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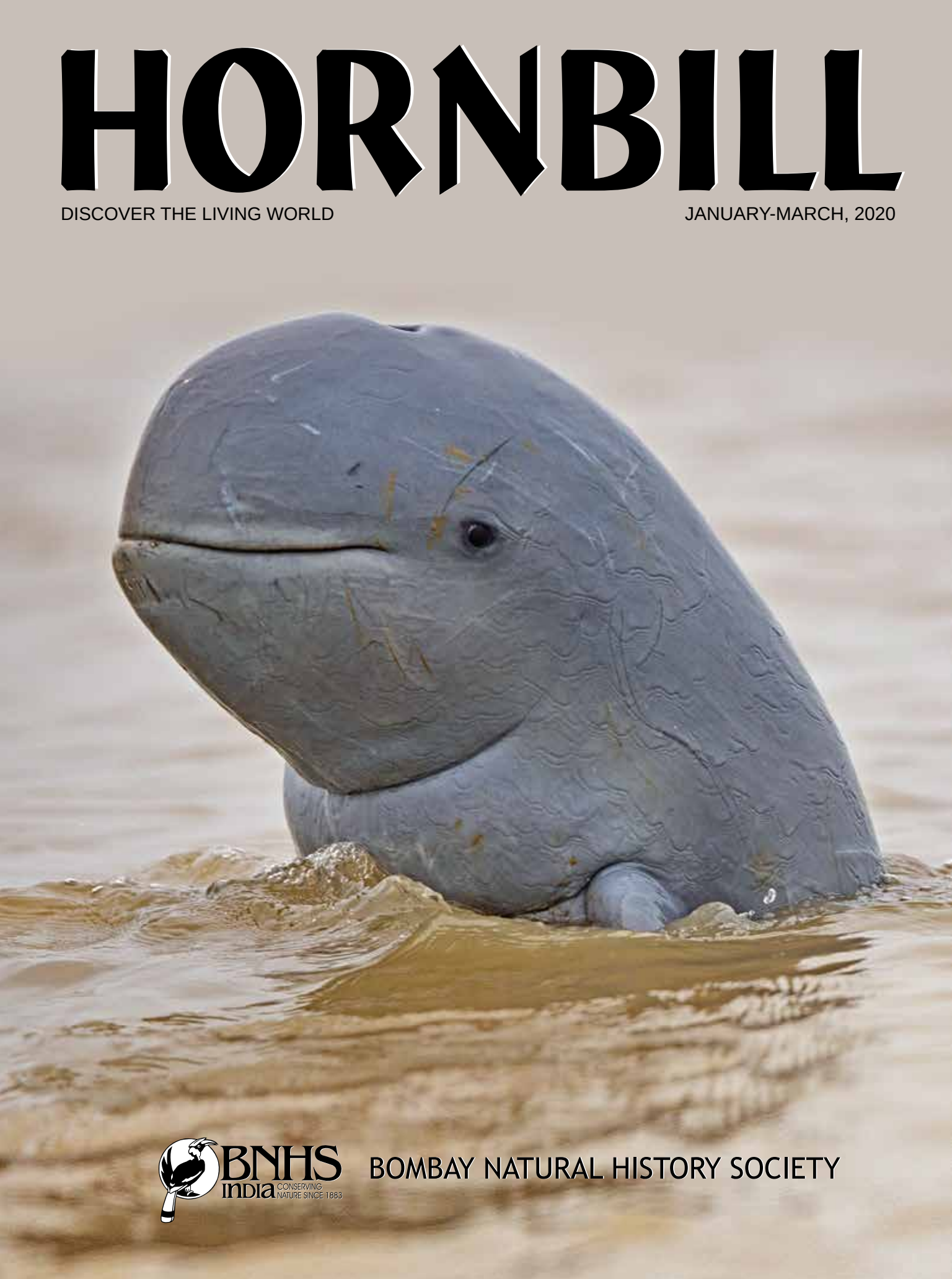

BNHS INDIA CONSERVING NATURE SINCE 1883

BOMBAY NATURAL HISTORY SOCIETY

HORNBILL

January-March, 2020

BNHS India CONSERVING NATURE SINCE 1883

COVER : **Irrawaddy Dolphin**
Anupam Koley

Published and printed quarterly by the Honorary Secretary for the Bombay Natural History Society, Printed at Akshata Arts Pvt. Ltd., Lower Parel, Mumbai.
Reg. No. RN 35749/79, ISSN 0441-2370.

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From the Editor's Desk...

First and foremost, I wish to extend warm greetings for a safe, healthy, and happy New Year. I hope that the year will bring good news for our wilderness too.

I hope you have had a chance to go through our latest e-newsletter *ecoScapes*, along with the abstracts of various research and conservation projects undertaken by BNHS presented during our Annual Research Seminar. The response to the e-newsletter has been overwhelming, and we have received some donations to continue our work on endangered species.

The last quarter has been very hectic for Team BNHS. Our "International Conference on Wetlands and Migratory Waterbirds of the Asian Flyways" received an overwhelming response, with 280 delegates including scientists, academics, conservationists, state forest officials, and decision makers from 18 countries participating to review the current status of migratory waterbirds and conservation issues related to the wetlands of the Asian flyways, with focus on the Central Asian Flyway. A resolution from the conference will be tabled at the upcoming 13th Conference of Parties (COP) of the Convention on the Conservation of Migratory Species of Wild Animals (CMS) being hosted by India.

On the last day of the conference, BNHS presented the Sálim Ali International, National, and Community Nature Conservation Awards, and the newly initiated J.C. Daniel Conservation Leader Awards for Young Men and Women. Some of the keynote talks of the conference and the entire awards ceremony were live-streamed.

The New Year will witness another major event, CMS COP 13, hosted by the Government of India (GoI) in Gandhinagar from February 15–22, 2020. BNHS is assisting GoI not only in the preparations but will also contribute to the scientific documents related to the event. BNHS Senior Scientists Dr P. Sathiyaselvam and Dr Ramesh Kumar Selvaraj are currently deputed to MoEF&CC to assist in CMS COP preparations. BNHS is also assisting Government of Gujarat in the preparatory work, and Dr Dishant Parasharya and Dr Bhavik Patel are deputed for the same. BNHS has received an invitation to the COP High-Level Segment, where ministers of CMS range countries will discuss core issues of policies and conservation measures for migratory species.

BNHS's wetland and bird migration research is expanding by leaps and bounds under the leadership of Dr P. Sathiyaselvam and his team comprising Dr S. Sivakumar, Dr Ramesh Kumar Selvaraj, Dr Madhumita Panigrahi, Ms Tuhina Katti, and Mr Omkar Joshi with scientific advice by the legendary bird migration specialist Dr. S. Balachandran, Deputy Director, BNHS. We received a boost for this programme with major financial support from MoEF&CC. Under this grant, BNHS will be working across 17 states, 48 waterbird sites, and 31 landbird sites. Our first key objective is to develop site-specific actions related to conservation of migratory bird species and their habitats in Protected Area Plans (both Management and Working plans) and also to formulate action plans for non-protected areas. The second key objective is to train 350 forest department staff in bird ringing and CAF related work; the third is to develop comprehensive bird sensitivity maps and GIS tools to guide in the setting up of wind farms and transmission lines; and the fourth is to develop a National Action Plan for 20 key migratory species.

Similarly, we have been assigned a major project by the Government of Maharashtra to develop a conservation blueprint for six key wetlands of Maharashtra specific to CAF. The Government of Bihar recently approached BNHS to develop a proposal to set up a conservation blueprint for the major wetlands of Bihar with specific focus on CAF. BNHS member Mr Manoj Mishra helped us develop the proposal, which is at an advanced stage of discussion. Soon BNHS is expected to start a regional center in Bihar with support from the Bihar State Government. Recently, the Jammu and Kashmir, Lakshadweep, and Andhra Pradesh governments approached us to assist them in bird monitoring and management plan work in Wular Lake, Pitti Island, and Kolleru Bird Sanctuary, respectively.

The last quarter also witnessed a tragedy unfolding at Sambhar Lake, with mortality of about 20,000 waterbirds due to avian botulism. BNHS assisted the Rajasthan Forest Department during the period. We ringed about 300 rescued birds, and released them into the wild. We will continue to monitor these birds.

Conservation breeding programme for the Great Indian Bustard (GIB) received a major boost recently and the GIB breeding centre in Rajasthan now hosts nine healthy chicks that hatched from eggs collected from the Thar Desert. BNHS continues to work in the desert landscape, especially in its community engagement programme under the able leadership of Dr Sujit Narwade, to save the Critically Endangered Great Indian Bustard.

At the end, I wish to express my appreciation to Mr Anupam Koley for sharing his stunning image of Irrawaddy Dolphin from Chilika Lake for the cover of *Hornbill*. It is probably one of the finest images of the species that I have seen so far.

Deepak Apte

Raptor Migration in India –
Time to Unravel the Mystery!

Text: **Sachin Ranade**

SACHIN RANADE

Pallas's Fish-eagle has been uplisted to Endangered due to its declining population throughout its range

It was February 2003. Our small team of scientists was working day and night to catch a few Eurasian Griffons in Panchkula district of Haryana. We had just established a Vulture Care Centre at Pinjore to study the behaviour and causes for the decline of *Gyps* vultures in India. Although the populations of only resident vultures in India had shown declines, we were anxious to know the trends in the migratory species as well. Of the nine species of vultures known from India, four are winter visitors. The Himalayan Griffon comes from the high altitude areas in the Himalaya, while the Eurasian Griffon, Cinereous Vulture, and a race of Egyptian Vulture travel a huge distance from their breeding grounds to the wintering grounds in India. Considering the possibilities of spread of communicable diseases from Indian vultures to these migrant species of vultures, it was necessary to determine their migratory routes and distribution.

To our success, we were able to trap two Eurasian Griffons and three Himalayan Griffons. All the birds had PTTs (Platform Transmitter Terminal) attached on them, through which their movements could be tracked by satellite tracking. The PTT, which weighs about 140 gm, was tied like a backpack on the vultures. Tracking studies revealed that after spending the winter in India, these griffons travelled a long distance, up to Mongolia. This was my first experience of satellite tagging work on birds.

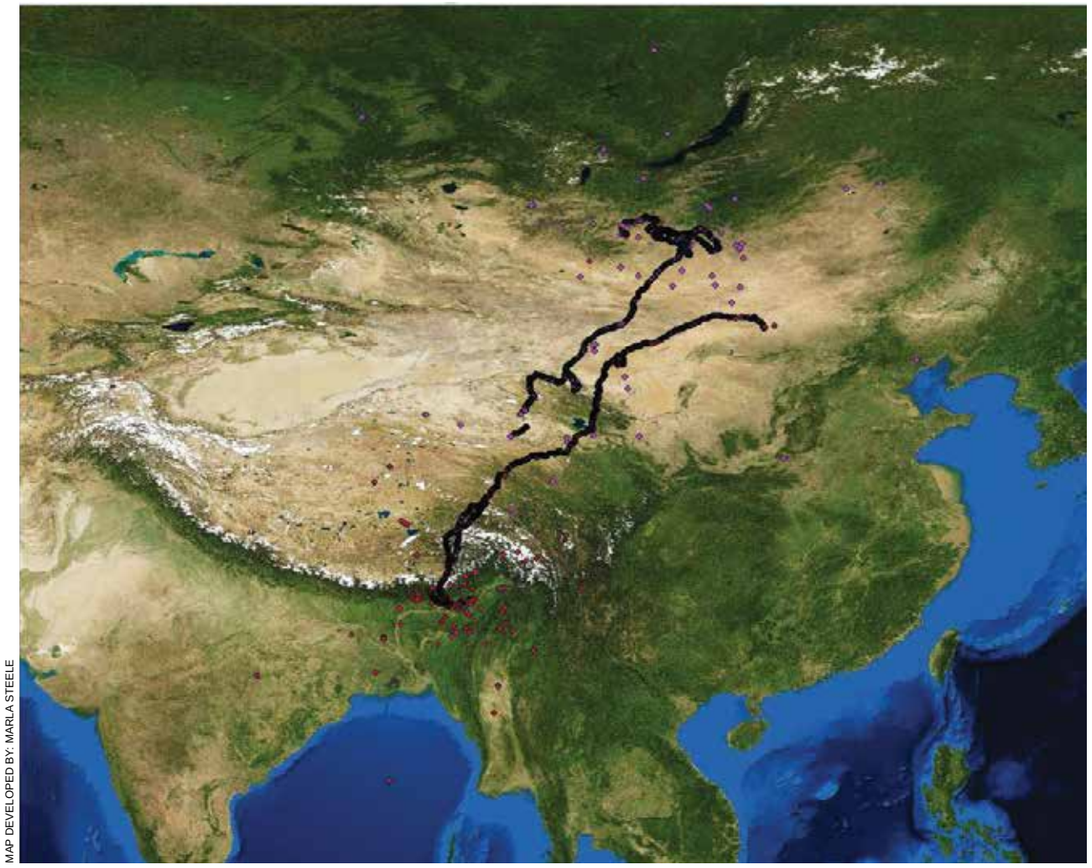
This experience not only taught me a few skills in bird handling, but also broadened my knowledge about the species. When one comes to know that a bird that was sighted a few days ago in one's backyard is now flying over Mongolia, covering a distance of about 2,000 km, it really changes one's perspective. One starts thinking about the entire globe as a single community. One would then realize that local pollution, mismanagement of toxic wastes, outbreaks of diseases may also affect the health of distant populations of wild animals, as well as humans. The involvement of economics and health related issues made this study on migratory

SACHIN RANADE

PTT being fitted on a Himalayan Griffon, Haryana, 2003

SACHIN RANADE

The juvenile in flight with PTT on its back while the adult perched on ground



Migration route of Pallas's Fish-eagle, Assam–Mongolia, 2014

birds, including raptors, a new and challenging field of science.

Our next satellite-tracking exercise was on the Pallas's Fish-eagle (PFE). As this species has been recorded from Mongolia to Bangladesh, it would be natural to presume that it is widespread and probably also doing well as a species. However, Dr Gombobaatar Sundev (National University of Mongolia and Mongolian Ornithological Society) had observed that the PFEs resided in Mongolia only for a short duration and did not nest in the area. Dr Marla Steele got interested in the study and chose it as the topic for her PhD thesis. As BNHS had maintained records of raptors in India from 1983, we had sound information on their occurrence in India. We had recorded the species in Corbett and Kaziranga national parks during surveys. Knowing that there were good sightings of Pallas's Fish-eagle in Kaziranga, this area was selected for satellite tracking studies on the species.

After struggling to capture PFE through the entire month of January, we were lucky to capture, ring and satellite-tag two young birds in February 2014. About a month later, the two birds — for the first time in their life — travelled directly to Mongolia, crossing the mighty Himalayan range at a height of about 6,000 metres. Interestingly enough, they were joined by a third eagle that had already been tagged in Mongolia. The transmitters worked well for at least three years and their travel between Mongolia and Myanmar has been well recorded. Although they have not yet visited their natal ground in India, their PTT data has provided insights into their arduous journey and migratory instinct! Isn't it amazing that birds just a few months old cross the Himalaya, visit a totally new land and thrive there! Our findings also add weight to Kaziranga's status of World Heritage site, as it provides safe habitat for the species.

For the conservation of raptors, Buxa Tiger Reserve (BTR) in West Bengal is equally important as Kaziranga National Park! It is located at the junction of the Himalayan foothills and the Gangetic plains. One of our Vulture Conservation Breeding Centres is located in a forest village in Buxa Tiger Reserve. Buxa is well known for raptors with an impressive record of 23 resident and visiting species. One day, after a heavy shower in the previous night, we had a small spell of cloudy weather. While casually looking out for raptors in the cloudy sky, we came across a small flock on the horizon. More and more raptor individuals continued to join the flock, now circling above us. This was a rare sighting for the Indian subcontinent – migration of Oriental Honey-buzzard. That day, I witnessed about 50 birds passing over the area in an hour.

Excited by the finding, I started to look for more information on raptor migration. There are systematic Migration Watch programmes run in various countries, where thousands of migrating raptors are observed, counted, and photographed for scientific study as well as for recreation. A study using radar in Israel showed that European honey-buzzard can travel 300 to 450 km in a day! Yet another research paper reported 19 migratory raptor species in Thailand in 2007, and counted a whopping 43,451 individuals. And this count included many rarities in thousands, including black baza, Oriental Honey-buzzard, Chinese Sparrowhawk, and Grey-faced Buzzard. The Oriental Honey-buzzard's spring and autumn migrations were studied by scientists using PTTs. It was awe-inspiring to see the migration route followed by these buzzards from Japan to


RAGHAV GUPTA

Eurasian Griffon is an inhabitant of rocky areas, grasslands and scrub country


RAGHAV GUPTA

Cinereous Vulture appears to be suffering a population decline in its Asiatic strongholds

Southeast Asian islands like Java and Borneo. These birds followed aerial routes, avoiding the ocean as much as possible and flying over land masses. It would be interesting to see if the Indian population of the Oriental Honey-buzzard also participates in this annual migration.

India is a country of mega biodiversity. As Rishad Naoroji states in his book BIRDS OF PREY OF THE INDIAN SUBCONTINENT (2007), 69 species of raptors have been recorded in India. These could be further identified as 104 forms, including subspecies and races. He also asserts that 41% of these forms are partially or completely migratory, which means India has not only species richness but also a massive population of migratory raptors.

So far, birders in India have not really withnessed the mass migration of raptors due to the chance absence

ASAD R. RAHMANI

Migration of Amur Falcon across the Arabian Sea coincides with the migration of dragonflies

ASAD R. RAHMANI

A flock of migrating Amur Falcons

RAGHAV GUPTA

Egyptian Vulture, now classified as Endangered, is rapidly declining in India, Europe, and Africa

of birdwatchers at the right place and time, or lack of technology to track birds. The best example of advanced tracking technology, I would say, is the PTT deployed on Amur Falcon. This solar powered gadget, weighing only 5 gm and not hindering its normal activities, revealed the treacherous journey undertaken by the Amur Falcon during migration. These falcons begin their flight from Amurland (bordering Russia and China) to reach Nagaland in north-eastern India. In the next lap of their journey, they cross the Arabian Sea, reaching the grasslands in South Africa. Every year this grand phenomenon takes place, which could be compared only to the African Great Migration. For decades we missed it, but the public support for its conservation and scientific intervention made the study possible to know about this wonderful phenomenon. Amur Falcons are mainly insectivorous, feeding on termites, grasshoppers, beetles, and the like. They also feed on small rodents and birds. Their valuable role in the control of insect populations in our agriculture dominated habitat must be studied and appreciated.

In the Indian scenario, there is a need to study migratory raptors in greater detail. Tagging and ringing of these birds using satellite telemetry could tell us more about the grand routes followed by them in their lifetime. Inventories at stop-over points and seasonal raptor counts would help to identify the important areas that need extra protection. For the study of raptor migration in India, the sky is the limit!

Sachin Ranade is the Senior Center Manager supervising the Vulture Conservation Breeding Centres (VCBC) of BNHS in Assam and West Bengal.

A Tale of Two Ospreys

Text: **Nirav Bhatt, Meenu Dhakad, and Ishan Dhar**

URMAS SELLIS

A breeding pair, Serzhik and Usina satellite-tagged in the Sayano-Shushensky Nature Reserve, Russia

While the November, 2019 tragedy at Sambhar Lake may have been caused by a natural phenomenon, it does not negate the fact that India is no longer safe for avifauna. The progressive loss and degradation of habitats, along with excessive infrastructural development activity, have rendered the remaining wilderness extremely unsafe for both local and migratory birds.

In late 2019, a breeding pair of Osprey was satellite tagged in the Sayano-Shushensky State Nature Reserve, Russia. These raptors bond for life and this pair, like others of their kind, reared their brood before starting their long migration. The male was named Serzhik and the female Usina. Both birds flew to India to avoid the harsh winter of their homeland. Ospreys are diurnal, fish-eating birds of prey with a cosmopolitan distribution range. The purpose of satellite tagging these birds was to find out the reason for their precipitous decline in the Altai-Sayan region – one of the most inviolate areas of Russia. The decision to undertake this study was arrived at during the 2nd International Scientific and Practical Conference "Eagles of the Palearctic: Study and Conservation", after it was concluded that the decline of ospreys in this region probably originated in their wintering grounds.

MIROSLAV BABUSKHIN AND JAN KRANER

Ospreys prefer to nest in sites that have easy access to open, shallow water that allows them to hunt fish

Under the project leadership of Dr Miroslav Babushkin, along with Dr Igor Karyakin, Elvira Nikolenko, Elena Shikalova, Urmas Sellis, and Gunnar Sein, with financial support from Jan Kraner, all tirelessly monitored these two tagged birds from day one. According to the data recorded, both birds travelled independently about 300 to 400 km per day for 15 days, a total of about 5,000 km, to reach their wintering ground. When the birds are in India, raptor researcher Nirav Bhatt (first author) maintains a close watch on the satellite-tagged birds in coordination with the Russian team of scientists.

The female Osprey, Usina, started migration on 14th September, reached

MIROSLAV BABUSKHIN AND JAN KRANER

Osprey nests are large and built of sticks

DEVELOPED BY IGOR KARYAKIN

Map-podpisi

MIROSLAV BABUSKHIN AND JAN KRANER

Female osprey that started migration on September 14, 2019 was found healthy on Dec. 11, 2019 in Udaipur, Rajasthan

close to Udaipur, Rajasthan on 28th September, and is still there till date (14th January, 2020), confined to an area where there are a few lakes.

While in Rajasthan, Nirav coordinated with Rajasthan based conservation biologist Dr Dharmendra Khandal for ground surveys. Khandal visited the site near Udaipur, found the bird healthy, saw the transmitter on the bird, and also photographed it.

The male Osprey, Serzhik, started on 20th September, went further south and reached Madhya Pradesh on 7th October, where he stayed for about 20 days. He then travelled even further south to Karnataka near the town of Ilkal, and mysteriously died there.

On 13th and 14th November, Russian researchers Igor Karyakin and Elvira Nikolenko personally visited the area to determine the cause of the death, and found that the area had a large number of windmills.

MIROSLAV BABUSKHIN AND JAN KRANER

A transmitter each was fitted on the Osprey pair

DHARMENDRA KHANDAL

The female Osprey recorded near Udaipur in Rajasthan

The bird fell into the turbulence zone of the wind turbine, was shell-shocked, and could not continue its flight, although it remained alive. The osprey rose from the ground and sat on the support of the power transmission line, where it was killed by electric shock. The researchers could record these details because the satellite tag gives detailed readings of the location, velocity, elevation, etc. of the tagged bird every 10 minutes. The osprey corpse was missing and may have been taken away and eaten by feral dogs, but its feathers were found under an electric pole.

Unfortunately, wind mills and power lines are an unmitigated menace, killing a large number of resident and migratory birds. Igor even reported that when he was looking for the tracker he saw a flock of starlings flying into a turbine, and at least 20 of them fell to the ground on collision with the mill! From the findings of the satellite tracking on the two ospreys, it is now presumed that many Siberian birds that fly to India do not return due to death from windmills. Raptors migrating from Siberia to the Middle East and Pakistan, where wind power is poorly developed and there are fewer power lines, appear to be the only surviving birds for now. There are practically no raptors migrating to Central India and China to overwinter, as the local conditions are now detrimental to their survival.

It is India's call now. If we want the raptors to keep arriving, to find safe harbour in their natural habitats, we need to secure their wintering grounds, to fulfill our responsibility as a guardian country of such precious species, to match our actions with our words, however impassioned they may be.

Nirav Bhatt is a keen ornithologist with special interest in studying and documenting raptor identification, behaviour and migration for almost two decades.

Meenu Dhakad is a conservation biologist with Tiger Watch in Ranthambhore.

Ishan Dhar has served as a Research Officer at AII@Delhi and is associated with community conservation work in Ranthambhore through Tiger Watch.

Secretive Migrations of Indian Freshwater Fishes

Text: **Unmesh Katwate**

UNMESH KATWATE

The only remaining large-sized population of the Deccan Mahseer *Tor* cf. *khudree* in the river stretch along the temple of Tilase, in Vaitarana river. During floods in the monsoon these big fish migrate far upstream in search of the perfect breeding ground, spawn and return back to the residential pool

VISHAL JADHAV

Labeo spp. climbing the waterfall in secondary streams of the northern Western Ghats

Indian freshwater fishes have evolved to all sizes and shapes, and show an array of diversity in form. Some species undertake seasonal movements in rivers, travelling short or long distances upstream or downstream and back, to spawn or feed. Some species among them literally climb hills, as they spawn exclusively in streams at mountain tops. Then, there are those that migrate from rivers to the seas, and vice versa, with some venturing into the depths of the Indian Ocean.

As a kid and as a student, and now as a full-fledged ichthyologist, I always have been fascinated by the diversity of fish life in Indian freshwaters. Back in 2009, just after graduation, I was startled to see a small species of hillstream fish, probably a loach, climbing up the rocky slopes of a waterfall of more than 10 m gradient in Tamhini Ghat, Maharashtra with ease. I was aware of salmon and sea trout migrations and their epic journeys from the sea to temperate rivers, mostly learned through textbooks, but this was something new to me.

When I started digging out literature on migration patterns of Indian riverine fishes, I realized that there was absolutely no information available on the migration aspects of Indian fish species, except for a few notes on the spawning migration of the Indian Shad *Tenualosa ilisha* (locally called Hilsa) and Indian Mottled Eel *Anguilla bengalensis*. The unavailability of information on migration, besides breeding biology, of most Indian fish confirmed the complete research and knowledge

UNMESH KATWATE

An endemic species, mostly restricted to west flowing rivers of the Western Ghats, Malabar Labeo, *Labeo dussumieri* is known to undertake massive migrations during the monsoon

UNMESH KATWATE

A local fishermen disentangling his morning fish catch from the widely used gill net

STEVE LOCKETT

A close interaction with this powerful migratory fish of Indian rivers, the mahseer – my first catch in 2015

gap in Indian Ichthyology for me. Considering this state of tabula rasa, I attempt here to throw some light on information on fish migrations in India, through some available anecdotal records, local knowledge, and from my surveys and studies, and also touch upon the threats impacting migratory fish species.

Globally, there are about 1,100 migratory freshwater fish species, and ecologically, these can be classified as anadromous (species that migrate from the sea to freshwater to spawn), catadromous (species that migrate from freshwater to the sea to breed and spawn), and potamodromous (species that migrate within freshwater systems). Some species travel short distances, like the loaches of the Western Ghats which migrate a few kilometres up the hillstreams to spawn, whereas others like the Atlantic Salmon *Salmo salar* migrate about 9,500 km annually from the sea to spawn a new generation in the rivers where they were born. The giant Dorado Catfish or Guilded Catfish *Brachyplatystoma rousseauxii* of the Amazon River grows to 2.1 m in length, and holds the record for the world's longest exclusively freshwater fish migration – an epic life-cycle journey stretching from the Amazon estuary to its spawning grounds in or near the Andes Mountains.

In the Indian region, probably the most well-known case of anadromous migration is that of the Indian Shad, popularly known as Hilsa, a major fishery resource in the Bay of Bengal. In India, mostly in the Gangetic basin, Hilsa is known to travel up to cities like Agra and Delhi, covering a distance of about 1,287 km. In West Bengal, this species (Ilish in Bengali) ascends the Hooghly River for about 298 km. In parts of the Indo-Burma region like in Myanmar, in the Irrawaddy River, Hilsa is known to ascend up to a distance of about 724 km from the sea. The range of migration in the Brahmaputra basin is up to Tezpur, a distance of about 306 km from the Bangladesh border.

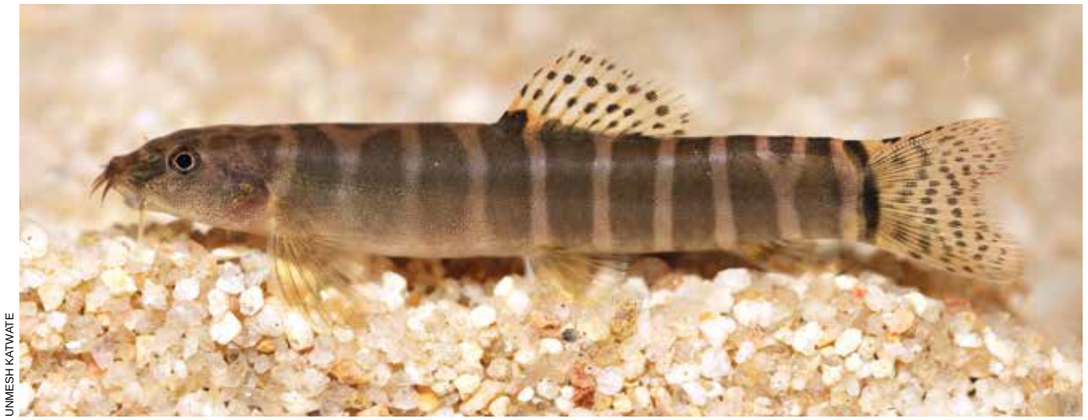
Generally, two types of migratory patterns have been recorded for Hilsa: south-west monsoon migration and winter migration. The monsoonal migration commences in July, peaks in August, and declines from September onwards. The winter migration usually occurs in the months February to March. This species lives in the sea; and around monsoon and usually during flooding, it swims against the tide and ventures to the river where it was born to spawn. What really triggers the migration of Hilsa is yet to be

UNMESH KATWATE

The endemic Nukta *Bangana nukta*, one of the big Indian carps, takes long distance migrations in monsoon. The species has been recorded from the east flowing Hiranyakeshi river, a tributary of Krishna river system

resolved, but it must be linked with the sexual development, period of maturity, and monsoonal changes in physico-chemical parameters of water quality. The winter movement in February has often been related with rise in temperature in the Bay of Bengal, and increase in the volume of water in the rivers due to the melting of snow in the Himalaya during spring and the hot months. Sadly, the highly sought after, much prized, and once abundant Hilsa is now on the verge of extinction. Almost year-round and totally unregulated intrinsic fishery, especially in the breeding season, and blockage of migratory pathways through construction of dams, have all had detrimental impacts on breeding populations, spawning migration, and recruitment success of Hilsa in the Ganga. Hilsa fishery in the Indian parts of the Gangetic Plain is now almost dead. The Hilsa population of the Bay of Bengal that migrates to Padma and Meghana rivers in Bangladesh still exists, but escalating fishing pressure and extensive use of illegal gill nets across the spawning grounds has cast a shadow on the overall fate of this anadromous species.

There are several potamodromous fish in Indian rivers, mahseer *Tor* spp. being the most well-known. This group comprises about 16 recognized species, with certain species attaining weights of over 50 kg, hence they are considered premier sport fishes. The adults of mahseer usually inhabit lowland rivers and lakes in the dry season, but migrate upstream in the peak monsoon to reach suitable spawning grounds upstream. It is well-documented that the endangered Golden Mahseer *Tor putitora* migrates during floods (in the monsoon) to the tributaries of Ganga River in the Himalaya to breed and spawn over stones, gravel substrates, often in well oxygenated headwaters. After breeding, the fishes travel back to their feeding grounds in the lower reaches of the Ganga. In the south is present the Deccan Mahseer *Tor* cf. *khudree* which we had surveyed in the River Vaitarna of Maharashtra. The only population of this species that reaches large body size in Vaitarna is now found downstream near Tilase. Here the species is considered sacred and is protected by the locals in the river stretch near a temple. We have observed these 'monstrous' (about a metre long) fishes migrating



UNMESH KATWATE

Among hill stream migratory fishes of the Western Ghats, *Schistura denisoni*, a commonly found loach, has been recorded as a leading migrant

UNMESH KATWATE

Stone loaches like *Garra* spp. have been recorded undertaking monsoonal migration multiple times; it is known to head upstream to breed in cascading and more oxygenated waters

UNMESH KATWATE

Common Spiny Loach *Lepidocephalichthys thermalis* is known to migrate short distances in the monsoon season. It usually prefers quiet, flowing waters with a sandy substrate

upstream in the monsoon, crossing natural barriers like cascades and waterfalls. We recorded juveniles post-monsoon far upstream (up to 70 km) in the Gargai and Pinjal rivers, which are tributaries of Vaitarana River. This suggests that the mahseer in this small stretch of west-flowing river also migrate and breed upstream with the onset of monsoon, like the Golden Mahseer in the glacier-fed rivers of the Himalaya.

Habitat degradation as a result of pollution, riverine flow modification through construction of dams and channel diversions, and over-exploitation through unregulated targeted fishery has resulted in decline of mahseer species and populations throughout the Indian rivers. Mahseer are highly dependent on free-flowing rivers and are often celebrated as flagships of freshwater conservation. The existence and survival of this species group relies upon the quality of the riverine environment that is their only home; any slight change in the attributes of the environment can lead to the elimination of these spectacular fishes.

Like mahseer, there are several other carps that migrate upstream in the monsoon to breed and spawn, but their migration largely goes unnoticed and has not been a subject of study. The so-called blue revolution (a Govt of India scheme to boost inland fish production by advanced fish breeding, rearing, marketing, and export interventions) has created a false impression about a steady rise in inland fish production in India, which is mainly because of commercialization of major Indian carps like Catla *Labeo catla*, Rohu *Labeo rohita*, and Mrigal *Cirrhinus mrigala* for aquaculture. However, all these carp species have become commercially extinct in many upstream reaches of the Gangetic and peninsular Indian rivers. Getting wild populations of these fish is now "a tale of tales".

While studying the fishes of the Deccan in the mid 19th century, the famous English ichthyologist and naturalist Col. William Henry Sykes described *Bangana nukta* from the Indrayani River, a tributary of the Krishna River system, near Pune. Sykes named this cyprinid fish after its local name *nukta* (meaning uplifted nose in Marathi), due to the prominent horn-like structure on the snout. In juvenile or immature fishes, this character is almost absent but as the fish grows and attains maturity, the head undergoes a dramatic morphological transformation. It is also a large fish, growing up to 70 cm long. After the mahseer, the 'river giant' that has mesmerized me the most is the Nukta.

Nukta is endemic to peninsular India and is listed as Endangered in

UNMESH KATWATE

Sun Catfish *Horabagrus brachysoma*, an endemic catfish from the Western Ghats is known to migrate from rivers to paddy fields to spawn and breed

UNMESH KATWATE

Indoreonectes evezardi is the only known fish to climb summits and spawn on mountain top plateaux, in the ephemeral primary streams of the northern Western Ghats

UNMESH KATWATE

Garra sp. climbing basaltic cliff of waterfall in a mountainous stream; this image was captured in an upstream catchment of the Savitri river

UNMESH KATWATE

A lizard look-alike, the Stone Loach *Balitora laticauda*, an endemic species from northern Western Ghats, adheres to rocks during its upstream migration

the IUCN Red List. Once distributed across the Krishna and Kaveri river basins, this species has now become a rare sight. Habitat loss is the major cause of its rapid population decline, and along with this, overfishing and competition for resources from introduced carps is pushing this species towards extinction. It has already been declared as locally extinct from its type locality, the Indrayani, and Mula-Mutha rivers of Pune. There is a major lacuna in the information on this species, especially regarding breeding and spawning. However, while discussing with local fishermen, we came to know that Nukta, like mahseer, also travels to upstream tributaries of the Krishna, where it breeds and spawns, after which it returns to lowland areas, mostly regarded as its feeding grounds.

Besides large fish, there are small or even miniature Indian fish species that migrate upstream to spawn. Some of them are record-breaking climbers, reaching the heights of mountain peaks, where no other fish is able to reach. We have recorded several hillstream groups of fish like loaches, hillstream minnows, garra and torrent catfish, making their journeys to the high-altitude cascading streams in the Maharashtra part of the Western Ghats. Among loaches, fishes of the genera *Indoreonectes*, *Schistura*, *Lepidocephalichthys*, and *Balitora* have been recorded climbing walls of waterfalls and steep cliffs in primary streams. Among all these, the migratory loach *Indoreonectes evezardi* of the northern Western Ghats of Maharashtra may be considered as the unbeaten hero of the 'fish run'. Usually, *Indoreonectes* loaches occur in the waters of downstream rivers or valleys, where they do not breed. With the onset of monsoon and as all the primary ephemeral stream starts flowing, they begin their migration, literally 'climbing' to reach there. The summits (800–1,600 m above sea level) of the mountains of the northern Sahyadri have typical features of a plateau, which is usually a grassland with unique wild flowers and small to large temporary pools and streams. No fish except for *Indoreonectes* species has been recorded climbing to these summits and spawning in the ephemeral primary streams. Along with loaches, hillstream minnow-like fishes of genera *Parapsilorhynchus* and *Garra* secretively swim in masses without getting noticed much, they are the blade runners of this altitudinal migration marathon. Torrent catfish of genera *Glyptothorax* and *Pseudolaguvia* have also been found migrating up fast flowing hillstreams.

Apart from anadromous and potamodromous fishes, there are the catadromous fish that are unique in their own way. Eels of genus *Anguilla* have survived and are using inland freshwater ways since at least the early Miocene (23 million years ago). This mysterious group of fish are known to breed and spawn deep in the sea, after which they migrate into inland freshwaters to feed and grow. In the course of a lifetime, they travel many thousands of miles, and pass through several very different stages, marked by changes in their colour and morphological transformation. They call the freshwaters home, survive and grow (up to 2 m) for many years in the riverine habitats, live for 35–52 years and even up to 100 years, sometimes more. We do not know exactly how freshwater eels know when it is time to return to the ocean, but something triggers their return migration. As the eels enter brackish water, they undergo a shocking transformation: their eyes bulge and enlarge about ten times, the skin thickens, and the fins get larger. It is miraculous to see this freshwater eel making a seamless transition from freshwater to saltwater, which can be toxic for an ordinary freshwater fish. Their back-to-sea migration is one of the largest unseen migrations on the planet. No one has seen or documented yet their seaward migration, so we do not know what really happens during the journey in the ocean. But the hypothesis is that hundreds and thousands of mature eels gather at a common site deep in the ocean, intertwine in large masses, and release their eggs and sperms in a giant farrago of panmixia, where all individuals are potential partners. Since no one has seen adult eels returning to freshwater habitats, it is assumed that after having completed the long, exhausting, and most mysterious journey of all living beings, they die deep in the ocean in the same place as they were born. After a couple of days, the eggs hatch into unusual leaf-like leptocephalus larvae, which then radically transform into a completely different but quite eel-like form (called glass eels), then in the elver stage enter estuaries, and finally acquire eel-like form as they swim upstream in freshwater to continue the cycle.

UNMESH KATWATE

Indian Mottled Eel *Anguilla bengalensis* in fish catch; a catadromous migrant, it moves from freshwater to sea to spawn

Two species of anguillid eels, the Shortfin Eel *Anguilla bicolor* and Indian Mottled Eel *Anguilla bengalensis* are known to occur in Indian freshwaters. Like the other migratory fish of India, we still have no clue about the natural history of these least understood species. However, all freshwater fish researchers agree on the fact that the size and population of both these species have significantly reduced. Since most of the rivers in India are heavily dammed, the most acceptable argument is that habitat modification through damming of rivers must have taken a heavy toll on migration of both these species, and ultimately on their populations.

Freshwater fishes across the globe, with more than 15,000 species, are considered as a 'mega-diverse' group of vertebrates with a high rate of new species descriptions (240.2 species/ year during 2003–2013). Besides their high diversity, a third of all freshwater fishes are globally threatened with high risk of extinction, making them high priority taxa for urgent conservation actions. On a hectare-for-hectare

basis, freshwater ecosystems are richer in species diversity than the more extensive terrestrial and marine ecosystems. However, there is hardly any type of anthropogenic activity that does not impact freshwater ecosystems and their biodiversity. According to the latest Living Planet Report (2018), published by World Wide Fund for Nature (WWF), the Freshwater Living Planet Index (LPI) has declined by 83% during the period 1970–2014 (4% per year since 1970, based on 3,066 populations of 757 species). One in three freshwater species is threatened with extinction, which makes the freshwater ecosystem more threatened than any other ecosystem on our planet. Moreover, freshwater fish are the second most threatened group of vertebrates in terms of extinction risk. Anthropogenic threats like habitat modification, fragmentation, and destruction, spread of invasive species, overfishing, and environmental pollution are collectively affecting the existence and functioning of biological processes of migratory fish species. And as discussed earlier, lack of knowledge of the biology and life history of many fish species is a big impediment in designing conservation policies and management plans for migratory fish species.

UNMESH KATWATE

Team of ichthyologists searching for fish in lowland areas of Kerala, where some fish species show seasonal short distance movements in the breeding season

UNMESH KATWATE

Fishermen putting a locally made bamboo trap to catch migrating loaches

Considering the current trend in Indian ichthyology, sincere efforts are now being made to address knowledge gaps associated with diversity (Linnean shortfall) and geographical distribution (Wallacean shortfall) of species, but less is being done to understand the biology and ecology (Raunkiæran biodiversity knowledge shortfall) of Indian migratory fishes. With more Indian freshwater fishes getting threatened with the risk of global extinction, we need to focus our research on studying these less understood fish species and address their conservation issues. If a fish cannot reach its breeding and spawning grounds, it will not be able to reproduce and maintain or grow its population. Many of these migratory species are still unknown to the general public, and even to science, and so too their patterns of migration. Thus, much still needs to be done before it is too late to turn the tide.

Unmesh Katwate is a fish scientist, leading the freshwater and ichthyological research at the BNHS. He is fascinated by areas in ichthyological sciences such as freshwater fish taxonomy, ecology and evolution.

A Lifetime in Flight –
Epic Migration over Generations!

Text: **Neha Mujumdar**

Survival lies at the very core of an organism. Over millions of years of evolution, animals have developed strategies to overcome various environmental challenges. Mankind is no exception to this, being nomadic once upon a time in search of suitable areas to feed and breed. This basic instinct to survive and increase one's tribe is also the driving force behind all the spectacular and mysterious journeys we know as migration.

ALBIN ABRAHAM JACOB

Mating pair of Wandering Glider dragonflies in the air. Odonates first appeared around 325 million years ago. Masters of aerodynamics, they can hunt, fly backwards, and even mate while in flight

Insects, like other organisms, show some of the most extraordinary migrations. Ironically, despite being the most dominant taxa in the animal world, the migratory movements of insects have not been studied in detail. Migration of the Monarch Butterfly *Danaus plexippus* is an exception, though. A single generation of this butterfly has been documented to fly 7,000 km annually between southern Canada and Mexico, by researchers and citizen science volunteers. This laborious travel to escape the harsh cold winters of Canada to the forests in Mexico where they can hibernate until spring is appreciated across the world. This was considered the longest insect migration known to science, until another example of a migratory dragonfly came to light.

Odonates (dragonflies and damselflies) are fierce predators and are known for their excellent aerodynamic skills. They can catch prey very efficiently, hover, move backwards, take 360 degree turns, and even mate while in flight – rare qualities for insects to possess. Their nymphs are aquatic (freshwater) while the adults are terrestrial. The dragonfly *Pantala flavescens* very aptly bears the name Wandering Glider or Globe Skimmer. This species migrates between Africa and India. It flies over the West Indian Ocean, covering a distance up to 18,000 km and glides at altitudes up to 1,000 m. It is known to breed in ephemeral pools or stagnant waterbodies. Swarms of Wandering Glider arrive in India during the south-west monsoon and leave after the post-monsoon showers. They follow the monsoon currents of the south-west and north-east monsoon to cross the West Indian Ocean. The intercontinental migration of this diminutive species was discovered by the marine biologist Dr Charles Anderson and his team only in 2009. Researchers have observed that this dragonfly starts its migration from India around the end of September and reaches the Maldives in October; subsequently it travels to Seychelles, ending its journey at Aldabra (Outer Islands of the Seychelles) near Africa by December. Further, the species is supposed to breed taking advantage of short equatorial and summer rains in parts of east and southern Africa till May, before returning to India. That is how its intercontinental migration circuit is completed!

NEHA MUJUMDAR

Wandering Glider migrates between India and Africa every year, in which four generations of the species take part. It the longest insect migration known

This migration is a well-coordinated process, such that the adults reaching India find their perfect habitat in seasonal ponds and paddy fields, the nymphs complete their development (*c.* 38 to 45 days) before the water bodies dry out, and then fly out as adults of the next generation. Thousands of Wandering Glider individuals can be seen hovering in the sky over agricultural fields, open grasslands, plateaux, and even in urban and semi-urban areas by the end of September, signalling their return journey. They are known to feed on minute insects in the air, and have ability to glide on strong winds that facilitate their migration.

It is also assumed that migratory birds like Amur Falcon *Falco amurensis* and Pied Cuckoo *Clamator jacobinus* crossing the West Indian Ocean follow the same route as these dragonflies, probably feeding on them en route. Other species of odonates like Vagrant Emperor *Hemianax ephippiger* and Keyhole Glider or Red Marsh Trotter *Tramea basilaris* have also been observed migrating with Wandering Glider. More information on this migration can be found on <https://www.ted.com/speakers/charles_anderson>.

Another interesting aspect of insect migration in India is the migration of butterflies. Though it is well known locally, very few scientists have carried out in-depth studies on this aspect. Some of the migratory butterflies in India are: Blue Tiger *Tirumala limniace*, Plain Tiger *Danaus chrysippus*, Striped Tiger *Danaus genutia*, Common Crow *Euploea core*, Painted Lady *Vanessa cardui*, Pea Blue *Lampides boeticus*, Common Emigrant *Catopsilia pomona*, Mottled Emigrant *Catopsilia pyranthe* and Crimson Rose *Pachliopta hector*. Their local movements coincide with the monsoon, probably in search of sites with fresh and abundant larval host plants.

NEHA MUJUMDAR

Mottled Emigrant females laying eggs on Tanner's Senna *Cassia auriculata* in the plains of Bellary district, Karnataka. Hundreds of individuals can be seen in this area during October; possibly a part of migration

Dr Krushnamegh Kunte, scientist from National Centre for Biological Sciences, Bengaluru, has studied the migration of milkweed butterflies (including Tigers and Crows) in southern India from the Western Ghats to the plains. He explains this behaviour as an escape from heavy rains in the forested areas where conditions get damp and humid during the monsoon. Hundreds of butterflies move towards the plains that receive less rain from south-west and north-east monsoons. They travel back to the Ghats after the monsoon rains are over. Some recent observations have also shed light on the migratory movements of Common Emigrant *Catopsilia pomona* through urban areas of Bengaluru.

ADRIAN PINGSTONE / WIKIMEDIA COMMONS

Desert Locust, *Schistocerca gregaria*, is one of the most notorious agricultural pest species in the world. During migration, large swarms of these insects can travel up to hundreds of kilometers and feed equivalent to their body weight in a day

Recently we witnessed a havoc created by the locust attack in Rajasthan and northern parts of Gujarat by the Desert Locust, *Schistocerca gregaria*. The term 'locust attack or locust plague' indicates a large swarm of locusts, comprising of thousands, sometimes millions of individuals, migrating in search of new feeding or breeding grounds. An otherwise solitary species, it also exhibits gregarious behaviour in times of sudden population outbreak. Competition for food in a local area triggers the migration in search of new feeding grounds that coincides with monsoon currents. Locusts are known to migrate with the winds from northern parts of Africa across the Arabian Peninsula into Pakistan and north-west India. Locusts attacks can cause a major destruction of crops leading to high food scarcity. To control these upsurges, migration of these species has been monitored regularly across the world.

Overall, migration is one of the most intriguing events in nature, be it birds, mammals, or the insects that have intricate relationships with each other. We know very little about them. This underlines the need for more studies on this aspect, especially on insects. It is up to us how to contribute. Next time when you see a swarm of butterflies in the forest or dragonflies hovering, upload your observations on biodiversity portals like iNaturalist (https://www.inaturalist.org/) or India Biodiversity Portal (https://indiabiodiversity.org/) and become a citizen scientist!'

Neha Mujumdar, works at the BNHS as a scientist (Entomology) with Conservation Department. Studying butterflies and odonate biology is her major interest.

When the Entire Indian Ocean is your Swimming Pool

Text and Photographs: **Adhith Swaminathan**

A female Leatherback Turtle tagged with a satellite transmitter in 2012

Camp site in West Bay, Little Andaman

Speak to most people living in the Andaman and Nicobar Islands and they will tell you that they believe leatherback sea turtles make their way to the islands through the Indian Ocean, all the way from Australia. While this has recently been recently proven through satellite tracking of individuals, sustained research over the last 12 years has also been able to identify the nesting patterns and migratory routes of Leatherback Sea Turtles nesting in the Andaman and Nicobar Islands. The Leatherback is the largest and one of the most migratory of the seven species of sea turtles that come to the Andaman and Nicobar archipelago to nest between November and April every year.

Although there were records of Leatherback nesting from the Indian mainland dating back to the 1960s, its nesting is currently restricted to the Andaman and Nicobar Islands. Satish Bhaskar was the first researcher to report nesting of the species in the Andaman and Nicobar Islands in 1979, and subsequent research has established Great Nicobar Island, Little Nicobar Island, and Little Andaman Islands as key nesting sites.

The most commonly used technique to identify individual sea turtles is using external flipper tags. The external identification tags are applied on the rear flippers of Leatherback Sea Turtles, and these tags bear a unique identification number and contact information of the tagging agency for anyone who sights the animal. Additionally, sea turtles are also tagged with a Passive Integrated Transponder (PIT), a microchip with a unique barcode. These tags have proved to be more reliable in the long run, as they are injected with a needle between the skin and the muscle. Tagging has resulted in the recording of valuable biological data and is a cost-effective way of tracking this taxa.

Several tagging studies from across the globe indicate that sea turtles show high site fidelity to their breeding site; individuals are typically encountered at the same nesting beach where they were originally tagged. However, recent research indicate that Leatherback Turtles show less nest site fidelity in comparison to other sea turtles; there are records of them changing nesting sites such as the Leatherback tagged in Australia that was recovered from Great Nicobar.

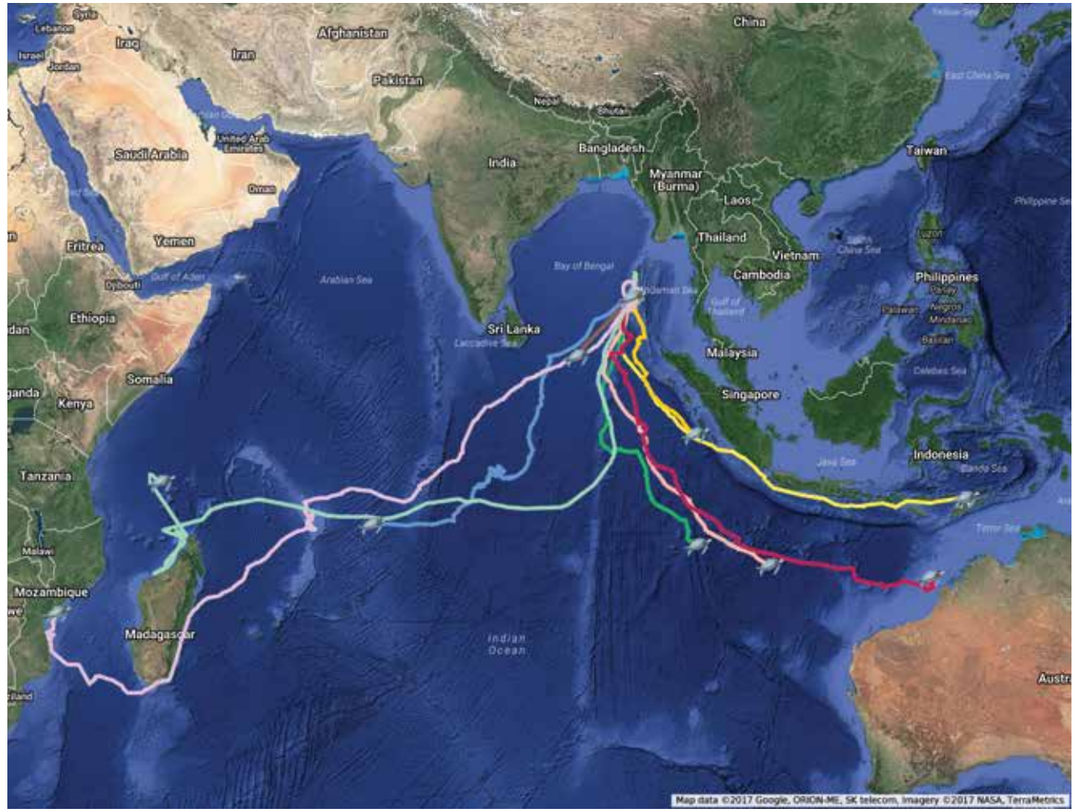
Map of Little Andaman, Little Nicobar and Great Nicobar Islands

In 2008, a project was initiated in Little Andaman Island, the southernmost island of the Andaman group, to monitor the nesting recovery of Leatherback Sea Turtles from the devastating Indian Ocean earthquake and tsunami of 2004. Since then, two sites, South and West Bay of Little Andaman Island have been monitored annually and over 150 individuals have been tagged. The turtles lay four to seven clutches through the nesting season, often with inter-nesting intervals of 8 to 11 days. Once a turtle is encountered and identified, the nesting data enables us to predict when we are likely to reencounter the turtle through the nesting season, as they typically nest with intervals of 8 to 11 days between clutches.

A team of six, with three stationed in each of the two monitoring camps, spend two to three months at a stretch between December and March in Little Andaman Island, during which the team patrols the nesting beaches on a daily basis. A regular night patrol would involve walking 14 km over five hours. In recent years, South Bay has been inaccessible since we have to cross a creek having a good population of salt water crocodiles to reach the nesting beach. West Bay is a 7 km stretch that is difficult to cover more than once. However, encountering turtles, especially those individuals that we had predicted would nest (based on the database amassed) is rewarding.

Between 2011 and 2014, we received a large grant to carry out satellite telemetry studies on ten Leatherback Turtles. As West Bay receives nearly three times more the number of nesting females than South Bay, our efforts to tag turtles with satellite transmitters were focused on West Bay during the peak nesting season. Over three years, we tagged 10 nesting females with satellite transmitters with batteries that last for a year. The transmitters are programmed to turn on and record the location every time the turtle surfaces to breathe.

Three of the four turtles tagged in the first two years were recorded heading south-east along the waters of Indonesia towards Australia. The fourth turtle transmitted data



Migratory paths of the Leatherback Turtles tracked from West Bay, Little Andaman Island

The nesting sites are typically located around river mouths and creeks, which are infested with crocodiles. While surveying Little Nicobar Island in March 2019, we came across a crocodile head hung around one of the traditional Nicobari houses

only for 69 days till south-west of Little Andaman. The turtles tagged in 2012 gave us a better insight into their migratory corridors, with one transmitting data close to 200 days. And the three turtles tagged in 2013 and 2014 transmitted the most interesting data, with records from the east coast of Australia and west coast of Africa. One of the turtles travelled 12,328 km in 395 days, skimming the northeastern coast of Madagascar. Yet another travelled 13,237 km in just 266 days to reach the west coast of Mozambique. The satellite tagged turtles travelled an average of 31 to 60 km per day. All these turtles tracked were heading to their respective foraging sites. While we could guess where these turtles were coming from through local knowledge, reencountering a turtle that we tracked highlighted the nest site fidelity that these turtles exhibited. Although South and West Bay are only a few kilometers apart, we have never recorded individuals interchanging beaches. They always returned to the same beach they were originally tagged from, even

Predation of sea turtle eggs by monitor lizards is a common sight in Little Andaman as well as the Nicobar Islands

A Leatherback hatchling ready to start its journey through the Indian Ocean

after their long journey through the Indian Ocean.

In general, Leatherbacks show diverse migratory routes, accessing several foraging sites. The migratory corridors of the turtles nesting in Little Andaman span the entire Indian Ocean. During their migration, they are found diving to depths of close to a kilometer in search of jellyfish, which they exclusively feed on. They spend from one to three years following concentrations of jellyfish before they are ready to breed again. Sea turtles are able to maintain a direction while migrating as they possess a compass sense to the magnetic field of the earth, enabling them to reach their respective breeding and foraging sites.

Recent surveys of Leatherbacks in Great and Little Nicobar Islands, and the recorded nesting in Little Andaman Island in 2019 clearly indicates a stable or increasing population. The Andaman and Nicobar Islands is a haven for Leatherback Turtles of this region. However, not so far from this haven, the Malaysian rookeries have undergone a well-documented decline from about five thousand nests/year in the 1960s, to less than ten nests/year in the 2000s due to intensive egg poaching. The population nesting in the Andaman and Nicobar Islands has shown resilience to natural calamities, but they are still vulnerable to anthropogenic threats, especially fishing related mortalities.

While we have obtained some insights into the post-nesting movement patterns of Leatherbacks in the Indian Ocean, a higher sample size could help us assess if these turtles use other migratory corridors, and also help us identify their exposure to fishing in the high seas. The upcoming coastal development plans for the islands, specifically in Little Andaman and Great Nicobar Island, where the Leatherbacks nest in good numbers, will pose a threat to this regional nesting population of Leatherback Turtles.

Adhith Swaminathan is a researcher working with Dakshin Foundation and has been fascinated by sea turtles since the age of ten. He is, since 2010, conducting research on leatherback sea turtles of the Andaman and Nicobar Islands.

The Dugong in India

Text: **K. Sivakumar**

CAMPA PROJECT

Dugong a herbivorous marine mammal, can stay underwater for six minutes before resurfacing

India is home to several migratory animals, including the dugong. *Dugong dugon,* also called sea cow, is one of the four surviving species in the Order Sirenia and the only existing species of herbivorous mammal that lives exclusively in the sea. Dugongs are usually found in calm, sheltered, and nutrient-rich waters, generally in bays, shallow islands, and reef areas that are protected against strong wind and rough seas, with extensive seagrass beds. Such habitats are still available in the Gulf of Mannar, Palk Bay, Gulf of Kachchh, and the Andaman and Nicobar Islands in India. However, dugongs are not confined to inshore waters but have also been recorded near reefs up to 80 km offshore in waters up to 37 m deep.

The population of dugongs in India seems to be less than 250 individuals, dispersed in highly fragmented habitats. Several threats contribute to their continuous population decline, which include seagrass habitat loss and degradation, entanglement in fishnets, indigenous use, poaching, hunting, and coastal pollution, among others.

In order to conserve and manage dugongs at the global level, the 7th meeting of the Conference of Parties of CMS passed a resolution and urged all dugong range states to cooperate to develop and adopt a Memorandum of Understanding (MoU) and an Action Plan for the conservation and management of dugongs throughout the species range. In this connection, in October 2007, UNEP/CMS organized an Intergovernmental Meeting in Abu Dhabi to finalize the MoU on the conservation and management of dugongs and their habitats throughout their range. The agreement came into force on October 31, 2007 with the signatures of seven range states, and later with the approval of the Union Cabinet, Government of India also signed this MoU in April 2008 to strengthen the ongoing conservation programme on dugongs and their habitats in Indian waters with the support of the international community.

CAMPA PROJECT

Dugong stranding is a major threat to the species in India

The CMS Secretariat then sought the advice of Signatory States on the need for a sub-regional grouping for active implementation of the CMS-Dugong MoU in the range states. Five sub-regions were identified, namely South West Indian Ocean, North West Indian Ocean, South Asia, and the South East Asian and Pacific sub-regions. India, Bangladesh, Pakistan, Maldives, and Sri Lanka fall within the South Asia sub-region. Home to the largest habitat for dugongs, with perhaps the highest population in the region, India may volunteer to lead the South Asia sub-region in implementing the recommendations of the CMS-Dugong MoU by developing a comprehensive proposal for survey, assessment, and conservation of dugongs, in active collaboration with UNEP-CMS, Signatory States, particularly South Asian nations, concerned research and academic institutions, State/Union Territory Governments, NGOs, and the local communities, particularly fisher folk.

The First Official Signatory State Meeting of UNEP/CMS Memorandum of Understanding for the Conservation and Management of Dugong and their Habitats

CAMPA PROJECT

Death of a dugong due to suffocation from entangling in fishing nets in Gulf of Kachchh

throughout their Range States, was held at Abu Dhabi from October 4 to 6, 2010. With India having the largest population of dugongs in the South Asia sub-region, it has a significant role to play in dugong conservation at the global level in general and in the South Asia sub-region in particular. In this context, the Ministry of Environment, Forest and Climate Change (MoEF&CC) under the Government of India constituted a Task Force for Conservation of Dugongs to look into the entire gamut of issues related to conservation of dugongs and implementation of the UNEP/CMS-Dugong MoU in India, and also to facilitate the country to act as the leading nation in the South Asia Sub-region with respect to dugong conservation. This Task Force has developed the national level Dugong Recovery Plan with the help of Wildlife Institute of India (WII). MoEF&CC with support of CAMPA Fund entrusted WII to implement the Dugong Recovery Programme with support from the State Governments of Tamil Nadu, Gujarat, and Andaman and Nicobar Islands, in collaboration with the Indian Navy, Indian Coast Guard, and other national/state level institutions. Dugongs and their habitats are being recovered now.

Further, dugongs are listed in Schedule I of the Wildlife (Protection) Act, 1972 which accords them the highest degree of protection against hunting. Important dugong habitats have been designated as Protected Areas, thus securing their habitat. Government of India has been implementing a Centrally Sponsored Scheme titled 'Integrated Development of Wildlife Habitats'. Under this Scheme, financial and technical assistance is being provided to the State/Union Territory governments for conservation of wildlife and their habitats. One of the components of the scheme is 'Recovery of Critically Endangered Species' and the dugong has been identified as one of the 15 species under this recovery programme in India. Moreover, Government of Tamil Nadu with help of UNDP-GEF and Japan International Cooperation Agency (JICA) has initiated several management actions to conserve dugong in the state. Similarly, the Gujarat government has been managing dugong habitats with the help of Integrated Coastal and Marine Area Management (ICMAM) project. The Andaman and Nicobar Administration, with support from MoEF&CC, has also initiated a research and management programme on dugongs.

The National Recovery Programme for Dugong has first harmonized all ongoing conservation actions into four goals of the project. One of the goals is to minimize threats to dugongs and their habitat. Dugong Scholarships, a programme for schoolchildren of the fisher folk community, has been launched in India to reach out to their parents who fish in dugong habitats, to dissuade them from killing these animals. An incentive scheme for those who rescue and rehabilitate incidentally captured dugongs has been working well in Tamil Nadu, where it is being implemented jointly by Tamil Nadu Forest Department and WII with the help of CAMPA Fund. Indian Coast Guard, Indian Navy, and Marine Police have been involved in patrolling and protection of dugongs and their habitats. A network of youths, named Dugong Saviours, has been created in Tamil Nadu, Andaman and Nicobar Islands, and Gujarat to save dugongs incidentally caught in fishing nets, and also to spread awareness among the people. Earlier, India completed an interview-based assessment of dugong distribution, habitat, and risks due to fisheries and other anthropogenic activities, following the standardized Dugong catch/ incidental catch survey developed by UNEP/CMS Dugong MoU Secretariat. In this survey, dugong mortality due to human activities other than fishing was ascertained. Necessary conservation actions have already been initiated based on the findings. Seagrass habitat in the country has been mapped by various scientific organizations, but it needs to be updated. Assessment of population status using aerial survey, underwater sonar technique, etc. are ongoing. A study on Ecological Services provided by seagrass habitats has been initiated in Tamil Nadu and Gujarat. Genetic studies on the fragmented populations of dugong are also underway.

Incidental entanglement in fishing nets (bycatch) is the prime reason behind dugong mortality, and therefore, appropriate conservation measures were initiated to regulate harmful practices like the use of gillnets in dugong habitats, with the help of 'Dugong Volunteer', a network of youths from the fisher community. A compensatory scheme was also initiated on a small scale in Palk Bay and the Andamans, where the direct threat of fishing, net entanglement was reported as high. Furthermore, ghost nets and pollution are major threats to seagrass habitats in India, especially in the Gulf of Kachchh and Tamil Nadu. Therefore, a study was initiated to understand the impact of pollution on nutrient contents of seagrass, so that an appropriate mitigation plan can be developed including restoration of seagrass meadows. With the help of the Coast Guard and volunteers, the Forest Department/WII was able to free several seagrass meadows from ghost nets in the southern group of islands of Gulf of Kachchh.

Efforts are underway to manage critical dugong habitats outside PAs and conserve them with the help of local communities. An area of about 360 sq. km in northern Palk Bay has been proposed as the first Marine Conservation Reserve of India exclusively for dugongs and

CAMPA PROJECT

Indian Coast Guard has become involved in saving dugong and its habitats

CAMPA PROJECT

Exam for Dugong Ambassadors: 168 schoolchildren were selected as Dugong Ambassadors and their education was supported in 2019

their associated species. Similarly, about 400 sq. km dugong habitat in Ritchie's Archipelago has been notified as the buffer zone of Rani Jhansi Marine National Park. The economic value of ecological services provided by dugongs and their habitats to humankind was estimated at approximately two crore rupees per year per dugong habitat in India.

It is obvious that creating awareness about the importance of dugongs among stakeholders is the key to the success of the Dugong Recovery Programme. WII has organized a series of stakeholders' consultation and awareness programmes. Selected stakeholders were provided SCUBA training to promote eco-tourism and community based marine biodiversity monitoring. Several awareness rallies and coastal clean-up programmes were organized with schoolchildren, youths, men and women. The efficacy of these programmes was related with volunteer reporting of dugong sightings and stranding, the number of dugongs rescued and released from fishing nets, reduction in poaching of dugongs and other protected marine life. A total of 127 outreach programmes were conducted during 2018–19 in all three sites, covering over 10,000 people. A total of 168 schoolchildren of economically disadvantaged fisher families, who have been fishing in critical dugong habitats, were selected as 'Dugong Ambassadors' and their education was supported with 'Dugong Scholarship Programme (DSP)' in 2019, that was in addition to 152 Dugong Ambassadors selected in 2017–18.

The Dugong Volunteer Network of the project has also increased the local people's investment in dugong and seagrass conservation in India. With continuous streaming of information on dugong distribution and stranding by this network, the field team and forest department are able to respond swiftly and initiate action on the ground. Improved partnerships have also led to a better understanding of the interests and activities of the participants in decision making in the Endangered Species Recovery Programme. Awareness and nature education programmes in partnership with stakeholders, especially local institutions and communities, have proved to be highly efficient in conservation of marine species, especially dugongs, in India.

Implementing DSP at school level helped us to form a strong Dugong Volunteer Network in the study areas, with parents and relatives of Dugong Ambassadors joining as volunteers. We conducted community workshops for parents and relatives of the Dugong Ambassadors, informed them about the importance of their traditional knowledge in conserving dugongs, and distributed logbooks to document the dugong sightings by the seafaring fisher families of the Dugong Ambassadors.

Capacity building of the local stakeholders is an important objective of the Dugong Recovery Programme. Capacity building programmes were organized to strengthen capacity in monitoring and management of marine animals for State Forest Departments and the Indian Coast Guard personnel in Tamil Nadu, Gujarat, and Andaman and Nicobar Is. Actions were initiated to involve communities, especially fisherfolk youth, in monitoring dugongs and their habitats. Special training, including SCUBA diving, was provided to young fisher folk at Palk Bay, Tamil Nadu. These trained youths will also be involved in marine eco-tourism as guides.

Between 2017 and 2019, 20 training programmes were conducted, where about 400 frontline staff from three state forest departments were trained for underwater marine biodiversity programmes. The course included Illegal Trade in Wildlife and Role of Wildlife Forensics in Dealing with Wildlife Crime, and SCUBA diving and underwater marine biodiversity monitoring, orientation workshop on the importance and conservation implications of marine life in the Islands, and workshops for handling stranded marine mammals. The training mainly involves introduction to tools and techniques (snorkelling, boat survey methods and handling equipment and seagrass mapping by random quadrat method, forest management practices in protected marine areas and identifying living organisms in the sea) used to carry out research and monitoring in the coastal environment. Common animals and shore types were shown to them, such as sandy shores, coral reefs, and seagrass beds.

Effective capacity building benefits both the partners and local stakeholders by generating inclusive processes that strengthen trust and build commitment and good relationships. With continuous streaming of information on dugong distribution and stranding, the WII field team and forest department can respond swiftly on the ground. During 2016–19, under State Forest Department supervision, 10 dugongs have been successfully rescued and released so far (Tamil Nadu 7, Andaman & Nicobar 2, Gujarat 1). These rescues were supported by the frontline staff of Marine Police or coastal security police and have helped to avert poaching attempts in two instances. Now, it is planned to use drones to monitor the Indian population of dugongs. Initial surveys helped us to identify some unknown dugong habitats in India, and this technique will soon be intensified to assess the population status of dugong.

MoEF&CC is also planning to build capacity to handle stranded dugongs with the help of UNEP-CMS Dugong MoU Secretariat and IWC.

We believe that illegal capture of dugongs has been reduced in India and reporting of stranded dugongs has also increased through our volunteer networks. Most importantly, more than 10 incidentally captured dugongs were successfully rescued and released into the sea, an indication of the success of this programme.

K. Sivakumar is Scientist 'F' with the Wildlife Institute of India (WII), Dehradun. He leads WII's Marine Biodiversity Programme.

We are grateful to

SETH PURSHOTAMDAS THAKURDAS & DIVALIBA CHARITABLE TRUST

for a generous donation to the

Pratap Saraiya Hornbill Fund

to support the publication of *Hornbill*

Critically Endangered Amphibians of India

Text and Photographs: **Saunak Pal**

Amphibians have been living on this planet for more than 300 million years, and are found in habitats ranging from deserts to tropical rain forest canopies. Habitats where they cannot survive are the oceans, seas, and brackish water. To cope with environmental and habitat changes over all these years, amphibians have evolved into various shapes, sizes, and forms. The growing interest of researchers, especially towards understanding lesser known species like amphibians, is integral to the survival of these evolutionarily unique organisms.

India is home to 432 species of amphibians, more than 100 of which have been described in the last decade alone. A majority of these new species are from the biodiversity hotspots of the Western Ghats and the tropical forests of north-east India. Many of these species are locally endemic and known from only a few localities. It is quite evident that we are far from fully understanding the diversity of amphibians, yet many of these poorly known animals are rapidly being pushed towards extinction.

To evaluate the extinction risk faced by any species, the International Union for the Conservation of Nature (IUCN) has defined a set of quantitative criteria, to categorize species as Vulnerable, Near Threatened, Endangered, or Critically Endangered using available information such as population trends, threats, and distribution. Critically Endangered species are those which face an extremely high risk of extinction in the wild. Nineteen species of Indian amphibians are currently categorized as Critically Endangered.

The Western Ghats mountain range, a global biodiversity hotspot, is also one of the most threatened regions. Seventeen of the 19 Critically Endangered species of amphibians are endemic to the Western Ghats. Very little is known about the population trends, habitat requirements, and ecology of these amphibians. Recently, *Batrachochytrium dendrobatidis*, a pathogen that causes chytridiomycosis, a disease associated with global amphibian population declines, was reported from the Western Ghats. Although amphibian decline due to this pathogen has not yet been reported in India, it is important to study its effects on local populations.

Kottigehar Dancing Frog
Micrixalus kottigeharensis is endemic to the Western Ghats of Karnataka. It inhabits fast-flowing streams in primary and secondary forests. It belongs to Micrixalidae, a family of frogs in which the males are known for their foot-flagging behaviour, which is a signal to potential mates.

Amboli Toad *Xanthophryne tigerina* belongs to a unique genus of toads. The species is endemic to the northern Western Ghats of Maharashtra and is known only from the forests and plateaux of Amboli in Sindhudurg district. It breeds in temporary water pools collected in cavities of lateritic rock.

Dattatreya Night Frog *Nyctibatrachus dattatreyaensis* is known only from the high-elevation shola forests of Dattatreya Peeta and adjoining areas in the Western Ghats of Karnataka. This species is found amidst rocks in high elevation montane forest streams. Due to the extremely wrinkled skin, frogs of the genus *Nyctibatrachus* are referred to as wrinkled frogs.

Amboli Bush Frog *Pseudophilautus amboli* is endemic to the northern Western Ghats. It was described from the forests of Amboli in Maharashtra, and is also known to occur in the adjoining forests of Goa, northern Karnataka, and Kolhapur. This is an arboreal frog found in bushes, shrubs, and short trees.

Chalazodes Bubble-nest Frog *Raorchestes chalazodes* also called Gunther's Bush Frog, is endemic to the high-elevation wet evergreen forests of Agasthyamalai Hills. It was rediscovered in 2011, 135 years after its initial description in 1876. This secretive frog spends most of its time inside bamboo and reed hollows, the male squeezing through cracks or holes made by beetles and calling from inside to attract females.

Griet Bush Frog *Raorchestes griet* is a small frog endemic to the southern Western Ghats. Currently, this member of family Rhacophoridae is only known from forests around Munnar, Idukki in Kerala. This arboreal species is common in montane forests, but has also been recorded in secondary growth close to shola forest and tea plantations.

Kaikatti Bush Frog *Raorchestes kaikatti* is known only from Kaikatti, in the Nelliyampathy Hills of the Western Ghats of Kerala. It occurs in evergreen forests and is a tree dweller.

Munnar Bush Frog *Raorchestes munnarensis* is endemic to the high elevation forests of southern Western Ghats, and is presently known only from the forests around Munnar in Kerala. It predominantly occurs on forest tree trunks and has a distinct loud call.

Ponmudi Bush Frog *Raorchestes ponmudi* is endemic to the Western Ghats and occurs primarily in evergreen forests. This fairly large-bodied bush frog is known to call from high up in the tree canopy in the late evenings. Described from Ponmudi in the Agasthyamalai Hills, this species might have a much wider distribution.

Resplendent Shrub Frog *Raorchestes resplendens* is endemic to the high elevations of southern Western Ghats, above 2,000 m elevation, near Anaimudi peak in Eravikulam National Park. This tiny frog with short limbs is found on grass clumps and short vegetation in grassland.

Toad-skinned Frog *Sallywalkerana phrynoderma* is endemic to the Anaimalai Hills of the southern Western Ghats. This ground-dwelling frog is associated with thick leaf litter on the forest floor of wet evergreen forests. Earlier thought to be a member of the genus *Indirana*, it was recently allocated to the new genus *Sallywalkerana*, named after Dr Sally Walker, for her lifetime contribution to wildlife conservation.

Anaimalai Gliding Frog *Rhacophorus pseudomalabaricus* is endemic to the high elevation forests around the Anaimalai Hills of the southern Western Ghats. Frogs of this genus are referred to as gliding or flying frogs, as many of them can glide between trees and shrubs. These frogs make a foam-like nest on vegetation overhanging stagnant water bodies. Once hatched, the tadpoles drop from the nest into the water below.

Green-eyed Bush Frog *Raorchestes chlorosomma* is endemic to the high elevation shola forests of the southern Western Ghats. Currently, it is known only from forests around Munnar, Idukki in Kerala.

Saunak Pal, is ‘Scientist B’ at the Natural History Collection department at BNHS. His primary interest lies in understanding the diversity and distribution of reptiles and amphibians.

Wildlife hunting in bustard areas

Text: **Sujit Narwade**

As a wildlife researcher, I have spent many hours in the field in various parts of India, especially in bustard areas collecting data on different species of birds and mammals — apart from my designated study species. In the course of my work, I have come across quite a few cases of poaching of wildlife, and here I narrate some of these.

Maharashtra

COURTESY: LIMBARAM GAIKWAD

This photograph was taken 20 years ago, of forest department staff with a poacher nabbed with the carcass of a blackbuck. The current forest department staff of the Great Indian Bustard Sanctuary, Solapur informed me that the poacher was charged under the Wildlife (Protection) Act, 1972. However, during the course of the case, the poacher's advocate argued that the accused was wrongfully charged for the crime as he belonged to the minority community of Phase Pardhis, who are traditional hunters. Because of the local politicians, nobody came forward as eyewitness and the poacher was pronounced not guilty and freed! Not long after this, Manohar Adgale, one of the forest personnel who had caught the poacher, was murdered, most probably as revenge. The acquittal of the poacher and the killing of the forest department personnel demoralized the forest staff.

PUNE WILDLIFE DIVISION

PUNE WILDLIFE DIVISION

An individual of the Critically Endangered Great Indian Bustard was found dead in January 2006 near Mardi village in the Great Indian Bustard Sanctuary, Solapur. The bird had a leg injury. The specimen is now in the BNHS Collection. Another similarly injured bird was found in the same area and brought to the office of the forest department in February 2012, treated and kept in care for one and a half months, but it died. Though the cause of the injury was unknown, both birds had similar leg injuries. The birds could have got caught in nooses laid for Blackbuck by Pardhis, or maybe injured as a result of collision with power lines, which in most cases is fatal for the birds.

On May 15, 2007, I came across a few persons putting out nets for Black-naped Hare on passage to a waterbody in Masla village, Tuljapur tehsil, Osmanabad district. They informed me that they occasionally hunted the hare for "fun" and were not traditional hunters. When I told them of the Wildlife (Protection) Act, 1972, under which hunters can face prosecution, they laughed and told me that hunting hare, blackbuck, partridge, and quail is a common practice. They removed the trap only after I explained to them the protected status of wildlife, and from fear of the legal action that might follow if I filed a complaint against them.

SUJIT NARWADE

NATURE CONSERVATION CIRCLE, SOLAPUR

DHANANJAY GUTTE

On March 21, 2009, volunteers of Nature Conservation Circle, Solapur (NCCS), accompanied by the local police and forest department, found a few people feasting on cooked wild meat near Boramani village, 15 km along the Solapur-Hyderabad road. All the guns, ammunition, meat, and Blackbuck horns were seized. There were also ice packs full of meat, samples of which were sent to the Centre for Cellular and Molecular Biology (CCMB), Hyderabad for DNA analysis. The meat was identified as that of blackbuck. The vehicle used was seized. A case was filed in the Sessions Court, and more than 10 years have lapsed. Similar case was also reported from Latur area in 2016, in which police played a crucial role, with prompt action.

Karnataka- Maharashtra border

SUJIT NARWADE

ARAVIND KUMBAR

While travelling towards Karnataka in April 2010, Dr Arvind Kumbar from Akluj, Solapur, came across evidence of hunting of painted stork at a lake near Donaj village, Mangalvedha tehsil, Solapur district. He witnessed a couple of dogs eating the body parts of the species, and this issue was raised through local newspapers, especially in the Solapur edition of *Sanchar* and later in *Maharashtra Times,* which helped in creating awareness and control on hunting in the area.

On June 24, 2011, while conducting a survey around dusk, assisted by Bhagavat Mhaske, Forest Guard, Nannaj, we saw a Phase Pardhi tribal laying a noose trap for Blackbuck at Narotewadi on the boundary of Nannaj Bustard Area. Concealing our identity, we began talking to him and gathered that more people would be coming at the night to feast on the catch. According to him, these large nylon nooses are not available locally and are purchased from fishermen of Ujani backwaters, about 150 km from Nannaj. We seized the trap, and let him go, with a strong warning to him not to engage in such activities in future.

SUJIT NARWADE

SUJIT NARWADE

On January 21, 2012, with the help of BNHS staff, I rescued a Black-headed Ibis (or Red-naped Ibis) caught in a noose trap laid in Hotgi lake, 4 km south of Solapur. Piles of heron and egret feathers seen at the same spot were evidence of continuous hunting pressure on the wetland birds in the lake. On contacting the forest department and after frequent follow-ups, the culprits were punished. During our next visit to the lake in February 2012, a few persons approached my colleague, Mr Sameer Bajaru, Mammalogist, BNHS, and threatened to kill him as revenge for reporting on them for hunting birds. Fortunately, the gang ran away on the arrival of our team members.

SUJIT NARWADE

On June 15, 2012, during a survey of painted stork, I found a few people skinning a carcass on the edge of Donaj lake, Mangalvedha, Solapur. From a photograph taken from a distance of 200 m, I identified the animal as a Black-naped Hare, but before I could reach the spot from across the lake, the poachers escaped.

SUJIT NARWADE

On May 27, 2015, near Achegao, Solapur, a tribal woman was seen carrying shells of turtles, which had been eaten two days earlier.

SUJIT NARWADE

While conducting field surveys in Akola-Washim district on October 23, 2016, we landed in a tribal area near village Vadala, where a pangolin was being boiled up to loosen the scales, which local people believe has medicinal value!

SUJIT NARWADE

On March 05, 2015, a man was seen carrying live birds in a bag at Hipparga lake, Solapur. After enquiring, the bag was opened and the bird turned out to be the Ruddy Shelduck which was released by us.

Andhra Pradesh

SUJIT NARWADE

On November 22, 2018, while I was travelling to Rollapadu WLS, a person was seen selling a roasted mongoose in banana leaves, which indicated no knowledge or fear of the Wildlife (Protection) Act, 1972.

Thar Desert, Rajasthan

KAMLESH JANI

KAMLESH JANI

Hunting is prevalent in large expanses of the Thar desert, especially in winter, where the forest department seized some individuals of Chestnut-bellied Sandgrouse and nabbed the poachers. Injured birds were sent to a rescue centre and the carcasses were burnt. In March 2019, a joint operation was led by Mr Kamlesh Bishnoi, Forest Guard, Desert National Park (DNP) with the help of Wildlife Crime Control Bureau (WCCB) which nabbed the poachers, and made a strong case leading to punishment of the culprits. This also led to reduction in poaching of the Spiny-tailed Lizard in Great Indian Bustard areas of Pokhran, Jaisalmer.

Ajmer, Rajasthan

NEELAKANTH BORA

Releasing a Monitor Lizard captured by locals at the outskirts of Ramsar village, a Lesser Florican site, near Nasirabad, on December 07, 2019.

Though I have cited only a few examples of poaching of wildlife in the GIB and Lesser Florican, there are likely many cases that go unnoticed or unreported, as narrated in the article. Unless culprits are given strong punishment according to the law, this killing will not stop. The Indian Wildlife (Protection) Act is a strong and all-encompassing piece of legislation, but its implementation has been far from satisfactory. Education and awareness, sensitization of locals as well as officialdom towards the wildlife laws of the land, and coordination between agencies like NGOs, forest departments, police, forensic labs, etc. will help create evidence-based cases strong enough to clear the wildlife crime.

Sujit Narwade, Project Scientist, BNHS, executes projects relating to conservation of bustards and floricans. He also helps Forest Departments to execute conservation plans.

News Briefs

National Biodiversity Authority visits BNHS

BNHS PHOTO LIBRARY

Expert panel from the National Biodiversity Authority reviewed BNHS Natural History Collections to recognize it as a national repository

On July 24, 2019, an expert panel from the National Biodiversity Authority, which included Dr Sanjay Kumar, Director, CSIR-Institute of Himalayan Bioresource Technology, Shri Darshan Shankar, Chancellor, Foundation for Revitalisation of Local Health Traditions, and Dr Yogesh Shouche, Senior Scientist, National Centre for Cell Science, visited BNHS to review the BNHS Natural History Collection. The review visit was conducted on BNHS's request to Government of India to recognize the Collections as a national repository for fauna under the Biodiversity Act 2002. The visitors were highly appreciative of the treasures in the Collection. ■

New species discovered by BNHS Scientist

HARSHAL BHOSALE / MANDAR SAWANT

Trachischium apteii, a new species of burrowing snake discovered by BNHS scientist, Mr Harshal Bhosale and his team

Harshal Bhosale, a BNHS scientist, and his co-researchers Gaurang Gowande of Fergusson College, Pune, and Zeeshan Mirza, National Centre for Biological Sciences, Bengaluru, have discovered a new snake species from the montane forests of Arunachal Pradesh. The new species, a burrowing snake *Trachischium apteii* has been named after Dr Deepak Apte, Director, BNHS who is a well-known marine biologist. The snake was found under fallen logs at Talle Valley Wildlife Sanctuary during an expedition in June–August 2019, under the project "Documentation of herpetofauna and arachnofauna of Arunachal Pradesh" led by Harshal Bhosale. ■

Workshop on Sustainable Development Goals

A national workshop on Sustainable Development Goals (SDG-14) was organized by National Centre for Coastal Research, Ministry of Earth Sciences (MoES) on September 27, 2019 at NCCR, Chennai, to address the implementation of SDG-14 and to frame the course of action to protect our environment. MoES is the nodal ministry in India for the implementation of SDG-14, which is one of the 17 Sustainable Development Goals adopted by the General Assembly of the UN 2030 Agenda for Sustainable Development. Goal-14 deals with 'life below water' for conservation and sustainable use of oceans, seas, and marine resources.

Dr M.V. Raman Murthy, Director, NCCR, inaugurated the workshop and explained the mandate given to MoES to develop SDG-14 targets and indicators for some of the goals for India. Dr Deepak Apte, Director, BNHS, explained the disconnect between SDGs and existing policies, regulations, and acts. India's 130 Marine Protected Areas make up less than 1% of the total coastline, but under SDG-14.5, 10% of the marine ecosystem is required to be conserved. He also informed that focusing on land for carbon sequestration may not help to achieve the targets; the ocean needs to be looked at as the best alternative for carbon sequestration to manage climate change. ■

Activities@BNHS-ENVIS

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Participants of the International Ozone Day celebration

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Workshops were conducted at Don Bosco and Shishuvan schools during the Wildlife Week celebrations

BNHS PHOTO LIBRARY

Participants of the Forest Owlet Conservation Day celebration

International Ozone Day, 2019: BNHS-ENVIS, Resource Partner on Avian Ecology, celebrated International Ozone Day on September 16, 2019, at Mrs Bhavnadevi Bhagwan Sambre International CBSE School and Special Science Jr College, Zadpoli, Palghar. The ENVIS team conducted an indoor session on spreading awareness about Ozone layer protection and curtailing the usage of single-use plastic.

Wildlife Week, 2019: Starting October 03, 2019, Wildlife Week was celebrated. BNHS-ENVIS conducted workshops on October 03, 2019, at Don Bosco International School and Shishuvan School, Matunga, Mumbai. About 150 students participated in the workshops, which were attended by Ms Katie Bagli, BNHS member and well-known children's author.

Forest Owlet Conservation Day, 2019: BNHS-ENVIS celebrated Forest Owlet Conservation Day on October 24, 2019, at the Zilla Parishad School, Piwali, Shahapur tehsil, Thane district, Maharashtra, in association with the Forest Department personnel of Tansa Wildlife Sanctuary and Owl Foundation. We conducted drawing competition for the children of Std 1–7 of the Zilla Parishad School. Session involving presentation on forest owlet habitat, conservation and bird identification of common birds, was conducted during the event. More than 30 students participated in the celebration. ■

Activities@CEC-Delhi

BNHS-Yamuna Walk Series: CEC-Delhi collaborated with Amaltash Nature Walks to conduct a series of walks around Yamuna river floodplains under the guidance of Yamuna Monitoring Committee. Starting October 2019, three walks were conducted with over 70 participants. The walks aimed at viewing wildlife in relation to environmental, educational, and aesthetic values. The riparian ecosystem and biodiversity along the Yamuna were visited to understand the significance of wetland flora and fauna, the decline of forests along rivers and its impact on biodiversity, such as the threat to livelihoods linked with the river.

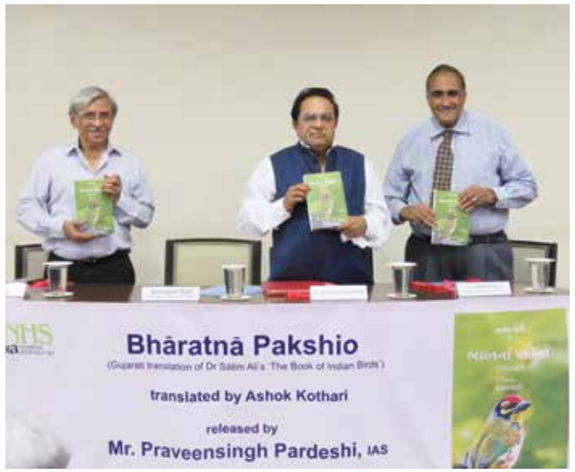
Butterfly Photography Workshop: In October 2019, BNHS-CEC conducted a workshop during the 1st Pawalgarh Titli Utsav, organized by Titli Trust and Pawalgarh Prakrati Prahari in Uttarakhand.

In November 2019, a Bird Survey was organized at Kuno National Park, Madhya Pradesh, by the MP Forest Department. BNHS-CEC provided the resource person to give a talk on butterfly conservation for the forest staff.

In December 2019, BNHS CEC-Delhi conducted a workshop on "Bird-Friendly Garden" at the Annual Christmas Fair at Select City Walk Mall, Saket. More than 1,000 children participated in the workshop. CEC personnel demonstrated the use of bird feeders and bird nest boxes. Posters on "Owls of Delhi" and a booklet on "Butterflies of Delhi" were distributed free of cost to the children.

To partner or participate in CEC-Delhi activities, please follow our Facebook page: Conservation Education Centre-Delhi, ABWLS *or email* <cecbnhsdelhi@bnhs.org> ■

Gujarati bird book released



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(L to R): Mr Homi Khusrokhan (President, BNHS), Mr Vipin Reshammiya (Chief Guest), and Dr Ashok Kothari (translator) released the book

Ashok Kothari's Gujarati translation BHĀRATNĀ PAKSHIO of the landmark BNHS publication, THE BOOK OF INDIAN BIRDS by Dr Sálim Ali, was released at Hornbill House, Mumbai, on October 01, 2019, by the Chief Guest Mr Vipin Reshammiya. The Guest of Honour was Mr Ashutosh Salil, IAS, Jt Municipal Commissioner, Mumbai. The book was also launched at a function in Ahmedabad on October 05, 2019 by Dr C.N. Pandey, PCCF (Retd). The original, currently in its 13th revised edition, with more than one million copies sold, was earlier translated into Hindi (2006) and Marathi (2018). The Gujarati version is an important acquisition for birders, Forest Department staff, and school children, among others. The objective of the regional language translations is to develop a broad-based support from different sections of society for the conservation of birds and their habitats. ■

New anthology on nature conservation released

BNHS PHOTO LIBRARY

Ms Neha Sinha (second from right) authored a chapter in the book launched by Shri Jairam Ramesh, MP and Chairman of Parliamentary Standing Committee on Science, Technology, Environment and Forests

The launch of NATURE CONSERVATION IN THE NEW ECONOMY – PEOPLE, WILDLIFE AND THE LAW IN INDIA was held in Delhi on October 25, 2019. This anthology has been edited by Dr Ghazala Shahabuddin of the Centre for Ecology Development and Research, and K. Sivaramakrishnan of Yale University. Neha Sinha, Policy and Advocacy Officer at BNHS, has contributed a chapter on wetland policy and practice in India, titled 'Water under the Bridge – Wetland Use and Abuse in India', which takes an in-depth look at changed Wetland Rules in the country. The book was released by Shri Jairam Ramesh, MP and Chairman of the Parliamentary Standing Committee on Science, Technology, Environment, and Forests. ■

SAVE Meeting 2019

The 9th annual meeting of SAVE (Saving Asia's Vultures from Extinction) was held near BNHS's Jatayu Vulture Conservation Breeding Centre in Haryana, India from 4th to 6th November, 2019. SAVE is a consortium of 24 partners working to implement priority actions for the recovery of Asia's globally threatened vultures. Attendees included 40 representatives from all six range countries, Chief Wildlife Wardens from Madhya Pradesh, Haryana, and West Bengal, the Indian Veterinary Research Institute, and most of the 24 SAVE partners. Dr Vibhu Prakash Mathur, Deputy Director, BNHS, who has worked extensively on vultures, participated in the meeting which was held to discuss progress and identify actions for the coming year, and urgently address the increasing gap in funding for vulture conservation. ■

Institutional Archives

The BNHS Library holds valuable official and personal records of luminaries like Dr Sálim Ali, Loke Wan Tho, and M. Krishnan, which are being digitally archived. Among these is an interview of Dr Sálim Ali by the journalist-cat expert Peter Jackson. A recent valuable addition is a digitized set of 36 natural history films shot by Dr Sálim Ali, from the Human Studies Film Archives, Smithsonian Institution, USA. BNHS is thankful to Ms Pam Wintel, Senior Film Archivist, The National Anthropological Films Collection and Mr Joe Gardner, Technical Services Manager, Northeast Historic Films, who enabled the digitization and acquisition process.

Requests for access to the Archives may be sent to the Director, BNHS. ■

Mass mortality at Sambhar Lake

As reports of birds dying in huge numbers at Sambhar Salt Lake started coming in from November 11, 2019, the Rajasthan State Forest Department approached BNHS to conduct a site visit. A team was deputed by the Director, BNHS to conduct the survey and give a preliminary report. The team reported sick/dead birds in two zones, one near Shakambhari Mata temple in Jaipur Division and Nava area of Nagaur division. Mortality of waterbirds was recorded in thousands, 40% of the carcasses being Northern Shoveller. Avian botulism was suggested to be the cause by IVRI, and the BNHS team made their recommendations to prevent such events in future. ■

BNHS organizes International Conference on Wetlands and Migratory Waterbirds of the Asian Flyways

BNHS PHOTO LIBRARY

(L to R): Mr Homi Khusrokhan (President, BNHS), Ms Patricia Zurita (CEO, BirdLife International) and Dr Deepak Apte (Director, BNHS) at the inauguration of the International Conference

BNHS PHOTO LIBRARY

Shri Babul Supriyo (left), Minister of State MoEF&CC, Shri Siddhanta Das (centre), Director General of Forest, MoEF&CC along with Dr Deepak Apte at the Range States meeting during the Conference

BNHS organized a 5-day International Conference on Wetlands and Migratory Waterbirds of the Asian Flyways at Lonavala, Maharashtra, on November 18–22, 2019. The conference was organized in collaboration with Government of Maharashtra, Mangrove Foundation, BirdLife International, and CBD-COP. Ms Patricia Zurita, Chief Executive Officer, BirdLife International chaired the opening of the conference. Keynote speakers included Dr Taej Mundkur, Wetlands International, Dr Evgeny Syroechkovskiy, All Russian Institute for Nature Conservation, Ms Courtney Price, Conservation of Arctic Fauna and Flora-Arctic Birds Migratory Initiative, and Ms Patricia Zurita. Experts from more than 20 countries gathered to deliberate on the status of wetlands and migratory waterbirds at the conference. The conference aimed to arrive at conservation initiatives that could be taken up to address the problems facing wetlands and migratory waterbirds, and to explore sustainable solutions for problems caused by the increasing dependence of humans on wetlands and other natural resources. A Range States meeting was arranged during the conference on November 20, 2019, inaugurated by Shri Babul Supriyo, Minister of State MoEF&CC ■

Sálim Ali Nature Conservation Awards and J.C. Daniel Conservation Leader Awards presented

BNHS PHOTO LIBRARY

Award winners at the ceremony hosted by BNHS

On November 22, 2019, BNHS hosted a ceremony to present the Sálim Ali Awards for Nature Conservation 2019 and J.C. Daniel Conservation Leader Awards for Young Men and Women 2019, during the BNHS International Conference at Lonavala, Maharashtra. The awards were presented by the BNHS President Mr Homi Khusrokhan; Ms Patricia Zurita, CEO, BirdLife International was the Guest of Honour for the event.

The Sálim Ali Awards for Nature Conservation 2019 were presented in three categories – International: Alexander Louis Peal (conservationist), National: Prof. Madhav Gadgil (ecologist), and Community Conservation: Tsuseki and Limthure (educators and conservationists). The Sálim Ali Awards recognize individuals for their outstanding contributions in the field of protection, management, and conservation of natural resources, including population, wildlife, pollution and hazardous materials control, education, information, and legislation. These biannual awards include an amount of Rupees One lakh and a citation, with a trophy initiated in 2019.

BNHS instituted two awards in 2019: J.C. Daniel Conservation Award for Young Men and Young Women, in memory of Mr J.C. Daniel, a leader who inspired generations of researchers and conservationists. The J.C. Daniel Conservation Leader Award for Young Men 2019 was presented to Anant Pande (ecologist and conservationist) and the J.C. Daniel Conservation Leader Award for Young Women 2019 to Sonali Garg (taxonomist). The J.C. Daniel Awards are conferred to honour an individual's relentless personal efforts towards nature conservation. ■

ERRATA

Hornbill October–December 2019: article titled 'Value the Invaluable' authored by Pooja Patki pp. 34–40.

On Page 34: Column 1

For Para: Over the last decade, the focus of conservation has moved away from predominantly looking only at protecting nature for its intrinsic worth to a view which is largely utilitarian, often linking it to human well-being. towards linking it to human well-being.

Read: Over the last decade the focus of conservation has moved away from predominantly looking only at protecting nature for its intrinsic worth to a view which is largely utilitarian, often linking it to human well-being.

Published on January 10, 2020, by Mr Debi Goenka for Bombay Natural History Society, Hornbill House, Dr Sálim Ali Chowk, Shaheed Bhagat Singh Road, Mumbai 400 001, Maharashtra, India.

Programmes 2020

NATURE TRAILS
Karnala Bird Sanctuary
Date: February 16, 2020

NATIONAL CAMPS
Eaglenest Wildlife Sanctuary
Date: March 02–05, 2020

INTERNATIONAL CAMP
Sri Lanka: Emerald Island
Date: March 21–27, 2020

FEW UPCOMING CAMPS
North Sikkim, April
Corbett and Pangot, May
Madagascar, October

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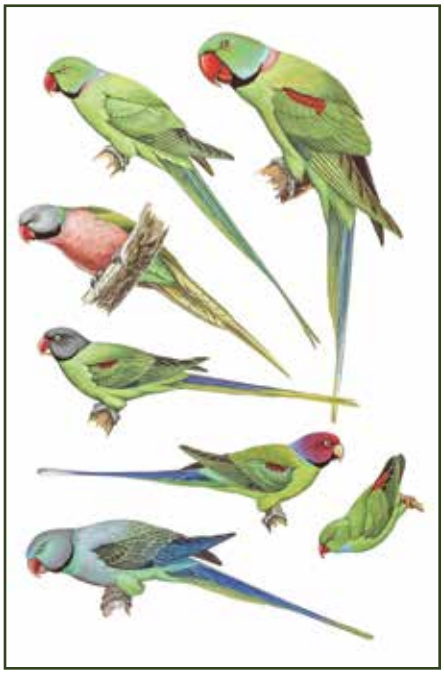

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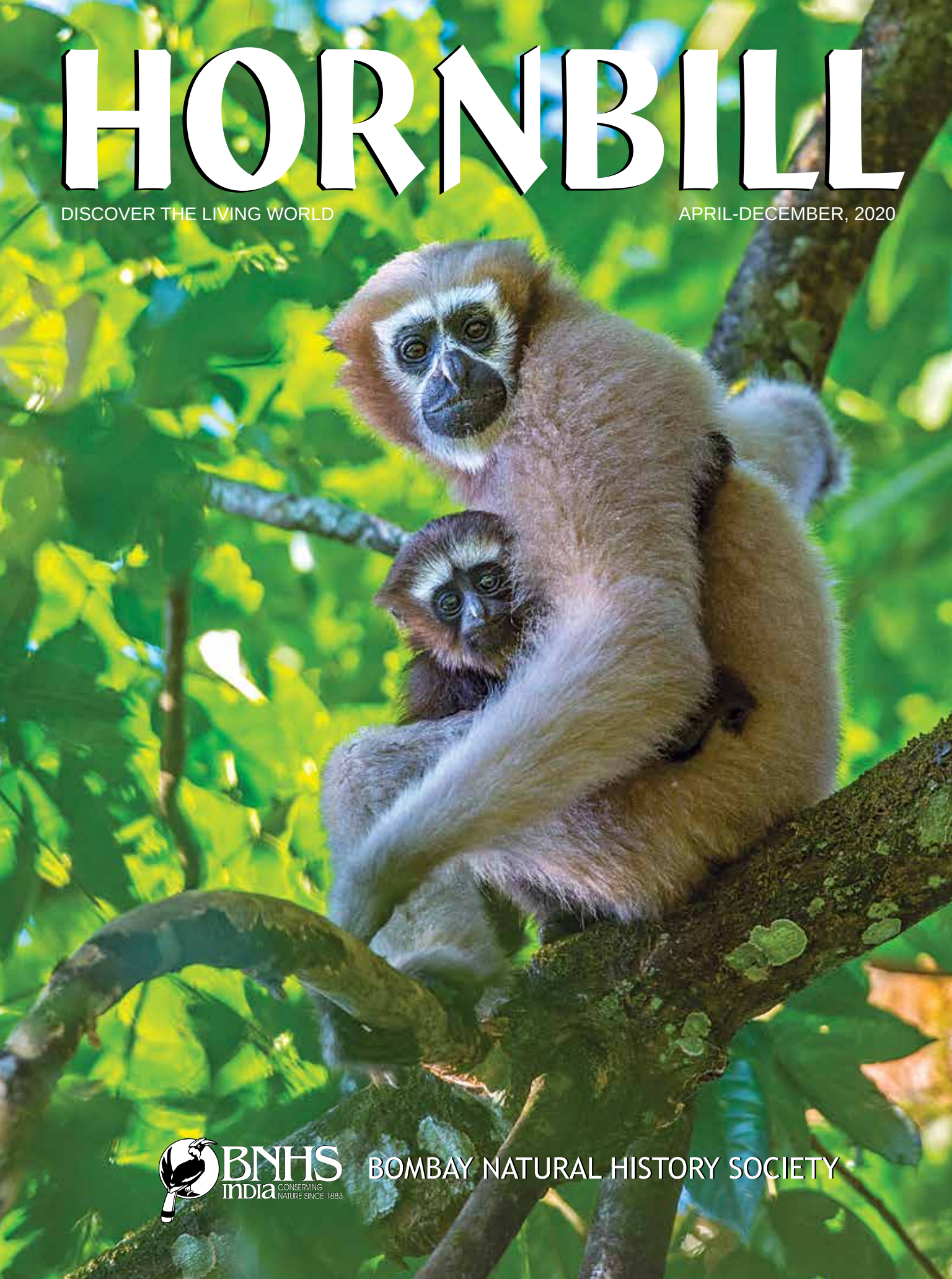

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COVER : **Hoolock Gibbon**
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Published and printed quarterly by the Honorary Secretary for the Bombay Natural History Society, Printed at Akshata Arts Pvt. Ltd., Lower Parel, Mumbai.
Reg. No. RN 35749/79, ISSN 0441-2370.

For more information on the Society and its activities, write to the Honorary Secretary, Bombay Natural History Society, Dr. Sálim Ali Chowk, S.B. Singh Road, Mumbai 400 001, Maharashtra, India.
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Realigning Priorities!

Just as we desperately need a vaccine for COVID-19, we also urgently need a vaccine to restrain human arrogance and greed! It is this arrogance that makes us believe that we control nature and the environment. We forget that we have little control over nature; in fact, we are always at her mercy. Be it the raging bush fires of Australia, or the wild fires in the USA, or recent forest fires in Uttarakhand, the increase in storm surges and their intensity (we have just witnessed the strongest storm ever recorded in the Bay of Bengal), the recent locust outbreak across Rajasthan, Madhya Pradesh, and Maharashtra, or the unpredictably extended monsoon of 2019, and the latest enraging El Nino that is causing widespread coral bleaching in northern Indian Ocean including reefs of Lakshadweep, Gulf of Kachchh, and Gulf of Mannar, I can cite several more examples of Mother Nature's fury. Nothing is going right in 2020. Humans are the most dispensable entity in nature – can humans survive without nature? The tragedy is that the so-called literate are the least bothered about climate change or about nature, unless it starts pinching them in their comfort zone. On the other hand, those whom we call illiterate are actually more mindful than the 'literates'. They are the accommodative fighting voices for nature, but unfortunately they suffer most from environmental degradation. What an irony!

The last few months saw some extremely controversial projects getting various clearances, such as Dibang-Etalin and Dihang-Patkai. I believe some wilderness areas are beyond economic considerations – only their intrinsic values should be considered. If we do not fight to save such areas, then we as a race have nothing left to fight for. And the greatest irony is that we are trying to establish 'ecological values' on goods through the so-called 'environmental economics'! I have always had a cautious approach towards environmental economics. For me, it is like putting a price tag on an invaluable asset, as if it is a traded commodity. This is the very same economic logic that is used to facilitate clearance of developmental projects by paying a monetary premium. The NPV (net present value), as per prevailing guidelines, of one hectare of forest in Dibang-Etalin, is estimated to be Rs 10.43 lakhs, which in my view is rubbing salt to the wound!

Post COVID-19 (whenever that may be) provides us with an opportunity to look at investments differently. We must think about how we can decongest cities, improve rural organic agriculture, decontaminate soil, air, and water, think of ways to make best use of technologies, to reduce travel and save precious fuel, to reduce our ecological footprint, invest in systematic habitat restoration, improve health and education sectors, and curb wildlife trade. Investing towards a rural, small scale agrarian economy and moving away from an industrial economy is not a bad idea.

The recent study by Trisos *et al.* (2020)[1] suggests that if global warming is kept below 2°C, less than 2% of assemblages globally are projected to undergo abrupt exposure events of more than 20% of their constituent species; however, the risk accelerates with the magnitude of warming, threatening 15% of assemblages at 4°C, with similar levels of risk in protected and unprotected areas. The study highlights the impending risk of sudden and severe biodiversity losses from climate change and provides a framework for predicting both when and where these events may occur. It is a very insightful read and I suggest all our young researchers should wade through this excellent paper.

Our current model of development will only increase our conflict with the people and wildlife that are still surviving, occupying the last remaining patches of wilderness. It will also increase the exposure of humans to zoonotic diseases. COVID-19 is certainly not going to be the last zoonotic disease impacting us; this experience shows us that there are super-monsters in the making. We cannot continue to behave recklessly, contaminate the air, soil, water, and food resources, and compromise our immunity with our habits. Imagine what it would be like if the melting of the deep permafrost releases zoonotic diseases of the dinosaur era? How dreadful life may be then for the coming generations. For sure, it is time we put our collective wisdom together and realign our priorities to a changed reality and a changed world!!

Deepak Apte

[1]Trisos, C.H., C. Merow & A.L. Pigot (2020): The projected timing of abrupt ecological disruption from climate change. *Nature* 580: 496–501. https://doi.org/10.1038/s41586-020-2189-9

Nightlife in Mumbai's Forests

Text: **Raju Kasambe**
Camera trap photographs: **Priyadarshini Supekar, Raju Kasambe, and Dilip Giri**
Camera trap photographs of Indian Chevrotain courtesy: **Nikit Surve**

A male Leopard that started visiting the waterhole in the summer of 2019

A peaceful and gentle, but highly alert, herd of Spotted Deer visited the waterhole during the daytime

We were disturbed to read claims in the newspapers that there was no wildlife in Aarey Milk Colony in Mumbai, and that it was an "empty" forest. Aarey is an extension of Sanjay Gandhi National Park (SGNP), a beautiful forest that has existed from ages past situated in the midst of the ever expanding sprawl of metropolitan Mumbai. The Aarey Milk Colony forest patch is contiguous with Film City and the BNHS Nature Reserve, and there are no physical barriers to impede wildlife movements between them. Following the newspaper reports, we felt that there was a need to provide photographic evidence of the wildlife known from this area, and the possibility of adding to the faunal checklist. Accordingly, in January 2017, we started a survey to document the wildlife in the 33-acre forested area of the BNHS Nature Reserve, where our Conservation Education Centre is located.

The surveys revealed the presence of at least 120 species of butterflies and an equal number of bird species in the BNHS reserve. As for mammals, the regularly sighted species in the BNHS reserve were Five-striped Palm Squirrel *Funambulus pennantii*, Spotted Deer or Cheetal *Axis axis*, Barking Deer or Indian Muntjac *Muntiacus muntjak*, Bonnet Macaque *Macaca radiata*, and Rhesus Macaque *Macaca mulatta*, these feeding around the CEC building and some coming to drink at the waterhole that BNHS had created for wildlife. At times, the Southern Plains Grey Langur *Semnopithecus dussumieri* was sighted in the trees, feeding on leaves and fruits. The langurs seldom visited

Bonnet Macaque, endemic to the Indian peninsula, are seen in fair numbers in the CEC land

Barking Deer cautiously approaches the waterhole in singletons

Two Asian Palm Civets occasionally visited the waterhole at night

Indian Spotted Chevrotain (Indian Mouse Deer), is another nocturnal visitor

Small Indian Civet was camera-trapped only in the second year of camera-trapping

Wild Boar tend to be aggressive, pushing and squealing at the waterhole

the waterhole. The occasional alarm calls of the langurs indicated the presence of a large predator, which we never spotted.

With time, we realized that just recording the fauna that we could sight in the forest during the surveys was not enough, as it became apparent that numerous species of wildlife were eluding us both during the day and night. To overcome this, we decided to deploy camera traps to capture the elusive species in the reserve. We started by installing two camera traps at waterholes. Camera traps are now a favoured tool for wildlife experts, as the cameras can capture images and videos of any moving object passing in front of them. This technique is especially helpful in collecting valuable information on shy and elusive nocturnal animals, sometimes revealing the presence of species that one least expects in a region. BNHS had first used this technique in its Jerdon's Courser project with tremendous success, and more recently, in the ongoing eMammal Citizen Science project which has had excellent findings too.

Rhesus Macaque, the macaque of the northern Indian plains

Southern Plains Grey Langur is native to western, central, and south-western India

Our camera traps in the BNHS reserve continue to surprise us with clear and interesting images all through the day and night, some of which are given below.

A sounder of Wild Pig *Sus scrofa* were regular visitors to the waterhole. The video recordings showed the thirsty pigs shoving and pushing one another to get a good drink. Might is right, says the law of the jungle! The Sambar *Rusa unicolor* mostly visited the waterhole in the night, but occasionally came in during the day for a sip. The macaques, Spotted Deer, and Barking Deer were recorded only during the day.

Among the nocturnal visitors, we camera -trapped the shy Asian Palm Civet *Paradoxurus hermaphroditus* and the alert Jungle Cat *Felis chaus* coming for a drink, and a Ruddy Mongoose *Herpestes smithii* emerging from its secret home, the water pipes. In March-April 2019, our camera traps captured the nocturnal Small Indian Civet *Viverricula indica*. On May 17, 2019, Nikit Surve (who is conducting research on leopards in Sanjay Gandhi National Park using camera trapping) camera-trapped an Indian Spotted Chevrotain (or Mouse Deer) *Tragulus* (*Moschiola*) *meminna* just outside the CEC gate, that BNHS

Sambar, which are nocturnal or crepuscular, sometimes visit the waterhole during the daytime

education officers Priyadarshini Supekar and Eesha Shevade had sighted in the evening!

We were aware of the presence of a leopard on the BNHS reserve, and the camera-trap images confirmed this. A shy male Leopard *Panthera pardus* with time seemed to have lost its camera-shyness, and to our anthropomorphizing eyes, it even appeared to be posing at times. What was surprising for us was that six different leopards would visit the waterhole, including a female with a subadult. All the leopards were very alert; they had earlier eluded the BNHS staff who spent hours waiting in a hide just for a glimpse of these evasive carnivores. The leopards would visit the waterhole only after the observers had moved away from the hide – but the cameras work night and day!

The camera traps occasionally revealed leopard movements; stray dogs, an important food for leopards in this area; and even tribal women collecting firewood.

The forests of Mumbai may look 'empty' and devoid of wildlife to the human eye, but when seen through the eye of the camera, the story is different. Many of the 14 species of mammals that our cameras captured are nocturnal, and we hardly ever sighted them otherwise. With their powerful vision, hearing, and sense of smell, they detect human presence and avoid us. The wildlife of SGNP, and BNHS Nature Reserve and Aarey Milk Colony, do not recognize boundaries. For them the forest is one, and they venture into human occupied areas only due to sheer necessity. It is us humans who are constantly pushing the boundaries and encroaching upon their habitats.

Raju Kasambe is Assistant Director, Education and manages the Conservation Education Centre (CEC), Mumbai. His main interests are birds, butterflies, and environmental education.

PAINTING: D.M. HENRY

The Enigmatic and Elusive Jerdon's Courser

Text: **Ranjit Manakadan**

Jerdon's Courser *Rhinoptilus bitorquatus* has been both an enigmatic and elusive species for Indian ornithologists. It was first recorded for science by T.C. Jerdon during 1841–1842 in "hilly country above the Eastern Ghats, off Nellore and in Cuddapah" in Andhra Pradesh. Jerdon's notes on the species in his BIRDS OF INDIA (1877) are "found in small parties" and "not very noisy, but occasionally uttering a plaintive cry". An earlier report of the species was published by W.T. Blanford in 1867 in the *Journal of the Asiatic Society of Bengal* (38: 190) mentioning the sighting of birds "18 miles east of Sironcha". Later, writing in Volume IV of the FAUNA OF BRITISH INDIA (1898), he again refers to the sighting of three birds near Sironcha in May 1867, and the sighting of two pairs in March 1871 near Bhadrachalam, of which he managed to shoot a male each. Some of Blanford's comments on the species are "very far from common", "found in thin forest or high scrub", "never in open ground", and "never saw any on hills", which provide some insights into both its rarity and habitat.

L. SHYAMAL / CC BY-SA

The BNHS sound box that reproduces the call of Jerdon's Courser

After these, there was a "presumably authentic" (quoting Sálim Ali in the Oct.–Dec. 1977 issue of *Hornbill*) report in 1900 by Howard Campbell, near Anantapur in the Pennar Valley. Commenting on the same record, E.C. Stuart Baker wrote in THE FAUNA OF BRITISH INDIA: BIRDS, Vol. VI (1929) "Campbell saw it twice, in pairs, running about in dry bush-jungle ... "On both occasions, it ran away with great rapidity and not take to wing" … "Blanford's birds obtained in March and May were not breeding but Howard's male, the only one he managed to get, had very enlarged testes. This was in June, so presumably the birds breed about then." Apart from these three early records, an egg that was lying unnamed in a museum in Scotland – reportedly collected in 1917 from the Kolar Gold Fields area of Karnataka – was identified as of the species in 2014. There is also an unsubstantiated report of a clutch of two eggs collected (location undisclosed) in a newspaper, *The Asian*, in 1895.

Other than these records, the species remained elusive, and was considered among the four 'mystery' Indian birds, along with the Pink-headed Duck *Rhodonessa caryophyllacea*, Himalayan Quail *Ophrysia superciliosa*, and Forest Owlet *Heteroglaux blewitti* (now 'rediscovered'). Efforts were made to look for the Jerdon's Courser during the Vernay Survey of the Eastern Ghats (1929–31) and Hyderabad State (1931–32) surveys, and through two specific surveys by BNHS in 1975 and 1976 in collaboration with the Smithsonian Institution and WWF-India, but these surveys relied more on mist-netting (hoping the birds would fly into the nets) and there were not much focused searches on the species, especially during the first two surveys. The Jerdon's Courser was almost written off from the Indian bird checklist on the assumption that it was extinct after the failure of all the search efforts – till its spectacular rediscovery in 1986 by a (then) young BNHS scientist, Bharat Bhushan from Cuddapah (now Kadapa) district of Andhra Pradesh.

The rediscovery of Jerdon's Courser created a sensation in ornithological circles, and it would be interesting to analyse why Bhushan was successful while the others failed. As he had told me (we were colleagues in the Endangered Species Project), to start with, he meticulously read and scrutinized all the records of the species. He did a lot of reading "between the lines" to pin down the location and habitat in which the birds were collected, as these were not clearly spelt out by Jerdon and others. He also checked the Telugu names attributed to the species, and shortlisted those that were not used for other species and seemed appropriate for this elusive species, which considerably helped

narrow down the search. Its local name in the Kadapa area, as we know now, is *kalivi kodi*. *Kalivi* is the local name for the thorny shrub *Carissa* sp. (in which the species is reported to take refuge during the day) and *kodi* means fowl.

An advantage that Bhushan had was that he spoke Telugu. Conversing in the local language is important for carrying out surveys, especially for elusive species. Bharat distributed posters of the species with write-ups in Telugu to Forest Department personnel, bird trappers and villagers, which helped pass the word around. Knowing Telugu, he could easily communicate with the locals and judge their identification skills by asking them to point out the illustration of the target species among other similar-looking bird species in field guides. It was through such discussions with bird trappers that he started suspecting that Jerdon's Courser was a nocturnal species, which turned out to be true (as is the case with all its congeners in Africa). The earlier birders appear to be not aware (not reflected in their writings) that the species was nocturnal despite its tell-tale large eyes.

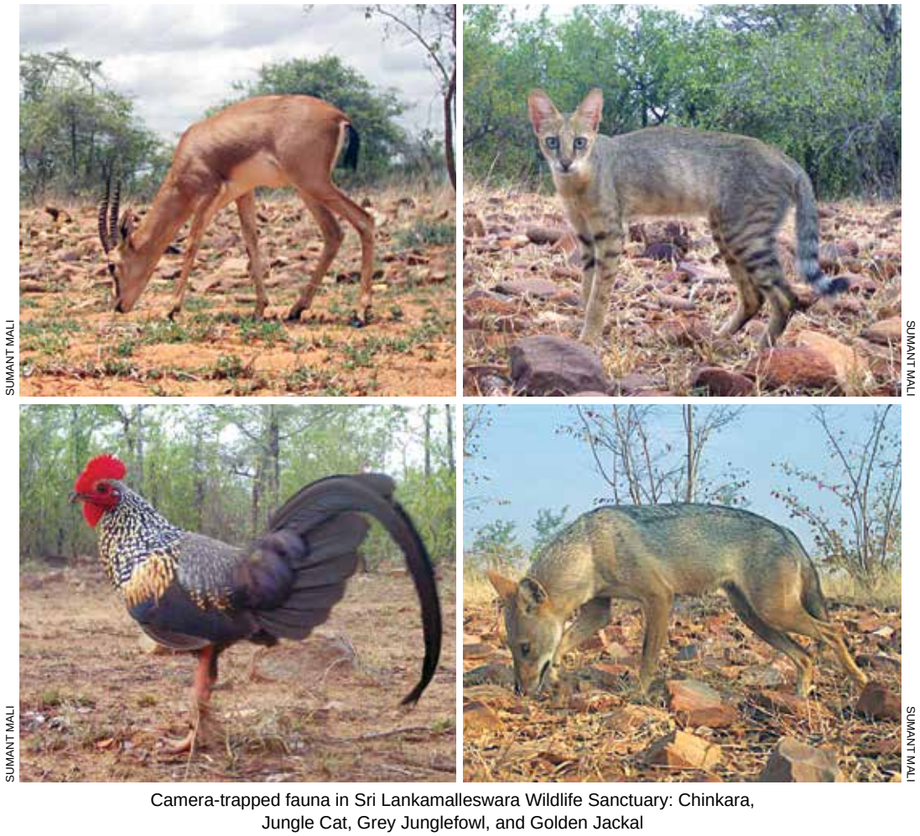
On January 14, 1986, Bharat Bhushan's efforts finally paid off, after one of the bird trappers he had been in touch with earlier, managed to catch a Jerdon's Courser near Reddipalli in the Lankamalai Reserve Forest of Kadapa district. After the rediscovery, he obtained a few other sightings in the area, including a photographic record taken during the day. The rediscovery of Jerdon's Courser in the Reddipalli area prompted the Forest Department to declare the area as a wildlife sanctuary, Sri Lankamalleswara Wildlife Sanctuary (464 sq. km). After some time, Bharat shifted to a posting at BNHS headquarters. After he left, in 1988, I almost got an opportunity to work on this enigmatic bird after my stint in Rollapadu Wildlife Sanctuary on the Great Indian Bustard came to a close. However, with change of plans at the very last moment, I was instead posted in Point Calimere Wildlife Sanctuary to work on the waterbirds of the Great Vedaranyam Swamp.

RANJINI MURALI / CC BY-SA

Egg of Jerdon's Courser, collected from the Kolar Gold Fields area of Karnataka in 1917

The next project by BNHS in Sri Lankamalleswara Wildlife Sanctuary was a two-year project (1994–1995) funded by the MoEF (now MoEF&CC, the Ministry of Environment, Forest and Climate Change). V. Elangovan, the researcher, obtained five sightings all in the Reddipalli area. The MoEF project was followed by a major project with funding from Darwin Initiative, which ran from 2000 to 2008. In this innovative project, the researcher, P. Jeganathan, laid out tracking-strips in potential areas to record the species' footprints, which were further confirmed by images captured by camera traps facing these tracking-strips. The call of the species was recorded for the first time, and its playback was used to detect the presence of birds at sites in the study area. However, despite this study, the species remained an enigma, with only a handful of short-duration sightings of birds obtained and with no records of nests, eggs, and chicks. Thus, much remains to be known about the species' population, ecology, habits, behaviour, movements, and breeding biology.

After a short break, the project resumed in 2009 with two researchers Rahul Chavan and Sumant Mali, with additional funding from the Mohammed Bin Zayed Species Conservation Fund and IUCN's Save our Species (SOS) Fund. However, they managed to sight only two birds in one instance during the entire tenure of the study till 2012. After this project, in 2013, I was asked to oversee a newly sanctioned two-year, MoEF project on the species in Sri Lankamalleswara Wildlife Sanctuary. However, this too 'fizzled out' for me at the last moment. The researcher of this two-year project, Sumant Mali, used around 200 cameras in an attempt to record the species. However, other than obtaining photographs of many species of interesting birds and mammals through the camera traps, there was not a single photograph of the Jerdon's Courser.



SUMANT MALI

SUMANT MALI

SUMANT MALI

SUMANT MALI

Camera-trapped fauna in Sri Lankamalleswara Wildlife Sanctuary: Chinkara, Jungle Cat, Grey Junglefowl, and Golden Jackal

In the past decade or so, there have been significant changes in the landscape of the Jerdon's Courser habitat, including the construction of the Telugu Ganga Canal (that supplies water from Nagarjuna Sagar Reservoir to Chennai), changes in the vegetation (including increase in shrub cover), and expansion of agriculture. Poaching of wildlife, including birds, is not uncommon as reported in Sumant Mali's study. Has Jerdon's Courser gone extinct from the area with all these changes and threats? Or has it moved to other more suitable and less disturbed adjoining areas – there are still tracts of scrub country in the plains along the hills of the Eastern Ghats in this region that look suitable Jerdon's Courser habitat. This is not to say that there are no pressures here – vast tracts of scrub habitat south of Kadapa have disappeared with government establishments, engineering and medical colleges, hospitals, and industries gobbling up land. And one can expect more of these wilderness areas to be lost in the coming decades in the name of development.

Over the years, I have been troubled by a nagging query whenever the topic of the Jerdon's Courser arose. What would have been

SUMANT MALI

Typical open scrub habitat of Jerdon's Courser

the 'story' if I had indeed shifted to Reddipalli in 1988 to work on the species? Would I have been able to locate nests, eggs, and chicks that eluded the others, and also managed to add significant insights into this enigmatic species – I tend to be 'lucky' in the field, my colleagues say! And similar questions arise about the second missed opportunity in 2013. I still occasionally ponder on undertaking a project on the Jerdon's Courser, even though age is not on my side now. Will I be lucky with a third (and final) try, or will the opportunity to work on this enigmatic and elusive species again elude me? Only time will tell, as the saying goes!

Ranjit Manakadan is Deputy Director (Ornithology) in BNHS and has been working with the Society for almost four decades.

We are grateful to

SETH PURSHOTAMDAS THAKURDAS & DIVALIBA CHARITABLE TRUST

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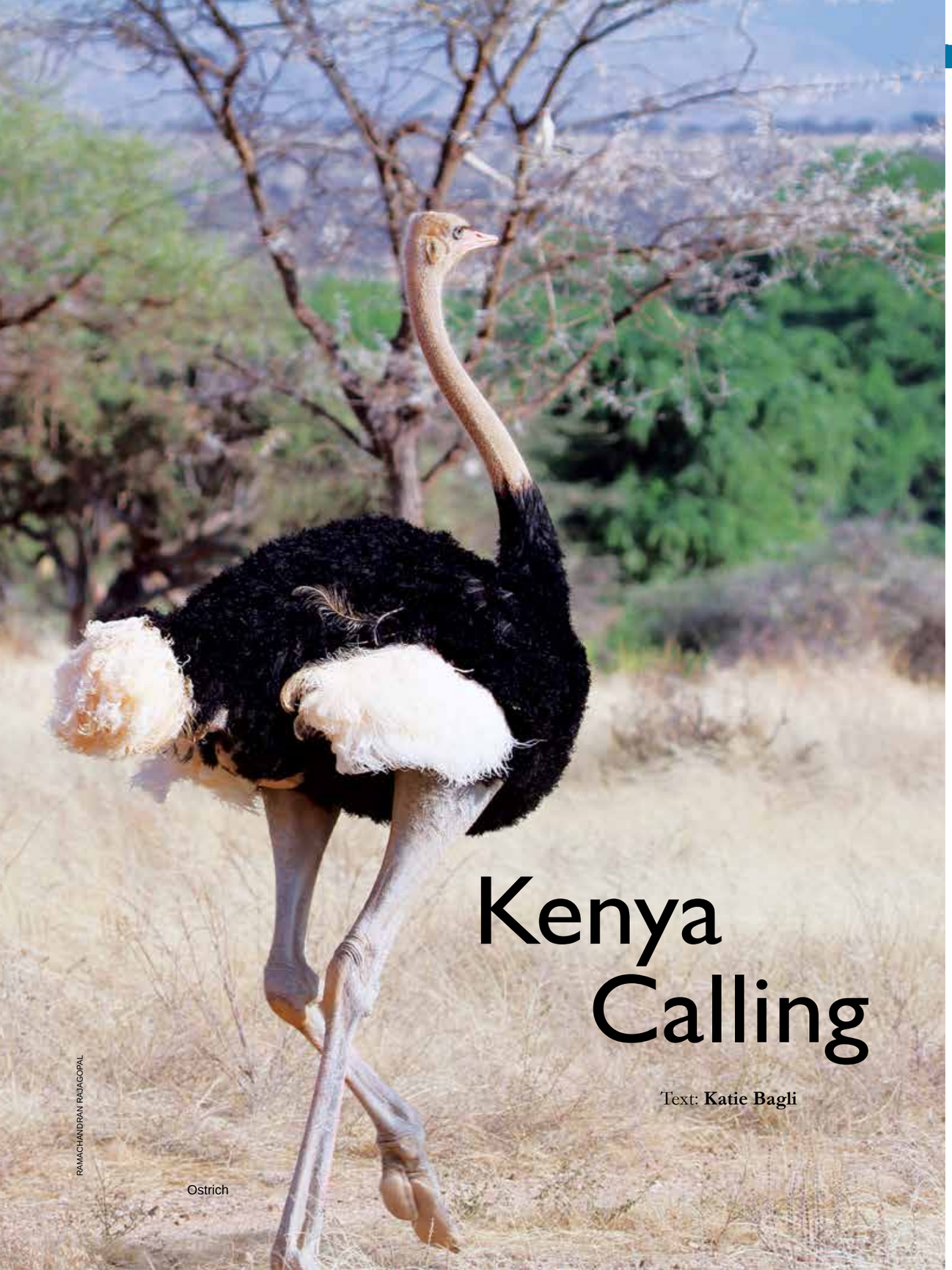
RAMACHANDRAN RAJAGOPAL

Crowned Hornbills wait to nab a swift fledgling from its mud nest

Kenya Calling

Text: **Katie Bagli**



RAMACHANDRAN RAJAGOPAL

Ostrich

Having more than a soft corner for wildlife, I enrolled for a BNHS trip to Kenya, but I had not in my wildest dreams anticipated that I would witness such diversity and plethora of fauna. Even as we, a group of 16 like-minded nature lovers and our leader Asif Khan, stepped on to African soil, we were greeted with the cawing of crows with white fronts. That was my first surprise, Pied Crow – the tuxedoed feathered bipeds of Africa. I was not aware that such crows existed!

After landing at Jomo Kenyatta International Airport, Nairobi, we headed straight for Aberdare National Park, a protected area in the Aberdare Mountain Range in central Kenya. The drive, though rather long, was over smooth, unpotholed roads bordered with African Tulip Trees, Cactus trees, and Umbrella Acacias. The acacias seemed as though they were decorated for Christmas, festooned with lantern-like weaver bird nests dangling from them. The Aberdare Country Club Resort simply took our breath away. Impalas with the typical black McDonald style 'M' marking on their butts, and Dik-dik antelopes that looked like toys, pranced around to the chorus of birds. Here we were thrilled to see our first hornbill species – the Crowned Hornbill – they were after the fledglings of swifts in their mud nests within the roof of the resort. We didn't know then that Kenya had so many other species of hornbills in store for us – Red-billed, Yellow-billed, Grey, and the amazing Southern Ground Hornbill with its black garb, beady eyes, and patches of bare red skin on the face and throat, the latter being inflatable.

Talking of birds, we came across some of the most spectacularly coloured ones in all of Kenya, as if nature had been trying out various combinations of paints on her palette. Just to name a few: the Cut-throat Finch with a blood-red band across its throat, Grey-headed Kingfisher with black and turquoise blue wings and tail and a russet underbelly, Chestnut Sparrow with its resplendent shades of sepia plumage, and the enormous Ostrich with its small head, long neck, and velvet black tutu of feathers, moving in the grass with the grace of a ballerina. Then the very handsome Bateleur Eagle with its crimson beak, flying about among the Yellow Fever Acacias, the sunny yellow Baglafecht Weaver, Red-cheeked Cordon-bleu that seemed to have put on too much rouge, and the species that brought us to our knees in

RAMACHANDRAN RAJAGOPAL

Red-cheeked Cordon-bleu looking as though it has put on too much rouge

SHAHROKH BAGLI

Chestnut-bellied Sandgrouse – are its chicks hiding in its underbelly feathers?

RAMACHANDRAN RAJAGOPAL

Black-capped Weaver contemplating on where next to build a nest

RAMACHANDRAN RAJAGOPAL

Superb Starling showing off its resplendent attire of colourful plumage

admiration – Superb Starlings with their coat of iridescent blue-green feathers contrasting with orange-red on the belly.

The diversity of mammals was mind-boggling too. Tall giraffes, walking with their 'heads in the clouds' – Samburu National Reserve had the reticulated variety with its geometrical skin patterns, while in Masai Mara we saw the Masai Giraffe whose skin appears to have paintbrush strokes, and the Rothschild's Giraffe that appeared to be wearing white socks. Strangely enough, the long necks of all giraffes have only seven cervical vertebrae, just like all other mammals. Imagine the length of each vertebra!

Then there was a mother elephant and her calf, using the sensitive tips of their trunks to pull out bushels of grass and popping them into their mouths contentedly, till the calf happened to pull out some kind of green fruit along with the grass. The mother grabbed it out of the calf's mouth and tossed it away! Perhaps her instinct told her that it was poisonous. All this was done in silence but I suspect she was scolding her young one for being careless, through infrasonic rumblings – a differently pitched voice used by elephants that is inaudible to us.

It was incomprehensible to us how the zebras and wildebeest communicated with each other. In Masai Mara, we saw what seemed like thousands of them gathered together, covering the entire horizon. And then to our delight, there was the slow migration, like a great exodus, apparently in search of greener pastures, along part of their loop migration to Serengeti in Tanzania. It would be around March when they would return to Masai Mara. The zebras always lead as they have a good memory and remember the route. Also, they are clever enough to avoid danger. The wildebeest just follow each other blindly – exhibiting typical herd mentality – and sometimes they fall prey to crocodiles in the river, and lions, cheetahs, and leopards on land.

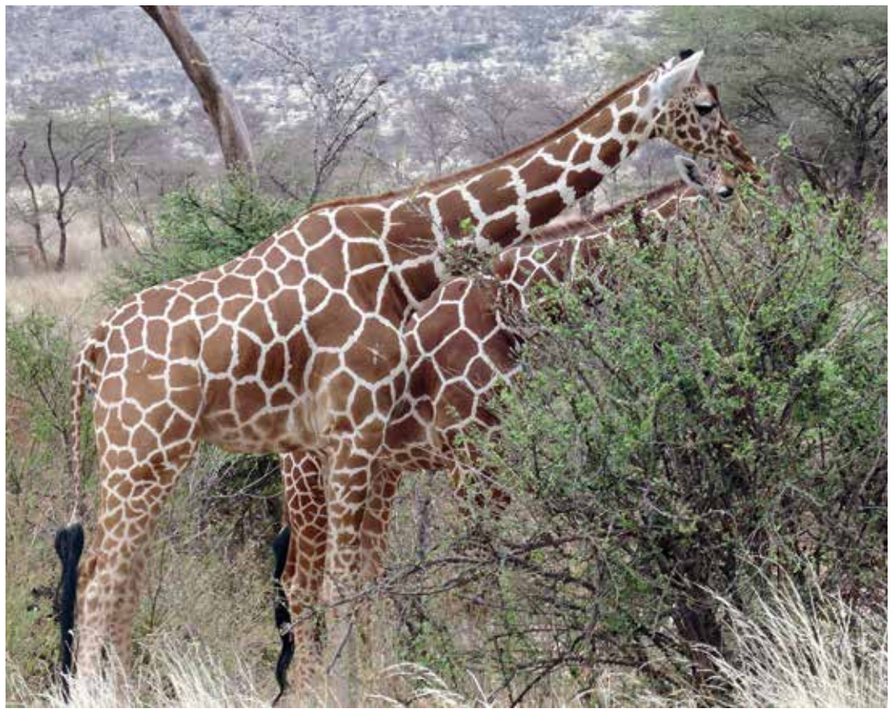
The hippopotami that we came across in the Mara River were expressing their *joie de vivre*. Their twinkling eyes and wiggling ears above the water surface would suddenly give way to monstrous forms as they emerged, splashing and ducking with loud snorts. It was difficult to believe that these carefree creatures can be one of the most dangerous animals on the planet. The highlight of the show was when a hippo climbed on to the bank, vigorously swinging its tail, and with voluminous grunts sent forth an unexpected shower of poop.

In Samburu National Reserve, we came across a female cheetah with four cubs all relishing her kill, a Thomson's Gazelle. Having fed to their hearts' content, they lay down in the shade of an acacia tree. But a little while later, on seeing vultures scouring the skies, they became alert and went back to the kill to stuff themselves before the scavenger birds could get their turn. The vultures – Lappet-faced, White-backed, and Ruppell's Griffon Vulture – along with three Tawny Eagles and a Steppe Eagle, seemed to be waging war. Fanning out their enormous wings, jostling and scrambling, calling out to each other aggressively, they finished every bit of the kill in no time, leaving behind only the horns and bones for perhaps the hyenas. After all, nature provides for all creatures, nothing is wasted.

On another occasion, we got to see a similar drama of vultures scavenging upon the carcass of a wildebeest. But this time there were three Marabou Storks standing tall and unperturbed,

SHAHROKH BAGLI

Hippopotami wallowing in the Mara river



SHAHROKH BAGLI

Reticulate Giraffe are typical inhabitants of Samburu National Park

in a dignified gentlemanly manner by the side of the rowdy crowd of vultures and eagles. After quite some time, they decided it was their turn. The unmannerly birds had eaten enough. So, using their big pointed bills to push the vultures aside, and inflating the yellow gulars dangling from their throats, they began voicing their rights to the kill. When some of the vultures didn't heed, the Marabous asserted themselves by pulling the wildebeest's entrails right out of their beaks! Indeed, the Marabous taught us a lesson in patience and perseverance.

RAMACHANDRAN RAJAGOPAL

Spotted Hyena after a belly-filling meal

During one of the safaris, our van nearly ran over a pair of Chestnut-bellied Sandgrouse and their two chicks, so well camouflaged were they with their cryptic sandy plumage and markings. But what took us by surprise was that under our very eyes, while we were photographing them, the chicks just disappeared. The parents had probably taken them into their fold, hiding them under their belly.

Lake Nakuru was a beautiful sight, surrounded by grassland and scrub, with an abundance of aquatic birds – ibises, egrets, cormorants, darters, and of course, the Lesser Flamingos. But the number of flamingos was far less than expected, probably because the water is losing its alkalinity, getting diluted by the treated water from a nearby town, we were told. But while boating in another smaller lake –

RAMACHANDRAN RAJAGOPAL

Marabou Storks waiting politely for their turn to scavenge

RAMACHANDRAN RAJAGOPAL

Grey-headed Kingfisher on the ready to dive below for fish

Naivasha – we got to see some very interesting species: the Black Giant Kingfisher, Sacred Ibis (which was worshipped by the ancient Egyptians), pelicans, and Egyptian Geese.

It was thrilling to get the jungle feeling and to be among the wild in all the resorts where we were put up. This is thanks to the well-planned animal-friendly ecotourism of Africa, whether it was in Aberdare where we got to hear loud croaking of toads while Impalas watched us from behind trees, or in Samburu where we had to keep our cottage doors closed as families of baboons decided to camp just outside. Early in the morning, outside these same cottages, we were greeted by dik-diks and 40 to 50 guineafowl. Hornbills and weavers birds would even come begging to our tables while we breakfasted (but of course, we did not encourage them as it was not their natural food). An unexpected visitor came one night, climbing up the wire net on the window of our room – it was a civet cat! In Nakuru, the kingly breakfast we were served did not tempt us enough to keep us glued to our chairs, as there were so many never-seen birds flying in and out of the dining hall, some of them boldly eating right out of the plates as soon as our backs were turned.

As for Masai Mara, we got goose bumps listening to the hyenas moaning by night, and felt we were in wonderland when watching Bushbuck and Waterbuck antelopes freely moving around the resort by day. One of the best feelings was when all 16 of us got off our vans in the middle of the Masai Mara savannah and sat in the grass under the shade of an acacia, to have our packed lunch. It thrilled all of us to be in the very lap of nature, with starlings and weaver birds fluttering around us. The weak-hearted among us were thankful that no other large animal came along to have us for lunch!

The eight days we spent in Kenya convinced all of us how invaluable grasslands can be as habitats for innumerable creatures. Sadly, grasslands have been considered as wastelands in our own country and have been put to other uses, making their own rightful inhabitants homeless and driving them to extinction. Our trip also made us appreciate the abundance and diversity of life on our planet. Truly, nature's bounty seems to be infinite.

Katie Bagli is a children's writer who prefers to write about Nature. She also conducts innumerable workshops on wildlife and creative writing.

Indian Moon Moth *Actias selene*

Editors' Choice

A Walk in the Wild

A spell is cast, a drama unveiled,
enter their arena and you feel the mystique,
a lot to offer, both majestic and mild,
they will enchant you with their style!

Competing around, feathery ones excitedly greet,
as you watch them hide and seek, they fondly tweet.
Ungulates express their surprise as you move by,
munching and munching and
only munching in the areas nearby.

Langurs jump about and wish you joy,
scratching and playing they look down and enjoy.
Unseen eyes watch and keep guard,
shy and sly, the leopards avoid the main trail,
such that a sighting of theirs makes you applaud.

Bison and elephants and buffaloes you may meet,
ponds and lakes and streams with birds wetting their feet,
crocodiles may give you a glance oblique,
vultures and raptors and owls may intimidate!

Trees tall and short, stout and lean,
supporting winding creepers umpteen,
a breeze carries their whispers aloud,
as day rises, a keen sun peeks from the cloud.
A hale and healthy forest welcomes all as one,
they say nature differentiates between none.

Then a spectacle unfolds,
trees stand their ground in quiet,
all other inmates are rooted to their site,
and the path shudders with fright,
as the sun shines a glaring spot light,
his skin glistens, a golden bright,
he walks the road with majesty and might!

You stay fixed as if bound, you dare not make a sound,
till the King judges and permits your pass,
for it is his to decide whether to let you last!

If accepted, you may travel forth,
rocky and winding; straight and steep;
such is the trail as you venture deep.
You will definitely relish the sojourn,
and take back wild memories as you move on!

As you trace the route back and bid goodbye,
there is a request they want to make –
a promise is what they need,
an enduring support is what they plead,
hoping that someday, some of you will heed,
and their Call from the Wild will grow to
a Call for the Wild!

Journey through their beautiful world,
For you are sure to love this walk in the wild!

– Shalini Gopalakrishnan

ABOUT THE POSTER

The Indian Moon Moth *Actias selene* (also known as Indian Luna Moth) is one of the largest moths of the genus *Actias*. It has a wingspan of 130–166 mm. First described by Jacob Hübner in 1807, this moth belongs to family Saturniidae, which includes the largest moths in the world. It is widely distributed in the Indian subcontinent and Southeast Asia, further north to Russia and eastwards to Japan. Moon moths are so named because the eyespots in the forewing and hind wing look like moons. These eyespots vary in the different species of this genus.

Among the prettiest of moths, the Indian Moon Moth is nocturnal or crepuscular, and is often attracted to light. The species is sexually dimorphic – the female is larger than the male, has a larger wing surface area, thin antennae, generally rounded wingtips, and a heavier body. The male is smaller, but with much brighter colours, more falcate wing tips, larger antennae, and a pair of claspers at the terminal end of the abdomen that serve to hold the female while mating. The female attracts the male moths through pheromones, which are chemical substances secreted for this purpose. Males are known to detect the pheromones from as far as 11 km!

A sericigenous moth (i.e. a silk producing moth), a single cocoon of this species is known to produce a continuous unbroken fibre of 300 to 350 m. It is popular among amateur entomologists for its beauty, and among hobbyists who like to rear it from eggs that are available from commercial sources. The adult moth has rudimentary, non-functional mouth parts and no digestive tract, as this phase is devoted almost entirely to reproduction.

Our fast vanishing forests are a cause of concern for the survival of wild silk moths, including this gorgeous denizen of the dusky nocturnal world. ■

DHRITIMAN MUKHERJEE

Indian Moon Moth *Actias selene*

Otter Attack!

Otters have been known for their curious and playful behaviour and researchers have always taken a keen interest in their intelligence and strong family bonds. Their family bonding make them aggressive and they are known to take on even large crocodiles to protect the pack when threatened.

Otters are not known to be a threat to humans in general, but there are some extremely rare reports of attacks on humans. The Giant River Otter of South America, with males growing as large as large as 2.1 m, is very protective of its young and the pack will attack intruding boats. In Florida (USA), there are reports of the North American River Otter attacking kayakers and children playing in the river causing severe injuries.

In India, we recently learnt of an attack by a Smooth Coated Otter family in Rawatbhata, a small town in Chittorgarh district of Rajasthan. Rawatbhata is situated on the banks of River Chambal, which flows through the rocky mountains of the region. The river flows between Bhainsroadgarh Sanctuary and Rawatbhata. This terrain provides excellent habitat for Smooth Coated Otter. On the outskirts of Rawatbhata is a small lake adjoining River Chambal and a small fishermen community depends on this lake for their livelihood.

It was the morning of January 20, 2019, Pappulal a contract labourer went to the lake for bathing. There were no otters around when he arrived at the lake. He was unaccompanied and there was no soul in his visibility range. He said that he was sitting when the otter family attacked him from the rear. Taken by surprise, he lost his balance and fell into the lake and soon the pack of around seven otters was all over him. The attack lasted for around five to seven minutes; he was badly bitten on his thighs and feet. He was not faking the number of otters attacking him as we had regularly observed about eight otters in this area. People nearby heard his cries and rushed to the site. The otters returned to the river at this point. The man was severely injured and was rushed to a hospital. The locals blamed the otters for a similar incident last winter, though there was no witness. A local fisherman, who went for fishing late evening, was found dead in the lake the next morning. We found a report in *The Hindu* of a similar attack in Kerala and a report published by Suresh K. Govind and E.A. Jayson from wildlife department Kerala, in which one fatal and two-non fatal incidents were recorded in Thrissur district of Kerala in 2010 and 2011.

We work for the conservation of otters in our region and spread awareness of their importance in riverine systems. This incident has had an adverse impact on our advocacy. An attack can result from an adult's instinct to protect the pups. But in this case this could not be the reason, as the bevy had adults and sub adults. Our intent is to inform people and hope that observations on otter behaviour can aid our awareness programme.

Rimal Sudhindran, Charchit Jain &
Anirudh Singh Chauhan
Rawatbhata

Biodiversity Hotspeck vs a Hydropower Plant

Text: **Girish Jathar, Monsoon Jyoti Gogoi, Biswajit Chakdar, Harshal Bhosale, Mandar Sawant, and Rohan Bhagat**

In 2009, the Arunachal Pradesh government decided to develop a 3,097 MW multi-purpose hydro-electric project, one of the biggest power projects in the country. However, its approval triggered opposition due to possible environmental impacts and the forced relocation of the locals. If you had a choice between conserving biodiversity and uninterrupted power supply, what would you choose?

ROHAN BHAGAT

River Landscape, Arunachal Pradesh

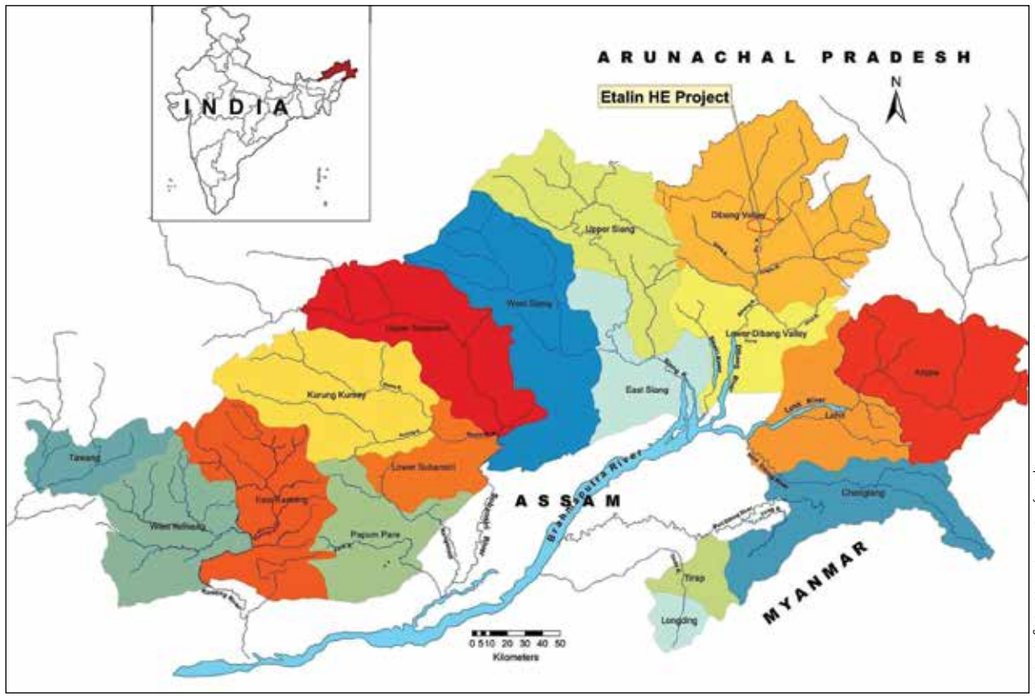
Mishmi Hills and biodiversity

Mishmi Hills, a biodiversity hotspeck (a subset within a biodiversity hotspot), is part of the Himalayan biodiversity hotspot, which is one of the three mega biodiversity hotspots in the Indian region. The rugged landscape of Mishmi Hills ranges from 200 m at the foothills to 5,500 m up to the snowline. This complex hill region with varying elevations receives heavy rainfall, which can be as much as 4,500–5,000 mm annually in the foothills.

The topographical diversity and climatic conditions of the area have favoured the growth of luxuriant vegetation, ranging from grasslands, bamboo forest, evergreen forest and others, to temperate conifers and alpine meadows, which are home to myriad biodiversity. The area supports about 6,000 plant species (including 500 orchids and 50 rhododendrons), 100 mammals, and 680 birds, besides a large number of butterflies and other insects. This unique assemblage of life forms can be attributed to its geographical location, which is at the trijunction of the Palaearctic, Indo-Chinese, and Indo-Malayan biogeographic zones. The only human footprints in this region are small hamlets and patches of subsistence agriculture at the edges of the forest, and paddy fields in the foothills.

This region is important especially for globally threatened and near threatened species. Six globally threatened mammal species are found here, of which three are Endangered and three Vulnerable (Table 1). The region harbours about 56% of the total number of bird species of India. Among them, 19 are Threatened (4 Critically Endangered, 2 Endangered, 12 Vulnerable and 10 are Near Threatened species (Table 2). The region also has three very rare, range-restricted, endemic bird species.

Dibang Valley is a butterfly haven, with more than 500 species recorded. Many species and subspecies of butterflies occurring in southeast Tibet and Yunnan are also seen in Dibang Valley, e.g., the Chocolate Tiger *Danaus melaneus* that is distributed in southeast Tibet, Yunnan, and Dibang Valley. The Brahmaputra river basin serves as a barrier to the dispersal of many butterfly species, resulting in high rates of endemism and speciation in Dibang Valley. For example, the



Source: ETALIN H.E.P. EIA report by R.S. Envirolink Technologies Pvt. Ltd.

Proposed project site in Dibang Valley

Table 1: Globally Threatened and Near Threatened mammal species in Dibang Valley

Species	Global Status
Hoolock Gibbon *Bunopithecus hoolock*	Endangered
Red Panda *Ailurus fulgens*	Endangered
Bengal Tiger *Panthera tigris*	Endangered
Leopard *Panthera pardus*	Vulnerable
Mishmi Takin *Budorcas taxicolor*	Vulnerable
Chinese Goral *Naemorhedus griseus*	Vulnerable
Himalayan Serow *Capricornis thar*	Near Threatened

Table 2: Globally Threatened and Near Threatened bird species in Dibang Valley

Species	Global Status
Bengal Florican *Houbaropsis bengalensis*	Critically Endangered
White-rumped Vulture *Gyps bengalensis*	Critically Endangered
Slender-billed Vulture *Gyps tenuirostris*	Critically Endangered
Red-headed Vulture *Sarcogyps calvus*	Critically Endangered
Greater Adjutant *Leptoptilos dubius*	Endangered
Black-bellied Tern *Sterna acuticauda*	Endangered
Swamp Francolin *Francolinus gularis*	Vulnerable
Chestnut-breasted Partridge *Arborophila mandellii*	Vulnerable
Blyth's Tragopan *Tragopan blythii*	Vulnerable
Sclater's Monal *Lophophorus sclateri*	Vulnerable
Rufous-necked Hornbill *Aceros nipalensis*	Vulnerable
Pale-capped Pigeon *Columba punicea*	Vulnerable
Lesser Adjutant *Leptoptilos javanicus*	Vulnerable
Rusty-bellied Shortwing *Brachypteryx hyperythra*	Vulnerable
Beautiful Nuthatch *Sitta formosa*	Vulnerable
Marsh Babbler *Pellorneum palustre*	Vulnerable
Jerdon's Babbler *Chrysomma altirostre*	Vulnerable
Black-breasted Parrotbill *Paradoxornis flavirostris*	Vulnerable
White-cheeked Partridge *Arborophila atrogularis*	Near Threatened
Yellow-rumped Honeyguide *Indicator xanthonotus*	Near Threatened
Great Hornbill *Buceros bicornis*	Near Threatened
Ward's Trogon *Harpactes wardi*	Near Threatened
Blyth's Kingfisher *Alcedo hercules*	Near Threatened
White-tailed Eagle *Haliaeetus albicilla*	Near Threatened
Black-necked Stork *Ephippiorhynchus asiaticus*	Near Threatened
Great Thick-knee *Esacus recurvirostris*	Near Threatened
River Lapwing *Vanellus duvaucelii*	Near Threatened
Red-breasted Parakeet *Psittacula alexandri*	Near Threatened

Dibang Valley endemic Roy's Argus *Callerebia dibangensis* was described only in 2013, while many hairstreaks, rings, and skippers, among others found in the region, are yet to be described. Species like White-bordered Argus *Callerebia baileyi* is restricted to Mishmi Hills and south-east Tibet. This rich diversity of butterflies and their unique colourful patterns (like the Northern Jungle Queen *Stichophthalma camadeva*) have found a place in Mishmi lives, folklore, and in the traditional weaves

Himalayan Serow (1), Hoolock Gibbon (2), Red Panda (3), and Malayan Giant Squirrel (4) are some of the globally threatened mammal inhabitants of Dibang Valley

of the region, including their war attire. Some other range-restricted butterflies of Dibang Valley are the False Tibetan Cupid *Tongeia pseudozuthus*, Chinese Silverline *Spindasis zhengweilie*, Khaki Silverline *S. rukmini*, Evans' Silverline *S. evansii*, Tiger-mimic Admiral *Limenitis rileyi*, Mottled Argus *Callerebia narasingha*, Tibetan Brimstone *Gonepteryx amintha thibetana*, Grey Commodore *Bhagadatta austenia purpurascens*, and Abor Freak *Calinaga aborica*.

India's energy needs and hydropower

India ranks third among the largest producers and consumers of electricity in the world. In November 2019, India's installed power generation capacity reached 364.9 gigawatts (*The Economic Times* 2019), which is sufficient to meet the country's present electricity demand. Despite this, we hear of plans to build new plants to generate electricity. Why so? The reason is that though there

is enough electricity for the country, there are problems in the distribution systems, which lead to power cuts and connectivity issues for consumers, placing further demands on energy. Moreover, the aggregate electricity demand of India is likely to go up to 2,785 TWh (6.2% more than at present) by 2030 (Ali 2018). To meet this demand, India must generate more electricity through both renewable and non-renewable sources.

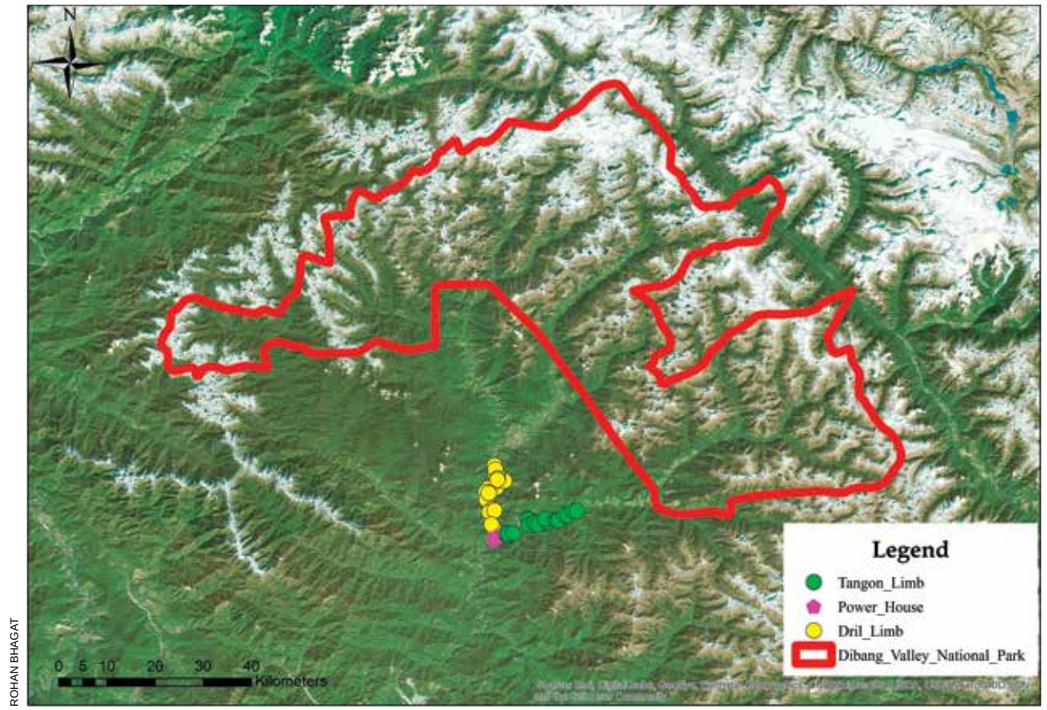
Of all the available sources of power generation, hydropower is considered to be the most efficient and cheap, and it is also renewable energy. Owing to its geography, India has several rivers, and these are perceived to have massive potential for harnessing hydropower. Thus, hydropower contributes about 12.4% of the total energy generation in India (Power Ministry 2020).

The Government of India has announced many policy initiatives for sustainable hydropower development in the Himalaya and the hills states of the Northeast. However, the Himalaya and especially the Northeast states are among the most seismically active regions of the world. Massive earth moving, road construction, and industrial drilling projects could only worsen the frequency and magnitude of geological disasters and natural calamities. However, the energy requirements of the country are being considered as high priority, far greater than the risks of natural calamities!

Etalin Hydroelectric Project

The 3097 MW Etalin Hydroelectric Project (HEP) is a storage-based hydroelectric project, which proposes the construction of two dams: a 101.5 m high dam on the Dri river near Yuron village, and an 80 m high dam on Tangon river, both of which are tributaries of Dibang river. An underground powerhouse is proposed, with 10 units of 307 MW each.

The area proposed for the Etalin HEP lies within Dibang Biosphere Reserve, in the Lower and Upper Dibang Valley districts of Arunachal Pradesh, which are part of the Mishmi Hills. The altitude ranges from 400 m to 5,000 m above msl. Ashupani, Deopani, Jowe, Enjopani, and Diphu are the main perennial streams flowing through the reserve into the Dibang river, which is one of the main tributaries of Brahmaputra. The



ROHAN BHAGAT

Proximity of the project site to Dibang Wildlife Sanctuary

proposed project site is merely 14 km from one of the most uninhabited protected areas of India, the Dibang Wildlife Sanctuary, which itself is part of one of the most contiguous wilderness areas of India, which can only be compared with Namdapha National Park in Arunachal Pradesh. Many animals mentioned in Tables 1 and 2 are likely to be present in the vicinity of the proposed project area. Any developmental activity would jeopardize the existence of many threatened and near threatened species.

Owing to the fragile ecosystem of the project site, the project proponents carried out the mandatory Environmental Impact Assessment of the project. The first assessment was carried out by R.S. Envirolink Technologies Pvt. Ltd. Further to this, on 23rd June, 2017, the Forest Advisory Committee of the Ministry of Environment, Forest and Climate Change (MoEF&CC) recommended that the Wildlife Institute of India should conduct a year-long study to prepare a wildlife conservation plan for the impact zone of Etalin HEP. Both these studies have several flaws as discussed below.

R.S. Envirolink Technologies Pvt. Ltd (2015)

The report submitted clearly lacks scientific merit, as it has several technical and scientific flaws. The report states, "Sampling was carried out on fixed width trails of 2 km wherever the terrain permitted, and point counts were carried out at fixed distances at random intervals. As the normal usual systematic transects for mammals and birds were not possible in this study area, due to difficult terrain, therefore mostly trails were used for faunal sampling." This indicates biased sampling of the flora and fauna, and will result in overlooking of important, and possibly some undescribed species of this region, Below, we address some important aspects of the various taxa that were overlooked in the report.

Avifauna: The section on birds is flawed in terms of methodology and the results derived from it. There are flaws in sampling, seasonality in sampling, analysis of the data, and interpretation. The report indicates the presence of only 33 bird species from the survey area, which is a gross underestimation of the avifaunal diversity of this rich region. In fact, the Dibang Valley boasts of the presence of 680 bird species, almost 50% of the total bird species of India. A birder can easily record 33 bird species within half an hour in any part of the Mishmi Hills. Thus, sighting of only 33 species in a span of one year, covering three seasons, raises questions on the findings of the study. Surprisingly, the report does not mention the presence of threatened bird species, whereas at least five Threatened and four Near Threatened species are known to occur in this area. The report mentions that felling of large trees would have an adverse impact on birds and other fauna, which depend on the forest. However, it fails to indicate the importance of this habitat to the Threatened and Near Threatened bird species.

The report completely ignores mention of the adverse impact of construction activity on the floodplains of Dibang River. The downstream floodplain is an excellent grassland, which harbours at least 11 globally threatened species (four Critically Endangered, two Endangered, five Vulnerable), and three Near Threatened species. The most notable impact will be on the habitat of Bengal Florican, from where at least 20 individuals had been estimated. Other threatened species such as Swamp Francolin, Marsh Babbler, Jerdon's Babbler, and Black-breasted Parrotbill are also reported. This makes the downstream grasslands critical in terms of the conservation of threatened bird species. Changes in the grassland composition due to alteration of hydrology, landslides due to deforestation, and dumping of debris directly into the rivers would impact the downstream soil quality and lead to degradation of grassland habitats.

Entomofauna: The report records only 18 insect species (excluding butterflies) from the study area, which includes dragonflies, cicadas, bugs, bees and wasps, ants, flies, beetles, which is a gross under-representation of the true entomological diversity of the HEP site. Approximately 80 percent of the world's species are insects, and it is strange that only 18 species of insects were reported from a rich, biodiverse region like Dibang Valley! This reflects adversely on the quality of the EIA report.

All the insect groups mentioned above show significant diversity in Dibang Valley. Beetles (Coleoptera) which are among the most diverse insect groups, known to constitute 25% of all known animal life-forms, were not covered adequately in the study. Also, insects other than

butterflies are reported only up to class (bug and beetle) level!

The only well-studied group of entomofauna in this report is butterflies, with representation of 45 species, but even this is considerably low for Lepidoptera. A single-day species count during summer (the most favourable season) in Etalin area could easily yield 100–150 species of butterflies; in fact, the Etalin area could have more than 300 species of butterflies owing to the vegetation diversity. The life cycle of butterflies and their dependency on host plants is totally ignored in the project. The report further fails to provide information on moth species, despite this group being mentioned in the report. The report also fails to provide details of methodology.

The following errors were found in the butterfly checklist (Table 7.30):

Species no. 10: Common Grass Dart *Taractrocera maevius* does not occur at the elevation of Etalin.

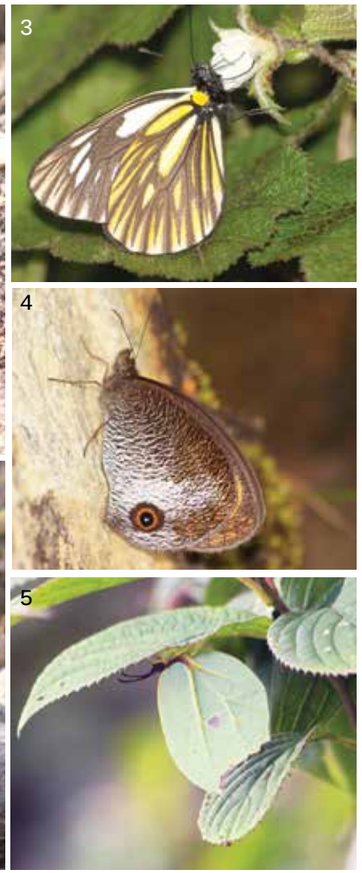
Species no. 25: Eastern Blue Sapphire *Heliophorus oda* does not occur in Northeast India.

Species no. 33: Small Copper *Lycaena phlaea* does not occur in Northeast India.

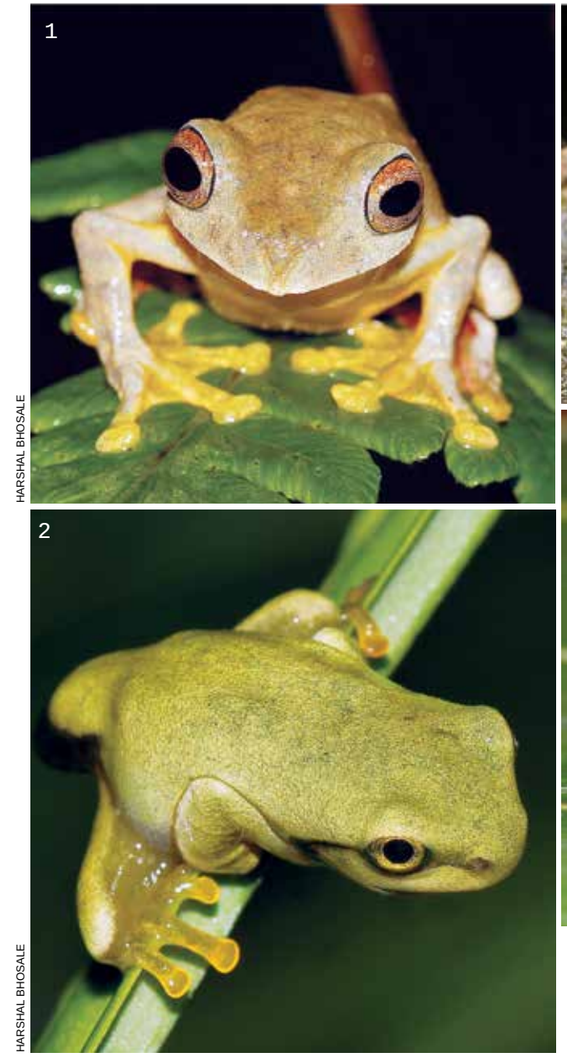
Species no. 46: Dark Pierrot *Tarucus ananda* is not likely to occur in the elevation zone of Etalin.

Species no. 74: Dwarf Crow *Euploea tulliolus* does not occur in Northeast India.

Species no. 103: Dark Glassy Tiger *Parantica agleoides* does not occur in Northeast India.



De Niceville's Windmill *Byasa polla* (1), Single Silverstripe *Lethe ramadeva* (2) and Bhutan Blackvein *Aporia harrietae bailey* (3) are legally protected in India under Schedule I of the Wildlife (Protection) Act, 1972. Roy's Argus *Callerebia dibangensis* (4) is endemic to Dibang valley, the Tibetan Brimstone *Gonepteryx amintha thibetana* (5) is restricted to Arunachal Pradesh and SE Tibet



The EIA survey for amphibians was not conducted in monsoon, their peak activity period. In this collage: Gliding Frog (1), Post metamorphic tadpole of a gliding frog species (2), Himalayan Tree Frog (3), and Horned Frog (4)

Species no. 119: Common Three-ring *Ypthima asterope* does not occur in Northeast India.

Species no. 162: Redspot Jezebel *Delias descombesi* does not occur in the elevation zone of Etalin.

Species no. 163: Painted Jezebel *Delias hyparete* does not occur in the elevation zone of Etalin.

In conclusion, the report completely ignores the entomofauna, mentioning only 18 species of insects, other than the 179 species of butterflies recorded at the HEP site.

Herpetofauna: A study by Roy *et al.* (2018) reported 38 species of amphibians from Dibang Valley. This includes 11 unidentified species of frogs, which indicate that these species are rare and potentially new to science. However, the EIA report mentions the occurrence of only five species of amphibians, which is an under-representation for this biologically rich area. The EIA report also enumerates 11 species of reptiles from the HEP area. There are several discrepancies regarding scientific names, classification at family level, and identification of species. The methodology followed to survey the herpetofauna is the same as that for mammals, which indicates a naïve approach to the study of herpetofauna.

Flora: The EIA report lists 372 species of angiosperms, 7 species of gymnosperms, 29 species of pteridophytes, 11 species of bryophytes, 14 species of lichens, 6 species of fungi, and 10 species of algae. Though the listing looks impressive, there are numerous errors in the species list, such as spelling mistakes, repetition of species, inaccurate records, and incorrect scientific names. There are some glaring errors, such as occurrence of a desert species, *Ephedra aspera*, which is very unlikely to occur in the area. This creates doubts on the credibility of the list.

Wildlife Institute of India (2018–2019)

Avifauna: The report laid emphasis on the ecological role of birds as indicators and the ecosystem services they provide. The report is compliant with the methodologies used to study birds, listing 230 species. However, it fails to provide details on the replicates used to confirm the occupancy and species accumulation curve, that would reflect on the adequacy of sampling. A longer study covering different microhabitats for better representation of the avifaunal richness of the area should have been carried out.

Globally threatened species such as Rusty-throated Wren-Babbler (also known as Mishmi Wren-Babbler) was rediscovered from the area in 2004 after almost 60 years. However, it does not find mention in the report. Rasmussen *et al.* (2017) reported this species from Anini area, which is 30 km north of Etalin. There is high probability of its occurrence in the Etalin area as the altitude is favourable to it. Black-headed Greenfinch and Elliot's Laughingthrush – new additions to the birds of India – were recorded from this region (Dalvi 2013), however, these species are not mentioned in the WII report.

A total of 16 species of birds in the area are listed as being species of conservation importance. The high species richness of birds, including many endemic and globally threatened species recorded during the short-term study, indicates the rich avifaunal diversity of the area. The report ignores the fact that construction and widening of roads leading to the project site would severely impact the habitat there (apart from the actual project site).

A mitigation plan was suggested for only 32 cavity-nesting bird species, but does not provide any mitigation plan for the resulting loss of habitat for the other 198 bird species. The mitigation plan recommends installation of artificial nest boxes for cavity-nesting birds in nearby forest patches to compensate for the habitat loss. However, proving artificial nests will not solve the problem, as different species have specific microhabitat preferences for feeding. Besides, the birds may not use the artificial nest boxes provided; there is no empirical evidence of use of artificial nests by forest birds in India. Artificial nests are usually provided to generalist birds found in urban areas or other human habitations. Installation of nest boxes will not compensate for the loss of habitat.

Macro-invertebrates: Benthic macro-invertebrates are considered one of the most important bio-indicator groups for freshwater ecosystems. These key taxa were identified only up to the family level, considering each family as a different taxon, which results in a significant under-representation of the actual diversity.

Invertebrate fauna: The report lists 159 species of butterflies, 11 species of odonates, and 51 species of moths, which is low and may not be a true representation of the study area's species richness of entomofauna. There are many threatened and endemic insect species even in the Etalin area that have not been reported. Further, many species mentioned in the report have been erroneously assigned to different taxonomic groups. Despite this, the discovery of 200+ species of entomofauna underscores the immense evolutionary and ecological wealth of this area. Specific comments are given below.

Butterflies: 381 species of butterflies have been reported from Dibang Valley in the last 10 years (Gogoi 2020, unpublished data), while up to 500 species are believed to exist in the region. However, the report mentions only 159 species from the project site, of which 12 species are not in fact distributed in Northeast India. The riparian habitat within the Etalin area is likely to have around 290–300 butterfly species, judging from a four-month survey in a similar habitat in Lower Dibang Valley that recorded 294 species (Gogoi 2012). The report appears to consider the importance of butterflies (and other insects) as limited to pollination services ("it is very important to conserve butterfly species, as they help in pollination", p. 172). The role of butterflies

Sixteen birds, Oriental Pied Hornbill (1), Ward's Trogon (2), Beautiful Nuthatch (3), Bengal Florican (4), Blyth's Tragopan (5), Rusty-throated Wren-Babbler (6) and Yellow-rumped Honeyguide (7), – to name a few – are found in the proposed project site area are species of high conservation importance

is not confined to being essential pollinators, but extends to the food web, where they are key prey species for predators. They also have a cultural significance to indigenous Idu Mishmi tribes and are vital for ecotourism in the region.

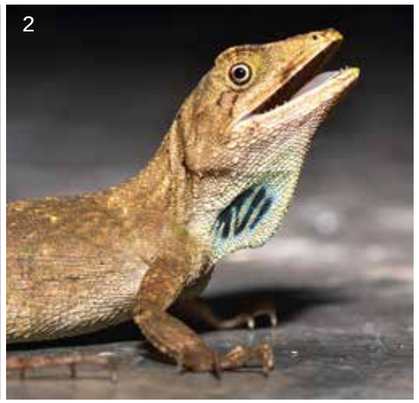
Moths: The report's account of 51 moth species is an extremely low representation. Around 10,000 species of moths occur in India, and the Etalin area is likely to have 600–700 species. Many species in this habitat type and elevation are yet to be discovered.

Odonata: The report states that 11 odonate species occur in Etalin area, which is a considerably low estimate. More than 60 species are expected to be found in the Etalin area with adequate sampling and correct identification (Arajush Payra 2020 pers. comm.). Only two species of damselfly are reported, which is a serious underestimate for Dibang Valley. Even common species observed at virtually all water bodies across Dibang Valley, such as *Ischnura rubilio*, *Ceriagrion coromandelianum*, *Calicnemia miles*, and *Pseudagrion rubriceps* have not been included, indicating inadequate sampling. A species new to India, *Echo perornata*, recently reported from Hunli-Anini road in Dibang Valley (Gogoi and Payra 2019), does not make it into the report as well.

Arachnids: Lesser-known invertebrate groups like spiders need focused studies. According to the report, 113 species of spiders were recorded, among which around 70 species and 4 genera were not fully identified. This could mean that these species are new to science or are lesser-known species. There is also a huge possibility that these species are endemic to the area. A thorough study and identification of these species is essential, for how can we devise a conservation plan if we don't even know what to conserve?

Herpetofauna: Rapid assessment survey for reptiles and amphibians was carried out by WII in winter. However, the peak activity periods of these two groups are during summer and monsoon. Therefore, the study has an inbuilt bias of representation of the taxa. The WII report lists the presence of 13 species of amphibians in the


HARSHAL BHOSALE


MANDAR SAWANT


MANDAR SAWANT

Under-representation of reptiles found in the area is a major concern with surveys conducted in the proposed project area. In this collage: Abor Hill Agama (1), Green Fan-throated Lizard (2), and Bent-toed gecko (3)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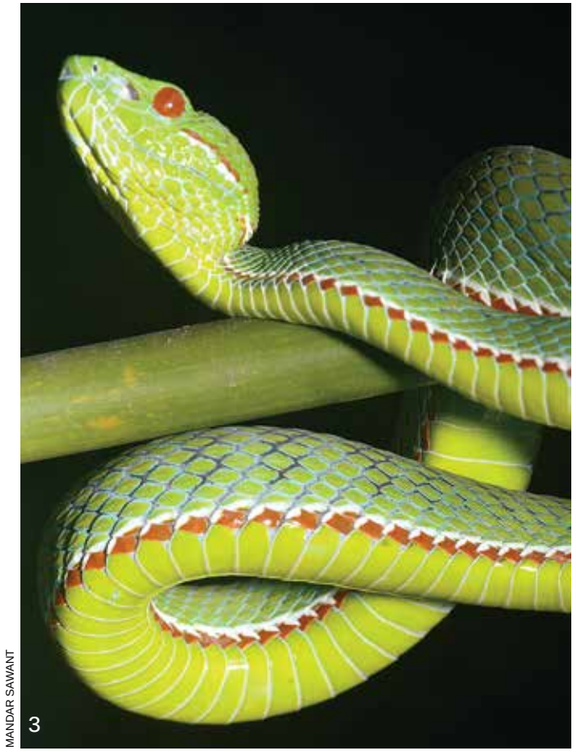
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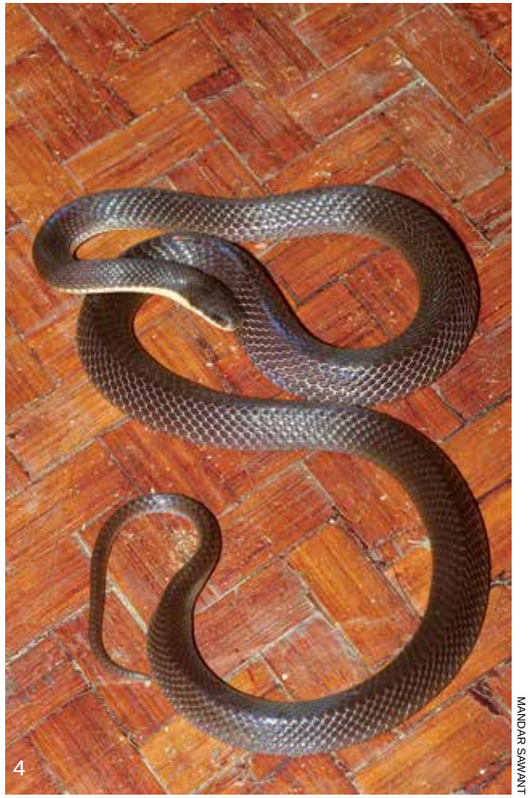
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HARSHAL BHOSALE

The herpertofauna of Northeast is biodiverse. Zaw's Wolf Snake (1), Common Mock Viper (2), Pope's Pit Viper (3), Greater Black Krait (4), and Large-eyed False Cobra (5) are some snake species found in the area

ATHARVA SINGH

One of the fifty Rhododendron species in bloom in the Dibang Valley

RAFIKUL ISLAM

The Dibang River is one of the pristine rivers of India

study area. However, Roy *et al.* (2018) had reported 38 species of the amphibians from Dibang Valley. Eleven unidentified species of frogs were recorded, which suggests that these species are rare and / or potentially new to science. In addition, errors in scientific names, distribution records, and incorrect identification are other issues that require scientific scrutiny.

A recent survey in Kamlang district, which adjoins Dibang and West Kameng of Arunachal Pradesh, has led to discoveries of two new snakes, namely *Trachischium aptei* and *Trimeresurus salazar*. This shows that Arunachal Pradesh has great potential for new discoveries. Hitherto, Dibang Valley has not been explored to its full potential, and several species yet unknown to science are waiting to be discovered here.

Other concerns

- The Etalin hydroelectric project is in a seismically active zone (Zone V) – of the Himalaya. Four earthquakes have been reported in Tangon river basin [28 December 2008 - M 3.7, and 1 March 1983 M 5.0]; Dri river basin [8 May, 1993 - M 4.7, and 8 November 1997 M 4.7]. This makes the area vulnerable to natural disasters. Hence, the dam, if built, will not only threatens the life of people downstream, but also poses a threat to the larger landscape of the Brahmaputra floodplains.
- This entire region falls under the IUCN management categories III and IV, Endemic Bird Area, Global Biodiversity Hotspot, and Key Biodiversity Area, indicating its vital importance at the global level. In fact, this area has greater biodiversity than any other part of the country. Therefore, it is advisable to conduct multiple seasonal replicate studies for biodiversity assessment.
- The scale of the project will result in a huge amount of debris during excavation and construction. The report does not mention any plan for disposal of the debris created. If it is dumped in the area, the debris will have significant ecological impacts on the entire Dibang river basin.
- Heavy degradation of forest is inevitable once the project is functional. Pylons to carry the high-tension electric lines will pass through this ecologically sensitive area. To maintain these linear structures, tracts of vegetation will have to be cleared, causing more damage to the forest.
- The possible impact of vehicular traffic on wildlife remains unexplored. Construction on this scale would require huge logistic support, which will increase traffic in the area. All this traffic would go through Mehao Wildlife Sanctuary and Idu Mishmi Community Conserved Area. Road widening would be required at many places. This will lead to degradation and fragmentation of the area.
- In order to compensate for forest loss due to the project, the State Forest Department has proposed compensatory afforestation in Tawang block of Western Arunchal Pradesh. The afforestation area is about 420 km from the project site. It is not clear whether this afforestation will be carried out in degraded land or elsewhere. A valid question also arises on how this so called 'compensatory afforestation' will compensate the forest loss in Etalin.
- Finally, according to University of Colorado, National Snow and Ice Data Center and GLIMS (Global Land Ice Measurements from Space), Dibang has around 300 glaciers that are melting rapidly due to warming. Establishing a hydropower plant in close proximity to these glaciers will increase the risks of glacial flood outbursts, which would cause havoc and destruction in widespread regions of the Dibang Valley.

Conclusion

River Brahmaputra acts as a biogeographic barrier for several taxa such as birds, reptiles, and amphibians. This increases its potential for a rich endemic biodiversity. Eastern Arunachal Pradesh (Mishmi Hills) and especially the tributaries of Brahmaputra still remain understudied with regard to biodiversity. Large parts of Dibang Valley remain scientifically unexplored.

The studies conducted by R.S. Envirolink Technologies Pvt. Ltd and WII contain discrepancies such as biased sampling, usage of incorrect names for species, and doubtful checklists of flora and fauna. These studies are inadequate to draft a conservation strategy and conservation management plan for the project area.

It is crucial to conduct thorough scientific studies of the region, so that true representation of flora and fauna is reflected in reports. Lack of such information endangers the existence of the region's rare and threatened flora and fauna, some of which may not yet be known to science. A decision support system based on a scientific foundation would give justice to the development plans of the area resulting from the proposed project. Any decision in the absence of such a system may cause harm to the ecosystem, species living in the area, as well as the well-being of the people who belong there. ■

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Harshal Bhosale is currently a Scientist at the BNHS. He has described a new snake species from Arunachal Pradesh.

Mandar Sawant is a Naturalist Explorer with the BNHS. He is interested in travel for it has to be wildlife photography.

Rohan Bhagat, a Scientist at the BNHS, is an expert on GIS and mammals. He assists the Director in conservation programmes of the BNHS.

Report on State of India's Birds (2020)

A report titled STATE OF INDIA'S BIRDS was released on February 17, 2020, at the 13th Conference of Parties of the Convention on the Conservation of Migratory Species of Wild Animals (COP 13) at Gandhinagar, Gujarat. The report was released by Shri C.K. Mishra, IAS, Secretary, Ministry of Environment, Forest and Climate Change. The first-of-its-kind for India, this analysis was carried out by 10 governmental and non-governmental research and conservation organizations: Ashoka Trust for Research in Ecology and the Environment (ATREE), Bombay Natural History Society (BNHS), Foundation for Ecological Security (FES), National Biodiversity Authority (NBA), National Centre for Biological Sciences (NCBS-TIFR), Nature Conservation Foundation (NCF), Sálim Ali Centre for Ornithology and Natural History (SACON), Wetlands International-South Asia (WI-SA), Wildlife Institute of India (WII), and World Wide Fund for Nature-India (WWF-India).

Common and widespread species are declining the world over, but in India, conservation attention has been focused on only a few species (usually large, charismatic and threatened) due to lack of information. This report

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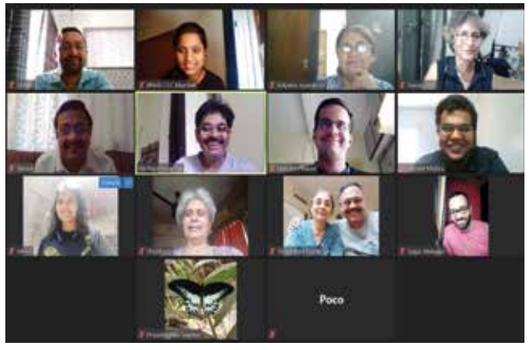
(L-R) Shri Dhananjai Mohan, Shri C.K. Mishra and Shri Sanjay Kumar releasing the report

is the outcome of the first comprehensive assessment of the distribution range, trends in abundance, and conservation status for most of the Indian bird species, and is a significant step forward in the monitoring and conservation of India's rich and varied biodiversity, as it assesses the status of 867 Indian birds using information contributed by over 15,500 birdwatchers to the online platform eBird. You can read and download the report at https://www.stateofindiasbirds.in/ ■

Lockdown Lessons



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Screen shot of the butterfly course wrap-up session

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Dr Raju Kasambe conducting a webinar

Since the lockdown began in March, the BNHS Conservation Education Centre (CEC) in Mumbai has remained closed for all public activities. But the Centre has been hosting free webinars by experts on environment and wildlife. The webinar series started on April 4, 2020, with a talk on 'Basic Bird Identification and Birdwatching' by Dr Raju Kasambe (Assistant Director – Education). Since then, more than 25 webinars have been conducted, and the response of people across India and abroad has been phenomenal. More than 7,260 enthusiastic citizens, amateurs, and students interacted with the experts. If you missed these webinars, you can watch them on BNHS's YouTube channel. Innumerable people have viewed the videos on the channel so far. ■

Winter Bird Walk at Surajpur Wetland

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Students of Step by Step School watching birds with a spotting scope

About 150 students of Step by Step School attended a Winter Bird Walk at Surajpur wetland, Uttar Pradesh, conducted by the BNHS Conservation Education Centre, Delhi in collaboration with Ninox – Owl about Nature, in February 2020. The walk started with a basic introduction to birds and their importance in the ecosystem.

Our resource persons elucidated on the birds found in different habitats in the area, such as wetland and forest. Bird species like Grey Heron, Cattle Egret, Spot-billed Duck, and Yellow-wattled Lapwing were seen during the walk. The students were amazed to see the migratory birds that had arrived at Surajpur. They observed the birds with the spotting scopes provided by BNHS. ■

Understanding Climate Change and Spreading Awareness

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Participants of the activities conducted on February 21, 2020, at Labrang Monastery, Phudong

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Students of Classes IX-X and teachers of Jawahar Navodaya Vidyalaya, Phudong attended the lecture on March 03, 2020

BNHS PHOTO LIBRARY

Students of Classes VI-VIII along with four teachers and Principal of Namok Junior High School attended the talk

A BNHS study on the impacts of Climate Change on specific indicator species like pheasants and finches across the Himalaya is in progress since 2016. This project titled "Status, Distribution and Conservation of Pheasants (Phasianidae) and Finches (Fringillidae) in Eastern Himalaya (Sikkim)" is a long-term research programme funded and supported by Oracle, and facilitated by CAF-India.

While carrying out studies on the target species in Sikkim, the BNHS team is also focusing on developing different resource groups from different sectors – educational institutes, monasteries, State Forest Department, and panchayats, among others. This is done to facilitate public participation and activities, ensuring sustainable development and continuous monitoring and conservation of forest biodiversity at large. One of the primary objectives of these activities is raising awareness among the communities about the rich biodiversity of the Sikkim Himalaya and highlighting the challenges faced by pheasants and finches (and other birds) as a result of climate change. Dr Himadri Sekhar Mondal (Scientist A, BNHS) and Mr Atharva Singh (PhD Scholar, BNHS) gave talks on Climate Change and its impacts on wildlife and biodiversity. ■

BNHS-ENVIS Activities

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A beach clean-up and marine education workshop was conducted on February 21, 2020, along with the Oracle team, Children's Scrappy News Service, and Rishi Valmiki Eco School, Goregaon

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To mark International Day of Forests 2020, a photography competition was organized on March 21, 2020. Around 88 participants joined the programme

ENVIS Resource Partner on Avian Ecology (BNHS-ENVIS) contributes in myriad ways to disseminate information on avian ecology. Beach clean up and celebrating International Day of Forests, Earth Day, World Wildlife Day with citizens were a few of the activities conducted by the ENVIS team. ■

A special moment for BNHS

Hornbill House had a rare and distinguished visitor in January 2020. Ms Gwendy Butler, the daughter of Stanley Henry Prater, one of the most cherished stalwarts of the Bombay Natural History Society, came down from England with her family to reconnect with her father's past and relive her memories of Bombay. BNHS Director Dr Deepak Apte and the Collections team took her through the natural history specimens at Hornbill House, gathered over a 100 years ago when her father was the Curator.

To recall in brief, S.H. Prater was associated with the BNHS from 1907 to 1948. He was appointed Curator of the Society in 1923. At that time, the Natural History section of Prince of Wales Museum (now Chhatrapati Shivaji Maharaj Vastu Sangrahalaya) was still under the management of the Society. Prater brought in significant changes to the way natural history collections are exhibited in the museum. THE BOOK OF INDIAN ANIMALS by Prater, published in 1948, remains a landmark publication till date. Prater was deeply committed to the protection of wildlife in India. When he emigrated to Great Britain in 1948, he left the BNHS well set to take on the challenges of a post Independence future. ■

BNHS PHOTO LIBRARY

BNHS stalwart S.H. Prater's daughter Ms Gwendy Butler holds a specimen as she listens keenly to BNHS Director Dr Deepak Apte

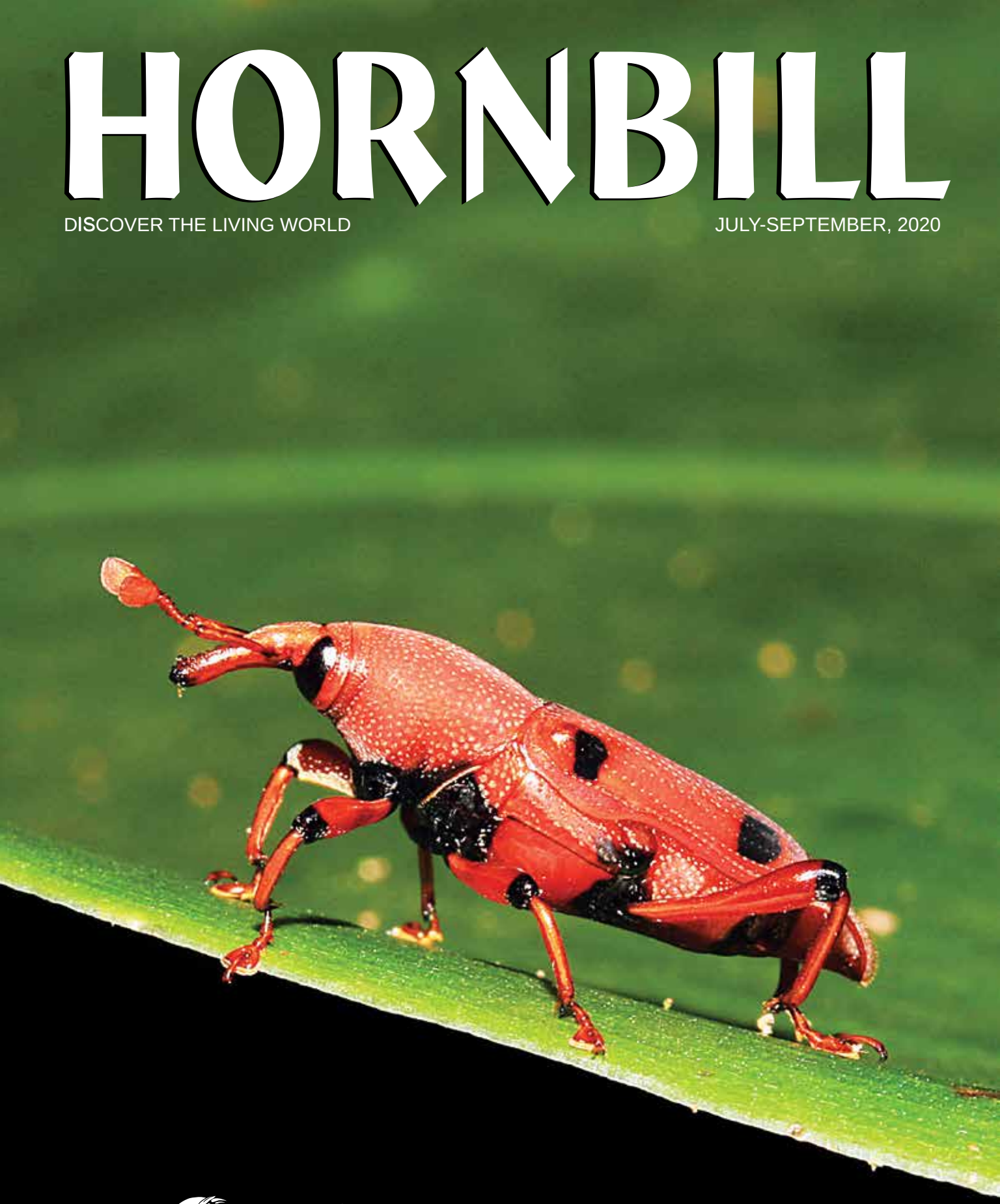
Published on June 30, 2020, by the Honorary Secretary for Bombay Natural History Society, Hornbill House, Dr Sálim Ali Chowk, Shaheed Bhagat Singh Road, Mumbai 400 001, Maharashtra, India.

Registered with Registrar of Newspapers under No. **RN 35749/79**

HORNBILL

DISCOVER THE LIVING WORLD

JULY-SEPTEMBER, 2020



BNHS INDIA CONSERVING NATURE SINCE 1883

BOMBAY NATURAL HISTORY SOCIETY

HORNBILL

July-September, 2020

BNHS India CONSERVING NATURE SINCE 1883

COVER : **Weevil *Sphenocorynes* sp.** by Saunak Pal

Published and printed quarterly by the Honorary Secretary for the Bombay Natural History Society, Printed at Akshata Arts Pvt. Ltd., Lower Parel, Mumbai.
Reg. No. RN 35749/79, ISSN 0441-2370.

For more information on the Society and its activities, write to the Honorary Secretary, Bombay Natural History Society, Dr. Sálim Ali Chowk, S.B. Singh Road, Mumbai 400 001, Maharashtra, India.
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Where Tigers Roam – Bandhavgarh-Sanjay-Dubri Landscape

Sharad Kumar, Kedar Gore, and **A.J.T. Johnsingh** narrate their experiences in the land of the tiger – Madhya Pradesh. From the narration, the importance of these forested landscapes becomes obvious to anyone with an inclination towards conservation.

10

Being a Biologist in a Wounded World

Time and again, we have been alerted about the alarming and deleterious human impact on the planet. **Giovanni Bearzi** hopes that we will start to seriously ponder on this issue, take steps to prevent further damage, and contribute to environmental healing. Thus we would secure a better heritage for our future generations, sparing our fellow humans as well as wildlife some of the suffering.

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‘Pandemic Reflections’ and Looking Ahead

The world continues to suffer due to the COVID-19 pandemic, and India is no exception. All BNHS field stations have, since April, been attending to priority work only. Several BNHS employees and their families tested positive, but thankfully all have recovered and are doing well. Life came to a virtual standstill in the past few months, and now there is a debate on how life should be post COVID – how humans can work towards nature-based solutions, reduce their carbon footprint by adopting new work styles, focus on and monitor zoonotics, aim for a climate neutral economy, and enhance health and agriculture infrastructure.

BNHS has shared digital versions of the last two issues of *Hornbill* with members, who have appreciated this move. While there are some who would prefer hard copies, I feel the time is right now to move to a digital version altogether. It is, however, up to our members to decide on the same.

We recently concluded two important projects supported by MoEF&CC, Government of India, titled ‘Temporal changes in the population and behaviour patterns of waterbirds in Point Calimere, Tamil Nadu, with respect to land use and climate change’, and ‘Predictive modelling of climate change and El Niño related impacts of Giant Clams in Lakshadweep Archipelago and its conservation implications’.

Point Calimere is one of the longest running field stations of BNHS. Till now, a total of 272 bird species have been recorded from Point Calimere Wildlife and Bird Sanctuary. Out of these, 107 species are land birds, 33 are raptors and 132 are waterbirds. The sanctuary supports 22 globally Threatened and Near Threatened bird species, which adds to its ornithological importance. Studies under the Point Calimere project examined the arrival and departure pattern of 18 common species. The data showed that there were no major changes in the arrival and departure patterns of 16 of these species. However, the number of over-summering birds has increased in recent years, and overall, 13 migratory waterbirds were reported to over-summer in Point Calimere and the Great Vedaranyam Swamp (GVS). The studies also showed an overall population decline in the 17 dominant waterbird species wintering in Point Calimere-GVS. Arctic breeding shorebirds, namely Little Stint *Calidris minuta* and Curlew Sandpiper *Calidris ferruginea* that were the most common species among waders, have declined drastically. A decline of over 60% in population was recorded in Little Stint and over 75% in Curlew Sandpiper in the last four decades. A steep decline in the numbers of other common species, namely Lesser Sandplover *Charadrius mongolus*, Greater Flamingo *Phoenicopterus roseus*, Ruff *Philomachus pugnax*, and Black-winged Stilt *Himantopus himantopus*, was also observed. On the other hand, three waterbird species showed an increasing trend in numbers. For example, Eurasian Wigeon *Mareca penelope*, whose numbers did not exceed a hundred birds during the 1980s and 1990s, was recorded in thousands in the recent years. A maximum of 7,000 individuals were recorded during January 2008. For Spot-billed Pelican *Pelecanus philippensis*, a maximum of 3,000 individuals were recorded in 2013, which constitutes almost 25% of its global population (as per the IUCN Red List data). There are several other important findings from the completed study. Conservation and restoration of key coastal wetlands like Point Calimere-GVS will be vital for migratory birds of the Central Asian Flyway. BNHS is working closely with the state government to undertake a restoration strategy for Point Calimere-GVS.

Our studies in Lakshadweep assessed the impacts of elevated sea surface temperature (SST) on Giant Clams and coral reefs in the Lakshadweep Archipelago. Our findings, published in *Ecological Indicators,* concluded that Giant Clam *Tridacna maxima* may be facing an uncertain future, with declining density and high risk of quasi-extinction under the prevailing high-incidence bleaching.[1] Severely depleted Giant Clam populations cannot be expected to recover without reintroduction/restocking in future. Mariculture may help to prevent further depletion of stocks (leading to local extinction of *T. maxima* in Lakshadweep Archipelago) and should be considered as an important intervention to secure the future of the species.

We also fear that coral reefs in Lakshadweep may be nearing thermal maxima. How will this affect coral community structure needs to be understood. However, we need to carefully plan restoration policies and undertake reef restoration before it is too late. In this context, declaration of three proposed conservation reserves, covering reef areas of 675 sq. km, assumes great significance. This intervention will provide for participatory reef restoration measures and adoption of reef-friendly fishing practices.

The pandemic has provided us all some time off from field responsibilities, but this time was utilized aptly by our researchers. Several papers have been published by BNHS scientists in the last six months, the latest being a monograph ‘Systematic revision of the genus *Peronia* Fleming, 1822 (Gastropoda, Euthyneura, Pulmonata, Onchidiidae)’.[2]

We hope the pandemic will be behind us soon, so we can resume field work and continue to strive towards a deeper understanding of conservation science. Meanwhile we encourage our members to visit our online retail outlet at www.bnhs.org. Your support is vital for BNHS. I am glad to state that despite the worst fears of an economic impact, we have remained relatively unaffected till now, thanks to our supporters and donors who continue to repose faith in BNHS. The next couple of financial years, however, appear to be challenging and we need to continue to work hard to achieve both conservation goals and the financial stability of our institution.

Deepak Apte

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WHERE TIGERS ROAM

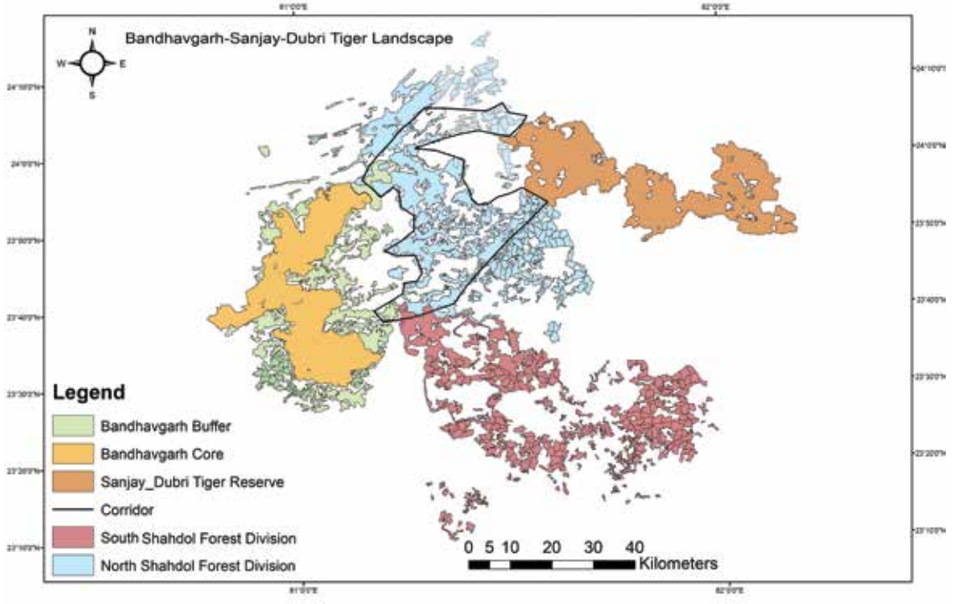
Bandhavgarh-Sanjay-Dubri Tiger Landscape

Text: **Sharad Kumar, Kedar Gore, and A.J.T. Johnsingh**

"Bheem, the largest male tiger in Bandhavgarh, was seen near Khitauli Gate in the morning, and you may see him if you go there for an evening drive." This was the message we got during lunch time on November 16, 2018 as we were getting ready for our afternoon drive in Bandhavgarh Tiger Reserve. A little past 15:00 hrs, we entered Khitauli Range of the Reserve and our driver drove us to Amliyawah *jheel*, one of the most scenic locations in Khitauli, where the chances of seeing wildlife, including the tiger, were greater. There were two Red-wattled Lapwings and one Lesser Adjutant feeding along the edge of the waterbody, and a lone Little Grebe foraging in the middle of the wetland. There was also a group of 10 female Chital peacefully browsing in the nearby meadow. They did not show any sign of nervousness, and we concluded that possibly Bheem was not in the vicinity. A noisy flock of Plum-headed Parakeets flew restlessly over us, and a Brown-headed Barbet called from one of the dry trees overlooking the *jheel*.

A.J.T. JOHNSINGH

Bheem crossing the path of our vehicle, November 16, 2018, Bandhavgarh Tiger Reserve



Bandhavgarh-Sanjay-Dubri Tiger Landscape

As we continued our drive, we sighted Bheem calmly padding along the road although he was followed by a van full of excited wildlife tourists. We too followed Bheem, who, after some distance, walked into the forest. Our driver and guide were experienced and after driving for some distance, they parked the vehicle near a well-used wildlife trail, saying that Bheem would take this trail to go to a waterhole nearby. One of the finest and most exciting experiences for any wildlife lover is to wait for a tiger in the jungle when its movements are indicated by the alarm calls of animals such as Northern Plains Grey Langur, Chital (Spotted Deer), and Sambar. Such a sighting can give you goose bumps, and we experienced them that evening! As expected, Bheem came along the trail, heralded by langurs and Chital, glanced at us once as he majestically walked past our vehicle into the forest. We were told he was heading towards a waterhole. We observed him – a magnificent animal weighing several kilograms over 200 kg. He was reported to be a little over 10 years of age and had a cut on his nose, indicating his struggle to retain the *numero uno* position among his rival males in Bandhavgarh. Since he was past his prime, we wondered how long he would be able to hold onto the core area in the Reserve – the average territorial tenure of an adult male tiger is about five years.

We were in Bandhavgarh to attend the annual meeting of The Corbett Foundation (TCF), and we made use of this opportunity to know more about the landscape of Bandhavgarh and Sanjay-Dubri tiger reserves (along with the corridor connecting both the reserves). Bandhavgarh Tiger Reserve occupies an area of 1,536.94 sq. km (including 716.90 sq. km of core and 820.04 sq. km of buffer zones) and Sanjay-Dubri Tiger Reserve covers an area of 1,674.51 sq. km (including 812.58 sq. km of core and 861.93 sq. km of buffer zones). The corridor forest of North and South Shahdol Forest Divisions connecting these two tiger reserves is spread over 6,000 sq. km. This landscape has over 400 villages, with approximately 3,00,000 people. Administratively, Bandhavgarh TR is divided into six core ranges (Tala, Magdhi, Khitauli, Kallawah, Pataur, and Panpatha) and three buffer ranges

(Dhamokhar, Manpur, and Panpatha), while Sanjay-Dubri TR is divided into four core ranges (Bastua, Dubri, Pondi, and Mohan or Kusumi) and four buffer ranges (Madbas, Tamsar, Beohari, and Bhuimad).

This landscape is steeped in history, with fascinating anecdotes related to the tigers. Bandhavgarh forest was a private game reserve of the Maharajas of Rewa. The most famous white tiger Mohan was caught on May 27, 1951 from Bagdara forest (Sidhi) in Bastua Range of present day Sanjay-Dubri TR by Maharaja Martand Singh of Rewa. There is a signage in Panpatha Wildlife Sanctuary (Pataur Range), 12 km from Tala on the Tala-Barahi road, with an inscription on a stone pillar which marks the location where the Maharaja shot his 100th tiger on March 21, 1954. Hunting continued until 1968, when Bandhavgarh was constituted as a national park. In 1993, Bandhavgarh was declared a tiger reserve under India's most successful conservation programme – Project Tiger.

In Bandhavgarh TR, we explored two buffer ranges (Dhamokhar and Manpur) and Tala Range, the prime core of the reserve. We also visited the Bandhavgarh-Sanjay-Dubri Corridor (BSDC) area to see the excellent conservation work being carried out by TCF in collaboration with the Madhya Pradesh Forest Department. One notable achievement of TCF is the creation of solar-powered waterholes: 10 in the core area of Bandhavgarh TR and 22 in the BSDC. Another valuable attempt TCF has initiated is the establishment of five vegetation restoration plots totaling 83 ha, protected by chain link fencing. The species planted are all native trees such as Burmese Silk Orchid tree *Bauhinia racemosa*, Indian Rosewood or Kala Sheesham *Dalbergia sissoo*, Banyan *Ficus bengalensis*, Gular *Ficus glomerata*, Mango *Mangifera indica*, Pongam Oil tree *Milletia pinnata*, Emblic Myrobalan or Amla *Phyllanthus emblica*, Jamun *Syzygium cumini*, Arjuna *Terminalia arjuna*, and Baheda *Terminalia bellirica*. The presence of such vegetation cover in the corridor will facilitate the movement of large mammal species between the tiger reserves. However, protection of these restoration plots will be a challenge, as the pressures from livestock and people would be enormous, particularly when there is profuse growth of grass in the enclosures.

The first buffer range we visited was Dhamokhar Range. It was on November 16, 2018 that we drove into the range from Parasi Gate. As the range was added to the Tiger Reserve in 2014, it had not yet recovered from the past unregulated impacts by local people and livestock. The Sal *Shorea robusta* forest was sparse without much regeneration, but Dwarf Date Palm *Phoenix acaulis*, only nibbled by wild ungulates, was common. The road network was good, there were many waterholes, and a tigress with three cubs was reported to use the area. We saw the site where a buffalo had been killed by a tiger two days earlier. Large-billed Crows (or Jungle Crow) were descending from the trees to feed on the kill, which possibly indicated that the tiger was not in the vicinity. If they are resting nearby, tigers usually do not tolerate such intrusions. Indian Grey Hornbills flew around and Five-striped Palm Squirrels chirped, indicating that

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Waterhole created by TCF in Sanjay-Dubri Corridor

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Sharad near the restoration plot protected by chain-link fence

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Crested Hawk-Eagle, on the way to Sanjay-Dubri TR

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Cattle seen on the way to Jabalpur

some danger, possibly a bird of prey, had alarmed them. In one place we came across five Yellow-wattled Lapwings, maybe parents with three chicks, which indicated the dryness of the range, as these birds are partial to dry habitats. We came out of the range satisfied with the sighting of five groups of Chital. Their numbers could not be counted, as they were moving amidst the invasive *Lantana camara* bushes.

On 18th evening, we walked in Manpur Range that is adjacent to the core zone of Tala Range. The area being close to villages Bijhariya and Tala, signs of biotic pressure were exceedingly high. Even large Sal trees had been cut down and taken away. Sal and other trees are in great demand by the local people for fencing and firewood. We saw two men carrying axes going into the forest. Cattle dung was everywhere, and interestingly, there were also dung piles of Nilgai, the largest antelope in India, and pellet groups of Chinkara or Indian Gazelle. The area also harbours Golden Jackal and Indian Fox. We found a large Mahua tree that was host to the parasitic Mistletoe *Loranthus*. The beautiful red flowers of *Loranthus* attracted a number of nectar-feeding birds such as the Thick-billed Flowerpecker. Other bird species that we saw on their 'hunting spree' were a female Verditer Flycatcher, Small Minivets, White-bellied Drongos and a group of Indian White-eye. Noisy Plum-headed Parakeets flew overhead. An Oriental Honey-Buzzard flew over us and landed atop a dense canopied Haldu *Haldina cordifolia* tree. A lone male Purple Sunbird, adorned in its eclipse plumage, was chirping its heart out.

By this time, the half-moon of the day was clearly visible up in the cloudless blue sky and through the fog of the evening; Bandhavgarh Fort atop the distant hills of the Tala Range was faintly visible. We got down into a dry *nallah* with cream-coloured sand and walked along searching for signs of animals. Soon we were pleasantly surprised to see the tracks of a large tiger, possibly a male. As we walked back to our vehicle pleased by this finding, we discussed the possibility of restoring such degraded and disturbed habitat by growing fodder and firewood species in the vicinity of the village, by involving the villagers and also by setting aside some area of the forest along its boundary for such a programme. Enormous effort and dedication for several decades will be needed if one has to be successful in such tasks to reduce the anthropogenic pressures on the forest. But such initiatives are the need of the hour in most of the wildlife habitats in India, including the Bandhavgarh-Sanjay-Dubri TR landscape.

We visited Sanjay-Dubri Tiger Reserve on the 19th, crossing the beautiful Son River that flows along the eastern boundary of Bandhavgarh TR.

KEDAR GORE

There is severe pressure on timber trees used for building houses

A.J.T. JOHNSINGH

The scenic Tala Range covers hills and grasslands

The road traversed a mosaic of natural forest, villages, and large-scale plantations of the exotic *Eucalyptus*. This species is believed to deplete ground water and is unsuitable for local biodiversity, therefore it is best avoided.

Some of us stayed at Sanjay-Dubri TR for the night in the newly built forest rest house in Dubri village. The rest house was in an old campus full of trees such as Neem *Azadirachta indica*, Sheesham *Dalbergia latifolia*, Mango *Mangifera indica*, Kaim *Mitragyna parviflora*, and Indian Kino *Pterocarpus marsupium*. The reserve has 52 villages in its core zone (of which 10 have been resettled and another 30 have received compensation and will be resettled soon) and about 100 villages in the buffer zone. On the 19th and 20th we drove a total of around 70 km in the Dubri Range of Dubri Wildlife Sanctuary, which is a part of the Tiger Reserve, and saw less than 10 Chital and 10 Nilgai. Water was not a problem in the range as the Banas and Umarari rivers flow through the range and numerous *nallah*s had a copious amount of water. Check dams had been built across the *nallah*s with sacks filled with sand and covered with mud and these impoundments merged well with the surroundings. Concrete check dams are an eyesore in a forest area and should be avoided. Our brief stopover at River Banas revealed only one River Lapwing and two Woolly-necked Storks. There was a marked absence of migratory waterfowl.

Our brief observation of the area indicated that the habitat is not suitable for Sambar as the area is full of inedible Kurchi *Holarrhena antidysenterica*, which dominated the understorey. This is a latex-laden species avoided by ungulates. Other common species were Indian Laburnum *Cassia fistula*, East Indian Ebony *Diospyros melanoxylon*, Crepe Myrtle *Lagerstroemia parviflora*, Sal *Shorea robusta*, and Fire-flame Bush or Dhataki *Woodfordia fruticosa*. Mature fruits (pods) of *Cassia fistula* are eaten by Sloth Bear. It appears that even the leaf-eating langurs find it difficult to get enough food, as they were seen on only two tree species – Axlewood *Anogeissus latifolia* and Indian Laurel *Terminalia tomentosa*. Langurs feed on the petioles of the leaves of Mahua and the leaves dropped by the langur are eaten by Chital. Subhash Singh, a local wildlife guide working in this area for the last 15 years, said that a few Sambar are seen only in the Kusumi Range of the reserve, close to the Chhattisgarh border. So in the absence of abundant wild ungulate prey, particularly Sambar, the tigers of Sanjay-Dubri TR primarily live on cattle, the population of which is growing in the country. Based on a study, the Indian Council for Forestry Research and Education estimated that India's forests support 270 million cattle for grazing, against the carrying capacity of 30 million. Uncontrolled grazing of livestock is a serious issue that needs to be tackled on a war footing, using reasonable decisions in livestock management to ensure the health of forest ecosystems throughout the country.

One vital information we got during the stay in Dubri village was evidence that Jackal are still fairly common in the area (a pair was seen in the forest in the evening) – we often heard them howling all around the village at night. This once common canid has disappeared from many areas in the country, maybe as a result of rampant development, road kills by speeding vehicles, and possibly by the diseases transmitted by free-ranging dogs, so common in our country.

Before leaving Bandhavgarh TR, our final wildlife drive was in the extremely scenic and famous Tala Range, which teems with wildlife. Its hills clothed with dense bamboo, streams, and well-maintained waterholes, picturesque grasslands with an abundant Chital population, make it a great destination for wildlife lovers. We learnt from Shri Mridul Pathak, the Field Director of the Reserve, who was about to retire, that presently four tigresses raise cubs in the 105 sq. km Tala Range and one tigress was even reported to have had five cubs. One of the exemplary field conservation programmes of Madhya Pradesh Forest Department is the reintroduction of Gaur in Bandhavgarh TR from Kanha Tiger Reserve. After the small population of Gaur had disappeared from the area in the late 1990s, the Gaur reintroduction programme was initiated in 2011 with 19 Gaur (14 females and 5 males) from Kanha Tiger Reserve. Soon more introductions followed, and despite predation by tigers, their number has grown beyond 150. Tala Range is one place where one is sure to see Long-billed Vultures, which nest on the cliffs. In most parts of India, these vultures have succumbed to the veterinary drug diclofenac administered to livestock – vultures outside forest areas largely feeding on contaminated cattle carcasses. In Tala Range, food for the vultures primarily comes from wild ungulate kills of the tiger and leopard (which are free from diclofenac). A vulture population survey conducted by TCF in 2015 estimated 520–640 vultures in BTR.

The importance of forested landscapes like Bandhavgarh-Sanjay-Dubri TRs would be appreciated by anyone travelling by road from this landscape to Jabalpur. On either side of the road in most places one would see vast tracts of a ravaged landscape with the top soil eroded, resulting from decades of extensive grazing by goats and cattle. The vegetation in this stony landscape is primarily *Lantana camara* and *Hyptis suaveolens* (= *Mesosphaerum suaveolens*), both exotics from Latin America. *Nallah*s with some water, or even a little moisture, are infested with *Ipomoea carnea*, another exotic from Latin America, which has the detrimental capability to convert a water body into a terrestrial habitat. Such a landscape will have reduced water holding capacity, which in the years to come would make the life of the people of the area miserable, as they would have to struggle even to get drinking water. We are not sure whether our leaders have the knowledge, vision, and dedication to restore the health of such landscapes. In such a situation, the restoration efforts undertaken by The Corbett Foundation with support from the Forest Department and corporates such as Jet Privilege Pvt. Ltd show the way to nurture and heal such terribly wounded landscapes. Under these circumstances, one may appreciate the worth of forested landscapes such as Bandhavgarh and Sanjay-Dubri. The value of these landscapes, which give rise to numerous streams, becomes even more appreciable as they harbour some glorious mammals – Sambar, Gaur, and Tiger – that make India rightly proud. ■

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SILVIA BONIZZONI

Atlantic Bluefin Tuna *Thunnus thynnus*, classified as Endangered in the IUCN Red List

Being a biologist in a wounded world

Text: **Giovanni Bearzi**

By the 1970s, we had been alerted repeatedly about the risks from unsustainable human impact on the planet, and the warnings of upcoming disaster were becoming ever more credible and worrying. However, we were also exposed to the cultural diversions of complaisant media and to the mystifications of industry-driven think tanks that, among other denials, had been deliberately concealing climate change. Under sanitized and distorted cultural scenarios, even the most compelling evidence of rising greenhouse gases could be downplayed, and the risks could go unperceived. Apart from the climatologists and a few visionaries, not many could discern an immediate climate emergency of the ominous kind that has loomed over us in these last few years. In the face of warnings unmatched by proportionate reactions within our intellectual milieu, many biologists (including myself) went on behaving as if there was still plenty of time to solve the environmental and climate crisis. Perhaps we just weren't ready to leave our comfort zone and venture into a complex realm of inconvenient truths. My own awakening to these truths happened gradually, then suddenly. And it came as a shock.

To my dismay, I was becoming aware that living systems and the physical environment had been depleted and disrupted, resulting in losses of biodiversity, mass extinctions, and catastrophic climate and ecological changes. In 1949, one of the fathers of the environmental movement, Aldo Leopold, wrote: "*One of the penalties of an ecological education is that one lives alone in a world of wounds. Much of the damage inflicted on land is quite invisible to laymen. An ecologist must either harden his shell and make believe that the consequences of science are none of his business, or he must be the doctor who sees the marks of death in a community that believes itself well and does not want to be told otherwise.*" Today's world is, indeed, as wounded as ever, and some of the long-predicted calamities are happening with increasing intensity or frequency (e.g., extreme weather events, bushfires, droughts, floods, glacier melting, sea level rise, heatwaves).

Whether or not these facts are accurately reported by the media or acknowledged by present-day political leaders and their electorates, those who are familiar with the scientific literature know that little time is left to prevent irreversible warming and avert the risk of a Hothouse Earth pathway. This inconvenient truth is emphasized in signs held by the young people attending global strikes for climate: *Normal is Over*, *There is No Planet B*.

Nobody should be fiddling while the planet is burning down, certainly not biologists and ecologists who know what is really at stake. As noted by Gary K. Meffe two decades ago, "*The time has long passed when we could merely pontificate in our journals, impress our colleagues, and proclaim that we are above the political fray.*" This rings even truer today. Continuing to live and work as if everything is fine makes change impossible and breakdown inevitable.

The time has come – and indeed passed – to consciously upgrade our values, methods, and behaviour. As our global leaders demonstrate their inability to respond to the crisis and ward off the drivers of self-destruction, it is becoming clear that the ideas needed to reshape our future must stretch beyond the confines of our current system. The question then is: How can we capitalize on our expertise as biologists and ecologists and contribute most effectively to the solutions that need to be taken? What does it take to bridge the gap between conservative scientific disciplines and the global conservation imperatives of our time? Below, I offer a few hints in a spirit of constructive self-criticism (I wish I had done all that is being preached here long ago).

SILVIA BONIZZONI

Mediterranean Monk Seal *Monachus monachus*, classified as Endangered in the IUCN Red List

GIOVANNI BEARZI

A trio of Common Dolphinfish *Coryphaena hippurus* in the Mediterranean

1. Proclaiming that we care

To get out of this mess, we must first relinquish our belief in progress as everlasting and unconstrained growth, and replace it with value systems leading to environmental sustainability and social justice. As biologists, we can help envision a world where the role played by humans is consistent with the laws of nature and the reality of a finite planet. Paraphrasing Wendell Berry, we must not only suppose or imagine but loudly proclaim that "*the ultimate standard of our work is the health and durability of human and natural communities*." We should take responsibility and become conservation stewards who are thoughtful of the consequences of their choices and actions. Such commitment must be placed at the core of our profession – to the point that everything we do truly does have the goal of benefiting the larger community of humans and life on Earth rather than ourselves, our circles or our nation.

2. Communicating effectively

For decades, we have been working in a scientific environment that discouraged individual researchers from expressing views that could be interpreted as green activism or have political connotations. However, not expressing one's opinion and not engaging in activism also is a political choice, as it often implies supporting (or at least not challenging) the status quo and therefore implicitly endorsing it.

Contrary to what we have been conditioned to think, supplying information is not enough. Even climate scientists, whose early warnings went unheeded in part because of ineffective messaging, have realized that their science does not communicate itself and that high-quality outreach is essential. We, too, need to leave behind jargon and sectarian arguments and enhance our communication, lifting the antiquated taboo on "saving the planet" language and placing emphasis on defending what we love. Our care for the living world should not only be made explicit but also become the core of compelling narratives we use to engage human society. We must aim to tell heartfelt, captivating stories centred on our own experience, bringing to life a capacity to think outside the box and dream big. To reach people at a deeper emotional level, we may even team up with conservation non-governmental organizations and groups of environmental activists or collaborate with designers, art directors, artists, and celebrities, as well as fellow scientists in various disciplines.

3. Embracing real sustainability

Because economics and environmental conservation are largely intertwined, we cannot deal effectively with a crisis unless we confront the economic, social, and political reality that generated the crisis. As biologists, we should not only document the threats to life but also help clarify how the extraction, production, and consumption system can be steered away from damaging and unsustainable practices. On a more fundamental level, we should accurately characterize the decisions driven by industrial or commercial interests and reject any system that sees nature merely as a resource to be pillaged in pursuit of perpetual growth and material wealth. Changing the status quo and tackling the causes, instead of merely mitigating the effects, requires judicious and imaginative planning, leading to thoughtful strategies for research, outreach, and management.

4. Fostering individual and systemic change

Many of us have attended conferences and workshops organized in fancy resorts located in exotic locations that require multiple flights. Conference attendees may even banquet on bottom-dwelling shrimp right after having learned about the damage caused by bottom trawls and shrimp aquaculture. No matter how effective such gatherings may seem to be in advancing conservation biology, they carry an embedded inconsistency, as if those responsible for environmental damage are invariably others, somewhere else. Such inconsistencies are increasingly debated, particularly with regard to restraint in flying (to reduce our carbon footprint) or switching to a plant-based diet (to reduce the environmental and climate impacts of meat and seafood production and consumption).

Biologists and other scientists who appear to overlook their own footprint often contend that individual behaviour does not matter and that it is the system that needs to be changed. That is correct. A change in the system (and a new breed of political leaders) is unquestionably needed to tackle the environmental and climate crises. It is also true that neoliberalism and corporate agendas have conned us into tackling the crisis as individuals, whereas most of the damage originates from the choices of a handful of giant companies and mighty executives. That, however, does not mean that individual and social behaviour is irrelevant.

First of all, the effects of individual behaviour are rarely experienced only by the individual. Our choices affect and influence those around us. This must be even truer for biology professionals, whose actions may be taken as a model by colleagues and students. Secondly, a change in the system can only be instigated through the coordinated efforts of a group of individuals, and more often than not, it is the initiative of a single individual that triggers collective efforts. Third, one cannot truly choose between individual change and system change. Rather, one can choose to (1) become aware and develop a deeper understanding of a problem; (2) do something about it on a personal level, thus helping to drive market and policy choices; and (3) encourage change in others while pushing for transformation in the system. The latter can be done more effectively by directly influencing political decision-making, lobbying for greener and more responsible leaders, connecting with people and organizations that help us become empowered and engaging in coordinated action. Even if not all of us have the opportunities or the skills to succeed in each of the above-mentioned tasks, any of us can do his or her best, at all levels.

5. Supporting environmental activism

Steering humanity away from environmental and climate disasters requires committed activism, mobilization, and civil resistance. A well-planned environmental campaign can pave the way for significant change. Even the unwavering activism of a single individual sometimes results in an unpredictable uprising, setting in motion perception shifts and changes in collective behaviour. Within one year, the solitary strike for climate of young activist Greta Thunberg developed into a global protest by millions of people. While some may mock or dismiss these initiatives, research shows that non-violent mobilization has enormous potential. *In the past 100 years, non-violent campaigns have been twice as successful as violent uprisings, and the active and sustained participation of just 3.5% of a population can result in important political or societal change.* As biologists and knowledgeable scientists, there is much we can do to support, motivate, and inform non-violent activists who demand policies ensuring that our planet remains habitable. We may even join the protest ourselves.

6. Relinquishing contempt for spirituality

For centuries, humanity's mandate to subdue nature and have dominion over its living resources, as expressed in the Bible (Genesis 1: 26–28), provided a theological and moral justification for exploiting the natural world. This right to dominion and sovereignty over nature has become part of the cognitive foundation of the western

world, as epitomized by Francis Bacon when he wrote, "*Man, if we look to final causes, may be regarded as the centre of the world (…) For the whole world works together in the service of man; and there is nothing from which he does not derive use and fruit (…) insomuch that all things seem to be going about man's business and not their own.*" These deeply rooted ideas, combined with René Descartes' portrait of nature as a machine, culminated in the 19th century western vision of humankind engaged heroically in conquering nature, which provided a further justification for reckless exploitation. Such conceptual frameworks are ingrained into modern science and into our culture, which still sees progress as an increased dominion over nature and regards the whole of nature as a commodity.

Acknowledging this theological bias of science or the subtle influence of some religious thinking, however, does not imply that the entire corpus of religion and spirituality should be opposed or discarded within the context of environmental science and conservation. The void of spiritual and ethical values produced by materialism and neoliberalism clearly cannot be filled by science alone. Conversely, values consistent with equality, self-restraint, non-harming, respect for all living beings and environmental sustainability are at the core of spiritual wisdom dating back thousands of years. Some of the non-theistic and non-dualistic spiritual traditions from the East are often considered closer to the holistic approach needed to divert humanity from self destruction. However, a different interpretation of Christianity also can be envisaged, consistent with the message of the greatest spiritual revolutionary in western history, Saint Francis of Assisi. Francis (born 1181) proposed an alternative Christian view of nature and humans' relationship to it: the idea of the equality of all creatures, including humans. His message has been ignored for centuries but is as modern as ever – to the point that a different Francis has recently revived this vision in his encyclical LAUDATO SI': ON CARE FOR OUR COMMON HOME (2015).

Though few modern scientists have expressed interest in pursuing a dialogue between science and religion of the kind advocated by E.O. Wilson (2006) in his book THE CREATION: AN APPEAL TO SAVE LIFE ON EARTH, religious leaders and scholars have increasingly embraced environmental conservation (including the Ecumenical Patriarch Bartholomew, Pope Francis, and the Dalai Lama). One religious leader (the Dalai Lama) has even exhibited openness to the idea of modifying

SILVIA BONIZZONI

A Striped Dolphin rides the bow of a yacht in the Gulf of Corinth, Greece

SILVIA BONIZZONI

Common Bottlenose Dolphin *Tursiops truncatus* near Itea, Greece

obsolete dogma based on scientific evidence. Whereas the approaches, conceptual frameworks and competences of science and religion will remain different, a challenge as great as saving the Creation requires unity and consilience rather than division. In science circles, relinquishing contempt for spiritual teachings that recognize the interconnectedness of all forms of life, and endorsing a more ecocentric and holistic vision, would help advance the biosphere-saving synergies advocated by E.O. Wilson.

HOPE IS OPTIONAL, ACTION IS NOT

It is almost impossible to grasp, let alone fully accept, the bleak reality of what humans have collectively done to our only home. Being aware of the impending climate and ecological breakdown – and the reckless policies of limitless capitalism – may cause legitimate ecological grief, which includes sadness, hopelessness, fear, and despair. However, nihilism and inaction won't help, and those of us who do not react, or indulge in negativity, risk becoming ourselves a part of the problem. As Alexandria Ocasio-Cortez put it, "*Hope is not something that you have: hope is something that you create, with your actions.*" In other words, hope is neither blind optimism nor a matter of estimating the odds. It is a choice and a state of mind inspired by the recognition that change is non-linear and often unpredictable.

Even if we cannot avert catastrophes that are beyond our control, as biology and conservation experts we certainly can prevent some of the damage or contribute to environmental healing, thus leaving a better heritage to future generations and sparing some of the suffering to fellow humans and animals. This is and will remain possible – with or without hope. ■

This article is based on: Bearzi, G. (2020): Marine biology on a violated planet: from science to conscience. *Ethics in Science and Environmental Politics* 20: 1–13. https://doi.org/10.3354/esep00189

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Spare a Thought for the House Sparrow

Text: **Lt Gen. (Retd) Baljit Singh**

In the animal world, there are two creatures that have, of their own volition, cast their lot with humans. It is believed that the dog had made the choice to be "man's devoted companion", or live in the midst of humans about 14,000 years ago. The House Sparrow simply moved into human dwellings, probably as early as the hunter-gatherer *Homo sapiens* began transitioning to agricultural settlements, aeons ago.

Coming to the House Sparrow, it is to the credit of human sensibilities to have accepted this special cohabitation, of almost an umbilical kind, with this vivacious avian species and named it *Passer domesticus*! Admittedly, the House Sparrow is a comparatively sober looking bird; nevertheless it makes its presence felt in India by its ubiquitous presence; from Leh in the north to Cape Comorin in the south and from the Somnath Temple in the west to Camorta Island in the Bay of Bengal, at the eastern end.

No matter where in India, you may be sure to spot them entering homes nonchalantly, and chattering non-stop as they set about arranging their personal comfort by adding heaps of straw to any potential nest-site, utterly unmindful of the householder's presence! No wonder the late Dr Sálim Ali had labelled them as "man's hanger-on". So obviously there also was a time when anywhere on the globe, humans could set their chronometer to local sunrise time, simply by listening to the first cheep of a sparrow! This phenomenal genetic ability of the bird is still active and accurate, but we can no longer perceive it because of man-made noise pollution. A day might come when most Indians would perhaps know this bird only through photographs, because I fear that not even one out of fifty Indians may lay claim to having seen the bird *per se* in the outdoors.

Why do so few of us now encounter the bird despite its worldwide spread? Well, the fundamental reason is the accelerating shift to new lifestyles (even among the rural communities), which are in severe conflict with the House Sparrow's basic existential needs. In one extreme case, there were the peoples' communes in China that had failed to usher in the Green Revolution, so Chairman Mao simply decreed that the House Sparrow was their crop pest number one, and by about the end of the 1960s, it was totally exterminated from China. Shortly thereafter, by the same black logic, the tiger too was deemed a pest and so ceased to exist in China by the mid 1970s, compounded by other factors.

V. GOPI NAIDU

Looking for a safe haven? Nesting pair in an old wall

On the other hand, where change was tempered by reasoned biological science, that very "pest number one" became the angel of progress, when both America and Australia consciously opted for the biological pest control route in agriculture, introducing the hitherto non-existent House Sparrow into their countries, rather than relying on imperilling chemical alternatives. In time, the House Sparrow came to be unequivocally feted by both the continents, and today, the bird figures in their avian literature among their cherished resident-breeders!

No description of the bird will be complete without a mention of the strong streak of tenacity in the sparrow's character. And here I can do no better than quote the master, Edward Hamilton Atkins (EHA who was born in Satara, Maharashtra, around 1845 to Scottish parents) from his book COMMON BIRDS OF BOMBAY (1900):

"*And when a Sparrow makes up its mind, nothing will unmake it except the annihilation of that Sparrow. Its faithful spouse is always, and very strongly, of the same mind. So they set to work to make a hole in the corner of the ceiling-cloth and they tear and tug with an energy which leaves no room for failure. Then they begin to fetch hay and the quantities which a couple will carry in a day is miraculous… I declare solemnly that you might have fed a horse on the hay which I removed daily as most of it tumbled down…*"

And for the precocious nature of this tiny bundle of feathers, I simply have to reproduce an inimitable observation by Dr Sálim Ali:

"*A communal display has been described, consisting of three to four males courting a single female. The group suddenly bursts in from somewhere amidst noisy twitterings and drops down to the ground. The suitors prance and strut around the hen with puffed breast, drooping wings and cocked tail, she now and again making sudden feints at one or the other, sometimes plucking out a feather.*" Voila!!

V. GOPI NAIDU

Once feared to be in a decline, the House Sparrow is regaining lost ground due to Citizen Science efforts

Talking of designating names to species, the Persian (also Baluchi, according to Ali and Ripley) found musical virtue in House Sparrow cheeps, and they named it *Ginjishki*, but in our local dialects the closest to the *Passer domesticus* is its name from the tribal belt of Chhota Nagpur, that is, *Garhwa*.

Much like most bird species, the House Sparrow is highly adaptable. Even though its traditional wilderness has been usurped and its living niches inside the once mud-and-thatch human dwellings have been replaced by glass and concrete, the House Sparrow could well be the last on this living planet if humankind were to spare just one hundredth of its cereal intake and put up hedges and indigenous shrubs around homes. I say so based on my wife's daily indulgence over the last 15 years of scattering a mixture of millet, rice, wheat grain, and shelled peanuts on our rooftop, which draws, among other birds, 20 to 30 House Sparrows, always. And House Sparrows live and breed inside the two hedges on either side of our house, as a permanent feature! The much touted artificial nesting boxes and nesting pots simply don't count in the long run to its survival. ■

Lt Gen. (Retd) Baljit Singh served in the Indian Army for over 36 years. Concomitantly, he strove to promote conservation of wildlife as a way of life within and by the Indian Army.

A Trip to Point Calimere

Text: **A.S. Bishnoi**

SHAKTI BISHNOI

The participants birding in the Great Vedaranyam Swamp

Seeing migratory birds in Visakhapatnam airport in Andhra Pradesh, my curiosity grew day by day. I wanted to have a closer look and learn more about them. And, what better place to fulfill this dream, I thought, than Point Calimere, which is home to thousands of migratory waterbirds from the Palaeartic countries that come to spend the winter each year in the Great Vedaranyam Swamp. Besides, there are the resident waterbirds and land birds that dwell in the forested areas of Point Calimere. Moreover, BNHS has been carrying out intensive bird migration studies here since the 1980s. Point Calimere is one of the mandatory field trip sites for course participants to visit, to qualify for the BNHS Basic Ornithology Course. The course covers all aspects concerned with birds, and in Point Calimere, one gets to see and learn about bird banding and bird migration studies.

The Journey

What could be more exciting than travelling in your own car all the way to your destination? And so, on October 28, 2012, my wife Shakti and I started the journey to Point Calimere from Vizag, that is Visakhapatnam. The journey commenced with us driving through the Eastern Ghats ranges that run through the Vizag area, and as we drove further south, we passed through scenic stretches of paddy fields and villages (some vibrantly active and others serene amidst the tranquillity of nature). We reached Point Calimere after three days, with halts at Rajahmundry, Chennai, and Pondicherry. On arrival, we headed straight to the BNHS Bird Migration Study Centre in Kodiyakadu, one of the two villages in the sanctuary area, the other being Kodiyakarai. As we had reached late in the night, after braving Storm Neelam that had hit the coast, we were exhausted and slept like logs.

Field Outing

Point Calimere Wildlife and Bird Sanctuary is situated in Nagapattinam district of Tamil Nadu and is the only Ramsar site (i.e., wetland of global importance) of the state. The Sanctuary is a unique mix of tropical dry evergreen forest, grassland, brackish-water creeks, mudflats, and beaches with sand dunes. There are also salt pans, spread across a huge area.

The next day, we were refreshed and all ready to start. After a steaming hot south Indian tiffin, we proceeded to the Sanctuary with our team leader, Dr S. Balachandran, who was instrumental in establishing this Bird Migration Study Centre. We saw herds of Spotted Deer during our walk to the Great Vedaranyam Swamp. Land birds sighted included Indian Paradise-Flycatcher, Indian Pitta, Brown Shrike, Red-vented Bulbul, White-browed Bulbul, Barn Swallow, Black Drongo, Rose-ringed Parakeet, and Indian Roller.

Our excitement increased as we approached the swamp that was brimming with waterbirds, and we watched intently with our binoculars so as to not miss out on any species. The birds reported from Point Calimere include Spot-billed Pelican, Spoon-billed Sandpiper, Black-headed Ibis, Asian Dowitcher, Lesser and Greater Flamingo, and Oriental Darter. We could hear screeching seagulls and terns, an assortment of waders, Painted Stork, Brahminy Kite, Lesser Flamingo, and Spot-billed Pelican, among others.

While birdwatching, we were being constantly briefed on the birds and their habitat by our ever smiling guru, "Bala Sir", a living encyclopedia on migratory birds. We were walking joyously in mud, in water, and in the rain. No one complained, as Bala Sir himself was leading us through all the rain, mud, and slush.

SHAKTI BISHNOI

The BNHS Bird Migration Study Centre at Point Calimere

Seasons at Point Calimere

October to January: This is the best time for birding as the backwaters and swamps are full of migratory waterbirds such as ducks, terns, waders, and flamingos. The north-east monsoon turns the landscape a pleasant green at this time of year, but be warned: vehicles can get stuck in marshy areas after heavy rain.

February: Flamingos depart by late January, but February is still a good time for other birds. The weather is pleasant with light breeze, clear skies, and day temperature around 25 °C.

March to August: Summer temperatures range from 30 °C to 37 °C, occasionally reaching even 40 °C. It is hot and humid, but a good time to see mammals such as Blackbuck, Spotted Deer, Wild Pig, and feral horses.

SHAKTI BISHNOI

SHAKTI BISHNOI

Large flocks of Spot-billed Pelican and Painted Stork may be seen in the Great Vedaranyam Swamp, especially during winters

N. RAVEENDRAN

The Blackbuck in Point Calimere WLS occurs in the grassland-like habitat in the southeast

Bird Ringing or Bird Banding

From the third day onwards, we started participating in the bird ringing/banding operations carried out by Dr Balachandran and his colleagues Ms Tuhina Katti and Dr Ranjit Manakadan. We observed migratory birds such as Black-tailed Godwit, Common Redshank, and Common Greenshank, and resident birds including Indian Pitta, Common Tailorbird, Indian Paradise Flycatcher, as well as bulbul and warbler species being ringed. The captured birds were fitted with BNHS metal rings and their biometrics recorded. Bird ringing helps in obtaining information on the population, lifespan, breeding origin, migratory routes, and stop-over sites of migratory birds, besides other data.

We learned about bird trapping methods using mist nets and clap traps, and how to remove birds from mist nets without injuring them. Birds are tagged with rings of different sizes depending upon the circumference of the tarsus bone. Accordingly, we would select the appropriate ring to fix on their legs while holding them safely. We were also taught about sexing and ageing of birds by observing the morphological features, plumage, and by examining the cloaca. We also learnt about moulting in birds. We practiced recording morphometric measurements, namely wing, bill, tarsus and tail lengths, using measuring devices and making data entry in the record sheets. After ringing, the birds were released at the place of capture, ensuring that there were no predatory birds like Brahminy Kite around. BNHS has captured, ringed, and released over 200,000 birds during the course of several years at Point Calimere, and the work is continuing.

SHAKTI BISHNOI

Spotted Deer occur in the tropical dry evergreen forest part of Point Calimere WLS

SHAKTI BISHNOI

Two Common Redshanks waiting for their turn to be ringed!

SHAKTI BISHNOI

An immature Black Drongo on the lookout for prey

At the beach

One evening, as the clouds were floating away and the sky became clear, we marched toward a quaint old beach to the south of Point Calimere. It was fun to see Lesser Black-headed Gull, Brown-headed Gull, Caspian Tern, Lesser Crested Tern, Large Crested Tern, Whiskered Tern, and many other pelagic birds flying about or sitting at the beach front. We were glued to our binoculars for at least an hour, with Bala Sir constantly guiding us and helping us to identify the species. We also used a book A FIELD GUIDE TO THE BIRDS OF POINT CALIMERE authored by him. Here we witnessed terns catching fish in the sea. To the south and east of Point Calimere, the sea is home to sea turtles and dolphins; the turtles also nest along the beach.

We returned contented at dusk, and had a delicious dinner prepared by the dedicated staff of the Centre. We had discussions post dinner on various topics related to bird conservation and studies, and the initiatives undertaken by BNHS. The participants, coming from various fields of expertise, shared their experiences of Point Calimere. The next morning, with heavy hearts we started the journey back home – some preferred to stay on for a day more. And why not? Given the opportunity, a bird lover would definitely prefer to stay on, as Point Calimere is enthralling and enchanting, and above all, it is an avian paradise.

We headed towards Chennai with a day's halt near Guindy National Park, Chennai. The next day, we visited Pulicat Lake situated to the north of Chennai. Pulicat is an important wintering ground and **stop-over** site for migratory birds. We spotted good numbers of Lesser Flamingos, besides other waterbirds, and after that reluctantly headed back to Vizag. Point Calimere was an incredible and fulfilling life experience for both me and my wife. ■

A.S. Bishnoi is a passionate wildlife photographer, avid traveller and is in the Armed Forces. He is an ornithologist and has been participating in bird census at Chilika since 10 years.

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One Tree at a Time

We are taught to save trees and the environment. But the concrete jungle around us provides very little place for nature to flourish. So for me, environment became another subject to be learnt at school, until I shared my dilemma with my grandmother a few years back.

My grandparents live in Bramhapuri in Chandrapur district of Maharashtra. A retired Professor of Botany, my grandmother has passionately worked on issues of environmental concern for over 40 years – tree planting and anti-polythene drives, to name a few. During one visit, she asked me to drive with her on her Kinetic Honda, and along the way, she showed me trees she had been planting over the years. There were hundreds of them and if she had planted them all at one site, Bramhapuri would have had a small forest of its own. I was surprised and wondered how she did it. All she said was, "I don't know, I planted one tree at a time over the years." This was my eureka moment. I realized that all I needed to do was just plant one tree at a time to make a small difference. And thus began my journey.

Since then, for the past four years, I have been planting trees. I travel to Bramhapuri twice a year; my tree count till date is 55, and growing. I plant trees in areas permitted by the municipality, which are close to where people stay. Day to day care, including watering of plants, is done by the people staying closest to where I plant trees. They do it without fail and without expecting anything. Sometimes just a photograph with them and some sweets I carry for them is enough. They promptly inform me if there is any problem with the growth of the trees or any other unexpected issue.

My journey has been one of great learning. I realized that one has to begin without much ado and then follow one's passion. Over years, perseverance helps accomplish what one desires. I also understood the importance of community involvement. Tasks like environmental sustainability require commitment and support by all concerned. This experience has opened up a whole new world for me. ■

Simran Bajaj
Mumbai

IN MEMORIAM

There are people who pursue the best because they wish to prove something to the world. And then there are those who strive for excellence because they know no other way. Mr Adhip Kumar Sarkar was one such person. He was Executive President at *Ananda Bazar Patrika*, a Life Member of the Bombay Natural History Society, and founder of the Nature, Environment and Wildlife Society, Kolkata.

Adhip Kumar Sarkar
(1950 – 1995)

He had a vast library of ornithological literature and a wide variety of books on mountains, trekking, and wildlife. He would patiently wait for the *Hornbill* magazine to arrive, and then read it from cover to cover. He was happiest miles away from civilization, pitching a tent during a week-long trek, and his heart soared in the mountains. Friends would keenly look forward to accompanying him on trips to reserve forests and national parks, and on treks, where he would surprise them by predicting the birds they would encounter a few miles up the road.

On the occasion of Mr Adhip Sarkar's 70th birth anniversary, his family extends their best wishes to the BNHS, and a donation towards its conservation activities. We are extremely grateful to them for this gesture. ■

Environment Impact Assessment

NEHA SINHA

What is our environmental footprint? Can we measure it, and how? In a developing country like ours, there is immense pressure on resources – wetlands are viewed as potential real estate, forests are seen as mines for bauxite and coal, and national parks as oil reserves. An Environment Impact Assessment (EIA) is undertaken to assess the impact a project is likely to have on the environment. EIAs are done under the EIA notification of 2006, which is derived from the parent Environment (Protection) Act, 1986. The government now intends to replace the EIA notification of 2006 and a draft EIA notification, 2020, has been circulated for comments from experts and civil society.

After extensive consultation with scholars, environmentalists and grassroots conservationists, BNHS has formulated its comments on the draft. It is important to highlight some of the significant changes proposed in the Act, to which BNHS has raised objections.

a) *Violations*

The draft notification says:

"The cases of violation will be appraised by Appraisal Committee with a view to assess that the project has been constructed or carried at a site, which under prevailing laws is permissible or expansion has been done which can be run sustainably under compliance of environmental norms with adequate environmental safeguards. In case finding of the Appraisal Committee is negative, closure of the project shall be recommended along with other actions under the law including directions for remediation."

This essentially means that projects that violate the EIA – those that come up without EIAs and therefore without valid environmental clearances – will be shut down only if the "finding of the Appraisal Committee is negative". This would mean that developers can start projects without valid clearances and resume operations after paying a fine. We are in a scenario where EIA regulations

are often flouted. Even with the EIA notification of 2006, many projects run without valid clearances and this often comes to light only after a disaster occurs. For instance, the Visakhapatnam (Andhra Pradesh) gas leak at a plant run by LG Polymers caused death and injury. And so did the recent gas and oil explosion at Baghjan, Assam. Both the sites did not have the required pollution control or environment clearances.

In order to strengthen the EIA regulation, we should discourage violations, rather than condone them. The draft EIA 2020 allows for post-facto approval – that is clearing a project after it has already started – in case the project 'can be run sustainably'. However, no definition of sustainability has been provided. In real terms, sustainable development refers to development that is done in a sustainable, phased manner, which does not cause serious harm to the environment. However, a project running 'sustainably' can also refer to operations that do not keep environmental degradation at bay. Suggesting that it is okay to have post-facto clearance is like saying it is okay to deem environmental considerations as secondary.

On April 1 this year, the Supreme Court ruled that the Central Government has no power to grant post-facto approval. It said that awarding clearances after projects were underway would be in derogation of the fundamental principles of environmental jurisprudence (Alembic Pharmaceuticals vs R. Prajapati and others). Justice Dhananjaya Y. Chandrachud held that 'environment law cannot countenance the notion of an ex post-facto clearance. This would be contrary to both the precautionary principle, as well as the need for sustainable development.'

b) *Who gets to report violations?*

As per the draft, violations can be reported by government representatives and the project developers.

BNHS questioned why there was no place for experts or NGO representation under the proposed Act to assess for cognition of violations. BNHS urged that for this extremely important issue, the views of experts such as biologists, virologists, conservationists, ornithologists, hydrologists, ecologists, environmentalists, site experts, and other scientific experts be taken. Towards this end, a separate category of "subject and non-governmental experts" should be added to those who can report violations.

c) *Dredging*

As conservation practitioners and researchers, we often 'see' things that others miss. There will be a moth under a bunch of leaves, a bird's nest in a hole in a wall, and frog eggs in a wet patch. Yet, seeing what is under water is a big challenge for researchers and an even bigger challenge to communicate. Freshwater and marine ecosystems and their conservation needs have been historically neglected. Our rivers are highly polluted, and provisions in the proposed Act will make it worse.

The draft says: "Dredging and de-silting of dams, reservoirs, weirs, barrages, river, and canals for the purpose of their maintenance, upkeep and disaster management" does not require impact assessment.

BNHS has urged the Ministry of Environment, Forests and Climate Change (MoEF&CC) to reconsider this, as river dredging can have a serious impact not only on wild population of species such as dolphins and fish, but also impact fish productivity. Currently, the National Waterways Act 2015 is in operation in India, and extensive dredging has been done to make 'waterways' in rivers (such as the Ganga). BNHS notes that all projects in respect of inland waterways have been put under a lower category of B2. It is important to continue having EIAs for river dredging. And it is dangerous for policy planners to turn a blind eye to that which can't be easily seen – fish, dolphins, gastropods, and aquatic vegetation that live in and under water.

d) *Highways*

The draft EIA 2020 has relaxed provisions for highways. It categorizes highway length of 100 km and a width of 70 m as requiring EIAs within category 'A'. BNHS has urged that instead we need to do EIAs for highways of 30 km with additional right of way greater than 20 m, involving land acquisition. Particularly, highways passing through or in the proximity of protected areas, wildlife corridors, ecologically sensitive sites/zones (both notified and non-notified), sand dunes, river basins, nesting, roosting, and foraging areas of migratory birds, heronries, salt pans, and Key Biodiversity Areas of the abovementioned length require EIAs. ■

Wetlands

For years, BNHS has been reiterating that wetlands are not wastelands. Many wetlands of importance get encroached or built upon, and ornithologically important wetlands are not notified or recognized as wetlands.

Recently, the National Green Tribunal has called upon state governments to report on significant wetlands and their status. The court has said:

"We also direct that the National Wetlands Committee may compile data of status of compliance of environmental norms in respect of all significant wetlands in the country to ensure remedial action. The State PCBs/PCCs and State/UT Wetland Authorities in India may give the status of management of wetlands in their respective States to the Secretary, MoEF&CC within three months."

NEHA SINHA

Bronze-backed Jacana, a beautiful waterbird seen in wetlands in India

BNHS has put out an appeal to citizens and citizen scientists to provide data on wetlands, their status, and appropriate bird and biodiversity information, to assist the state in building up the wetland database. We hope to keep adding to wetland lists, so wetlands are never again considered as wastelands. ■

Trains and Tigers

The state of Karnataka has been pushing to construct a railway line between Hubbali and Ankola in the Western Ghats. The Hubbali-Ankola stretch is an area with several elephants. It is also close to the Kali Tiger Reserve and is part of a forest corridor between Kali Tiger Reserve and Bedthi Conservation Reserve.

Section 38V (3)(b) of the Wildlife Protection Act says:

[we should have] ecologically compatible land uses in the tiger reserves and areas linking one protected area or tiger reserve with another for addressing the livelihood concerns of local people, so as to provide dispersal habitats and corridor for spill over population of wild animals from the designated core areas of tiger reserves or from tiger breeding habitats within other protected areas.

BNHS has opposed the railway line, as in the context of wildlife conservation, railway lines do not constitute 'ecologically compatible land uses'. Further, under section 38V (3)(c) of the said Act, provision has also been made to ensure that "the forestry operations of regular forest divisions and those adjoining tiger reserves are not incompatible with the needs of tiger conservation." In general, the managerial approach followed in buffer zones is applicable to tiger corridor areas as well. It is not amenable to tiger conservation to have railway lines in tiger corridors and landscapes.

Railways lines are also a serious threat to elephants. According to information provided by the MoEF&CC, 62 elephants died in various parts of India because of collision with trains during the

NEHA SINHA

A male tiger from Central Indian forest

period 2015–19. Several members of the Karnataka State Wildlife Board have recorded their objections to the proposed alignment of the Hubbali-Ankola line on the grounds that it will cause water scarcity in the Kali river catchment area.

BNHS has urged that this plan be dropped. Usage of other existing railway lines increases commute time between Hubbali and Ankola by about an hour and thirty minutes, but this time will save the biodiversity and forests of the area. ■

The 'Ecosystem' Around Coal

Recently, the Government announced the auction of 41 sites for coal mining as part of its stimulus package during COVID-19. Most of these are in central and eastern India, and many are located around elephant reserves. Other than actual mining, it is also important to look at the infrastructure around coal, such as railway lines or ports to carry the coal.

Dr Haripriya Gundimeda from Indian Institute of Technology, Bombay, stresses that coal has 'hidden costs' – such as transportation, damage to public health, and high fly-ash content. In this context, it is also important to consider the recent findings of a National Green Tribunal (NGT) committee.

The NGT constituted a multi-member committee to investigate coal mining in the North Karanpura landscape in Jharkhand. The Committee comprised representatives of MoEF&CC, Central Pollution Control Board, Jharkhand Pollution Control Board, and Dr Sharad Lele of ATREE. The committee, which submitted its report on September 14, 2020 to NGT, found large scale violations in the coal mining undertaken by South Eastern Coal Field Ltd. The findings could have important implications, given that a significant number of the new coal blocks auctioned are in the North Karanpura landscape. The report stressed that we must focus not just on individual mines but also on cumulative impacts of mines in the region, and the impact of coal is also in the transportation of it, which is likely be polluting. For instance, the people of Goa have complained on air quality deteriorating because of trucks carrying coal, dispersing coal dust.

NEHA SINHA

Forest stretch in Chhattisgarh, a region which sees intensive coal mining

The report says:

'The cumulative environmental impacts of these developments cannot be understood through individual EIAs or investigations of individual projects. In particular, coal transport outside project premises on public roads or via common railway sidings used by multiple projects. Similarly, in a region rich in rivers, the impact of cumulative forest loss and mining activity on rivers and groundwater hydrology can only be understood at the catchment or sub-basin level.

While studying the environment, we must fully understand the value and costs of the energy path India takes. Doing cumulative or landscape level studies and EIAs is one valuable way of understanding such costs, and making sound, scientifically robust decisions.' ■

Neha Sinha is Advocacy and Policy Officer with the Bombay Natural History Society. She is the Member Secretary of BNHS' Conservation Committee. She has a special interest in the intersection of politics and conservation.

Learn from Home

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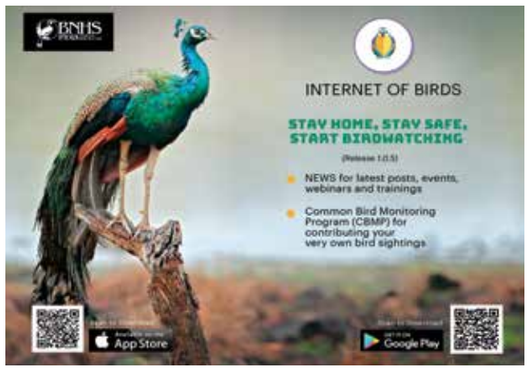
While everyone has been busy working from home during the past few months, BNHS reached out to nature lovers through a 'Learn from Home' initiative.

BNHS-ENVIS Resource Partner on Avian Ecology and CEC-BNHS have been conducting a series of free webinars, which were attended by thousands of participants from across the globe. The sessions included talks by eminent experts from BNHS and outside.

Under the Green Skill Development Programme (GSDP), BNHS-ENVIS organized a Certificate Course in People's Biodiversity Register (PBR). This technical training course was designed for the youth of rural areas where local communities depend heavily on bio-resources. A short documentary showcasing the training provided to the youth on how to put together a PBR is available on BNHS YouTube channels in Hindi and Marathi (with English subtitles). The documentary received more than 1,000 views within two weeks.

CEC Mumbai designed and initiated new online crash courses on 'Introduction to Birds', 'Introduction to Butterflies and Butterfly Gardening', and 'Introduction to Plants', for amateurs. The seven-week long certificate courses, consisting of seven webinars and study material, were attended by 159 registered participants. The popular course 'Introduction to Birds' was oversubscribed, and a second batch had to be announced. CEC Mumbai has started admissions for the Basic Course in Ornithology (11 months), Leadership Course in Biodiversity Conservation (11 months) and Basic Course in Herpetology (4 months). About 85 participants have registered for these online courses. ■

World Environment Day, a Digital Celebration



ACCENTURE

A blog titled 'Amidst the Lockdown, Birding Soars' was released by Accenture Labs and BNHS on World Environment Day, celebrated on June 5, and is available on the BNHS website. The Internet of Birds mobile application, a BNHS-Accenture Labs collaboration, blends technology with biodiversity to identify birds from the Indian subcontinent, and helps amateurs connect to backyard birding. Accenture Labs has provided *pro bono* services to design and build this program. Anyone can contribute to this citizen science platform by downloading the app which is available in Google Play Store and Apple App Store.

BNHS-ENVIS Resource Partner on Avian Ecology celebrated World Environment Day by releasing a series of digital posters and publications. The theme for 2020 was 'Biodiversity', which was celebrated by online poster releases on the State bird, mammal, insect, flower, and tree of Maharashtra, and Kingfishers of India. An online quiz contest on birds was conducted, informative matter on COVID-19, and a poem titled 'Fallen Dynasty' was shared. The day ended with a webinar on the Central Asian Flyway. ■

Climate Change and the Ethics of Birdwatching

A training workshop for ecotourism guides was organized by BNHS in Barsey Rhododendron Sanctuary, Sikkim from June 19–22, 2020, in collaboration with Mr Ugyen Sherpa of Kyilkhor Homestay, Okhrey. The workshop was aimed at engaging the youth of Sikkim to enrich their knowledge of the local biodiversity and enable them to pursue a career in ecotourism. During the workshop, Mr Atharva Singh from the BNHS Climate Change Programme team spoke about the potential of bird tourism in the sanctuary, and about the avian diversity of Sikkim. Considering the COVID-19 scenario, a limited number of youth were invited to attend the workshop, and strict safety protocols were maintained. Webinars on 'Climate Change – Its Impact on Biodiversity' and 'Ethics of Birdwatching' were also held, with support from the BNHS-ENVIS team. Watch the webinars at <https://youtu.be/46Afn1qk5T0> ■

Wildlife in My Backyard

BNHS PHOTO LIBRARY

Online environment awareness courses conducted by BNHS-CEC, Delhi

BNHS Conservation Education Centre, Delhi conducted an online course on 'Environment Awareness' for the students of Action for Ability Development and Inclusion (AADI) in July, 2020. The course consisted of 10 sessions, featuring topics like ecosystems, mapping backyard diversity, air, water, soil, vegetables, flowers, insects, and birds. There were exciting home tasks for which the participants brought some innovative ideas to the table. A digital valedictory function was organized to present e-certificates.

Some other online courses with participants from all over India were: 'Your Vegetable Garden', June 13 to July 5, 2020; 'All about Butterflies', June 20 to July 6, 2020, with BNHS Conservation Education Centre as a knowledge partner. An online course on butterflies was conducted for Delhi Bird Foundation and The Delight Factory. ■

The Butterfly Effect

BNHS PHOTO LIBRARY

Butterflies, like this Red Helen, are indicators of a healthy environment

Scientists from BNHS and Somaiya Vidyavihar University published a research paper 'Finding the forgotten gems: Revisiting the butterflies of Matheran after 125 years, with an introduction to the novel colour barcode for depicting seasons and activity of the Indian butterflies' in the community peer-reviewed *Biodiversity Data Journal*. The article summarizes eight years of fieldwork and usage of colour barcoding by Mandar Sawant, Nikhil Modak, and Sagar Sarang in the forests of Matheran. The scientists recommend the use of colour coding while uploading records on open databases, which help to convey information on the seasons and activities of butterflies. Butterflies are not just beautiful creatures, but also indicators of a healthy environment and ecosystem. Their long-term study will help to assess and conserve the health of the ecosystem. The paper is available at <https://bdj.pensoft.net/article/54333/> ■

Published on September 30, 2020, 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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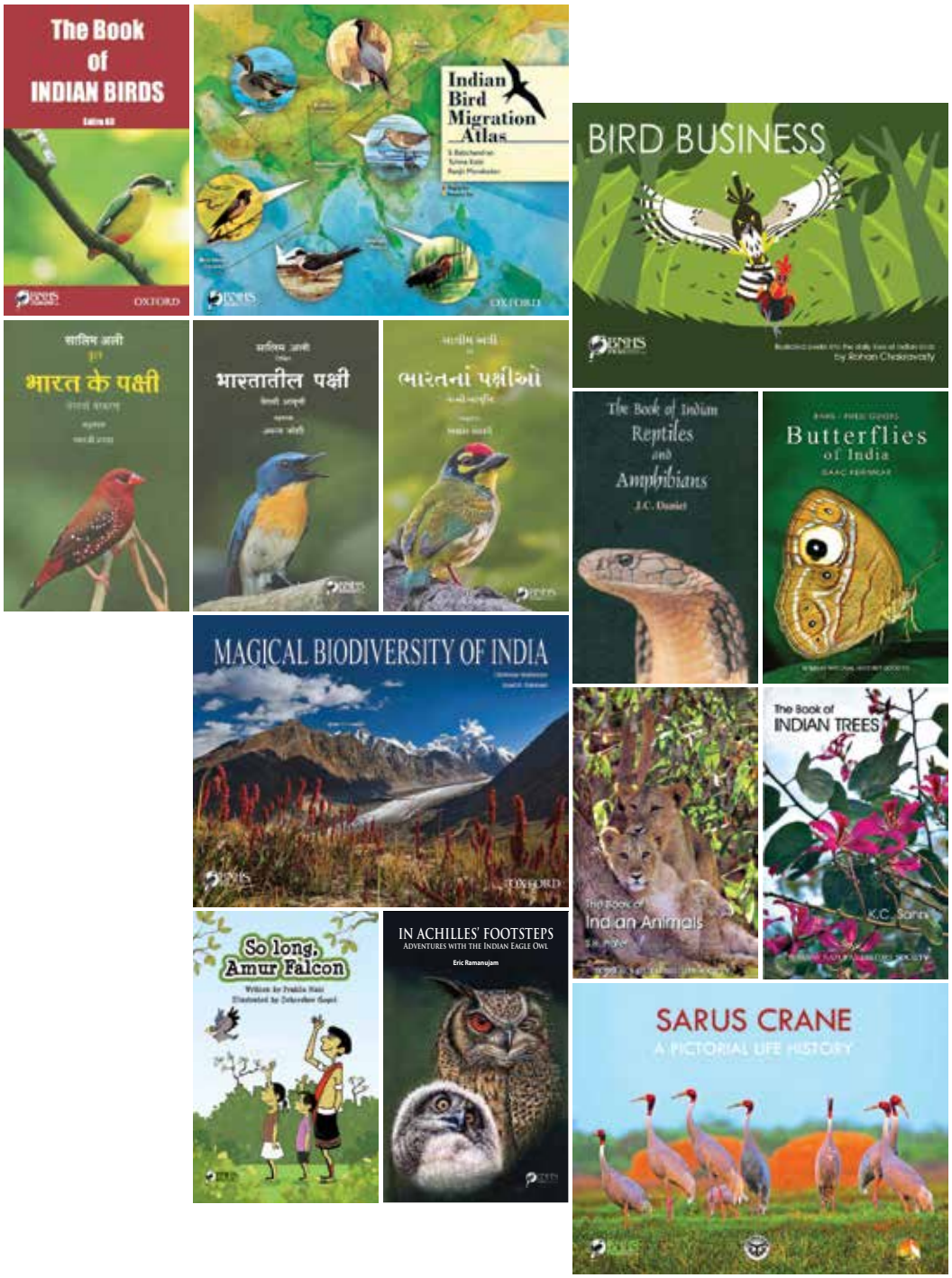

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BOMBAY NATURAL HISTORY SOCIETY

HORNBILL

October–December, 2020

COVER : **Himalayan Crestless Porcupine**
by Dhritiman Mukherjee

Published and printed quarterly
by the Honorary Secretary for the
Bombay Natural History Society,
Printed at Akshata Arts Pvt. Ltd,
Lower Parel, Mumbai.
Reg. No. RN 35749/79, ISSN 0441-2370.

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It is with mixed feelings that I write this last editorial for *Hornbill* in the capacity of Director of BNHS, as well as Editor of *Hornbill* and *Journal of the Bombay Natural History Society*. I am extremely happy that I could contribute to this magnificent institution in terms of strengthening science, institution building, financial stability, succession planning, and pursuing an unbiased conservation agenda.

The Wetlands Programme that we launched five years ago is today one of the flagship projects of the Society. Some remarkable work is being undertaken by a highly talented team, and the insights we are gaining through bird ringing and colour flagging have been remarkable as well, and will help shape the conservation agenda of key flyway sites in India. The recently launched national count of Indian Skimmer is part of this programme and we hope to generate excellent data. Indian Skimmer has been recently 'upgraded' to Endangered (from the earlier Vulnerable) category under the IUCN Red List, which reiterates that our rivers and associated habitats are declining in quality. It is a cause for concern, not just for conservation scientists but for the entire human population, that our freshwater security continues to be compromised and our river basins continue to degrade. At the same time, we are describing several new species of freshwater fish, reinforcing the fact that we know far too little about freshwater resources, and that they require a careful approach in any developmental agenda.

Our Vulture Programme is also at a crossroads; we released a few captive-bred vultures in the wild from our West Bengal Vulture Conservation Breeding Centre. The satellite-tagged birds continue to provide vital information on their movements and feeding locations. This data will help to streamline our full-fledged vulture release programme in the coming months and years.

Our Climate Change and Himalaya Programme continues to provide vital information on high altitude avifauna and we hope to generate substantial data over the next few decades to help us understand the distribution ranges of avifauna and how these are affected by climate change in the extremely fragile Himalayan mountainscape. It will help us develop a fresh conservation blueprint for this region.

The Marine and Coastal Biodiversity Programme continues to help us understand the intricacies of elevated sea surface temperature and coral reefs. We recently launched CoMBAT (Coastal and Marine Biodiversity Assessment Tool), a free app available at <http://combat.bnhs.org>. The tool, which is currently focused on the coastal areas of Maharashtra, took three years of hard work to develop. It will help citizens to understand key biodiversity sites of coastal Maharashtra. Please use the tool and send us your feedback at da.apte@bnhs.org so that we can continue to improve its user interphase.

And, last but not least, there has been a revival on projects on bird hazard to aircraft. Studies on bird hazard to aircraft in India were pioneered by BNHS in the 1980s with surveys of 22 aerodromes. After this project, except for some inconsequential work in the early 1990s, BNHS was out of this research domain for more than two decades. A revival took place in 2015, and till now BNHS has undertaken studies in a few airfields of the Indian Navy and Indian Coast Guard, along with a one-year study in the airport at Mumbai, the second busiest airport in India.

This year has been bad, especially since we lost some of the finest conservation stalwarts due to the pandemic – Ulhas Rane and Dr Bhavbhuti Parasharya. Another great loss, not due to the pandemic, but nonetheless a significant loss, was of my dear friend Ajay Desai, an authority on Asian Elephant. I have some fantastic memories of watching elephants in Mudumalai, Nagarhole, Bandipur, and Corbett, among other places, with him.

My journey of the last 27 years with BNHS has been extremely rewarding and the experience and knowledge I gained from the Society is more than any textbook could provide. Several people have been part of this journey, and I remain grateful to all those who extended support to me, and to the Society.

The new year will bring a new Director – Dr Bivash Pandav – to the Society. Bivash brings with him two decades of field experience in wildlife studies, and I wish him all the best, and great success. I hope he will continue to maintain the research-based conservation focus which is fundamental to the existence of BNHS and look after the staff, without which Hornbill House would be just four walls.

Deepak Apte, PhD

A Prime Minister and a Naturalist*

Text: **Jairam Ramesh**
Photographs: **BNHS Archives**

Indira Gandhi at the BNHS Centenary function in 1983
(L) Inaugurating the event (R) Releasing Sálim Ali's 'Pictorial Guide'

I

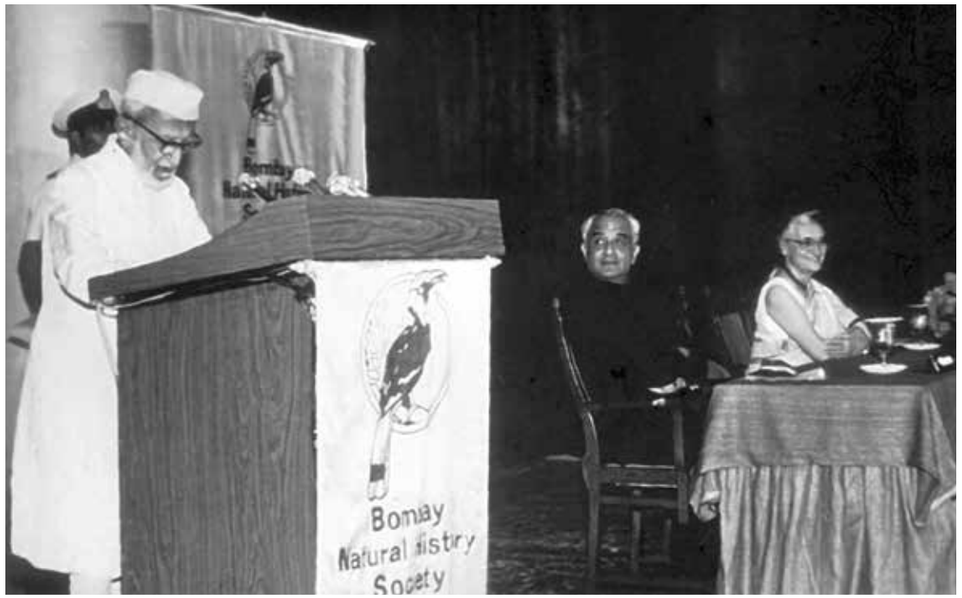
For Indira Gandhi, conserving India's magnificent biodiversity was a daily obsession, notwithstanding all the political and economic turbulence around her. At the UN's historic Paris Climate Change Summit in 2015, over 90 heads of state or government were present. How things have changed since June 1972 when, other than the host head of government, she was the *only* Prime Minister to address the very first UN Conference on the Human Environment at Stockholm, where her speech created a sensation. It is considered a milestone in the global environmental discourse and is recalled even today. To her personal initiative and leadership, we owe four laws that are still part of environmental governance – the Wildlife Protection Act (1972), Water Pollution Control Act (1974), Forest Conservation Act (1980), and Air Pollution Control Act (1981). To her we owe a number of successful species conservation programmes, of which Project Tiger is certainly the most visible. Our regulatory institutions – the ministries of environment and the pollution control boards – trace their establishment back to her time.

Sálim Ali was a legendary naturalist, best known for his association with the Bombay Natural History Society. His uncle was President of the Indian National Congress in the late 19th century, and at least three other members of his extended family built great reputations as naturalists themselves – Humayun Abdulali, Zafar Futehally, and Rauf Ali. The first two were also part of Indira Gandhi's circle. Before 1947, Sálim Ali had much to do with conservation activities in princely states like Bharatpur, Hyderabad, and Mysore. He collaborated with S. Dillon Ripley of the Smithsonian Institution, Washington DC, for over three decades and their co-authored 10-volume HANDBOOK on the birds of the Subcontinent remains a standard reference. Sálim Ali's autobiography THE FALL OF A SPARROW (1985) has acquired the status of a classic.

Sálim Ali's prolific correspondence with Indira Gandhi has been carefully archived at the Nehru Memorial Museum and Library. The National Archives also hold much material relating to exchanges between them. I used these and many other sources to write her environmental biography, INDIRA GANDHI: A LIFE IN NATURE (2017). [For readers who wish to examine the book in detail, the BNHS Library has copies. – Eds] Sálim Ali naturally figures very prominently in it.

The far-reaching decisions that Indira Gandhi took, particularly in regard to the protection of the Bharatpur Bird Sanctuary in Rajasthan, Chilika Lake in Odisha, Silent Valley rain forest in the Kerala Western Ghats and the sal forests in Bastar, in erstwhile Madhya Pradesh, were the direct outcome of Sálim Ali's interventions. So was her entire approach to development of ecologically fragile areas like the Andaman and Nicobar Islands. He also played a decisive role in convincing her that India should become a member of the Ramsar Convention on the protection of wetlands, which was finalized in 1971. He persuaded Indira Gandhi to sign a treaty with the USSR for the protection of migratory birds. This finally happened in 1983, when she also wrote to the President of Pakistan and Prime Minister of Afghanistan to join India in a collaborative endeavour to protect Siberian Cranes. Conservationists wanting to alert the Prime Minister on some issue or other would approach Sálim Ali, who would then intercede with her. Sálim Ali was frank and forthright in all his interactions with her, but she never took him amiss. She had full faith in his integrity and would always try and act on his advice. He would also bring the work of younger ecologists to her attention, and she would invariably initiate action thereafter.

*Excerpted from a lecture delivered at Janki Devi Memorial College, New Delhi, March 5, 2020



Sálim Ali addressing the gathering at the BNHS Centenary function in 1983

II

Indira Gandhi's interest in nature was aroused, first and foremost, by her father. He introduced her to the world of books on nature and she became a voracious reader. Her maternal uncle, a botanist and a collector of snakes, kindled her curiosity for nature at a young age. Her mother's illness meant that as a child and as a teenager Indira Gandhi spent considerable time in hill stations and developed a particular fondness for mountains. Her education first in Switzerland, later in Poona (now Pune), and more importantly in Santiniketan, further developed her communion with nature.

Indira Gandhi got to know of Sálim Ali before she actually met him. Sálim Ali writes that he met Nehru in Dehradun, where he had been jailed, and autographed his recently-released book called THE BOOK OF INDIAN BIRDS. This must have been between August 1941 when the book appeared and December 3, 1941 when Nehru left that prison.

The beginnings of Indira Gandhi's direct connection with Sálim Ali's book is best recounted in her own words, contained in a foreword she wrote in 1959 to another book on Indian birds:

[…] Like most Indians I took birds for granted until my father sent me Dr Sálim Ali's delightful book from Dehra Dun jail and opened my eyes to an entirely new world. Only then did I realize how much I had been missing. […] Birdwatching is one of the most absorbing and rewarding activities. First, one learns to distinguish the different species, their nesting habits and their calls. Then gradually one realizes that birds are also little individuals each with his own characteristics. […] We are fortunate still to be able to live amongst birds even in our cities. In other countries you will have to go deep into the countryside to see any.

At the BNHS Centenary celebration 23 years later, she reminisced about Sálim Ali's classic yet again:

Dr Sálim Ali's THE BOOK OF INDIAN BIRDS and [S.H.] Prater's THE BOOK OF INDIAN ANIMALS opened out a whole new world to many Indians. I had always loved animals. But I did not know much about birds until the high walls of Naini prison shut us off from them and for the first time I paid attention to bird songs. I noted the sounds and later on after my release my father sent me Dr Sálim Ali's book and I was able to identify the birds from the book.

That Sálim Ali had a pronounced influence on Indira Gandhi is proven by a letter she wrote to him on August 3, 1980, in response to his note of condolence on the death of her younger son Sanjay:

I am grateful for your message of sympathy. Sanjay was so full of fun and so vibrantly alive it is difficult to realize that he isn't there anymore.

You will have noticed that I am referring all issues concerned with ecology to you. I hope it is not too much of a burden and that you will help us to find amicable solutions. As you know, the State Governments are very persistent with their demands.

This was obviously no routine letter of acknowledgement.

III

Indira Gandhi was incarcerated from September 11, 1942 to May 13, 1943 in Naini Central Prison, Allahabad, where she developed a life-long interest in birdwatching, using Sálim Ali's book as a guide. As I have mentioned earlier, Sálim Ali co-authored ten volumes with Dillon Ripley on the birds of the Subcontinent. He would make it a point to send each of the volumes to Indira Gandhi, the first of these sometime in late July 1968, and on August 3, 1968, the Prime Minister sent him more than a perfunctory note of thanks:

I have not given up my interest in birdwatching, so I was delighted to receive your new book. How thoughtful of you to send it to me. News of this interest had travelled to Australia and New Zealand ahead of me and I was presented with two very lovely books there.

On May 12, 1972 he sent the fifth volume which evoked this response from her five days later:

I am delighted to have your latest Handbook of Birds. Unfortunately, it is no longer possible for me to go on birdwatching expeditions. I seem to be as great a curiosity as any bird to many watchers, including the security people! However, in my garden in Delhi, and on tours, I keep a sharp look out and it is surprising how many birds I do manage to spot sometimes even from an open jeep.

The 1970s were also a period where it was almost impossible for American academics to get visas for study in India. But here again Indira Gandhi treated Sálim Ali's requests sympathetically. One beneficiary of Sálim Ali's intervention was Steven Green, a young primatologist who wanted to research the endangered Lion-tailed Macaque which numbered less than 200 in the southernmost portions of the Western Ghats. As a result of the field research of Green and two of his colleagues, Kalakkad Reserve Forest was notified as a sanctuary for this macaque. Green left India in April 1975, and before leaving he sent a report to Salman Haidar, the Prime Minister's aide. He forwarded it to Indira Gandhi who after reading it queried, 'Is he still in India? If in Delhi, I should like to meet him.'

IV

Indira Gandhi and Sálim Ali would meet almost always in either her office or her residence in New Delhi. For the most part, theirs was a friendship carried on through letters. But there were two unusual face-to-encounters.

In 1973, Indira Gandhi had made an exception to a rule she adopted throughout her prime ministerial tenure and had become the patron of a non-

Indira Gandhi looking at the collections and rare books during her visit to Hornbill House in1974

Indira Gandhi at the release of volume of the 'Handbook' by Sálim Ali and S. Dillon Ripley

governmental body – the Bombay Natural History Society. On December 28, 1974, she spent about an hour at Hornbill House, the Society's headquarters in Bombay. She was received by Sálim Ali and others. There were no speeches and she spent her time looking at rare books and specimens, three of which attracted her special attention as a birdwatcher – Tickell's Flowerpecker, the smallest bird in India; the Monal Pheasant, said to be the most beautiful bird found in the Himalaya; and the Fulvous Griffon Vulture, one of the largest birds of prey.

On February 7, 1976, Indira Gandhi went to the Bharatpur bird sanctuary along with her family. Sálim Ali, who had just been conferred with the Padma Vibhushan to add to his Padma Bhushan of 1958, had already reached that venue. The Prime Minister's family and he went around the sanctuary lake by boat for about an hour, came back for breakfast and then went out again, returning a little before mid-day. They observed some 60 bird species. She spotted most of them using her own binoculars. Cranes came in for admiration on the boat drive – *nearly 75 Siberian Cranes in the park then*. Sálim Ali explained their ecology and outlined that these birds were spread up to Bihar during early decades of the 20th century, but their number had drastically declined. Reason, she asked. He said – loss of wetlands which were being drained or silted up. While leaving the forest lodge for a public meeting at Bharatpur, the Prime Minister wrote in the Visitor's Book:

A delightful and peaceful experience made all the more enjoyable and interesting by having Dr Sálim Ali with us. I hope something will be done to close the lateral road, which brings buses and noise into the middle of the Sanctuary.

V

Sálim Ali was indefatigable and advancing age did not seem to make any difference to his research. On May 27, 1981 Ripley wrote to the Prime Minister that Sálim Ali and he wanted to travel to an area in Arunachal Pradesh which had never been visited by a naturalist and was a 'treasure in India's garland of natural wonders'. He was not above using emotional blackmail, saying that Sálim Ali was keen to accompany him and hoped that 'it might be possible to visit this area before anything happens to our friend'. 'Our friend', that is Sálim Ali, was 85 years old. Ripley himself was 68. When Ripley failed to receive a response, he got Sálim Ali to forward his letter to the Prime Minister, which he did with this request:

Both Dr Ripley and I are most anxious [to go to the particular area] before it becomes too late (for me at any rate!).

Five days later, Indira Gandhi noted on Sálim Ali's letter:

I should very much like to oblige Shri Sálim Ali for whom I have high regard. So far as I know, Dr Ripley is reliable. But please look into the matter.

A flurry of correspondence followed involving the Intelligence Bureau, the Ministry of Home Affairs, the Department of Forests and Wildlife and the Department of Environment. The bureaucratic recommendation was that Ripley and Ali should be denied permission. But on July 12, 1981 Indira Gandhi wrote to Sálim Ali:

Last month you wrote for permission for you and Dr S. Dillon Ripley to resume your field study of birds of the Namdapha area in Arunachal Pradesh's Tirap district. I am glad to say that all concerned M inistries have given their approval. The Ministry of Home Affairs will send you and the Arunachal Pradesh Government formal intimation of this decision.

VI

Now and again, though, there were also some light-hearted moments in the correspondence between the prime minister and the ornithologist. On March 14, 1979 (when she was out of power) Indira Gandhi wrote a delightfully chatty letter to Sálim Ali:

One day I found a typescript of your Azad Memorial Lecture on my table. … I was delighted to read it. The story of Maulana Saheb's friendship with the sparrows reminded me of my father's experience with the creatures in his barracks in various jails. An aunt of mine, now advanced in her 80s, has suddenly blossomed as a trade union leader. But she was the wife of an ICS officer and most of her life was spent in the districts. In Mainpuri or some such place, she got very annoyed with a sparrow who used to enter her room to peck at the looking glass. So she had it arrested and caged for a week as a punishment! I cannot now remember whether or not this cured the sparrow.

This was also the year in which Indira Gandhi began to get involved with Silent Valley, an evergreen rainforest in Palakkad district, Kerala, in which a hydel project was being planned. Her struggle to save it was the crowning achievement of her life as a conservationist. She wrote to Sálim Ali on October 2, 1979:

I have just received your letter of the 27th September. I share your concern about the Silent Valley and have been following the press campaign in favour of its preservation. I shall try my best to project your view to our party people but when the interests of conservation conflict with those of economic development, I am afraid it is not easy to persuade people to forego what they consider to be political and economic gain.

Twelve days later she wrote to him again:

[…] When you saw me last you spoke of our including a passage on ecology in our manifesto. Some words have been put in but before we finalize the draft, it might be better for you to suggest the wording yourself. I cannot promise to accept it in its entirety but shall try to do my best. Could I please have this as soon as possible?

Sálim Ali sent her a full page of formulations on October 26, 1979 and the Congress's manifesto for the Lok Sabha elections held soon thereafter had an 'Ecology' section that declared:

The Congress-I feels deep concern at the indiscriminate and reckless felling of trees and the depletion of our forests and wildlife, which upsets the ecological balance with recurring misery to the people and disastrous consequences for the country's future. Projects which bring economic benefits must be so planned so as to preserve and enhance our natural wealth, our flora and fauna. In response to the economic and social necessity for ecological planning, the Congress-I will take effective steps, including setting up in the Government a specialized machinery with adequate powers, to ensure the prudent use of our land and marine resources by formulating clear policies in this regard for strict implementation.

That "specialized machinery" would come into being in November 1980 as a full-fledged Department of Environment, to which would be added the subject of wildlife. Indira Gandhi would remain its Minister till her death.

VII

On January 2, 1985 Sálim Ali congratulated Rajiv Gandhi for his landslide electoral victory and went on to recall Indira Gandhi:

It was her deep personal concern for nature and environmental conservation that is responsible for whatever little we have been able to achieve in saving our fast vanishing wildlife and forests and we shall look to you to help in carrying on the good work patronized by her all through her stewardship of the country.

Subsequently, on August 28, 1985, the 89-year-old Sálim Ali met the 41-year-old prime minister and wrote to him four days later:

I feel honoured at having being considered for nomination by you to the Rajya Sabha. As I tried to explain to you, my disqualifications for the responsibility at this stage of 'senile decay' are many and real. However, if you really feel that I may occasionally be of some help, especially in matters concerning environment and wildlife conservation I am willing to give myself a trial. It would give me the greatest satisfaction if I could be sure, as I was with your mother, that any environmental issue that I wished to bring to your attention would reach you directly and as quickly as possible. ■

Jairam Ramesh a member of Parliament, has held key ministerial portfolios between 2006 and 2014: rural development, drinking water and sanitation, environment and forests, power and commerce. He has authored a number of best-selling books.

Tell-tale signs in Nature

Text and Photographs: **Rushikesh Chavan**

Signs such as these tiger pug marks reveal the secrets of the natural world

Twenty-five years ago, I could not tell the difference between the most common birds. My bird identification was limited to *chiu* and *kaau*, that is House Sparrow and Common Crow. Everything else was *lahan pakshi* and *motha pakshi* (small bird and large bird), sometimes *rangit pakshi* – colourful bird. When I started my visits to Sanjay Gandhi National Park (SGNP) with Nitin, who was a novice like me, we barely saw anything and believed that the forest was empty; we just enjoyed being in there. But that was only until I went to SGNP with Shardul Bajikar, an expert naturalist. The same beaten paths of the forest were now teeming with life! He would turn a leaf – what appeared to me as any random leaf – and show me a spider or a bug, sometimes a caterpillar. It was like *yeh toh baazigar hai* (he is a magician)! Over the years, I learnt how to observe nature in the wild from researchers, naturalists, guides, and nature enthusiasts, and now I see much better. I never penned these experiences, as I believed that *Hornbill* readers are quite attuned to nature and would not find my writing a worthy read. But then a friend said "Never assume," so here are my miscellaneous notes.

I grew up in a suburb of Mumbai with buildings all around. Yet, throughout the year I saw more than 40 species of birds. The current lockdown helped to revive those good old memories, but this time with a pair of binoculars. While balcony-birding, I relied more on sound than sight to find the possible location of the bird. I noticed that different birds preferred different perches, the smaller ones were more likely to be seen in the bushes or in bushy trees, birds like kingfishers on overhead wires, while mynas would be hopping on the ground. Larger birds preferred sturdy surfaces – I would often see kites perched on ledges or pipes on terraces. Smaller birds were always chirping and moving around, White-browed Fantail being my favourite. So when I heard it call, I looked for signs of movement. The moment I noticed a disturbance among the leaves, mainly of the mango tree, I would find the bird. If you are a tea or coffee person, your morning and evening cup can well be accompanied with some birding!

Though I saw a lot of birds, I had little or no clue about the species I was looking at. So I started asking experts – we had no internet in those days. My queries were answered with questions … where had I seen the bird, what was it doing when I spotted it, its size and colour, and even tail movements. I soon learnt that in most cases, the answers helped to narrow down the probable list or to identify the species. Once I learnt about the breeding seasons of birds in my area, I was in for a treat, as bird activity increased during this time and I could see nest building, courtship, and caring of chicks. Sparrows, I found, bred three to four times a year. Tailorbirds and sunbirds, I noticed, would

Red-whiskered Bulbul, Indian Golden Oriole, and Oriental Magpie-Robin seen from my window

Multiple species can use a spot (as seen in the photo) Leopard spray marks and porcupine scat in front of a tiny cave

The feathers of a Yellow-footed Green-Pigeon with other signs suggests that a raptor had made a meal of the pigeon

Painted Grasshopper with droppings on leaf

Army caterpillars devouring a leaf

never directly go to their nest, but would perch at several places before darting to a particular spot. I noticed that this spot never changed; more often than not, that was where the nest was.

Other than balcony-birding, I have been fortunate to be able to go to different habitats, be they forests, grasslands, wetlands, mangroves, coasts, or coral reefs. Visiting these habitats multiple times improved my ability to look for wildlife in them. The best way to improve sighting skills is to keep returning to the same spot and making notes. When I walk in the forest, I see more birds, insects, herpetofauna, and plants, whereas from a vehicle I would see a greater number of large mammals.

With repeated visits to sites, I would notice small changes in the area like post monsoon dampness that brings in fungus, algae, and ephemeral plants on which different species feed. I would see tracks and signs of different species around a tiny puddle or wet gully created by runoff water. Bird droppings under a tree told me that birds roosted on the tree at night. So, I would either spend time near the tree on my way out in the evenings, to see the flock returning to roost, or reach the spot before sunrise to see the birds leave. But it was not always a roosting colony; many times it was just the chosen spot of a forest bird, a raptor or a cavity nester like a pair of hornbills. I would go back to the spot and find evidence of a raptor meal, most likely a bunch of feathers. Besides, it was not always droppings or feathers. In the case of owls, regurgitated pellets were a tell-tale sign of their presence.

If one looks closely at the forest floor, one can see many such tracks and signs. Large carnivores like tigers and leopards defecate along forest trails and then scrape the ground. Working with a big-cat expert helped me learn that tigers are likely to poop a little away from the edge of the road if

there is a broad clearing between the forest and the road; it is highly likely to see the scat close to the bends in the road. On these trails one is likely to also find tiger urine stains on tree trunks, fresh ones will also have a peculiar odour. Dholes, on the contrary, are known to poop in the middle of the road, with different individuals doing their business close by! My family was aghast looking at photographs from one of my trips with Aditya Joshi, who was collecting samples of tiger scats for genetic analysis. They expected photographs of tigers, birds, mammals, and landscapes, but what they ended up seeing was hundreds of close-ups of tiger and leopard poop!

Like all felines, tigers and leopards like to sharpen their claws. I have seen tigers use the soft bark of large trees to do that. Such tiger-claw marks are easy to identify. However, the most 'fun' scrape marks for me are the 'S' shaped ones of Sloth Bear, you can see them high up on trees. Tracks and signs is a subject in itself and several books have been written on it.

Tracks and signs are not only left by mammals, but all life forms. While walking in forests, I saw a lot of insect signs. I learnt to look for half-eaten leaves – if a leaf had been eaten in a semi-circular manner it was most likely the work of a caterpillar, rather than a bug or a beetle. And if the leaf had mustard-sized blackish pellets, there was surely the insect or its caterpillar on the plant. Rolled up leaves with silk stitches nearly always had an insect or a spider inside. Once I knew the food plants of butterflies and moths, I learnt where to look for the gigantic caterpillars of the Atlas Moth, the world's largest. I can never forget the beauty of butterfly eggs; they are the most stunning among all eggs across taxa. On numerous occasions, when I have turned a leaf of a food plant over, I have seen these magnificent eggs laid perfectly arranged. Macro photography has shown the world how beautiful insect eggs are and how meticulously they are laid.

Other instances when I had great fun were while looking for amphibians: frogs and their tadpoles, caecilians, newts, and salamanders. The sudden fall on slippery ground and the laughter that followed, and the literally bloody leech bites, which at that point was not nice. The amusing part of looking for frogs, which was then irritating, was that one could hear them croak but saw none. This was until someone suggested, "Use a red filter," and then life was easier. What I enjoyed most was looking for tree frogs during the monsoon. The moment I found a pond, I would search the overhanging branches and leaves for a foamy egg mass. Herpetologists taught me where to look for eggs in paddy fields, edges of streams, and ponds. The eggs are usually laid in a place safe from predators and where they will not desiccate. Toad eggs are equally fascinating, laid in ribbons entangled in reeds.

Though I enjoy the time I spend in terrestrial ecosystems, it is the marine ecosystem that takes my breath away. Thanks to marine biologists like Deepak Apte, Idrees Babu, and Dishant Parasharya, with whom I have explored marine habitats, I have had many fascinating experiences. The two most rewarding marine ecosystems I have explored are the coastline and coral reefs.

Sandy beaches are a delight for watching sunsets, but whenever I walked the waterline, especially during the lowest low tides, I also saw living wonders like the sand anemone, sea shells, crabs, starfish, egg cases of molluscs, even sharks and rays. The trick was to walk really long distances along the wet sand and look for movement and patterns. I think my best experience so far has been in Lakshadweep, when at midnight I came across a glowing blue, bioluminescent dinoflagellate *Noctiluca* species, commonly called Sea Sparkle. The sight was nothing less than magical.

A typical Leopard scrape mark is "V" shaped

It is best to understand the different zones of a typical rocky coast to observe marine life. The splash zone does not submerge during high tide but has water splashing over it; I have found periwinkles, isopods, and algae here. The richest zone in terms of marine life is the intertidal zone, especially tidal pools. In the high tide zone, one can see barnacles, limpets, shore crabs, and hermit crabs. At the middle intertidal zone, I have seen mussels, chitons, barnacles, and whelks. In low tide zone, there are chitons, coralline algae, and sometimes sponges. I have seen high diversity in tidal pools. Here you find practically everything – sponges, sea squirts, sea slugs, shells, starfish, anemones, sea fans, zoanthids, sea urchins, octopi, fish, and much more. It is a fascinating world and there is so much to observe. I noticed that most often barnacles and mussels live on one side of a rock. Being sessile, they cannot follow and catch prey, but have evolved to position themselves to make the best use of the natural water currents which carry their food towards them.

Author looking for amphibians

A pair of toads with strands of eggs in the foreground

Sloth Bear droppings identified from the Ziziphus seeds in them

Heaps of Nilgai droppings can be seen along forest trails

A Leopard sniffing for scents left by other leopards

Coral reefs are the most enthralling ecosystems. One either walks in this habitat (when in Gujarat) or dives (when in Lakshadweep or Andaman and Nicobar Islands). I had to be extremely careful when walking amidst the reefs at Gujarat as I did not want to harm life that was there. My search for sea slugs led to encounters with many other marine life forms, which I would have surely missed otherwise. It was a back-breaking experience but worth it. Diving or snorkelling is a completely different experience. I had to be calm and look in the nooks and crannies of the reef. I have never seen such a variety and number of forms in one small place anywhere else. The secret, I learnt, was to make as little movement as possible if I wanted the fish and other marine species to reveal themselves. It was exciting to see sharks resting under coral boulders, octopi looking for food, and the enchanting display of a cuttlefish wooing its mate.

The experiences that I have shared are mere examples; books can be written on the signs to look for in each species. I hope that naturalists will pen them down as it will surely help people see life in places they believe are bereft of any. Look out for the tell-tale signs that unravel the mysteries of the wild.

My longstanding association with nature has helped me understand the processes of life

Barnacles can be seen close to the shore on a variety of substrates

Tidal pools like this are common along rocky shores

Splash zones like this are created by waves

Sea slugs, sponges, and many other species can be seen on undersides of rocks along rocky coasts

Author with sea slug

Natural processes such as nutrient cycling are critical for ecosystems

better and developed my perspectives. I would like to share one such perspective with you. My experiences have taught me that there is more to nature than just spotting wildlife and rattling off the species names. One way to understand nature is by understanding the processes of nature. However, there is no central intelligence in nature that assigns functions to species or ecosystems, they are a result of certain interactions between biotic and abiotic components. These functions are emergent behaviours and provide services to users, making interactions critical for survival of the ecosystem and us. We are extremely dependent on them, and though we may create ersatz products or systems to replace them, we are ultimately deriving them from nature. Overharvesting destroys these complex processes. The toxins that we release into the environment will invariably come back to harm us. So the next time you visit wilderness, observe these interactions as well, it will enhance your understanding and make your experiences richer. ■

Rushikesh Chavan is a senior conservationist at Wildlife Conservation Trust. He has been involved in the conservation of nature for over two decades.

We are grateful to

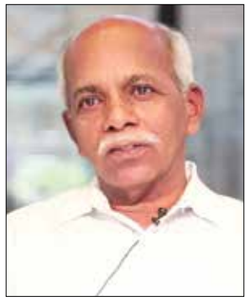
SETH PURSHOTAMDAS THAKURDAS & DIVALIBA CHARITABLE TRUST

for a generous donation to the

Pratap Saraiya Hornbill Fund

to support the publication of *Hornbill*

Remembering a Naturalist



Ulhas Rane

September 30, 1947 – October 27, 2020

On 27th October, 2020 we lost an ever smiling, mild mannered landscape architect, who was also a naturalist with vast knowledge of plants and animals. Though he took all precautions, Ulhas Rane unfortunately fell victim to COVID-19. A much involved and active Life Member of BNHS, he was a member of the Executive Committee, and a hardworking and dedicated Honorary Secretary of the Society from 1990 to 1992. At the request of Mr J.C. Daniel, he also became involved in the Education Committee.

Ulhas enjoyed tough treks and had climbed most of the peaks of the Sahyadri. A born leader, he led several BNHS camps, of which I had the opportunity to accompany him to Harishchandra Gadh, Manek Gadh, Saras Gadh, Pachmarhi, Malavali waterfalls, Chinchoti waterfalls, Kalsubai, Neral to Matheran trek, Malshej Ghat, and Mahabaleshwar, to name a few. During our Harishchandra Gadh trek, he himself cooked a meal for the participants with ingredients that he had brought along from Mumbai. It was Mahashivaratri, and that night a gang of idol thieves from Mumbai stole many old idols lying in front of the ancient temple. Ulhas was much perturbed and asked me to pursue the matter. Subsequently, Mr Humayun Abdulali and Mr A.P. Jamkhedkar, Head of the Archaeological Department, recorded my statement. When Ulhas learnt of this, he was pleased with the initiative.

A disciplinarian, he planned programmes with utmost care and precision. Dr Sálim Ali had great respect for his abilities and always trusted him. On the suggestion of Ulhas Rane, BNHS participants of a Pachmarhi camp were invited to the inauguration of Satpura National Park by Dr Sálim Ali. Ulhas looked after him on the rough forest tract with utmost care, as he would a child, and never left him alone in the forest, as there was a tiger which had killed a cow nearby.

Ulhas Rane used to lead a small group, popularly called Jungle Babblers, on weekend treks outside Mumbai. The group comprised Dr Meena Haribal, Dr Renee Borges, Dilip Patil, Arti Kaikini, Ashok Ghangurde, Manek Mistry, and Usha Ganguli, among others. To identify forest plants he would seek the help of Dr Marselin Almeida and Professor P.V. Bole, and for insects Naresh Chaturvedi and Isaac Kehimkar. During wanderings in the forest, he came into close contact with Dr Renee Borges, a promising scientist. Soon after, they decided to get married. Ulhas always helped other participants during BNHS camps. I remember a Neral-Matheran trek nearly 38 years ago – I was with my three daughters and Ulhas helped me to carry little Mamta through the difficult parts of the trek.

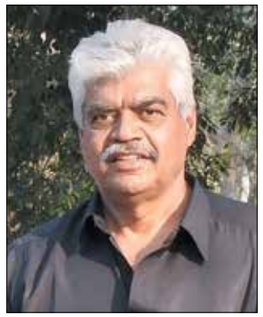
Ulhas Rane played a major role in planning Maharashtra Nature Park in 1983, and in the design of the BNHS Conversation Education Centre (CEC) at Goregaon, Mumbai. He ensured that most of the trees were preserved while constructing the CEC building. He created Rutu Chakra (Flower Calendar) in 1998, executed the Heritage Landscape project at Ajanta and Ellora Caves in 2001, and created the Zoological Park at Surat, Gujarat in 1993. He played an active role in the Save Sahyadri Movement nearly 30 years ago with Vice Admiral M.P. Awati. In 2005, when the Department of Forests and Wildlife Management, Government of Sikkim, needed to create a butterfly park, Usha Lachungpa, then Senior Forest Officer of Govt of Sikkim, suggested his name as he was a landscape architect with immense knowledge on birds and butterflies. He created another butterfly park named Butterfly Valley at Golaghat, Assam for Numaligarh Refinery Ltd.

Ulhas had his early education at King George High School, Dadar (now Raja Shivaji Vidyalaya) and graduated from Sir J.J. School of Arts and Architecture. He obtained his Master's in Psychology from Bombay University. A great swimmer, he completed a swim from Gateway of India to Sun Rock in the Arabian Sea. Later, he learnt yachting. He loved Marathi literature and Indian classical music; the legendary Kishori Amonkar was his favourite singer. He translated many English books into Marathi, and regularly contributed on nature to Marathi newspapers. He was a leading member of Maharashtra Pakshi Mitra Mandal and Marathi Vigyan Parishad. As a founder member of SACON (Sálim Ali Centre of Ornithology and Natural History) at Coimbatore, his legacy has borne abundant fruit.

When Dr Renee Borges, herself a leading scientist, was appointed at Indian Institute of Science, Bengaluru in 1995, Ulhas left Mumbai to settle there with her. After Renee's retirement, they planned to return to Mumbai and live in their Karnala home, surrounded by the innumerable indigenous trees planted by him. An avid trekker, Ulhas Rane talked about his next trek with his friend from the hospital bed, but this well-mannered man with immense knowledge departed too early, leaving his friends and admirers in grief.

– Ashok S. Kothari

Our Elephant Whisperer



Ajay Desai

July 24, 1957 – November 20, 2020

Ajay Desai, our very own Elephant Whisperer, conservationist par excellence, dear friend, colleague, mentor, and above all, a very humane soul, left us unexpectedly on the morning of 20th November, 2020.

I first met Ajay at the Bombay Natural History Society in 1985. He was a few years my senior, and he had come down to Hornbill House from his hilly abode in Mudumalai National Park for a meeting, along with Dr A.J.T. Johnsingh, then Project Scientist of the Elephant Project at Mudumalai. Later, as part of the organizing committee for the International Elephant Seminar at Mudumalai NP in 1993, Goutam Narayan and I travelled a month ahead, along with our 1.5-year-old child Sibya to Mudumalai. The International Elephant Seminar, where world elephant experts like Iain Douglas-Hamilton, Oria Douglas-Hamilton and others were to present their work, was truly a 'Week with Elephants', and the excitement - was palpable inside our war room!

The pre-conference days were piqued, with vendors not keeping to their timelines, and our only lifeline to the world outside, the telephone, often playing truant (those were not mobile times!), when only a good whack on the instrument would bring it back to life! Ajay gladly gave up his room to house us, but the chameleon on a woody tree in his room stayed, giving me the jitters – what if it started its hunting sojourns at night! But Ajay would have none of it, so the chameleon stayed where he had put it, and Bomma, our field assistant cum cook cum ombudsman, would bring in live crickets and dragonflies to feed it. The Bear House at Mudumalai, that was our field station, represented a war room during the run up to the Seminar. All through those trying times, Ajay never lost his cool; his humour was a balm for the weary. The seminar went off without a glitch (thanks also to the goodwill of all those who worked tirelessly, including the officers of the Tamil Nadu Forest Department). That made Mr J.C. Daniel, our Director, one happy man.

Ajay's expertise transcended countries and organizations (Sri Lanka, Indonesia, Thailand, WWF, IUCN, FAO, and several state forest departments in India), and everyone sought to avail of his flair, his discernment, for the well-being of elephants. Elephants meant the world to him, and he would brook no argument, giving even a so-called "rogue" a long rope before he was satisfied that it needed to be put down. More often, he would suggest rehabilitation for the pachyderm, and training to become a forest department worker. Such was his innate ability to listen to elephants!

During the same pre-international seminar organizing days, he demonstrated the movements of radio-collared elephants in Mudumalai, jumping up and down in Bear House like a child with his new toy – radio-collars – and then he went away tracking the pachyderm, only to return when the radio signals faded away and so did the light. Our walk to Ombetta, to watch the herd of elephants he was tracking – it was completely mesmerising, how close one could go to the elephants without their knowing. He taught me a few secrets about approaching these pachyderms, upwind and downwind. And one time that a Gaur mock-charged us in Mudumalai! How terribly upset he was that he had not anticipated this behaviour from the ungulate while he had visitors on foot in the jungle.

Most recently, he was supporting the Indo-German Project on Human-Wildlife Conflict Mitigation, as Coordinating Lead Author of National Human-Wildlife Conflict Strategy and Action Plan and for the guidelines on Human-Elephant Mitigation, apart from his contributions to training, planning, and implementation at the project pilot sites.

To us, Ajay Desai remained the ever-grounded research scientist and friend. I remember his call, *'Ladki! Tu kaisi hai?"* The last time that came was on 2nd July, 2020. He was taciturn about many things, except his elephants, but we often discussed Aaron and Swapneel, his children, of whom he was mighty proud, and Shanti, the love of his life! His pranks, his wry humour, his hearty laugh, and his never-ending leg pulling had us in splits and brought the house down. He had a minor aversion to spirits – he would leave his glass in an obscure place and walk away. His favourites – shrikhand, jalebi, anything sweet.

He gave us his all – talent, hard work, keen mind, straightforwardness, intelligence, humanity. Trust he has passed on to Elephant Heaven, and is romping among those gentle giants, of which he was one. We will miss him! ■

– Lima Rosalind

Human threats to pelicans and storks in Kaliveli Lake

Kaliveli Lake is the second largest among brackish as well as freshwater lakes in south India and is identified as an Important Bird Area (IBA) and Ramsar site. It is about 18 km north of Puducherry in the Villupuram district of Tamil Nadu. The lake is spread over 776 sq. km, and has a diversity of fish, aquatic plants, reeds, and trees that provide habitats for a variety of resident and migratory waterbird species. Many of the winter migrants visiting southeast India make a stopover here on their way to Point Calimere and Sri Lanka. The migratory bird season extends from October to March, depending upon the availability of water.

Spot-billed Pelican and Painted Stork comprise the largest waterbird populations in Kaliveli, forming nesting colonies on the islets deep within the lake area. These two species inhabit deep and shallow wetlands, man-made and natural, freshwater and saline, and build their nests on trees. In Kalivelli, both the species nest in mesquite *Prosopis juliflora* trees growing on the islets in the lake. The birds prefer these nesting sites as their eggs and nestlings are protected from land predators, mainly foxes, dogs, and cats. Crows and kites are also known to destroy the eggs and hatchlings.

Kaliveli Lake is also utilized for fishing and prawn culture by the locals. The movement of humans disturbs nesting birds, making them fly off. The unguarded eggs and hatchlings of pelicans, storks, and also Great Cormorant and Oriental Darter, fall prey to crows and kites. Hence, fishing activities and other disturbances in Kaliveli Lake need to be regulated by the Forest Department to provide safe nesting sites for these colonial nesting birds. I hope somebody is listening! ■

– R. Alexandar
Puducherry

In the lap of nature

I was born in a Central Public Works Department (CPWD) camp in the jungle of Changlang, Arunachal Pradesh. My interest in nature and biodiversity has been growing since childhood. My 'playmates' during my early childhood were my mother and the dense green forest. This is probably why I am fond of living alone in pollution-free rural areas rather than crowded, polluted urban areas. In those days, Changlang hamlet was very isolated, but today it is the district headquarters! In those days, no bus or vehicle, except the army's Shaktiman truck and a businessman's old Bedford truck that came every weekend with goods and passengers, plied on the narrow zigzag muddy road passing through my camp home towards Changlang.

Childhood is a period of innocence and curiosity. I still remember those days filled with mischief and loads of curiosity. Of the days I spent running after multi-coloured butterflies and dragonflies; collecting small crabs and fishes from the stream near my home; collecting coloured soil and rocks to draw pictures on my frameless slate; and making toys out of clay. Among all these activities, I found it most interesting to watch sparrows and small birds in our courtyard, and busy ants running in a queue like a tiny train carrying insects for food. The arrival of a pair of Hoolock Gibbon hanging from the branches of a big wild litchi tree, located a little distance from my home, caught my attention. I used to watch the gibbons jump and call throughout the afternoon, and listen to their high pitched chorus.

But times have changed. The stream that once was a perennial water source now has no water, and obviously no crabs or fish. My favourites, the butterflies, dragonflies, and Hoolock Gibbons, are also missing. The only audible sound is the howling of jackals. During my childhood, besides birds, I watched animals like Barking Deer, Dhole, elephants, bears, and tigers moving around in the valley, coming down from the dense mountain forests towards the stream. Now-a-days, there is hardly any wildlife around. The animals may be missing due to loss of their habitat from rampant destruction of forests, raging fires, wanton timber operations, and tea cultivation throughout the mountains.

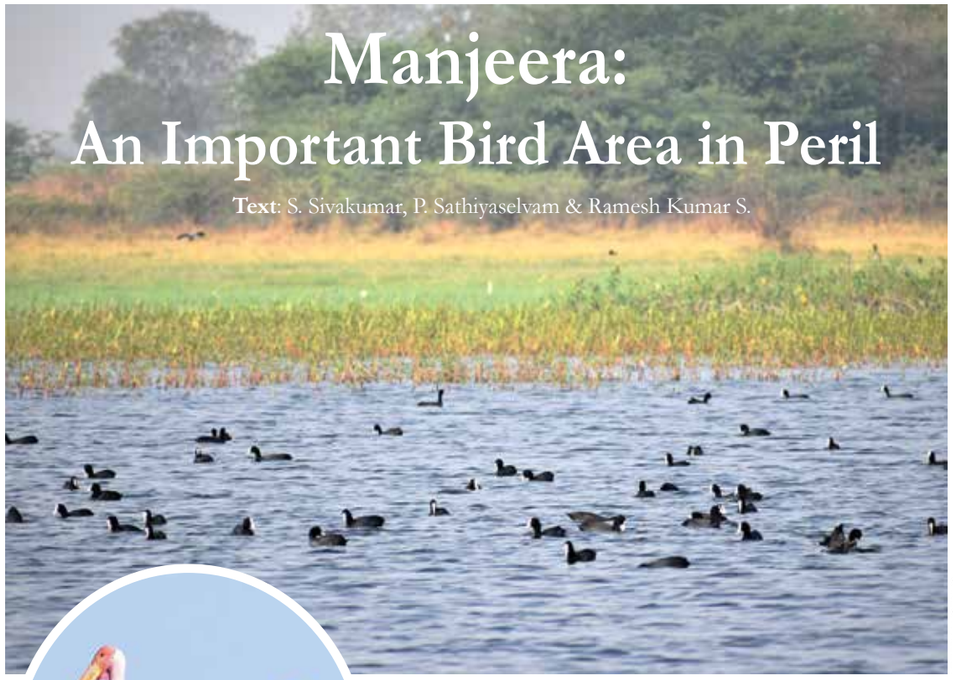
As I was born and grew up in the lap of the jungle, I believe myself to be an innate part of the wilderness. My curiosity encourages me to continue my interest in biodiversity. I grew up reading wildlife books, watching documentaries, and listening to the stories told by my father, who lived in close association with the Tangsa tribes of the region. The indigenous way of life, hunting, fishing, and collecting food from the wild, living in jungles, I learnt from my father and the Tangsa tribals.

The essence of biodiversity is not just the diversity within genes, species, and ecosystems, but also their functional interconnectedness and structural coexistence. Within an ecosystem, all life forms interact and depend on one another to survive. Although we consider ourselves as the most powerful and intelligent species, ironically our actions speak otherwise. ■

– Gobinda Palit
Itanagar, Arunachal Pradesh

Manjeera:
An Important Bird Area in Peril

Text: S. Sivakumar, P. Sathiyaselvam & Ramesh Kumar S.



GANESH PALLELA

A shallow region in Manjeera Reservoir where Common Coot and migratory ducks congregate in large numbers

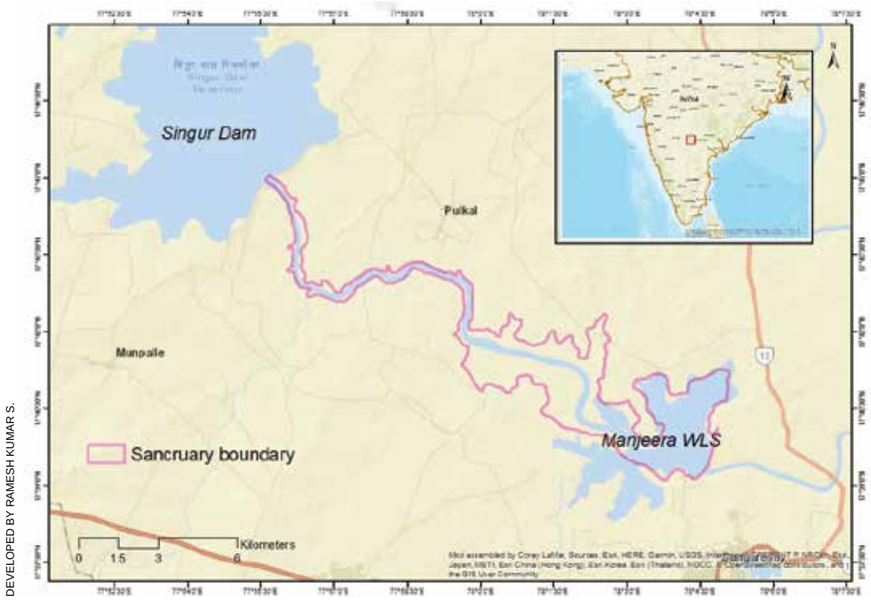
RAMESH KUMAR S.

Wetlands are crucial for large numbers of fauna and flora. Fulfilling the food and habitat requirements of waterbirds is one of the most important functions of wetlands. Many wetlands are stopover sites for millions of migratory birds that refuel their energy requirements to continue their migration.

River Manjeera is an important tributary of the Godavari River system. It originates in the Balaghat Hills in Madhya Pradesh, flows through Maharashtra and Karnataka, entering into Medak district of Telangana State before converging with the River Godavari at Basara. Manjeera Dam was constructed on this river close to Sangareddy town, solely to supply drinking water to Hyderabad. It was constructed by Hyderabad Metro Water Supply and Sewerage Board (HMWSSB). It is now the main source of drinking water for Medak and Nizamabad districts, and also the twin cities of Hyderabad and Secunderabad.

In 1974, the threatened Mugger Crocodile *Crocodylus palustris* in Manjeera were on the brink of local extirpation, with just four pairs left. Manjeera Wildlife Sanctuary (17° 57' 52" N and 78° 02' 22" E) was thus established, which was notified in 1978 and declared in 1998, and is located between Manjeera and Singur dams, and follows the course of river Manjeera for 36 km. The reservoir has nine small islands, including Puttigadda, Bapangadda, Sangamgadda, and Karnamgadda. These islands contain extensive marshy fringes, which support habitats for many waterbirds. Additionally, thick tree cover provides nesting sites for other birds. The reservoir also supports submerged and emergent vegetation. This mosaic of vegetation, combined with the unique landscape, provides safe nesting sites for a variety of waterbirds.

Manjeera Wildlife Sanctuary attracts numerous waterbirds and is important for migratory birds, as it provides them with roosting and resting sites, and food. The waterbody provides considerable ecological diversity to support a large population of wetland birds and has been designated as an Important Bird Area (IBA) in the state of Telangana. It has become a major birding hotspot for birdwatchers. Over



Map showing location of Manjeera Wildlife Sanctuary

280 species of birds have been reported in Manjeera Wildlife Sanctuary and its environs. These include globally threatened species such as Steppe Eagle *Aquila nipalensis*, Greater Spotted Eagle *Clanga clanga*, Indian Spotted Eagle *Clanga hastata*, Indian Skimmer *Rynchops albicollis*, Woolly-necked Stork *Ciconia episcopus*, Lesser Adjutant *Leptoptilos javanicus*, and Common Pochard *Aythya ferina*. The waterbody and islands provide ideal habitat for many waterbird species, including several migratory species. The woodlands, grasslands, and crop fields in and around the Manjeera reservoir provide habitats for a wide variety of landbirds.

The linkages of Manjeera with the breeding grounds of some migratory species have been established through past and recent bird ringing studies. A Greater Flamingo *Phoenicopterus roseus* ringed in Iran in 1971–74 was recovered at Manjeera in 1986–87. During the recent BNHS bird ringing programme in Manjeera, two Northern Shoveller *Spatula clypeata* ringed in the Sanctuary were recovered from their northern breeding sites in Russia. These two examples show the importance of the wetland for migratory waterbirds of the Central Asian Flyway (CAF). Apart from supporting a wide variety of birds, the waterbody harbours rich biodiversity, replenishes ground water, fulfills the domestic water needs of the local people, and foraging and water requirements for their cattle, and other ecological services.

The presence of a huge heronry is a feather in the cap for Manjeera Wildlife Sanctuary, which is known for the breeding of 14 species of colonial waterbirds. Darter *Anhinga melanogaster*, Asian Openbill *Anastomus oscitans*, Painted Stork *Mycteria leucocephala*, Common Coot *Fulica atra*, and Black-crowned Night-Heron *Nycticorax nycticorax* are the important colonial breeders in Manjeera.

The island Puttigadda provides ideal sites for colonial nesting birds, being covered with *Acacia nilotica* mixed with tall grass, and also with a few thickets of *Prosopis juliflora*. Dense growth of thorny *Acacia nilotica* on the island and surrounding water provides perfect nesting sites for these birds. This island habitat keeps the nestlings safe from terrestrial predators. Among all the heronry birds, Painted Stork was the predominant breeder.

During our visit to Manjeera in March 2018, a huge breeding colony of Painted Stork was recorded on Puttigadda Island. Around 7,500 individuals, including adults, chicks, and fledglings were seen along with other breeding waterbirds such as Grey Heron *Ardea cinerea*, Black-headed Ibis *Threskiornis melanocephalus*, Little Egret *Egretta garzetta*, and

Intermediate Egret *Ardea intermedia*. The water level was good and it was observed that many birds could hunt food easily, indicating that food was plentiful in the vicinity. A number of studies have demonstrated the link between reproductive performance and the availability of food and water for breeding birds. This was obvious in the healthy breeding numbers of Painted Stork and other species during 2018. Through literature survey we understood that this was one of the largest breeding colonies for Painted Stork in southern India.

Yet, during our visits in 2019 and 2020, we saw a changed scenario – the picturesque heronry had become pitiable. We did not see a single breeding pair of Painted Stork in Manjeera in these two years, and the whole area wore a deserted look. In March 2019, we observed that the reservoir itself had gone bone dry, though there were some stretches of stagnant water downstream. The dam, the stretch of river, and satellite wetlands near the barrage were completely dry during March 2020, yet nesting habitat in the heronry area was intact in both 2019 and 2020. The only possible cause of the total desertion by breeding birds during these years was lack of water. Secondly, the insignificant water level also paved the way for potential ground predators to the heronry, and dearth of food resources in the vicinity. Around 250 Painted Stork were found in the nearby satellite wetland, Peddacheruvu in 2019. The birds were trying to make a nesting platform on *Ipomea carnea* in the middle of the waterbody. Some birds were seen bringing nesting material to the site. However, their attempts were futile due to lack of suitable nesting substrate. This wetland was also almost dry during 2020, hence almost devoid of waterbirds. Other bird species recorded breeding earlier in the colony were also not found nesting during 2019 and 2020.

Painted Stork is a large eye-catching wading bird with nesting colonies across large parts of South and Southeast Asia, particularly India and Sri Lanka. Painted Stork has been classified as Near Threatened in the IUCN Red List of threatened species. According to BirdLife data, although Painted Stork is one of the most abundant of the Asian storks, this species is classified as Near Threatened because it is thought to be undergoing a moderately rapid population decline primarily due to hunting, loss of wetlands, and pollution. Its estimated global population is around 25,000 individuals, with the largest secure population reportedly found in India.

The record of 7,500 individuals at the breeding colony in Manjeera, equivalent to about 30% of the biogeographical population, makes this site crucial for this Near Threatened species. Many studies report that a number of breeding colonies of this colourful wading bird have disappeared, or the nest numbers have declined in different colonies in recent years. In such a scenario, the Puttigadda breeding colony in Manjeera becomes even more crucial to its survival.

According to the local officials and the public, both 2019 and 2020 were dry years with low rainfall. Therefore, the water level in the reservoir was poor, which also dried up early and left the dam empty. The same situation prevailed in 2016 as well. The dam was constructed for the sole purpose of

S. SIVAKUMAR

Metal structures erected in Manjeera by the forest department to provide additional nesting sites for breeding birds. Manjeera wore a deserted look due to lack of water, as seen in March 2019

RAMESH KUMAR S.

Manjeera Reservoir filled with water to its capacity in March 2018

supplying drinking water to Hyderabad, according to published sources. In recent years, the water is being diverted to some other areas as well.

The Hindu on April 19 and April 27, 2019 stated: "The water at dead storage level from Manjeera dam is being diverted to Narsapur and Patancheru constituency. According to officials the water is being pumped under Mission Bagiratha for the past two months. Now the water level has drastically fallen which has forced the crocodiles from the Manjeera Wildlife Sanctuary to search for any place where water is logged."

Another news item published in *The Hindu* on June 05, 2020 mentions the social conflict, stating that "illegal withdrawal of water from Singur dam" led to fall in water level to critical levels. Some other sources said that the growing human population with economic needs has caused great increase in water scarcity in Hyderabad and the areas near Manjeera, which has resulted in withdrawal of more water from the dam. Apart from drinking water, water is released for agriculture purposes.

As the needs of both people and animals cannot be ignored, there must be a check on how much water is being drawn from the river, so that at least a minimum amount of water is maintained for the crocodiles and avifauna to survive. To preserve the natural ecological character of the wetland, it is essential to allocate water as close as possible to the natural regime. This requires multi-level approval, political will, and awareness among the farmers on the importance of water for ecological services.

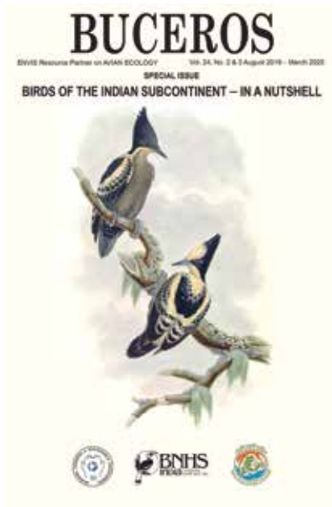
It is the need of the hour that HMWSSB, Forest Department, and other stakeholders cooperate to work out a common minimum programme to maintain the necessary level of water for the ecological functions of the dam, to manage the breeding population of Painted Storks and other waterbird species and the iconic Mugger for which the wildlife sanctuary is known. As Manjeera is an important breeding site for Painted Stork, insufficient water levels in the dam may imperil the future of the overall population of this Near Threatened species. ■

S. Sivakumar, a BNHS scientist, works on bird migration and wetland dynamics for the BNHS Wetlands Programme. His other interests are ex-situ conservation and environmental education.

P. Sathiyaselvam, Assistant Director, heads the BNHS Wetlands Programme and has been involved in Bird Migration studies since 2002.

Ramesh Kumar S., a scientist at BNHS, is currently on deputation to MoEF&CC to support Central Asian Flyway Initiatives of Government of India.

Buceros Special Issue



On the occasion of World Environment Day, BNHS-ENVIS published a special issue of *Buceros* (Vol. 24, Nos 2 & 3) with an article BIRDS OF THE INDIAN SUBCONTINENT – IN A NUTSHELL, authored by Ranjit Manakadan and Asif N. Khan. This article has turned out to be a 'bestseller' for BNHS-ENVIS! The publication provides a general account of the birds of the Indian Subcontinent, catering to both amateur birders and ornithologists. The article begins with a general profile of the birds of the Indian Subcontinent, dealing with the composition of native avifauna. This is followed by discussions on migrant birds from the Palearctic (or other regions) that winter in the Subcontinent, with some accounts on the movement patterns of resident birds. The next section is a treatise on the different biogeographic regions of the Subcontinent and their characteristic avifauna. Waterbirds of the Subcontinent and the major wetland habitats that support them are featured separately. The article concludes with an account of the migration and local movement patterns of birds in the Indian Subcontinent.

The article was uploaded on Research Gate (an international networking site for scientists and researchers) in September 2020, and has elicited a commendable response, garnering more than 6,000 reads till now, securing scores of "higher than 88% of items on Research Gate" and "higher than 99% of items published in 2020" by date of publication. The article is available on the BNHS website: https://bnhs.org/public/buceros-pdf/BUCEROS-SPECIAL-ISSUE.pdf ■

Free online environmental sessions

The Mumbai CEC, with financial support from Tata Motors Ltd, has conducted free online environmental sessions for more than 7,000 school students across India.

A webinar on "Eco-friendly Diwali" for employees of Bridgestone, Pune, was held on November 11, 2020, where the participants were educated on traditional and eco-friendly Diwali decorations, making of festive lamps, and the adverse impact of firecrackers on animals and the environment. ■

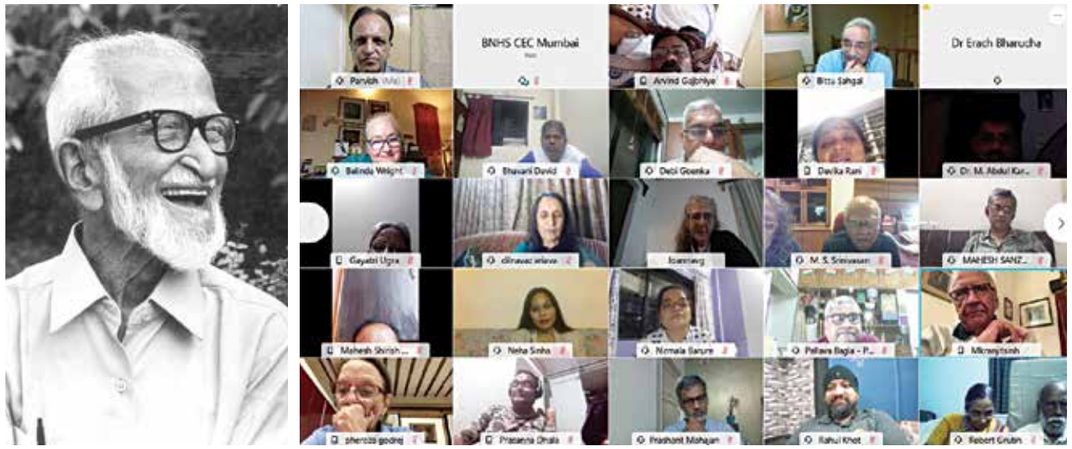
Celebrating Big Butterfly Month

BNHS PHOTO LIBRARY

Big Butterfly Month-India Poster with all partners

The Delhi CEC organized Big Butterfly Month: India 2020 in September. This was a first of its kind of biodiversity event in India where butterfly experts, enthusiasts, and more than 50 biodiversity conservation organizations took part. The festival covered 25 states and three union territories across India, and brought together people from varied backgrounds with one aim: to record observations on butterflies to help scientists gather large sets of data over a long period of time. Butterflies are key indicators of the health of the environment, which makes them ideal models for long-term climate studies. Around 30,000 observations were made, probably the largest single month record entry for butterflies in India. ■

Remembering Dr Sálim Ali



The webinar to remember Dr Sálim Ali was attended by his students, colleagues, and admirers

Stalwarts of Indian Ornithology came together at a webinar organized by BNHS on November 12, 2020 to relive their memories of Dr Sálim Ali. The speakers included Dr S. Balachandran, Aasheesh Pittie, Chris Bowden, Belinda Wright, Bikram Grewal, Dr Vibhu Prakash, Joanna Van Gruisen, Dr Robert Grubh, Shailaja Grubh, Tara Gandhi, Dr Deepak Apte, Usha Lachungpa, Bittu Sahgal, Debi Goenka, Toby Sinclair, Bill Harvey, M.K. Ranjitsinh, Dr Pheroza Godrej, Dilnavaz Variava, and Dr Erach Bharucha, among others. The webinar was enriched by the experiences of students, colleagues, and admirers whose lives Dr Sálim Ali had touched. They felt privileged to have walked the path of conservation with India's most famous ornithologist. If you missed the webinar, you can watch it on the BNHS YouTube Channel: https://www.youtube.com/watch?v=lrwuD21_Ny8

The entire staff of BNHS came together to pay tributes to the legendary Birdman of India, whose contribution to bird research and conservation in the country remains unparalleled.

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Birdwatch at Nagpur

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Special edition of *Dhanesh* was published by CEC-Nagpur

Celebrations at Nagpur: BNHS Nagpur Office conducted birdwatching sessions for school students at Navegaon-Nagzira Tiger Reserve, Tadoba-Andhari Tiger Reserve, Pench Tiger Reserve, and Raj Bhavan Biodiversity Park, Nagpur. A special edition of *Dhanesh Weekly* was published on Critically Endangered birds of India and bird conservation.

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Bird walk participants at Bhandup Pumping Station, Mumbai

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Birdwatch at Bhamburda Hills, Pune

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Nature trail to Sálim Ali Point, SGNP by CEC-Mumbai

BNHS PHOTO LIBRARY

Sálim Ali bird count at Asola Bhatti Wildlife Sanctuary by CEC-Delhi

Celebrations at Mumbai: Birdwatching trails were headed by Nandkishor Dudhe and Asif Khan of the BNHS on the morning of November 12, 2020 at Bhandup Pumping Station, Mumbai for a small group of birdwatchers.

BNHS Conservation Education Centre (CEC) at Mumbai was lit up in green to celebrate the occasion. A nature trail to Sálim Ali Point in Sanjay Gandhi National Park was conducted for guests. Dr Raju Kasambe took BNHS members and followers of BNHS on a virtual trail of the beautiful BNHS Nature Reserve on November 11, where more than 55 participants learned about the diverse flora, fauna, and interesting facts on camera trapping in the Reserve.

Celebrations at Bhamburda Hills, Pune: A bird walk was held on November 8, 2020 at Bhamburda Hills in Pune. The site is a biodiversity park maintained by the Pune Forest Division. A total of 24 bird species were observed by 14 participants. The walk was led by Dr Girish Jathar of the BNHS.

Celebrations at CEC-Delhi: BNHS CEC-Delhi conducted the Sálim Ali Bird Count at Asola Bhatti Wildlife Sanctuary and Yamuna Khadar on November 7 and 8, 2020 as part of the celebrations.

Sálim Ali Bird Count in India & Bird Week celebrations in Maharashtra: The BNHS, including its Environmental Information System (ENVIS) Resource Partner on Avian Ecology, in association with Bird Count India, Indian Bird Conservation Network (IBCN), and Maharashtra Pakshimitra Sanghatana, held a pan-India Sálim Ali Bird Count from November 5–12, 2020. A Bird Week was announced by the Government of Maharashtra from November 5–12 to celebrate the birthdays of the renowned nature writer Shri Maruti Chitampalli on November 5 and the legendary ornithologist Dr Sálim Ali on November 12. Dr Raju Kasambe gave a talk on the breeding behaviour of Baya Weavers. ■

Note: All necessary Covid-19 rules and precautions were followed during all the trails and walks organized by the BNHS

It all began with the Yellow-throated Sparrow

(now Chestnut-shouldered Bush-Sparrow)

As a little boy, Dr Sálim Ali shot down a Yellow-throated Sparrow, which he brought to the BNHS for identification and there began a historic birding journey. To remember that momentous first step, and how the little bird changed the course of his life, we organized a Photography Competition – Sparrows from your Window. 'The Fall of a Sparrow' proved to be 'The Rise of a Sparrow'. Here we share the winning images.

2nd winner

"Thirsty" by Saurav Kumar Boruah – Dhakuakhana, Assam; October 3, 2020. A group of Eurasian Tree Sparrow live in our home; they have been nesting between two walls for several years. Their chirping makes our home lively.

1st winner

"The Peeping Beauty" by Sandeep Sasidharan – Bera, Rajasthan; October 24, 2015. There was a well near the resort where I stay during my trips to Bera. I noticed many House Sparrows near the well. Here I captured a House Sparrow peeping out of a weaver nest.

3rd winner

"Russet Sparrow" by Swastika Anand – Kullu, Himachal Pradesh; May 16, 2020. This Russet Sparrow is challenging its reflection in the window glass assuming it to be a rival!

Biodiversity Assessment Tool Launched

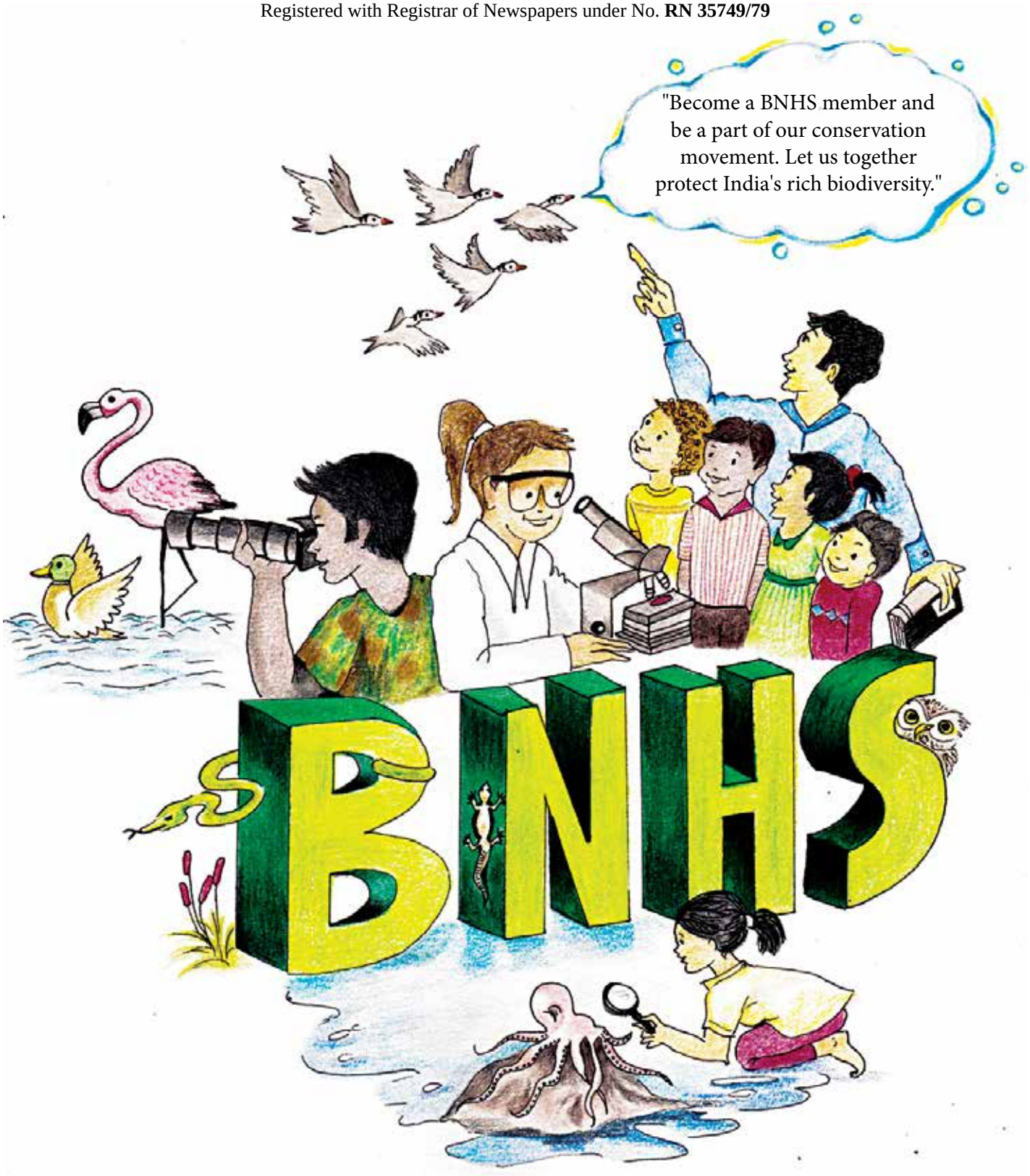
BNHS PHOTO LIBRARY

CoMBAT app launch event November 6, 2020

The BNHS, in association with Shell, virtually launched the Coastal and Marine Biodiversity Assessment Tool (CoMBAT) on November 6, 2020. The Chief Guest for the event was Mr N. Vasudevan, IFS, Managing Director of Forest Development Corporation of Maharashtra Limited. CoMBAT is the result of a massive exercise by BNHS to assess the Maharashtra coast for its biodiversity and to identify ecologically important pockets for focused and effective conservation efforts. A user-friendly open-source platform, the app will help stakeholders make informed decisions about coastal developments which can pose a threat to unexplored habitats. You can explore this web application on http://combat.bnhs.org/ ■

Published on December 25, 2020, by the Honorary Secretary for Bombay Natural History Society, Hornbill House, Dr Sálim Ali Chowk, Shaheed Bhagat Singh Road, Mumbai 400 001, Maharashtra, India.

Registered with Registrar of Newspapers under No. **RN 35749/79**



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