycatch (the accidental entanglement in fishing gear such as gillnets or shrimp trawling nets) is responsible for hundreds of thousands of turtle deaths and injuries each year. In addition, oceanic pollution and marine debris have been known to disturb and disrupt migration patterns. Vehicular traffic, development of beaches, and lighting around nesting regions disturbs the hatchlings, which crawl towards the light rather than to the ocean. Rising sea temperatures from climate change also affect turtle populations, since the incubation temperature of eggs determines the sex of the developing embryos. ■

Green Sea Turtle *Chelonia mydas*

DHRITIMAN MUKHERJEE

Bring Colour into Your Life

Text and Photographs: **Rajat Joshi**

Butterflies have always attracted people with their astonishingly striking colours and movements, and are possibly the most globally popular among insects. They are essential pollinators, as are bees, and an important link in the food web. India has huge butterfly diversity, constituting more than 1,400 species, which are distributed across various habitat types. A number of butterfly enthusiasts document these winged jewels through the year from all parts of the country. Here I discuss a few ways to attract butterflies to your own backyard or balcony garden.

Lime Swallowtail on Periwinkle

Provide a sunny site: The most important aspect of a butterfly garden is sunlight. Butterflies, like all insects, are ectotherms, i.e. they cannot regulate their body temperature internally. If you have spent time observing butterflies, you would have seen them basking in the sunshine to warm their bodies. So, when you plan your butterfly habitat, plant your floral sources in the sunniest areas of your backyard or balcony. Pay attention to the seasonal changes, too. The best site is one that gets loads of sunlight throughout the year, not just in the summer months.

Go native: Butterflies have co-evolved with the flowering plants they depend on. That is why your garden should have plants native to your geographical region. An ideal butterfly garden would be the right combination of colourful nectaring plants for the adults and host plants for the caterpillars. Introducing common host plants like lemon trees and curryleaf (for Lime Butterfly and Common Mormon), Passionflower (for Tawny Coster), English tamarind (for Common Grass Yellow) and rattlepod bushes and turnsoles (attract all the male milkweed butterflies like Crows and Tigers seeking essential alkaloids), can definitely up your chances of a female butterfly choosing your garden to lay her eggs.

Nectaring plants: The key to attracting butterflies is nectar, and lots of it. Grow the right variety of nectaring plants to attract these beauties to your doorstep. Include some wild flowers like coat buttons or wild pink lantana which never fail to attract butterflies. White lady's lace, marigold, cosmos, periwinkle, Mexican sunflower, and verbena, which can all be grown from seeds, are great favourites. Milkweed butterflies prefer poinsettia nectar. Plan the garden so that flowers bloom in sequence to attract butterflies for a longer time. Plant a diversity of flowers in your butterfly garden. Try to pick different flower shapes, colours, and sizes to meet the needs of the butterflies you wish to attract. Large butterflies like swallowtails prefer large, flat flowers that

Common Grass Yellow on snakeweed

Plain Tiger caterpillar feeding on milkweed leaves

provide them a good-sized landing area. Smaller butterflies like hairstreaks have a short proboscis and cannot drink from the deep nectaries of large flowers. Tiny flowers are their favourites, as they can perch and feed on one flower after another without leaving the cluster.

Colours matter: Butterflies are good at discriminating colours in their surroundings. They are attracted to red, orange, violet, and yellow. But butterflies are nearsighted. This means that while they can see quite well from a short distance, most things further away appear blurred. So, if space permits, you should plant your nectar plants in masses to attract more butterflies.

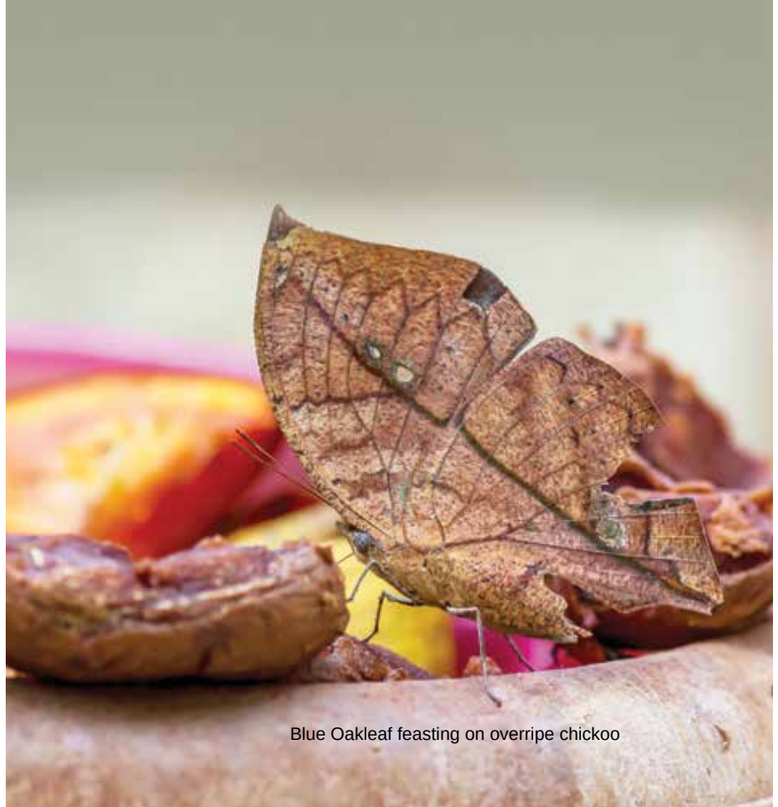
Juice it up: Another interesting way of attracting butterflies, apart from nectar, is overripe fruits. The strong odour emanating from them attracts butterflies that feed on the sugars in the fruit. Butterflies of family Nymphalidae (brush-footed butterflies) are known to feast on banana, orange, pineapple, guava, watermelon, and chickoo, among others. Set up a plate or tie a wire basket of overripe fruit to a tree at a height to attract these winged beauties. Common Nawab and Tawny Rajah are, however, enticed neither by flowers nor by fruits. It takes a rotting crab or prawn to draw them out.

Ensure an insecticide-free environment: Avoid applying insecticides to your plants, instead grow herbs and shrubs which naturally repel pests, like petunia and marigold. Keep a look out for pests in the garden, and if they reach a point where you must intervene, try the least toxic methods of control first – biopesticides.

Adopt the basic practices described above to attract a variety of these flying jewels to your garden, and bring colour and life into it. ■

Rajat Joshi is a student of M.Sc. Environmental Sciences. He is passionate about Ecology and study of pollinators, especially butterflies.

Common Mormon female on West Indian Jasmine



Blue Oakleaf feasting on overripe chickoo

Exiled in the WILD

Text and Photographs: **Gobind Sagar Bhardwaj**

After a brisk morning walk, I was reading the newspaper and enjoying my morning tea, when Salim, my driver, came to inform me that the leopard of Dantala Kund, a village *c.* 20 km from the district headquarters of Pratapgarh, Rajasthan, had been trapped in a cage that was installed to capture it.

Earlier, two villagers had been injured and hospitalized after a leopard attacked them inside a degraded forest adjoining their village Dantala

Kund. Further to this, I received a memorandum from the villagers to capture and to translocate the animal. There was also mounting pressure from the district administration and media to quickly take up the issue. A visit to the village, and conversations with the residents, revealed that the leopard was not a man-eater and had never harmed anybody before this attack. In fact, the two villagers who had been attacked while grazing their livestock in the adjoining forest had seen the leopard on a cow kill, and pelted stones at it, which resulted in the attack. My efforts to placate the villagers failed. "We cannot live peacefully with this animal around," was the clear and collective verdict of the villagers.

Finally, I ordered my staff to place a trap cage for the leopard, but instructed them to angle the cage in such a way that the animal would not get trapped. Two days passed in peace, but the villagers soon caught on to our trick, and a few wily villagers not only readjusted the trap but also put a live bait in the other compartment of the cage, to lure the elusive cat. The trick worked and on June 29, the feline walked into the trap.

I took off for the village immediately; the Assistant Conservator of Forests Veerpal Singh Rana and other field officers were already on their way. Meanwhile, the Superintendent of Police messaged to inform that hundreds of people were gathering to see the leopard. Within half an hour, we were in the village and the scene there was no less than a village fair. The small hillock, where the cage was placed, was thronging with hundreds of people from the adjoining villages too. It took us 10 minutes to climb the hillock, pushing our way through the crowds.

I could hear the growls of the animal reacting to this incongruous situation. The cage was covered with leaves, an attempt by my staff to protect the animal from further trauma of seeing the crowd; but their efforts were in vain as the inquisitive villagers kept lifting the leaves to look at the trapped animal. Every time someone touched the cage, the enraged cat banged on the iron bars, with a thunderous roar,

The dog kept as bait in one chamber of the trap cage looks wary of the leopard ensnared in the adjacent chamber. Dry branches of *Butea monosperma* with intact foliage were placed to camouflage the trap

The trapped leopard was covered with bed sheets to avoid visual interface with the villagers to reduce its stress. All forest divisions should have a capture and transportation cage available to deal with such situations

creating panic in the crowd. It was a female leopard; she had hurt her forehead and nose by repeatedly banging at the cage, and had broken two claws because of her continuous clawing on the cage.

We needed to bring the trapped animal down the hillock to the vehicle for translocating her. The crowd was pushed back and the cage was covered with dhurries (matting) and bed sheets, and was slowly and cautiously dragged 300 m down the bouldery slope of the hillock, which took around an hour. This one-hour journey must have been traumatic for the leopard. The cage was ultimately placed on a Canter and we started for Aarampura in Sitamata Wildlife Sanctuary, around 100 km away from the capture site. At Aarampura, before releasing her, we tried to feed her a few pieces of meat. The leopard ate a morsel or two, but out of rage and frustration, not hunger, as we could tell. On the gate of the cage being lifted, she jumped out and vanished into the thick woods.

We had successfully translocated the animal, but my mind was groping for answers. Would she get over the shock of relocation? As Sitamata WLS (though highly degraded) is the only protected area in the district of Pratapgarh, we chose to relocate the leopard here. What would she eat here? Sitamata WLS is more or less devoid of a suitable prey base for such large carnivores. In the last two and a half years, despite my repeated visits, I have not seen any quadrupeds except jackals, langurs, and the occasional Striped Hyena. Despite this, Sitamata WLS, which bears more than 400 sq. km of beautiful forest, is said to have 35 leopards (if we go by the census figures). This would suggest that most of the leopards depend on domestic livestock, feral cattle, and stray dogs from the villages which lie in the sanctuary or on its fringes.

Even if this leopard were to surmount all odds, and land up again in the same situation in her new location, then what next? The answer to these

The leopard snarled and charged against the bars as people approached the trap, injuring itself

The final leap: The trapped leopard was released in Sitamata Wildlife Sanctuary

and many such questions is not possible unless we monitor the leopard. Unlike identifying tigers in the wild (through their stripe pattern, besides other noticeable features), identifying leopards is not easy, and the only option is radio-collaring or satellite tracking.

In Pratapgarh region, with dense forest spread over 1,350 sq. km, has a leopard population of only 35, as per the census of 2008. In contrast, the 1,385 sq. km Ranthambore Tiger Reserve in Rajasthan has more than 50 leopards, and Sariska (881 sq. km) has around 60 leopards. The reason behind the good populations in these reserves is certainly their better degree of protection, and good prey base. As stated earlier, in the last two and a half years, I have noticed an acute dearth of prey base not only in the forests of Pratapgarh region, and Sitamata Sanctuary, whereas Ranthambore and Sariska are known for their bustling population of herbivorous quadrupeds. The lack of prey base in the forests compels leopards to venture into human settlements or buffer areas where livestock movement is higher. Even in Ranthambore, out of my eight leopard sightings in three years, five were in the buffer area, but the reason for this preference was to avoid the tiger.

Whatever the reasons for the movement of leopards near human habitations, there is great resentment from the villagers, who often turn hostile and demand relocation of the animal, irrespective of whether the leopard has harmed their cattle or not. Their apprehension is so steadfast that if the department fails to take action, the villagers do not even hesitate to contact poachers to exterminate the animal. In 2004, when I was in charge of Ranthambore National Park, I got a message from the Divisional Forest Officer of the neighbouring Tonk district that there was panic among the villagers of Siras due to the presence of a tiger. Immediately, I sent a team which reported that it was not a tiger but a pair of leopards, probably mating, on a small hillock amidst degraded forest on the periphery of the village. The pair had in no manner interfered in the lives of humans, however the villagers had sought their translocation. The DFO was compelled to trap one of them, and it was brought to Sawai Madhopur and released in Kachida area of Ranthambore National Park. Till date, no one knows what followed.

The leopard is one of the most contentious species amongst all large cats as far as human-wildlife conflict is concerned. The decrease in its natural prey base and the increasing interface with humans have resulted in stray instances of conflict in human habitations. It is time that we ensure our commitment to the conservation and monitoring of this neglected cat. At the same time, there is a dire need to improve the protection status of our reserve forests, and start with the scientific monitoring of the species, because only after such monitoring can we chalk out plans for their sustainable future. The next step, after habitat improvement of the reserve forests, would be the reintroduction of herbivores, where deficiency of prey base has led to leopards straying towards villages. An adequate supply of herbivores would check this deficiency and would work as a natural check for man-animal conflict. If these conservation measures are not implemented, there will be adverse impacts on the dwindling population of leopards in many well-wooded pockets of our country. ■

Gobind Sagar Bhardwaj joined the Indian Forest Service in 1994 and has since served in different protected areas, in different capacities. A keen traveller and writer, he also has a deep passion for wildlife photography.

We are grateful to

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In Quest of Avian Nemos

Text: **Raju Kasambe**

Sparrows and 'a Message in a Bottle'

As a child, I used to catch House Sparrows using a simple trap. Sometimes, I would colour them pink to distinguish them from the other sparrows and to track their movements. In those days, I had heard with interest the story of a man who would put a message in a bottle and toss it into the sea, in the hope that one day someone, somewhere, would find one of his messages and respond to him. These two memories from my childhood became ingrained into my mind, I guess, which I realized only when I got into birdwatching, and later when I undertook serious studies on birds.

VEDANT KASAMBE

How many birds have tags in this image? Answer on page 31

Tagging Birds

Ringing or banding of birds with a small, coded, lightweight aluminum ring and hoping that someone, somewhere, will come across it and send you a letter in response works on the same principle as the 'message in a bottle'. Tagging birds is an important tool to unlock the secrets of bird movements and migration. With newer technologies and methods in bird tagging came colour banding (plastic rings on legs), flagging (coloured specialized plastic flags on legs), neck collars (discussed further on), wing tags (numbered tags attached to the wing), geo-locators (small transmitters that can only tell the approximate location of the bird periodically – here, recapture of bird is essential to obtain the data), and PTTs (Platform Terminal Transmitters) that provide detailed information on the movements of the marked bird, like location, speed, and height of flight). PTTs have a solar-charged battery, and are the most expensive tool to unlock the secrets of bird migration.

TUHINA KATTI

Bar-headed Goose with a red neck collar inscribed with a white alphanumeric code

Though ringing still remains the cheapest way of tagging birds, the other methods have also become popular as they have their own advantages over the conventional method. Neck collars, used for birds like the geese and swans, provide increased re-sighting rates and make the need to re-capture birds redundant. Similarly, marking birds with wing tags has been successful for birds like eagles and vultures that soar, and are difficult to recapture. For long-legged birds like waders, tagging with flags and colour bands is widely practised. The bands have unique numbers in different colour combinations. Hence, even if one is unable to read or record the number on the band, the colour combination is sufficient to obtain information on the region where the bird was tagged. This is possible as there is an international bird banding protocol, and every country has its own colour combinations for marking birds.

ROSHNATH RAMESH

Orange wing tags with alphanumeric code attached to the patagium of a vulture, which also has a leg band

YASHODHAN BHATIA

Flamingo tagged with white and yellow leg bands. The yellow band is inscribed with alphanumeric code in black. The white band is blank

BNHS has been ringing and marking birds in India since 1927. The Society has tagged about 8,00,000 birds, using most of the tagging methods discussed earlier, including satellite tracking. These studies have significantly contributed to our understanding of the origin and migratory routes of birds that winter in the Indian subcontinent. BNHS-tagged birds have been recovered from 29 countries spread across five continents.

Avian Nemos

Finding a bird with a ring or tag in a flock of a thousand migratory birds is like discovering a needle in a haystack – akin to the search for Nemo by his father across the vast ocean in the blockbuster 2013 animation movie 'Finding Nemo'. And when it does happen, it is a moment of joy for every birdwatcher. The follow-up, finding out the details of its ringing location, is like completing a spy story for oneself! Knowing that the bird you photographed has travelled thousands of kilometres and has come from somewhere in another hemisphere is like a spy story!

My love for spotting ringed/tagged birds started in December 2007, with the sightings of a Mongolian-tagged Bar-headed Goose in Nagpur district, Maharashtra. The bird, with a numbered yellow neck-collar, was tagged in North Mongolia and had travelled a distance of 4,600 km to the wetland where I sighted it. With time, I came across other tagged birds, and also started helping other birdwatchers in finding the origins of birds sighted by them. My son Vedant followed my footsteps, looking for tagged birds during his birding trips. Recently, I teamed up with him, which has been a great boon in our search for Avian Nemos.

On learning that BNHS had tagged around 8,000 birds in the 2018–19 season in the Navi Mumbai area, we were inspired to visit this place. On May 11, 2019, a scorching summer day, we photographed 57 birds with rings and flags at one wetland in Navi Mumbai! The joy of finding so many tagged birds in a day alleviated the discomfort of the sun burns we got. All the tagged birds observed on that day had been tagged by BNHS scientists. A few highlights

VEDANT KASAMBE

In north India, waders like this Lesser Sandplover are tagged with two white leg flags, one with an alphanumeric code in red, and the other blank

VEDANT KASAMBE

Sometimes multiple tagged bird species are seen in a flock. In this flock, we can see seven tagged Common Redshank and a Little Stint

VEDANT KASAMBE

In Eastern China, waders like this Great Knot are tagged with two blank leg flags, one orange and another green, indicating where it was tagged

VEDANT KASAMBE

Answer to question on page 28:
It is not easy to locate tagged birds and read their flag numbers, especially in huge flocks of waders

RAJU KASAMBE

A Grey Plover with two white flags

PRANJALI KASAMBE

Vedant and Raju searching for tagged birds

BNHS PROTOCOL FOR BIRD RINGING/MARKING

Metal Rings: Each BNHS metal ring has the inscription "Inform Bombay Nat. Hist. Society" with a unique alphanumeric code, which may read like, K-1234 (K is the ring size and 1234 is the unique number of the ring). In odd years, the ring is put on the left leg, and in even years, on the right leg. These rings are invariably put on the leg of every bird, in addition to any of the tagging methods that may be used for studying the movements/ migration of birds discussed below:

Colour flags: In odd years, the right leg is flagged, while in even years, the flags are placed on the left leg. Flags are coloured bands with flags projecting perpendicular to the leg.

Colour flagging of waders

Southern India (includes Andhra Pradesh, Telangana, Karnataka, Tamil Nadu, and Kerala): Only one black flag with a unique alphanumeric code in white indicates flagging in the aforementioned states.

Rest of India (excluding the five states in southern India): Two white flags – one with a unique alphanumeric code in red, and the other blank, indicates flagging in the rest of India.

Colour tagging of Flamingos: Two leg bands: One yellow with a unique alphabetical code in black; the other a plain white band. The white band is placed below the yellow in southern India, and above in central and northern India.

Colour tagging of Bar-headed Geese: Red neck collar with a unique alphanumeric code in white.

Colour tagging of Vultures: Orange wing tags (also called patagial tags) with a unique alphanumeric code attached to the patagium of vultures.

of our sightings in this wetland and other sites visited over the years are:

- Sighting of a Great Knot (see image) at Alibaug beach, Raigad district, Maharashtra, which was tagged at Yalu Jiang, Liaoning Province, China (5,425 km away)!
- Sightings of more than 300 BNHS tagged birds, which included the sighting of more than 50 tagged birds by each of us over two days!
- Sighting of a Common Redshank *Tringa totanus* banded by BNHS on 24 February 2015 at NRI Wetland, Navi Mumbai and resighted at the nearby T.S. Chanakya Wetland on 15 December 2020, after a gap of more than five years!

RAJU KASAMBE

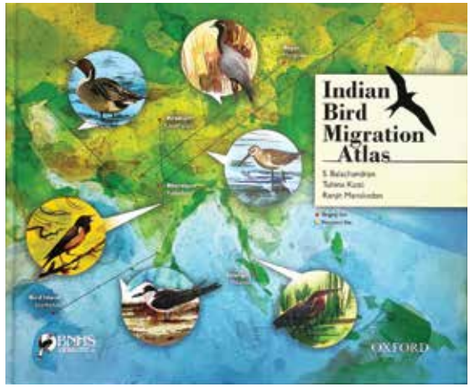
Little Stint (third from left) with a ring on its left leg

RAJU KASAMBE

Grey Plover being tagged in South India

RAJU KASAMBE

Eurasian Curlew with two white flags



The INDIAN BIRD MIGRATION ATLAS published by BNHS provides comprehensive information on the research on bird migration in India, gathered since 1927

RAJU KASAMBE

Various leg flags and bands used for colour tagging waders

My experience has taught me that it is not easy to spot a tagged bird in a flock. What one needs, besides good eyesight, is a pair of powerful binoculars or a spotting scope. And to record the flag or ring number, one needs a camera with 'mega' zoom lens. Fortunately, not too expensive digital cameras with 60 to 80 and even 100X optical zooms, are now available in the market. Providing record shots of tagged birds would be of additional help to the ringing agency to confirm the identity of the species.

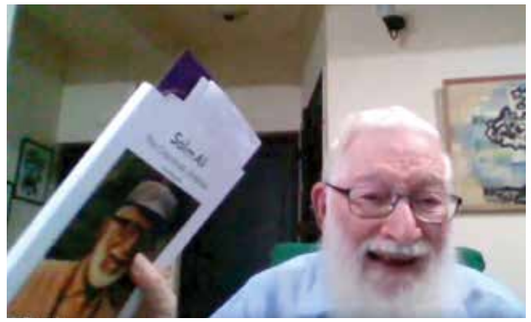
Reporting tagged bird sightings

As more people are becoming aware of the significance of reporting information on colour-banded birds, interesting information is being reported from all over the world. By reporting the sighting of a tagged bird, you contribute to mapping the migration routes between breeding grounds, stopover points, and wintering grounds, as well as help to understand behaviour like mate pairings and family structure. ■

Raju Kasambe is an Ornithologist. Presently he is Assistant Director – Education at BNHS and manages the BNHS Conservation Education Centre (CEC) at Mumbai

Online Book Launch

BNHS PHOTO LIBRARY



BNHS PHOTO LIBRARY

(L-R): Mr Bittu Sahgal, President, BNHS, released Dr Erach Bharucha's 'SÁLIM ALI – THE CHARISMATIC BIRDMAN' and Tara Gandhi's 'WORDS FOR BIRDS' during the event

BNHS PHOTO LIBRARY

The online celebration brought together a gathering of Dr Sálim Ali's friends and fans, and BNHS staff, past and present

Dr Sálim Ali was a personality with a strong commitment, who steered the BNHS for decades. He was a good communicator, a great teacher and mentor, a scientist, an able leader, a source of inspiration for many. In M.K. Ranjitsinh's words, Sálim Ali was among the few conservationists "who do not compromise or cave in, even when they know that their conservation work and the stand they take in this regard will be detrimental to their career prospects or personal gain. Such individuals are almost an extinct species now, yet these are the icons, the role models in conservation, and they are the true patriots."

To celebrate Dr Sálim Ali's 125th birth anniversary, BNHS organized an online programme with a series of events on November 12, 2021. The events began with the release of two books: SÁLIM ALI – THE CHARISMATIC BIRDMAN by Dr Erach Bharucha, and WORDS FOR BIRDS by Ms Tara Gandhi, on the most cherished 'Birdman of India'.

Dr Erach Bharucha, a member of the BNHS Governing Council and a well-known surgeon from Pune, in his book SÁLIM ALI – THE CHARISMATIC BIRDMAN, narrates the story of Dr Sálim Ali's life and times, which were an important fragment of the conservation movement in India. Few of those who came into contact with Dr Sálim Ali could claim to have known him since they were five years old. Dr Erach Bharucha is one such privileged person who tells us an inspirational story of the Birdman's incredible multifaceted personality, through his own reminiscences and those of Sálim Ali's friends and fans.

Renowned conservationist and author Ms Tara Gandhi was Dr Sálim Ali's student. In her book WORDS FOR BIRDS, she has compiled all the 35 broadcasts that were given by Dr Sálim Ali on All India Radio (AIR) – between 1941 and 1985 – probably unheard of by most people in the current century. The talks reveal Sálim Ali's exceptional skills as an oral communicator and bird propagandist. The book covers many topics – bird habits and habitats, birds at risk, among others – in an elegantly conversational and informative style. The book does need not to be read sequentially from start to finish, as each chapter is complete in itself and the sheer mastery of Dr Sálim Ali's language makes for enjoyable browsing.

The online celebration brought together a gathering of Dr Sálim Ali's friends and fans, and BNHS staff, past and present. People who had known him spoke with fond remembrance about the man and his works, and regaled the audience with anecdotes about their personal experiences with him.

To buy your copies of SÁLIM ALI – THE CHARISMATIC BIRDMAN and WORDS FOR BIRDS, please write to <cmd@bnhs.org> ■

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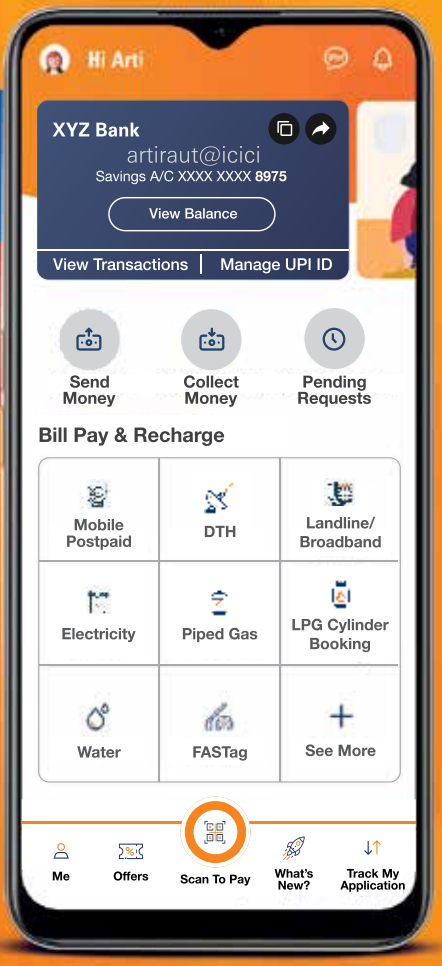

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