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Others

Andaman, Nicobar, and Lakshadweep in peril

The islands of Andaman, Nicobar, and Lakshadweep probably rank as the best in India for their beautiful seascapes and unique marine biodiversity. These islands have the most diverse coral reef formations in Indian waters. The Andaman & Nicobar Islands are also blessed with several endemic flora and fauna.

However, this pristine and rich diversity seems to have turned into a curse for the islands. The magnitude of infrastructural development envisaged for these islands is not just scary, but incomprehensible by any means. The islands are of great national strategic importance and thus the infrastructure development in this regard is understandable. However, if one browses through the recent documents of Niti Aayog 'Incredible Islands of India (Holistic Development)' one would be bewildered by the changes that are slated to take place in these extremely fragile ecosystems. The document states that 'tourism in the country can be one of the biggest drivers of growth and a major employment generator'. No doubt that tourism if done with extreme sensitivity can be an engine for growth, both at the national level and local level. However, considering the 'zero civic sense' of the majority of Indian tourists, developing tourism in these fragile islands is nothing less than an ecological blunder. We hardly need to look for further evidence for this, considering the sorry state of our national monuments, heritage sites, hill stations, and beaches that are currently on the tourism map. We need a generational change in the way we behave as tourists before we allow sectoral development, such as tourism infrastructure, in these fragile seascapes and landscapes.

Within the Niti Aayog blue print for the Andaman & Nicobar Islands, the most worrying project proposed is the Trans-shipment Project at Great Nicobar. The proposed site abuts Galathea Beach which is one of the best known nesting sites for Leatherback Turtle. Currently, the feasibility is being explored for a trans-shipment terminal at South Bay.

Recently, the Indian Government lifted the Restricted Areas Permit (RAP) for 29 islands, subject to certain conditions, in Andaman & Nicobar, namely East Island, North Andaman, Smith Island, Curfew Island, Stewart Island, Land Fall Island, Ayes Island, Middle Andaman, Long Island, Strait Island, North Passage, Baratang, South Andaman, Havelock, Neil Island, Flat Bay, North Sentinel Island, Little Andaman, Chowra, Tillangchong Island, Teressa, Katchal, Nancowry, Kamorta, Pulomilo, Great Nicobar, Little Nicobar, Narcondam Island, and Interview Island. Opening up these islands for tourism is an unwise decision considering the extremely fragile nature of ecosystems here.

Coming to Lakshadweep, there is an ominous plan to build water villas (44 Keys + 44 Villas) in Suheli Island, probably the only pristine lagoon reef along the entire coast of India. The misplaced logic that has been put forward as an example is how Maldives is doing it. Well, those who have visited the Maldives will tell the story of the stringent laws they follow and the kind of tourists they receive, ensuring clean and spotless beaches. We lack positives in all these aspects. Also, the Maldives has 1,200 islands grouped in a double chain of

VISHAL BHAVE

26 atolls, compared to 36 islands in Lakshadweep within 12 atolls. Suheli is probably the only island that has still remained untouched, except for local fisherman using the beach to dry fish seasonally. It is probably among the last few remaining islands on the west coast of India with excellent nesting areas for Hawksbill Sea Turtle. Along with Suheli, two more important islands Thinakkara and Cheriyam have been promulgated to be opened up for tourism. While in Bangaram and Thinakkara, huts and tents have already been constructed by the Lakshadweep Tourism Department, it is not known what else is proposed on these islands. Cheriyam is an equally important island within Kalpeni lagoon.

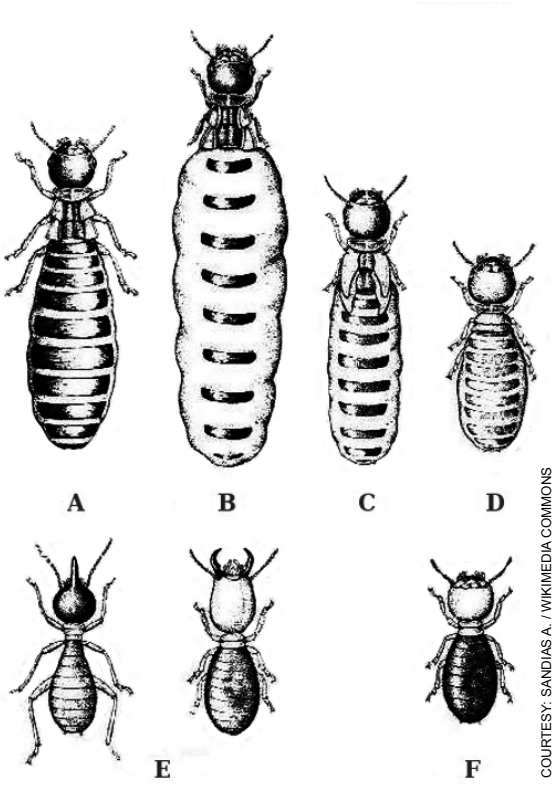
While our mainland coastline has undergone tremendous transformation, developments now taking place along the most pristine seascapes of Andaman & Nicobar and Lakshadweep, will spell doom for these last remaining global marine biodiversity hotspots. Efforts should be made to sttengthen, add on and develop the existing infrastructure in the islands, instead of opening up pristine areas for development. We hope wisdom will prevail and areas like Suheli, Little Andaman, Great Nicobar, Little Nicobar, Narcondam Island, and Interview Island will remain protected for their biodiversity and intrinsic ecological values as national assets and for the future prosperity of the nation.

Deepak Apte

The World of Termites

Text: **Neha Mujumdar**

The complex social caste systems of some insect groups are among the most fascinating subjects of insect biology. Among these, termed as eusocial insects (which also include ants, bees and wasps) are the termites. Due to their overall appearance, which is similar to that of ants, and predominantly whitish coloration, termites are often called white ants, though they are not ants at all. Termites occupy habitats ranging from well-wooded forests to dry and semi-arid areas, in natural and man-made habitats. Around 3,000 species have been described till date, and many are yet to be described; about 286 termite species are reported from India. Let us explore some basic aspects of this interesting group of insects that is inadequately known as they lie hidden in their tunnels, mounds, or subterranean dwellings.



COURTESY: SANDIAS A. / WIKIMEDIA COMMONS

Caste system of termites
A: Primary king; **B**: Primary queen; **C**: Secondary queen; **D**: Tertiary queen; **E**: Soldiers; **F**: Worker

Caste system

Like many other hemimetabolous insects, termites undergo incomplete metamorphosis with three stages: egg, nymph, and adult, in contrast to the holometabolous insects like butterflies and moths which undergo complete metamorphosis with four stages, namely egg, larva, pupa, and adult. The queen of the colony, a female termite, is like a large egg-laying machine that lays thousands of eggs in a day. The eggs hatch into nymphs that later develop into workers and soldiers, king and queen. A typical termite colony has a single queen, a king, secondary reproductives (male and female), workers, and soldiers. The secondary reproductives are also capable of laying eggs and producing workers and soldiers. Workers are engaged in maintaining, building the mound and nurturing the young and the queen, while soldiers with their strong modified mandibles defend the nest against any danger. The workers and soldiers might be hundreds in numbers. Termites show extreme degree of controlled reproduction using pheromones, such that the workers and soldiers are sterile or with underdeveloped reproductive organs. Whether a nymph will turn into a worker or a soldier depends on the requirement of the colony. The queen secretes a pheromone that is passed on through food sharing or grooming, which in turn keeps a check on the sexual development of the immature termites. The queen can start producing fertile males and females at certain times of the year, like before swarming. According to some sources, in the absence of this pheromone (as when the queen is lost or becomes sterile), the secondary reproductives start producing eggs to maintain the balance of the colony. The new queens then start secreting the pheromone to prevent further development of new queens. Some authors maintain that the loss of individuals in a colony is balanced by the secondary reproductives even when the queen is active.

NEHA MUJUMDAR

RANJIT MANAKADAN

Termite mounds found in semi-arid areas of Mahendragiri Hills, Tamil Nadu. The mounds were up to 1.8 m in height, built at the base of *Acacia* or *Prosopis* trees (inset)

Food and feeding habits

The name termite comes from the late Latin *termes* which means "woodworms". Termites feed on a variety of food such as wood, plant matter, and soil. The bacteria and protozoans in their gut help to digest the ingested wood or cellulose. Some species among the lower forms of termites feed only on wood and grass as they rely on symbiotic protozoa and bacteria that can digest the cellulose ingested. On the other hand, higher forms belonging to family Termitidae produce salivary enzymes needed to start the digestion of cellulose, but there appear to be no termite enzymes that can complete

RANJIT MANAKADAN

Subterranean termites often build mud-tubes out of soil and wood for transportation between the nest and the food source. To check if a tube is active, one can test it by breaking its middle portion. If it is repaired within a few days, this has definitely been done by termites

SANJAY ACHARYA / COURTESY: WIKIPEDIA

COURTESY: U.S. DEPARTMENT OF AGRICULTURE (TAKEN BY SCOTT BAUER)

Older workers (with brownish heads) and young worker nymphs (with whitish heads and bodies) immediately start repairing the damaged parts of the mound

MADHUMITA PANIGRAHI

Termite Hill Gecko seen inside one of the openings of a termite mound. Herpetofauna are known to use termite mounds to regulate body temperature, but behavioural studies on this species on the use of mound are lacking in India

cellulose digestion; termites have to rely on symbiotic bacteria in their gut to help them further break down cellulose. According to a recent study from Kerala, the diet of some species also includes herbivore dung and the hooves and horns of ungulates. The mound-builders of subfamily Macrotermitinae also grow symbiotic fungi *Termitomyces*, on their excreta within the mounds in sponge-like structures termed as fungus gardens. The fungus decomposes the termite faeces that mainly contains lignin from its plant diet. It is also a valuable source of nitrogen which is not gained through cellulose. Hence this fecal matter and the fungus are both consumed by the termites.

Nesting behaviour

Termites are famous for their architectural skills in building mounds of up to a few metres, they also show a large variety of architecture in their homes. Some wood and grass eating termites build mounds and also partly subterranean nests that can extend into the roots and trunks of trees. Species of the subfamily Nasutitermitinae are known to dominate the savannah ecosystems in Australia. They build giant mounds up to 8 m with millions

of individuals living inside. Another group of termites build 'carton-nests' on the wood. Typically these nests are built in damaged portions of trees, between trunk and the branches, or around the branches under the bark on the main stem. On looking carefully, one can notice mud-tubes consisting of soil or excreta running from the nest to the ground. These are the pathways or runways for the workers to transport food. Termites feeding on dry wood are known to be the most destructive, rapidly eating away timber and wooden stumps.

Swarming

Swarming is a step towards the formation of a new colony. It occurs when the colony reaches a certain size and it is time to inhabit new places. Swarms are observed after the first or second showers of rain and when humidity is high. They can be observed during the early hours of the morning or at dusk. Winged males and females, called alates, start occupying the periphery of the mound and pair beforehand for a few weeks. These pairs fly out of the nest and mate, a process called nuptial flight. After mating, the alates fly off to start a new colony at a suitable location nearby and shed their wings. A large number of individuals are preyed upon by mantises, dragonflies, frogs, toads, lizards, birds, and bats

SAUNAK PAL

Winged reproductives (alates) flying out of the nest during swarming, an indication of a flourishing colony in the area. Swarming usually occurs after the first few showers

ABHISHEKA KRISHNAGOPAL

Alates are released in thousands to establish new colonies; they develop eyes before they fly away from the colony. These swarms are quite often mistaken for flying black ants. The dead bodies of the alates are taken away by ants or eaten by predators, leaving behind only the wings on the day following swarming. On occasion, the shed wings form intricate patterns. The reason behind the small flower-like clusters of alates in this image taken at Kalakkad Mundanthurai Tiger Reserve is a mystery, but their numbers indicate the size of the swarm

INTERESTING FACTS

- Termites transfer food to their nest-mates mouth-to-mouth, a phenomenon called trophallaxis, essential for fast transfer of nutrients and necessary gut flora of symbionts in the community. This phenomenon is also seen in other eusocial insects like ants, bees, and wasps.
- Workers and soldiers are either blind or with poor vision. It is only reproductive alates which can see.
- Soldiers, due to their modified mandibles, are not able to feed on their own, hence workers feed them. Similarly, the queen being very large in size also has to be fed and groomed, as she cannot move.
- Indians in ancient times were known to worship termite mounds. The clay from the mounds was used in the construction of vedi (altar) during rituals. The Indian philosopher, astronomer, and mathematician Varahamihira mentioned the importance of termite mounds as good indicators of water and mineral deposits.

NEHA MUJUMDAR

A termite soldier drumming its head on a dry leaf to alert nest-mates. Termites communicate through such vibrations to which they are very sensitive. Here, nest-mates are sent a warning signal about a disturbance or threat

during the swarming. Some individuals that don't mate shed their wings and die. Many of us have witnessed this process in the beginning of the monsoon, when alates get attracted to light during their flight. In Africa, and also in parts of India, swarming termites are often collected, roasted or fried with salt and spices, and eaten.

Fauna associated with termite mounds

The mounds or nests of termites, also known as termitaria, are porous and well ventilated. The temperature and humidity inside the mound is modulated by a regulated flow of fresh air entering from the lateral sides. Hence, it acts as a refuge to a variety of fauna. Scientists have studied the occurrence of termitophile herpetofauna in the pastures of Cerrado in Brazil, one of the 34 global biodiversity hotspots and a degraded savanna ecosystem with high endemism. The findings demonstrate that both amphibians and reptiles, especially lizards, select certain sections of the mound as a refuge to maintain their body temperature on hot days. Mounds are also used when the outside temperature is too low or unfavourable to maintain their metabolism, and to seek respite from predators. A specialized species of burrowing frog, Mueller's Termite Frog *Dermatonotus muelleri*, that feeds on ants and termites was also observed to occupy the nest. Studies in Australia reported that large mounds are utilized as a shelter by smaller mammals like mice, bandicoots, and small marsupials, while in India, the Termite Hill Gecko *Hemidactylus triedrus* is mainly found in the vicinity of termite mounds in semi-arid areas. In cacao plantations of southeastern Brazil, different species of ants are known to occupy active as well as abandoned termite nests of arboreal *Nasutitermes* sp., mainly for shelter.

Defence strategies

Termites are very sensitive to substrate-borne vibrations. I have on one occasion witnessed soldiers of a termite colony banging their heads against dry leaves on the ground while the workers were moving from place to place in lines. This behaviour is called head drumming, where the defenders of the colony alert other members through vibration in case of disturbance or danger.

Talking about the use of fungus by termites, research shows that not all types of fungus are useful for them. Termites that feed on damp wood give out signals in the presence of pathogenic fungal spores, so that other nest-mates can keep away from danger. The pathogenic fungus affects the motor functions of termites and can lead to

death. Termites can sense the odour of this fungus, and to maintain a healthy population, they groom the infected individual to remove the spores. Other techniques to keep away predators include using certain chemicals. The soldiers of all Nasutitermitinae species spray a kind of chemical aerosol (either glue or ant repellent), which enables them to effectively repel ants from a distance.

Biomimicry – Build it like them!

The use of biological entities or processes to come up with solutions to solve the problems of mankind through products or design is known as biomimicry. The efficiency of a termite nest in regulating temperature and humidity lies in its architecture. Hence, termites are aptly referred to as 'engineers of the ecosystem'. This architecture has inspired humans to build sustainable and energy-efficient structures, and design some modern day buildings. Most well-known among these are the Eastgate Centre in Zimbabwe and Council House 2, an administrative building in Melbourne, where the architects used a technique similar to termite mounds for ventilation of the building, to avoid expensive air conditioning systems in the entire building (http://www.mickpearce.com/biomimicry.html). They installed fans at the base of the building to draw in cool air that is circulated upwards through different floors. The air getting heated during the day is released through chimneys, making room for fresh air just as termite mounds do. These buildings consume 35% less energy compared to other buildings with air-conditioning systems.

Ecological significance

Though infamous for destroying paper, furniture, timber, and other wooden structures, termites play a vital ecological role in maintaining the ecosystem. They are detritivores, which means that they feed on or obtain nutrition from large amounts of dead and decaying leaf litter and humus. As they feed mainly on wood and soil, the health of the forest is maintained as they digest dead and decaying wood and recycle valuable nutrients, returning them to the soil through their excreta. In this way, they also help in keeping the soil fertile. Subterranean termites can dig up to 30 m in search of water to regulate the humidity in mounds; this makes the soil porous and helps in percolation of water. The mounds also provide shelter and food for a variety of organisms. In India, there is great scope for conducting research on the ecology of these under-studied taxa. Such studies can lead us to better and sustainable solutions not just by mimicking their structures but also in managing their population in more effective and less harmful ways. ■

SAUNAK PAL

Winged individuals of termites become vulnerable to predators during swarming. Many alates fall prey to a variety of predators like birds, toads, lizards, and bats. A Lynx spider can be seen feeding on an alate

Neha Mujumdar works at the BNHS as a Junior Research Fellow in the Conservation Department. Studying butterflies and odonate biology is her major interest.

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Arachne's Children

Text and Photographs: **Pranad Patil**

Lynx spider

"What are you most afraid of?" Almost six out of 100 people are likely to answer, "Spiders!" Arachnophobia is one of the most common fears, and some would say that this fear is warranted, as a few spiders are equipped with venom, potent enough to kill a human being. But spiders can be fascinating too, and even inspirational, and why not?

Among the most famous spiders in the world was probably the one that inspired Robert Bruce. According to a legend, when this Scottish king was on the run after the Battle of Methven in 1305, he hid in a cave where he observed a spider spinning a web, trying to swing across from one side of the cave's roof to another. It tried and failed but tried again, finally succeeding the third time. Inspired by the spider's persistence, Bruce

Spring Orb-weaver *Gasteracantha* spinning its web

returned to the conflict and managed to defeat the English in that battle, eventually gaining complete victory. The lesson we learn from that and many other spiders is: "If at first you don't succeed, try, try again."

Present day spiders have been around for more than 200 million years, and over 45,000 species of spiders have been reported from across the globe. They have conquered almost all types of habitats, except air and marine waters; colonized all the continents, though not yet recorded from Antarctica; have an excellent sensory mechanism; are superb architects; and have a highly effective venom-injection system. Almost all known species of spiders are predators, mostly preying on insects and on other spiders, with a few large species even taking birds and lizards. The lone herbivorous species, *Bagheera kiplingi*, was described in 2008 from Central America. It is estimated that the world's 25 million tons of spiders kill 400–800 million tons of prey per year.

I have a fascination for spiders and use every opportunity to photograph them across the country and gather information about them. In this article, I'll tell you how spiders spin webs and attack prey, and will try to unravel the world of some interesting spider species.

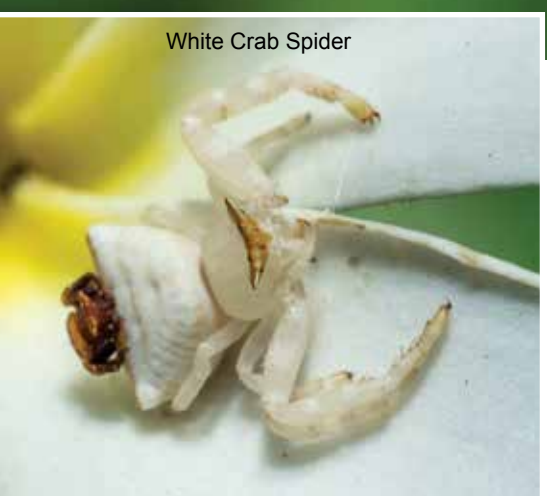
We are introduced to spiders at an early age, and taught that spiders build webs. But not all spiders build webs. Some live as wanderers, searching for their next meal. In fact, even for spiders that build webs, there is a great diversity in web shape, size, and structure. Webs are made from silk, an extremely strong fibre. Spiders have glands that secrete silk proteins, which are dissolved in a water-based solution. This protein secretion is pushed out through specialized appendages. The spider pushes the liquid solution through long ducts, leading to microscopic spigots on the its spinnerets. Depending on the species, there can be anywhere between one to four pairs of spinnerets, but usually there are three pairs. When exuded by the gland, the silk is actually a liquid. The way it is pushed out by the spinnerets causes the internal structure of the protein to change and it gets solidified. By winding different silk varieties together in varying proportions, spiders can form a wide range of fibrous material. They can also vary fibre consistency by adjusting the spigots to form smaller or larger strands. Some silk fibres have multiple layers. Spider silk can also be coated with various substances suited for different purposes, e.g. with a sticky substance or waterproof material.

The most well-known use of spider silk is to build a web, which is used to capture prey. Structure

Ant-like Crab Spider

Jumping Spider *Chrysilla*

Neoscona with prey



White Crab Spider

and placement of the web varies from species to species and depends on the choice of prey. Vertical, orb-shaped webs are most common, and are usually built to catch insects in horizontal flight. Some spiders build horizontal webs to catch insects flying up from the vegetation. Others have complex structures, and it is difficult to comprehend their hunting strategies. Spiders that build webs generally have poor eyesight, but are extremely sensitive to vibrations, and can deal with their prey even in complete darkness.

Spider silk is one of the most elastic and tensile natural substances in the world. This means that spider silk can be stretched more than most known materials before it breaks or loses shape. In other words, it can carry great amounts of weight before breaking. Some types are five times as strong as an equal mass of steel. Giant Wood Spider *Nephila pilipes* builds some of the most astonishing webs in India. Though not very complex, these webs are enormous. The females are known to build webs stretching between two tree trunks which can be more than 3 m apart and 6 m tall! These giant webs are used not just for catching insects, but even vertebrate prey, such as small birds and bats.

Impressive as Giant Wood Spiders are, they are not very particular when it comes to cleaning their webs. Dried leaves, small twigs, remains of consumed prey, and even unwanted smaller prey can be seen dangling in the webs for many days. But what is unwanted by the Giant Wood Spider is useful to other spiders. Dewdrop Spiders belonging to the genus *Argyrodes* are kleptoparasites. Though capable of spinning their own webs, they live on the webs of larger spiders. In fact, at times, they build a minimalistic web hanging from a bigger spider's web. These webs are not meant to catch prey, but probably act as a quick escape route, or a place to rest. *Argyrodes* may have a commensal or even a mutualist relation with their host, in fact some species even prey upon the host. *Argyrodes* spiders are small, most species not exceeding 1.5 cm in length. Giant Wood Spider females are only interested in larger prey that gets caught in their webs, while the smaller insects caught provide ample food for the smaller *Argyrodes*. A single Giant Wood Spider web can be home to several kleptoparasitic spiders.

Other spiders do not build simple webs as those of Giant Wood Spiders. Signature Spiders *Argiope* spp. and some others are known to decorate their webs with specialized silk. These decorative structures are known as stabilimenta (sing. stabilimentum), but their exact function is not known. Scientists have proposed and debated on various theories, including that they serve to attract prey, make the spider look bigger, and deter predators or animals that could damage the web. Garbage-line Spiders *Cyclosa* spp. also build stabilimenta, but their intention seems slightly more obvious. Besides the stabilimentum, they decorate their webs with garbage (hence the name), including leaves and twigs that fall on the web, and remains of prey. This ornamentation hides the actual location of the spider, camouflaging it from predator and/or prey.

Tunnel-web Spiders, mostly *Hippasa* spp., place thin silk threads radiating from their web-tunnel, spread over the ground. An unsuspecting prey walking over these web threads creates vibrations, which are sensed by the spider waiting in ambush. A similar strategy is used by several tarantulas and related spiders (infraorder Mygalomorphae). Most of these spiders live in tunnels built in the soil. Just like tunnel-web spiders, they too line their tunnels and surrounding grounds with thin threads of silks, which act as tripwires. Trapdoor Spiders (also belonging to the same infraorder) go one step further to conceal their burrows. The trapdoors are so well camouflaged against the ground that it is next to impossible to find them. When an alarm is raised by the tripwires, the spider leaps out in one swift movement, catches the prey and drags it into its burrow, placing the trapdoor back in position, all this within a fraction of a second.

Then there are some spiders that procure food without building webs at all. We are all too familiar with Jumping Spiders (family Salticidae), which can be found easily in our homes and gardens. Although jumping spiders can create silk, they don't build webs. Equipped with the best vision among spiders, they detect prey with their keen eyesight and then chase or ambush it. Their large frontal eyes aid their superior vision, which these spiders use to navigate and communicate. Quite a few jumping spiders are brightly coloured, and

Cyclosa Spider with garbage

Cyclosa Spider web with stabilimentum

Two-tailed Spider with egg case

Redstart caught in Giant Wood Spider web

males of some species are even known to 'dance' to attract females.

Another familiar group of spiders that do not build webs to catch prey are Lynx Spiders (family Oxyopidae). These display a variety of techniques to capture their prey, including ambush, chasing, and stalking. Again, just like jumping spiders, these spiders too have keen eyesight.

Some spiders use mimicry instead of a web to catch their prey. Most noticeable among these are the ant-mimicking jumping spiders. But they are not the only spiders that mimic ants. The ant-like Crab Spider *Amyciaea* sp. mimics the worker of weaver ants and preys on unsuspecting ants on their march in the forest.

Just like mimicry, camouflage too is an aid to hunting. Two-tailed Spiders *Hersilia* spp. live on tree bark. At first glance, it is extremely difficult to spot them even at close range. But just like tunnel-web spiders, two-tailed spiders also spread fine silk threads over the bark, which alert them to any movement around them. So, although it is not elaborate, two-tailed spiders do use a web to capture their prey. Some crab spiders do not need even this minimal amount of webbing to catch prey; these species are brightly coloured, an adaptation to match the colour of the flower on which they wait to ambush their prey.

Although the two-tailed and crab spiders do not build webs to catch prey, they are still capable of producing silk, and use it in other ways. Jumping and lynx spiders create safety lines while jumping long distances. Jumping spiders, which are diurnal, also build shelters to rest at night or to escape unfavourable weather. Several spiders wrap their eggs in a silken eggcase to protect them. The young of several spiders use their webs like parachutes while dispersing from their birth place.

One of the most common uses of spider silk is the dragline. As some spiders move from place to place, they lay out a thin, dry thread behind them. Just like a mountain climber, the spider uses the thread as a safety line. If it gets into trouble, it can quickly backtrack on the line to get to safety. Many female ground spiders secrete a pheromone on their dragline. When males of the same species come across the dragline, they "smell" the pheromone with the chemical sensors on their front legs and follow the dragline trail to the female.

Recent studies have revealed that several spider web proteins and toxins may have beneficial applications for humans, including as medicine. To understand these benefits, we first need to understand spiders. Having read all this, do you still find the spider creepy or fascinating? The choice is yours. ■

Pranad Patil is a naturalist working with a private lodge located at Kanha Tiger Reserve. He loves wildlife photography and writing about natural history.

Parley with the Mind

Text and Photographs: **Rushikesh Chavan**

Forest guards patrol forests in some of the most challenging environments, they are pivotal protectors of elephants.The present survival challenge is probably the toughest that elephants have faced in the five million years of their existence

It has been more than a year since my last article in *Hornbill* (Jan-March 2017, 10–15), and with each day that passed by, I drifted in and out of my day dream of the 'great things' that conservation could achieve, and also on ways of achieving these goals. The thing about working towards goals is that they usually have humble beginnings. Wes Jackson, who co-founded The Land Institute which aims for the development of "Natural Systems Agriculture", had said "If your life's work can be accomplished in your lifetime, you're not thinking big enough." But the question is, does one have the luxury of multiple lifetimes? When your life's work is conservation, you need to be reminded that you are

Protection camps are isolated from civilization, with most lacking basic amenities such as electricity, water supply, and comfortable living and working spaces. A forest guard's job profile is physically challenging and psychologically stressful, especially in tiger reserves. Talking to these guards to understand their associations with the forest and their job is essential

dealing with *Homo sapiens*. "*Sapiens*" means wise, but humans, I believe, are short-term and utility-maximizing idiots; what I mean is humans make choices that may maximize benefits in the short-term but tend to be disastrous in the long run.

This becomes a complex challenge as conservation is not one person's job, it is a collective responsibility. Then again, conservation cannot be achieved through people having just a liking for the wilderness, but through changing belief structures that lead to the desired change in action in a very short space of time. This requires one to parley with human minds, and this brings us to my subject of work – Conservation Behaviour. I started a division on Conservation Behaviour a couple of years ago at the Wildlife Conservation Trust, with a vision to bring about the desired change in humans to achieve conservation goals. This division, which I now head, provides technical inputs for designing conservation interventions. It uses frameworks from economics, psychology, sociology, and anthropology, with strong ecological foundations as tools to gather insights into ground realities. It acts as a catalyst between grassroots action and policy stimulus. We evaluate and compare existing policies and practices, and assess their impact using primary and secondary data, to come up with white papers. We use contemporary public policy design models to suggest optimal policy to aid conservation.

Our Division (Conservation Behaviour or CB) works across individuals, groups, organizations, corporations, government, and administration. Currently, it is using tools from economics and social psychology to understand the drivers for various actions, such as firewood consumption by villagers living in and around forest, and measuring associations of forest guards towards forest and their duties, making CB an amalgamation of economics, psychology, ecology, and other social sciences for the conservation of nature.

My last article talked about how the tools of economics, such as valuation of ecosystems, cost-benefit analysis, game-theory applications, Elinor Ostrom's principles, and much more, provide us with a language to

communicate. However, there are limitations, and one must understand that such tools are like a double-edged sword. In economics, we use the belief that people make rational choices. This rationality is based on the information that an individual has, and the short-term constraints he/she faces at that point of time. We do observe that not all such choices make economic sense. Are we then truly rational?

We know that choices are made based on our preferences and associations, and these lead to our actions. That's our cue for the parley with the mind. I am not trying to have a conference with the mind, or treat it as an enemy, or create a revolution. What I am trying here is to provide a perspective of thinking to people, a perspective that aligns our actions in a way that we have a continued growth path that does not destroy the ecosystems and the services we get from it. To do this, first I need to understand the human mind; how it thinks in a societal framework, and the connections of human behaviour and its interactions with nature. There lies the realm of conservation psychology.

It is romantic to think that you can provide people with a perspective by indulging their minds, but it is not that simple. The question then is how does one move ahead? We started with standard procedures and proven theories and applied them to conservation. What took really long was asking the right question. What exactly do we want? Are these tools the right ones? Are we doing things just because we found some tools? Once these questions were answered, we set to work on our conservation challenges.

Forest guards are the foot soldiers of the forests of India, forming the first line of defence. Therefore, we wished to understand how forest guards associate themselves with forests, wildlife, and their own duties. With this in mind, we went to collect data in tiger reserves, using a robust sampling method. We conducted two survey tests: one explicit, the other implicit. We interviewed 'sample' guards at their protection huts, filling up the questionnaires with their responses. This is tough, as you have to maintain composure at all times for days on end and remain neutral, ensuring that your own biases do not creep in. The rigour is tremendous but there are perks to this job, like being able to

Practically all Indian forests are dotted with villages and farmlands. The interaction of people with the forest on a daily basis is therefore unavoidable, invariably leading to conflicts. If both man and nature have to thrive, villagers will have to get better at understanding and conserving these natural resources

work in remote forests, and to watch the stars at night from the verandah of a century old forest rest house.

During a questionnaire survey, all care that can be taken is taken, surveyors are trained, questions are carefully worded, bias is eliminated, and so on; yet there is a chance that the response might be what the guards perceived to be the right answer. This we realized in one of the tiger reserves, where we sampled the guards who came to the centrally located health camp. The results were inconsistent and had to be discarded. Smart solutions do not necessarily give the desired results!

In the implicit test survey, known as Implicit Association Test or the IAT, we showed guards a set of pictures of forests, wildlife, villages, agriculture, on laptops. They were asked to hit a couple of keys in response, as quickly as possible. It plays out like a game that allows us to measure their associations. The data is just numbers, showing the time taken for each response, which is in milliseconds. But these numbers together reveal a story, providing us insights into the minds of the forest guards. So far, we have collected data from eight tiger reserves and one wildlife sanctuary. Our aim is to collect data from all tiger reserves in at least one state.

Researchers need to carry out qualitative assessments to understand forest dependence, associations, and culture of villagers living in and around forests to find solutions to problems

Once we have the data, we can analyse, interpret, and use it. It is easy to look at data, the results, and put forward findings, but one needs to be prudent, knowing what impact one's findings can have. We will use our results to design interventions that are targeted at improving motivation levels of frontline forest staff. This is possible as the associations forest guards have with their work, forest, or wildlife manifest into motivation (or the lack of it). If we can do this, that is, improve the associations resulting in better motivation, we could improve the protection of our forests multifold. After all, these forest guards are, as I stated earlier, the first line of defence, the police of the forest, the enforcers of law.

This sounds like a good start, but we also have to think of the forests that are not protected as such, and are forests that communities depend upon. The forest cover of India currently stands at about 21.34%. The total area protected as forest is only 5%, the rest is under multiple-use areas. Our researchers have been studying tigers living outside protected areas for a few years now, and have come across an extremely fascinating forest block with 600 villages and 44 tigers. This poses a challenge for conservationists, right in their faces!

The people who depend on forests for firewood, food, fodder for their livestock, income, and much more, are

some of the most marginalized ones in India. Such unprotected forests are rapidly degrading, and there is human-wildlife interaction that many a times leads to conflict. And in all this chaos, there are tigers breeding and their numbers constitute more than half of those inhabiting tiger reserves in this country, if compared one on one! The dilemma is, if you stop the people from exploiting the forests, you send them to the guillotine; if you allow business as usual, the forest would be gone and eventually the people would be in peril. So what do you prefer, a slow death or an instant one? That is what challenges looks like. Can we declare the area as a national park? No, we cannot. So people will have to change their behaviour for their own survival, if not for the survival of the forest and the wildlife it harbours.

CB Division decided to take up the challenge. We identified 144 odd villages that were of conservation priority, and set out to determine the drivers for firewood consumption. Firewood extraction from forests leads to degradation, and if this degradation is to halt, firewood consumption needs to go down, and besides alternative fuels, there has to be a behavioural change in the psyche of the people. Hence, our objective was to develop a map of the economic and psychosocial understanding of the communities with respect to firewood consumption. We collected the largest dataset from the region from over 3,000 households. The psychological insights that it will provide could be the key to finding an equilibrium, of having the cake and eating it too.

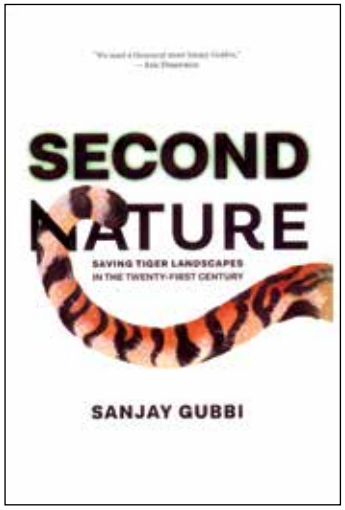
These are just a couple of initiatives I have started, and there is a lot to do. Conservation psychology will have to play a big role, if conservation has to succeed. We don't know where the tipping point is for nature to just accelerate the rate of destruction. We also don't know the tipping point of conservation action, where we could reverse the damage. But if there is one way to reach that tipping point, where we can hope for a snowball effect for conservation, it will be through the tools of conservation psychology. The applications of which are not just to change behaviours of individuals, but communities, bureaucracy, and the government alike.

My hope is that the seeds of conservation behaviour will spread and take root in mainstream conservation practices

Conservation psychology is in its infancy, at least in our country. Only time will tell if the promise that it holds fructified or not. What I can do is make an honest attempt. As for you guys, let me share a conservationist's frustration – passionate people with inadequate skills and skilled people with inadequate passion for conservation. One does not need to know major details of ecology to be able to contribute. If you have the skills, no matter in which field, you have a chance to contribute, if you can also develop the passion. So don't look at conservationists to solve problems, be a part of the solution. For this you will have to sharpen your skills, think how they can be applied, go out and try. Having said that let me put a caveat here – good intentions are not enough. You will have to build your understanding of conservation issues or else you might just spoil it for someone else forever. Let me give an analogy: I have a passion for saving lives, so I will operate on patients on Sundays! Harness your skill, develop it, put it in a conservation perspective, and join forces with conservation organizations. You could make a really meaningful contribution.

As for Conservation Behaviour, it is no magic potion, but it definitely is a melting pot for various sciences working towards the cause of nature conservation. It will not only provide the language to speak in, but also a platform for bringing about a desired change through collective action. ■

Rushikesh Chavan is a conservationist and leads the Conservation Behaviour Division at Wildlife Conservation Trust.



Second Nature: Saving tiger landscapes in the twenty-first century
Author: Sanjay Gubbi
Rainfed Books,
Tamil Nadu, 2018
Pages: 126
Size: 21.5 x 14.5 cm
Price: INR 499/-

Reviewed by: **Asad R. Rahmani**

A clear message that one gets after reading this book is that Sanjay Gubbi is a dogged fighter and will not relent till he achieves what he sets out to do. I met Sanjay about 15 years ago during a meeting in Delhi, and have admired his commitment to conservation since. This book has enhanced that admiration. I agree with Eric Dinerstein "We need a thousand more Sanjay Gubbis."

This sleek 126-page book describes Sanjay's fight for our beleaguered wildlife in eight chapters, each telling the story of labyrinthine bureaucratic processes, political manoeuvres, scheming *babu*s ready to serve their political bosses, dedicated forest officers working under pressure, and some upright no-nonsense IAS officers. It also tells us that it is not enough to be a devoted field biologist, collecting data and publishing the findings in "peer-reviewed, high impact journals". Good science should be written in a manner that it is understood by the judge who decides on a PIL, or a member of the State Wildlife Board who has to be convinced to expand a sanctuary or prevent mining in a forest or grassland. All young conservationists and advocacy/policy experts should read this book to know how intractable conservation battles are fought to their logical end. Sanjay writes "One has to be polite and simple in approach, speak the local language, and explain even the most scintillating scientific facts in a straightforward and simple manner." (p. 32).

The first chapter 'Closing the Mysore-Mananthavadi Highway at Night' sets the tone of the book. This chapter read like a detective novel with a plot, sub-plots, intrigues, scheming, and suspense thrown together until the end, when we come to know that an alternative road will be developed outside the reserve. Today, a 10-km stretch of Mysore-Mananthavadi road through Nagarhole Tiger Reserve has been officially decommissioned and a new route developed outside the reserve. Sanjay ends this chapter with a picture of a tigress with her three cubs frolicking undisturbed on the decommissioned road. What an achievement!

Sanjay has many battles to fight; he does not bask in the glory of a single achievement. Chapter two is about the blind spots on the highway cutting through Bandipur Tiger Reserve, and how he was able to ban night driving with the help of committed forest officers of Karnataka. His description of the atmosphere inside the court is delightful – "Everyone … folds their hand, bows their heads and [greets] the Judges as they enter or leave the court hall. The judges never seem to notice these gestures. Perhaps they would notice if they were missing, though!"

Chapter three is about the consolidation of Dandeli-Anshi tiger reserves, close to the Goa border. This chapter also proves how Sanjay's excellent scientific background was used to gather data on the adjoining high-biodiversity reserve forests outside the tiger reserves, and in the highly disturbed human-dominated areas that had been included in the 5,810 sq. km Dandeli Sanctuary. With meticulous planning, field work, old official records, and the help of committed forest officers, he was able to convince the Karnataka government to exclude disturbed areas, and include good forested areas. The result – Dandeli-Anshi is the fourth Tiger Reserve of Karnataka.

About this six-year struggle, he writes "i) Patience and long-term follow-up is necessary; ii) A proper understanding of the issue and its local implications; iii) Understanding the response of officers to conservation issues. And [most] importantly, knowing when to move, at the right time, and with the right people; iv) Understanding that working in tandem with government officials is the key to saving wild habitats." I cannot agree more.

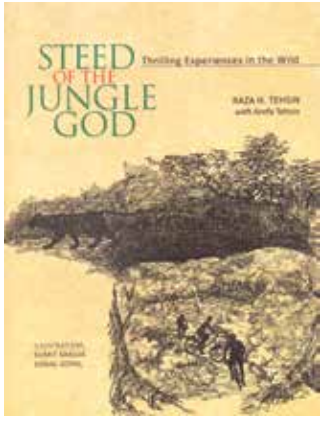
The fourth chapter is brief, and discusses the fight to establish large tiger landscapes in Karnataka. Sanjay worked with dedicated forest officials like Kaushik Mukherjee to expand the state's protected areas by 23%, and the geographical area of the PA network increased from 3.8% to 5.2%. He worked mainly on the corridors, so the current interlinked landscape is *c.* 9,500 sq. km of many protected areas. No mean achievement.

Chapter five deals with the area where the notorious Veerapan was operating before his death brought relief to everyone, including the tuskers and sandalwood that were

his main targets. The remaining chapters are pithy and a delight to read.

The only drawback of the book is the poor quality of images, all black-and-white. On p. 62, the author mentions some rare fish species in the Kaveri (Cauvery) river. It would have been useful if he had given their scientific names. On the same page, he mentions three species of otters, without their names. Of the three species of otters found in India, only two – Smooth-coated Otter *Lutrogale perspicillata* and Oriental Small Clawed Otter *Aonyx cinerea* – are found in south India. Which is the third one?

I recommend the book to all conversationists and decision makers. ■



Steed of the Jungle God: Thrilling experiences in the wild
Author: Raza H. Tehsin, with Arefa Tehsin
National Book Trust, New Delhi, 2018
Pages: 143
Size: 24 x 18 cm
Price: INR 575/-

Reviewed by: **Asad R. Rahmani**

One of the advantages of my peripatetic life in the last 40 years is that I have met some of the finest naturalists and conservationists of India – some well-known and some not known outside their spatial domain. Mr. Raza H. Tehsin is among the second type – well-known and respected only in the Udaipur area of Rajasthan, despite his outstanding conservation work in the last six decades. I first met Mr. Tehsin in 1983 at his house in Udaipur while returning from a survey of the Great Indian Bustard in the Thar Desert. Mr. J.C. Daniel, then Director of BNHS, had asked me to meet Mr Tehsin as he was extremely knowledgeable on natural history of the area. Since then, my visits to Udaipur are incomplete without meeting him. Every meeting enriches me. He is a true naturalist and hunter-conservationist of the old-world type. Unfortunately, there are very few like him.

Like most people of his age and family background, he started as a hunter. His first 'hunting expedition' was at age three in 1945! Even during his early hunting days – the book is replete with amazing stories of his childhood exploits – he was a keen observer of nature. Nothing escaped his eyes – and he can tell a readable story of a trip that happened five decades ago in a remote valley in the Aravallis. This book is full of amazing natural history stories.

The Prologue "Jungles and I" sets the tone of the book. All 20 chapters (two written by his sister, one by his brother) reminisce about days when the Aravalli forests, wetlands, and grasslands were full of wildlife; when the lakes of Udaipur used to brim with water, replete with murrels; marshes that provided nesting grounds for countless water birds, and every hillock had its resident leopard or tiger.

Mr. Raza Tehsin is a life member of the BNHS and has written many short notes in the *JBNHS*, recording 14 species new to southern Rajasthan, including Mouse Deer, Brown Flying Squirrel, and a mysterious snow trout species from a subterranean cave, suggesting an ancient connection of Rajasthan with the Himalaya, where snow trout are distributed.

The book is full of natural history observations from his young age to date. However, some may find his hunting exploits disturbing to read, but they are from the 1950s and 1960s when hunting was quite prevalent in India. If he did hunt a few leopards earlier, he has also been instrumental in the establishment of three wildlife sanctuaries – Phulwari-ki-Nal, Sitamata, and Sajjangarh. How many conservationists can claim such a credit? Besides, Mr. Raza Tehsin has established a cadre of young conservationists in southern Rajasthan. The respect that he commands in the region must be seen to be believed.

Mr. Tehsin frequently writes about the witches, ghosts, spirits, and demons that are supposed to frequent isolated and dilapidated forest rest houses, adding attention-grabbing twists to his narratives. I particularly liked the chapters *The Gliding Spirit* and *Airborne Evil*.

Mr. Raza Tehsin is a naturalist *par excellence*. His observations on parental care in murrels (snakeheads) rival research papers published on this issue by many.

The National Book Trust is known for publishing good books, and this is another feather in NBT's cap. The illustrations by Sumit Sakuja and Sonal Goyal verge on the mystical, quite appropriate for a book written by a writer with decades of natural history wisdom. ■

A walk in the woods

A walk in the woods after my morning tea has been my practice for long. On the morning of June 12, 2016, I got a call from Mr. Thimmanna Kunabi, a young tribal of our area. The next moment, I was out with him, and after walking for some time, we reached an open patch beyond which were the Western Ghats ranges rising elegantly along the horizon. On reaching Kaiga Ghat, we were mesmerized by the panoramic view of the majestic Kali river and the Kaiga Power Plant. As the sun emerged, a dim auroral glow engulfed the mist, and there was a dramatic change in the hues of the sky with every passing minute. Sunrays penetrated through the openings in the thick vegetation, the thick green foliage became visible, and peaks emerged from the mist. The morning dew lodged on almost every grass blade sparkled as light refracted through countless water droplets.


PUTTARAJU K.

Kaiga Nuclear Power Plant is situated on the left bank of river Kali that supports a wide spectrum of flora and fauna. The exclusion zone of the Kaiga Plant, an area of 1.6 km radius, is home to three species of hornbills, the Malabar Pied *Anthracoceros coronatus,* Malabar Grey *Ocyceros griseus*, and Great Pied *Buceros bicornis*, and several other species of birds. The Kaiga region has diverse fauna and flora, and harbours about 248 species of birds, 260 species of butterflies, and a variety of mammals.

Suddenly, we heard a loud sound of langurs escaping from the tree canopy. Then a young man exclaimed, "*Singalika*!" In Kannada, that referred to the Lion-tailed Macaque – an IUCN-listed Endangered species, not documented very often, and native to the Western Ghats. To photograph this species, I waited from 6:30 to 9:00 a.m., but I could only see langurs. All of a sudden, a langur started moving frantically through the canopy. I hoped that this might possibly be the time to see the Lion-tailed Macaque, and yes! I was lucky enough to see it. It plunged straight onto a Kokum *Garcinia gummi-gutta* tree to feed. This tree flowers during December to April, while its peak fruiting period is June-July. It is a valuable medicinal plant, rich in hydroxycitric acid. Tribals and other local people use it in their traditional food and medicine. Its culinary and curative virtues are well-known globally. *Garcinia gummi-gutta* is used in preparation of confectionery, whereas the fruit is used in fish and mutton delicacies, in the Western Coast of Karnataka and Kerala. When the Malabar coast was under the control of the Portuguese, they used to prepare a type of ghee from the seed of Kokum fruit, locally known as Uppage Thuppa.

Lion-tailed Macaque can be seen along the Kaiga forest just 3 km away from the Kaiga Power Plant. These are medium-sized macaques with shiny black fur and long greyish-white hair around the face. They derive their common name from the tail, which has a tassel at the end like that of a lion. They are very shy and spend most of their time high up in the trees in dense wet forest, in groups of around 20 to 30 individuals. I have been monitoring their activity since three weeks after my first sighting, and have seen three or four individuals, including a young male. Their presence gives us the hope that the relics of primeval forest still remain in the Kali valley. ■

Puttaraju K.
Karnataka

Where have all the sparrows gone?

Everyone has pleasant memories of childhood, mine are of sparrows. I learnt much later that ornithologists call it the House Sparrow or by its Latin name *Passer domesticus*. I first learnt about the sparrow in a short tale my parents would tell me – the story was about a selfish crow and a generous sparrow; I have been fascinated by sparrows since then and I could see and hear them, almost every day in my garden. It was as if characters from the story were coming to life.

One afternoon, I heard incessant chirping from my garden and couldn't resist looking out of the window. Around 50 sparrows were hopping about on a Pinwheel

Flower *Tabernaemontana divaricata* shrub. I had never seen such a large flock, almost no leaf was visible on the shrub as the sparrows had blocked them from my view – for a moment I believed that I was looking at a 'tree of sparrows'. This episode is engraved in my memory and is the reason for my love for birds.

I began feeding the sparrows daily, but time gradually weakened our bond. Years later, when I looked for my friends I realized that their numbers in my area had decreased. The shrub where I had once seen the huge flock was hardly visited by the sparrows. My garden has not changed over the last few years. This forced me to look for reasons behind the decline. Could the decrease be attributed to the increasing number of buildings in the area, or to the increase in population of other bird species? Experts feel that the decrease in sparrow population is mainly due to loss of habitat, loss of nesting sites, and food scarcity.

Recently I heard the same energetic chirping of a sparrow from the Pinwheel Flower shrub. The excitement of meeting my childhood friends was so high that I rushed to the window. I saw a sparrow hopping from one branch to another as if it was looking for something. I could not immediately locate the source of its curiosity, but it turned out to be a juicy green caterpillar which was so well camouflaged. After several attempts, the sparrow was able to find the caterpillar. But suddenly,

GOPI NAIDU

a pair of Red-vented Bulbuls flew in from nowhere, and began pecking at the sparrow. The sparrow abandoned its prey and flew away. This made it easy for the bulbul to pirate the caterpillar. The bulbul flew off with its prey in no time.

Like me, many others must be missing their childhood friends and wondering "Where have all the sparrows gone?" ■

Sailee Joshi-Gupte
Maharashtra

ABOUT THE POSTER

Kingcup is a rhizomatous perennial from the family Ranunculaceae that grows naturally in damp sites in marshes, swamps, wet meadows and woodlands, and along stream margins. It flourishes in places with oxygen-rich water near the surface of the soil, preferring fertile soil, and is shy of brackish water. It has shiny green, heart-shaped leaves borne on long, smooth, hollow stems. The rich golden flowers are five-petalled and form a cup, much like the smaller Buttercup. It is also known as Cowslip. A harbinger of spring, the plant flowers from March to August, depending on altitude and latitude, but occasional flowers may appear at other times. Each fruit produces up to two hundred seeds. When the follicles open, they form a "splash cup", which when hit by a raindrop at the right angle expels the seeds. The seeds have a spongy tissue that makes them float on water, until they wash up at a location suitable for them to germinate.

DHRITIMAN MUKHERJEE

Kingcup *Caltha palustris* L.

The generic name *Caltha* is derived from the Ancient Greek *kálathos*, meaning "goblet", and refers to the shape of the flower. The species epithet *palustris* is Latin for "of the marsh" and indicates its habitat.

DHRITIMAN MUKHERJEE

Kingcup *Caltha palustris*

Plantain-leaved Habenaria

Golden Yellow Habenaria

Habenarias of Maharashtra

Text: **Mandar Sawant**

Orchidaceae is one of the highly evolved, diverse, and successful families of flowering plants represented by around 28,000 species, distributed across the world, occupying almost all habitats except glaciers. It is the third largest family of flowering, plants in India, represented by *c.* 1,300 species and 168 genera. *Habenaria* is one of the largest terrestrial genera of the family Orchidaceae, represented by *c.* 848 species globally, of which 72 species are found in India, including 36 endemics.

The name *Habenaria* is derived from the Latin *habena* meaning whip or strap, referring to the thread-like fringes of the 'lip' of the flower in some species. The genus *Habenaria* was first formally described in 1805 by Carl Ludwig Willdenow. Identification of *Habenaria* species is somewhat tricky as there is little variation in its general habit. The plants can be herbaceous with perennating tubers or tuberoids; leaves are scattered on the lower part of the stem or clustered at the base; flowers usually have a three-lobed lip.

Lateritic plateaus make a unique habitat for these plants, hence rendering high endemicity. Otherwise, they also occur in open grass fields, undergrowth of evergreen forest, or the edge of semi-evergreen to dry deciduous forests. In the wild, new leaves sprout on these plants with the onset of rain. Most of these species flower through the monsoon. Flowers are white, green, yellow, and shades of these colours, or they can be vibrant in different shades of red, orange, and pink. The coloration of these flowers defines who their pollinator could be, moths and butterflies being the most likely pollinators.

The Western Ghats of India are well-known as a global mega biodiversity hotspot, with a vast diversity of habitats for different plant groups, including orchids, and especially *Habenaria.* At least 45 species of *Habenaria* are known to occur in the Western Ghats, of which 21 species are endemic. Described below are 19 species of *Habenaria* found in Maharashtra.

Long-spurred Habenaria

Commelina-leaved Habenaria

Gibson's Foetid Habenaria

Roxburgh's Habenaria

Beaked-fruit Habenaria

Dancing Doll Habenaria
(ACN: Doll Orchid)

Plantain-leaved Habenaria
Habenaria plantaginea
Height 20–40 cm.
Leaves 3–6, clustered at base,
elliptic oblong, spreading, acute.
Petals subfalcate.
Lateral lobes of lip longer than midlobe.
Spur longer than ovary length.
Found growing on hilltops or open slopes in
deciduous to evergreen forest.
Flowering and Fruiting: September–October.

Long-spurred Habenaria
Habenaria longicorniculata
Height 40–90 cm. Leaves 3–10, clustered near
base of stem; oblong, rarely linear, acute,
margins pale. Petals subfalcate. Midlobe of
the lip shorter or equal to the lateral lobes.
Spur longer than ovary. Found growing
in sloping grass fields on hill slopes.
Flowering and Fruiting: July–September.

Commelina-leaved Habenaria
Habenaria commelinifolia
Height 40–75 cm. Leaves 3–6,
spreading, alternately distichous, cauline,
oblong acute, and green. Lobes of lip not
similar in length. Spur just longer than ovary.
Usually found growing among grasses on hill
slopes in dry deciduous forests.
Flowering and Fruiting: August–September.

Gibson's Foetid Habenaria
Habenaria gibsonii var. *foetida*
Height 20–45 cm. Leaves 5–7, ovate, acute, wavy margin, upper surface pale green with yellowish hue, lower surface pale green. Lobes of lip not similar in length. Spur slightly longer than ovary. Found growing on hill slopes in moist deciduous forest. Flower with good smell is *Habenaria gibsonii* var. *gibsonii* while the one with foul smell is *Habenaria gibsonii* var. *foetida*. Flowering and Fruiting: August–November.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Golden Yellow Habenaria
Habenaria marginata
Height 10–35 cm. Leaves 2–5, spreading, sessile, scattered in the lower or middle part of the stem, oblong-ovate. Petals falcate from the base. Lobes of lip similar in length. Spur more or less equal to the ovary in length. Found growing in muddy areas near bushes or on hill slopes in dry to moist deciduous forests. Flowering and Fruiting: September–November.


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Roxburgh's Habenaria
Habenaria roxburghii
Height 30–40 cm. Leaves 2–3, flat on the ground, base sheathed, oblong, elliptical, acute; all lobes of lip of similar length, mid lobe linear with incurved apex. Spur longer than ovary. Found growing on grassy slopes of hillocks. Flowering and Fruiting: July–September. Endemic to India.


SACHIN DANGAT

Beaked-fruit Habenaria
Habenaria rhynchocarpa
Height 40–80 cm. Leaves 6–10, spreading, in a cluster near the middle of the stem, oblanceolate-elliptic, acuminate. Petals 2-partite. Lobes of lip not similar in length. Spur longer than ovary. Found growing in primary evergreen forests. Flowering and Fruiting: August–December.


MANDAR SAWANT

Dancing Doll Habenaria
(ACN: Doll Orchid)
Habenaria crinifera
Height 10–30 cm, rarely epiphytic on mango trees. Leaves 2–4, clustered at the base of stem; oblong-elliptic or oblanceolate, acute and somewhat tapered at the base. Lobes of lip not similar in length. Spur much longer than ovary. Found growing in wet deciduous to semi-evergreen forest. Flowering and Fruiting: August–September.


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Large-flowered Habenaria
Habenaria grandifloriformis
Height 10–18 cm. Leaves 1–2, opposite, usually single, solitary, orbicular to cordate and rounded, lying flat on the ground. Petals 2-partite. Lobes of lip not of same length. Spur and ovary almost same in length. Found growing on hill slopes along with grasses in deciduous to evergreen forests.
Flowering and Fruiting: June–September.
Endemic to India.


MANDAR SAWANT


MANDAR SAWANT

Spreading-flowered Habenaria
Habenaria rariflora
Height 10–25 cm. Leaves 1–2, clustered at base, thin, variable in shape. Petals bifurcate. Lateral lobes of lip scarcely longer than mid lobe. Spur longer than ovary. Found growing among vertical rocks, rarely on the ground, in semi-evergreen and evergreen forest.
Flowering and Fruiting: July–August.
Endemic to India.

Reniform-leaved Habenaria
Habenaria reniformis
Terrestrial slender herb with perennating tubers,
Height 10–25 cm. Leaves 1–2, flat on the ground, 2–4 cm, with or without a small leaf-like bract just above, coriaceous, ovate-oblong. Petals subfalcate. Lip white, 3-lobed, all lobes not similar in length. Spur and ovary almost the same in length. Found growing in open, moist or marshy areas in moist deciduous forest.
Flowering and Fruiting: August–September.


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Fork-lipped Habenaria
(ACN: Forked Habenaria)
Habenaria furcifera
Terrestrial herbs with perennating tubers, height 40–60 cm. Leaves 4–7, elliptical, acute, long, spreading, cauline, and clustered on lower stem. Lip green, lobe trifurcate right to the base; lateral segments diverging, much longer than mid lobe. Spur slightly longer than ovary. Found growing on hill slopes in moist deciduous to semi-evergreen forest.
Flowering and Fruiting: August–November.


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Panchgani Habenaria
Habenaria panchganiensis
Height 10–26 cm. Leaves 3–5, clustered at the base, sometimes spreading flat on the ground, linear-oblong, acute, erect. Midlobe of lip slightly longer than lateral lobes. Spur shorter than ovary. Found growing on hilltops and lateritic plateaux.
Flowering and Fruiting: June–August.
Endemic to India.


MANDAR SAWANT

Oval-leaved Habenaria
Habenaria ovalifolia
Height 20–60 cm. Leaves 4–6, clustered at the end of the stem or just above the ground, oblong-lanceolate, broad, entire, acute. Lobes of lip not similar in length. Spur longer than ovary. Found growing in undergrowth of semi-evergreen to evergreen forest.
Flowering and Fruiting: August–October.

Thick-leaved Habenaria
Habenaria brachyphylla
Height 10–30 cm. Leaves 2, rarely 3, fleshy, basal, appressed to the ground, dark green above, pale to dull green underneath. Petals not bifurcate. Lobes of lip almost similar in shape and length. Spur just shorter than ovary. Usually seen growing in shady areas of semi-evergreen forests.
Flowering and Fruiting: August–November.
Endemic to India.

Heyne's Habenaria
(ACN: Toothbrush Orchid)
Habenaria heyneana
Height 14–25 cm. Leaves 5–6, alternately imbricating, narrowly oblong, rarely ovate, acute. Petals somewhat falcate. Midlobe of lip longer than side lobes. Spur slightly shorter than ovary. Found growing on lateritic plateaux.
Flowering and Fruiting: August–November.
Endemic to India.

Digitate Habenaria
(ACN: Green Habenaria)
Habenaria digitata
Height 20–60 cm. Leaves 5–7, alternate, acute, elliptic to elliptic-lanceolate or ovate-oblong. Petals 2-partite. Lobes of lip almost similar in shape and length. Spur and ovary almost same in length. Found growing along streams in evergreen and semi-evergreen forest.
Flowering and Fruiting: August–December.


MANDAR SAWANT

Leafy Habenaria
Habenaria foliosa
Height 20–50 cm. Leaves 2–3, flat on the ground, base sheathed, oblong, elliptical, acute. Petal bifurcate. Mid lobe of lip longer than lateral lobes. Spur slightly longer than or equal to the ovary. Found growing in undergrowth of semi evergreen to evergreen forest. Flowering and Fruiting: August–November. Endemic to India.


RAJDEO SINGH

Many-tailed Habenaria
Habenaria multicaudata
Height 30–65 cm. Leaves 5–6, cauline, oblong or elliptic-oblong, apex acute, clustered towards the base of the stem. Petals bifurcate. Lobe 3-partite. Lateral segments of lobe irregularly contorted, longer than mid segment. Spur slightly shorter than ovary. Found growing in open areas in evergreen forests. Flowering and Fruiting: August–September. Endemic to India.

Threats

Many orchids including species of *Habenaria* are under severe threat of extinction. The major threat is from habitat loss due to deforestation, unplanned development, ill-managed tourism, and grazing. Due to habitat loss, even the pollinators are threatened, which in turn poses a threat to these orchids. Unfortunately, very few multidisciplinary studies exist on these orchids in India to understand how their populations are affected by these threats. At the same time, collection by botanists and enthusiasts adds to the threat.

Note: ACN = Alternative Common Name

Acknowledgment

I acknowledge Dr. Sachin Dangat for comments on the first draft and Dr. Pankaj Kumar for providing his expert comments on the final draft and guidance while drafting this article. ■

Mandar Sawant is a naturalist explorer with the BNHS. He is interested in travel, macro photography, and wildlife.

Inadvertent Conservationists!

Text and Photographs: **Arjun Kamdar**

Welcomed by the soaring Hollong trees constantly battling for sunlight, and the characteristic growling of a pair of Hoolock Gibbons, I entered the dense evergreen forests of Dehing Patkai. Morning light filtered through the canopy and the forest was resonating with the calls of cicadas; the whistle of a lone White-cheeked Partridge from afar. Deep Borah, a young lab assistant at Digboi College who was accompanying me, has been part of several studies carried out in these forests in the Dibrugarh and Tinsukia districts of Assam.

As we made our way along the dusty *kaccha* road, we came across a roadkill of an Emerald Dove, its metallic jade-green wings smeared with blood and dust. Not wanting scavengers feeding off the carcass to fall prey to speeding cars, we lifted the remains and left them in the undergrowth a few feet away. The road running through this part of the forest connects Duliajan to Digboi; the economy of both towns is largely run by the oil industry. A job in the government-run Oil India is highly coveted among the locals, as our driver Basha elucidated.

Just a few metres into the trail, a mixed flock of Scarlet Minivets, Sultan Tits, and Velvet-fronted Nuthatches flew noisily over our heads. The forest was teeming with birdlife; my neck ached from craning up to the canopy in an attempt to locate the sources of the melodic mix of calls! I didn't know whether to use my binoculars to locate the Yellow-naped Woodpecker calling from my left or to photograph the pair of Grey Treepies on my right, that were screeching at each other while playing a game of tag, darting from branch to branch! While following the flight of a Red-headed Trogon, we accidentally stumbled upon a gang of oil thieves at a pipeline. Alarmed, one of them brandished a large wrench and shouted at us to take another route and not come closer! There was no mistaking his words, though they were in Assamese. We obliged pronto, and returned to the main road via another *pugdandee* (narrow path). It was then that I noticed the pipelines that run through the jungle, transporting crude oil drilled out from the rig to the refineries.

I thought that such disturbance would be detrimental to the ecosystem of this pristine rainforest; but Deep and a few locals at a tea-house on the periphery of the reserve assuaged my fears. They told me that the oil thieves take great care to ensure that there are no oil leaks after they are done with the pilfering, as a leak would not only expose them but would result in tightened security by Oil India to prevent the theft and the damage to the environment! This is the first time that I have seen such environment-friendly thieves!

Secondly, the thieves not only use this oil to power their homes, cars, and bikes, they also sell the surplus at about Rs. 30 per litre. This reduces their need for firewood, and thereby, their need to venture into the forest. This reduces human disturbance in the forest and ensures that the dead wood that would have been collected as firewood remains, rots, and decomposes in the forest, completing the nutrient cycle.

Thirdly, to carry out this theft, the thieves require the cover of the forest, else they would be easily spotted and busted. Therefore, they make it a point to stop tree felling and their local goons prevent others from doing the same: inadvertent conservationists, so to say!

The loss in material terms for Oil India is not too great, for most thieves commute via two-wheelers and they can at best pinch only a few tens of litres per day in their jerry-

A Hoolock Gibbon (L – female; R – male) swinging from one branch to another in the canopy. The network of paths made by gibbons through the treetops can be traced by the worn condition of the branches

A Spiny Orb Weaver spider hangs from a strand of silk

Green-billed Malkoha has a distinct crimson eyepatch

Roadkill of an Emerald Dove on the Duliajan-Digboi road

Oil thieves making a hasty getaway on spotting the officials of Oil India

cans. Although Oil India officials patrol the area, it is not possible for them to keep a stringent watch on the pipelines that run for kilometres through the hostile forest. Besides, it is financially unviable for them to employ manpower to physically prevent such thefts. This is undoubtedly wrong morally and legally, but the conservationist inside me takes a guilty pleasure in this 'conservation model'!

On the way out, I came across a Coster butterfly flitting around a milestone as though it was reading the number of kilometres to Duliajan. I later learned that the site was the subject of a poignant image clicked by Professor Tariang of Digboi College – a large tusker walking past this same milestone, the pachyderm crossing the tarmac and entering the thick black green of the forest. The image reiterates the need for the preservation of this ecologically important corridor and the crucial part it plays in the survival of several species, both big and small, that dwell in this diverse rainforest. ■

Arjun Kamdar is a student at the National Centre for Biological Sciences. He is interested in the link between economics and conservation.

The New Birdmen of Kheechan

Text and Photographs: **Gangadharan Menon**

The Chugga Ghar was set up at the behest of Ratanlalji

Kheechan is a quaint little village in western Rajasthan that 'sleeps' for almost five months of the year. Around September, the tranquility of the village is replaced with the deafening 'kraaw-kraaw' of migratory Demoiselle Cranes. These birds, locally known as *kurja*, come all the way from Mongolia. Their number keeps increasing till it reaches a staggering 15,000 by January. In February, they begin their homeward journey, in noisy waves. Once the last bird has flown away, Kheechan turns silent again until the beginning of the next migration.

The tireless efforts of Ratanlal Maloo – the birdman of Kheechan – for the arrival of thousands of cranes in Kheechan year after year has been well-documented. I had the good fortune to meet this legend when I first came to Kheechan to witness the annual spectacle of thousands of Demoiselle Cranes descending on the mere thousand square metre Chugga Ghar, where grain is provided to the birds. Sitting under the shade of a 200-year old Khejri tree near his house, he explained how it all began with a mere 10 birds. What started innocuously as a Jain

ritual of feeding birds finally became a globally-known phenomenon. Malooji never failed to acknowledge the role of his Jain community in sustaining this amazing effort. And why not? One needs about 1,40,000 kg of grain to feed 15,000 birds for five months, costing somewhere close to 85 lakh rupees per year! Though the grain came from traders across India, it was Malooji who single-handedly executed the task of feeding the birds. But what happened to the famous cranes of Kheechan after the demise of Malooji in 2009. When I heard about Malooji's passing, I began to dread the thought that thousands of cranes would land in Kheechan as they had for the last 40 years, and would suddenly feel orphaned.

So I travelled to Kheechan where I met Sevaram Mali, a young man of 35, who offered a room in his house for my wife, my son, and me. He assured me that all was well in Kheechan. When the 77-year-old Malooji realized that his arthritic legs couldn't carry him any more to the Chugga Ghar, he trained a Rajput named Gangaram Kadela to carry on the feeding. The Jain community continued its generous contribution of grain under the watchful eyes of a trust.

There were newer problems that needed to be tackled, but Sevaram and his team of birdmen of over a decade, which included Bhojraj and Ranoo, had been doing their best to protect the birds and their habitat. If at all a kurja died in the village, the team would even get a post-mortem examination done to ascertain the cause of death. For his efforts, Sewaram has been conferred the prestigious Sanctuary Asia Award for Wildlife Service.

Sitting on his terrace that offers a ringside view of the spectacle, Sevaram shared with us the birds' routine. He

Demoiselle Cranes patiently waiting their turn for the grain

(R-L): Sevaram Mali with Bhojraj, a dedicated team member

A ringside view of the action from Sevaram's terrace that is open to all

Ratanlalji and his wife, Sundarbai

has been maintaining a meticulous record of the arrival of the first flock to the last, including the timing of their arrival at Chugga Ghar and their departure from there, as well as their daily numbers. Anyone is free to walk into his terrace; he charges no money for this or for the tea he offers with love. He nurses the cranes injured by vicious dogs until they recover and are strong enough to join their flock. In the past, he has fought with the state electricity board to remove open electric lines that were put up in their flight path. And he got the local land mafia to remove the shanties that they had put up perilously close to the Chugga Ghar.

The cranes spend the night in a salty landscape called Malhar Rinn, about 25 km from Kheechan. And just before the sun rises, they fly to the sand dunes overlooking the Chugga Ghar. After the entire flock of a few thousand has collected on the dunes, they slowly march towards Chugga Ghar that is a kilometre away. Here they wait outside the enclosure patiently, for almost an hour. Meanwhile a group of about 30 of them encircle the place, making sure it's safe to land. Once the leader of the flock lands, the entire entourage follows. And then all *heaven* breaks loose !

The cranes, after a sumptuous meal, fly off to the two lakes at the periphery of the village: Vijaysagar and Raatdi Naadi. Here they sip the blueness of the lake and then gobble copious quantities of the pebbles that lie on the lakeshore. Since they swallow the grains whole, they need these pebbles to act as grinding stones in their crop to make the grains easier to digest. Then they have a dip in the lake, and the more romantic among them indulge in ballet-like mating dances. Just before sundown, they call it a day, flying off to Malhar Rinn to spend the night standing on one leg. This routine continues till March, when in the thick of the night, without warning, they fly back to the land of their birth.

Of the 50-odd places where the cranes land, Kheechan is the most popular, probably because of the food they get there and protection afforded. Or, it's simply because the villagers treat them as their own kids. In fact, the farmers here refer to their newly married daughters as 'kurjadi'! Maybe because, like the Demoiselle Cranes, they too migrate to faraway lands to come back only the next year ... year after year. ■

How to get there: Take the road from Jodhpur to Phalodi, which is 135 km to the north. Kheechan is 10 km to the east of Phalodi. The base could be Phalodi, or Osian which is at the halfway mark on the Jodhpur-Phalodi Road.
Where to stay: If you are fine with a basic stay next to the Chugga Ghar, call Sewaram on 09982372596. For other options at Phalodi or Osian, check www.rajasthan_tourism.org
When to go: September to February.

Gangadharan Menon has over 120 articles published in India's leading newspapers. His books on travel, EVERGREEN LEAVES and TALES OF A DRIFTWOOD, are available on Amazon.

Assam MLAs' visit to the BNHS Collection

The wide array of diverse animal specimens housed at BNHS draw the attention not only of researchers, but also laymen, authorities from various fields, and politicians. On May 24, 2018, a group of 11 members of the Legislative Assembly and members of the Standing Committee on Education, Assam, visited the Natural History Collection at Hornbill House. Mr. Rahul Khot, Curator, BNHS, enlightened them about the history of the Society, its role in nature conservation and awareness, as well as the current projects and programmes in the country. He apprised them of the importance of our collections as reference material. Specimens of birds, mammals, and insects were displayed to the visitors by the Collection team, along with talks on these.

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Members of the Legislative Assembly and the Standing Committee on Education, Assam, visited the Natural History Collection

The MLAs were delighted to see specimens of fauna from their region and to learn about the preservation techniques used for each taxon. Before leaving, Dr. Mansing Rongpi, one of the members of the group, told us that the visit was a memorable experience for all of them. ■

Back to the Wild

On June 5, 2018, World Environment Day, BNHS felicitated a group of fishermen for releasing a Whale Shark accidentally caught in their nets around 60 km off Mumbai coast. Dr. Deepak Apte, Director, BNHS, felt that this act needed to be acknowledged and appreciated as Whale Sharks, till the recent past, were brutally hunted along the Indian shores. A Schedule I species under India's Wildlife (Protection) Act, 1972, the Whale Shark also receives international protection due to its inclusion in Appendix II of the Convention on International Trade in Endangered Species of Fauna and Flora (CITES). The Whale Shark is the world's largest fish and categorized as Endangered in the IUCN Red List of Threatened Species.

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Mr. Homi Khusrokhan, President, and Dr. Ashok Kothari, then Honorary Secretary, distributed the certificates

The felicitation programme was conducted at Hornbill House. Mr. Homi Khusrokhan, President, and Dr. Ashok Kothari, then Honorary Secretary, distributed the certificates of appreciation. Mr. Ganesh Nakhwa, Vice Chairman, Purse Seine Fishing Welfare Association, accepted the certificates on behalf of the fishermen. Mr. Nakhwa briefed the audience about the incident, and said that this felicitation would encourage the community towards sustainable fishing and help increase awareness about India's marine biodiversity and the need for conservation.

On this occasion, Mr. Digant Desai, a world-renowned marine photographer and co-author of FIELD GUIDE TO THE SEA SLUGS OF INDIA, made a presentation on the marine life of India where he talked about the mysterious underwater world. Mr. Pradip Patade, a Water Sports instructor at Rae Sports and one of the founders of 'Marinelife of Mumbai', spoke about his ongoing work of creating awareness on marine diversity among laymen. ■

MoEF&CC launches Green-Skill Development Programme

The Ministry of Environment, Forest & Climate Change, Government of India (GoI) has launched an initiative "Green-Skill Development Programme (GSDP)" through its Environmental Information System (ENVIS), to develop green-skill workers having technical knowledge and a commitment to sustainable development. To expand the programme to a larger scale, the Ministry plans to create a pool of master trainers in each course, to further train youth across the country. The vast ENVIS network of 31 States/UT hubs and 35 Resource Partners (RP), with specific thematic mandates, will conduct 32 certificate courses under GSDP.

BNHS, an ENVIS Resource Partner for Avian Ecology, hosted a Certificate Course on "Bird Identification and Basic Ornithology" under GSDP on August 06, 2018. Ten participants were selected for the one-month certificate course. Candidates from tribal areas were given preference for this course. Dr. Anandi Subramanian, Senior Economic Advisor and Mr. Kumar Rajnish, National Coordinator, ENVIS, MoEF&CC, GoI, visited BNHS to encourage the course participants.

The basic course in ornithology was conducted through classroom sessions and field visits in and around Mumbai region. The course was led by Dr. Girish Jathar, ENVIS Coordinator. Dr. Rajat Bhargava, Dr. Raju Kasambe, Mr. Vithoba Hegde, Mr. Rohan Bhagat, Ms. Akshaya Mane, Ms. Parveen Shaikh, Mr. Mandar Sawant, and Mr. Omkar Joshi were the subject experts for the course. Certificates of participation were distributed on completion of the course and a few participants were selected as Master Trainers for the next batch.

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MoEF&CC in discussion with the participants of the Bird Identification and Basic Ornithology course

BNHS-ENVIS conducted a one-month certificate course on "Bird Migration & Migration Study Techniques" on August 27, 2018, for 25 participants. ■

PCCF (Wildlife) of Maharashtra visits Hornbill House

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PCCF (Wildlife) of Maharashtra Shri A.K. Mishra, IFS, along with APCCF (Wildlife West) Shri M.K. Rao, IFS, visited the BNHS Collections on August 03, 2018. The officials discussed the role of BNHS in assisting the State Forest Department and other policy matters with Dr. Deepak Apte, Director, and Mr. Rahul Khot, Curator, BNHS, during this visit. The focus will be on i) Developing a decision support system for the Forest Dept., ii) Developing a long-term monitoring programne for one of the three wetlands of Maharashtra, and iii) Developing a State Level Flyway Action Plan. ■

Delhi Dragonfly Festival – 2018

Dragonflies are colourful, jewel-like, delicate insects, yet they are formidable predators in their aquatic nymphal stage. They are bio-indicators of the health of our environment and play a crucial role in controlling mosquito populations. The loss of wetlands threatens dragonfly populations around the world.

BNHS and World Wild Fund for Nature (WWF) jointly conducted a Dragonfly Festival covering dragonflies and damselflies in August, 2018, in Delhi. The festival was held from August 3 with schools of the Delhi NCR area participating in programmes like 'Be a Scientist for a Day', 'Poster Making Competition' and 'Campus Counts' on the inaugural day. BNHS educators made interesting presentations, using innovative study methods, and distributed a field guide on common dragonflies of Delhi to all the participants. There were also activities like 'Date with Dragonfly', 'Field Study to Okhla Bird Sanctuary', 'Dragonfly Photography Contest', 'Delhi Dragonfly Day', and 'Dragonfly Meet'.

The aim of the festival was to encourage the citizens to learn more about dragonflies and their conservation. Seven universities and 15 schools of Delhi NCR were involved in the dragonfly count, and more than 2,000 students and the general public participated in the various programmes. This month-long celebration helped to mobilize partners for the cause of dragonfly conservation.

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Enthusiastic participants photographing dragonflies during the Delhi Dragonfly Festival

Delhi has over 51 recorded species of dragonfly and damselfly, but the documentation is old. The festival has started a process of documenting these two taxa every year. The festival also aims to generate a database on Delhi's dragonfly and damselfly diversity.

The Conservation Education Centre-Delhi organizes a number of activities aimed at creating conservation solutions that equip the youth with tools to create synergies for a sustainable future. To partner or participate, please email cecbnhsdelhi@bnhs.org. ■

@ UK Birdfair

BNHS participated in the British Birdfair 2018 at Rutland Water, England. The Birdfair is one of the largest gatherings of birdwatchers, conservationists, wildlife tour organizers, artists, and other wildlife enthusiasts. Since 1989 this gathering serves a conservation cause annually. Birdfair chooses an international conservation issue to support every year. This year the cause was the creation of the proposed Ansenuza National Park, which will protect up to 800,000 hectares of Mar Chiquita ('little sea') – South America's second-largest water body, and the fifth largest salt lake in the world.

Parveen Shaikh and Tuhina Katti from BNHS represented BNHS at the Birdfair this year. They presented the organization's work on Central Asian Flyway and Indian Skimmer conservation in Chambal Sanctuary. The BNHS stand highlighted the threatened bird species project, vulture conservation programme, bird migration and wetlands programme. ■

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Published on September 27, 2018, by Mr. Debi Goenka for Bombay Natural History Society, Hornbill House, Dr. Sálim Ali Chowk, Shaheed Bhagat Singh Road, Mumbai 400 001, Maharashtra, India.

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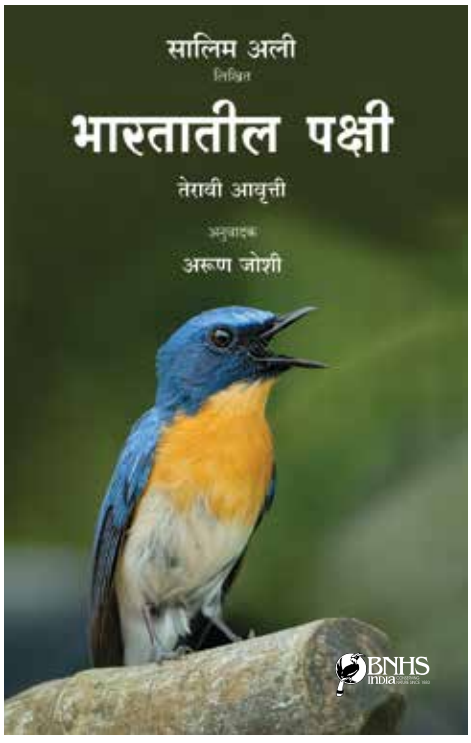

One of the most popular publications of the BNHS, with over a million copies sold since it was first published in 1941, The Book of Indian Birds by Dr. Sálim Ali is now available in Marathi. The book covers 538 birds illustrated in colour and fully described, and gives an account of nest and nesting behaviour, flight, bird migration, and birdwatching, among others.

For detaills contact:

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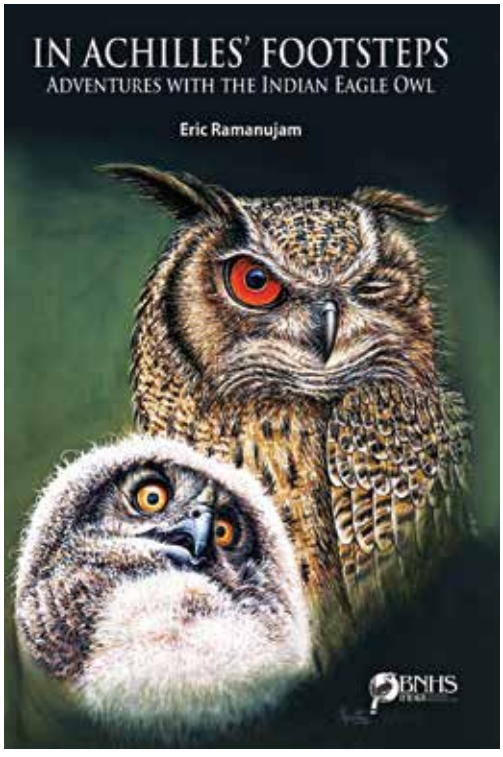

In Achilles' Footsteps

ADVENTURES WITH THE INDIAN EAGLE OWL

Eric Ramanujam

In Achilles' Footsteps: Adventures with the Indian Eagle-Owl (IEO) is an account of Eric Ramanujam's long journey with the IEO in and around Auroville, Puducherry. The book dwells on the ways of the IEO, its prey base, its association with its own and other species, its nesting and breeding ecology. Written lucidly, this scientific biography will be of interest to both the casual reader and serious researcher.

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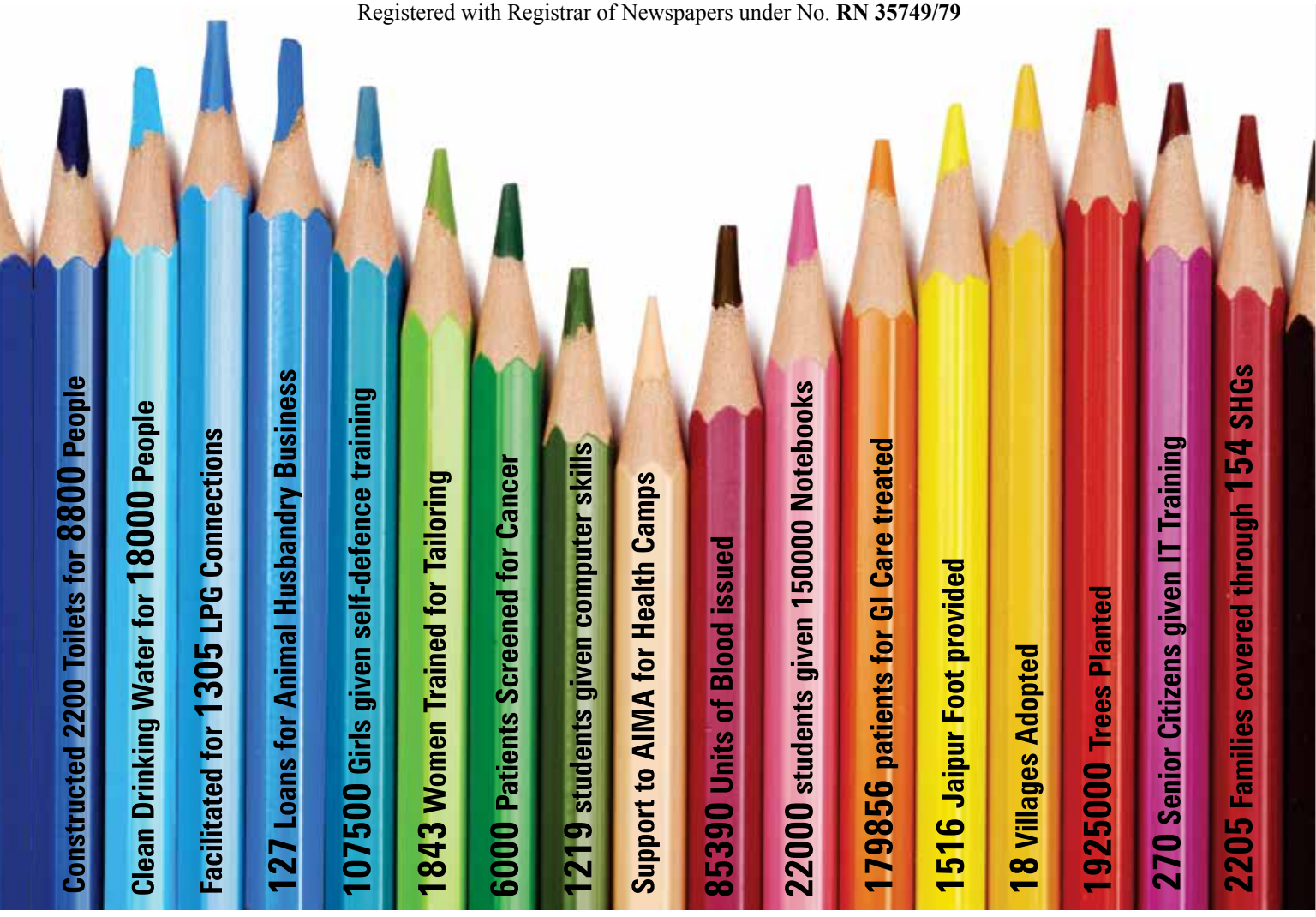

Painting New Paradigms

We paint new paradigms on to the social canvas with the shades of happiness. We enable and empower the community members to acquire new skills for their livelihood and better quality of life through community partnership model and need based interventions.

We believe that it is our responsibility to give back to the community we live in and make them self-reliant. This stems from our founder's philosophy that "I am not the owner, but a privileged trustee." At MSPL, we are committed to add more shades of happiness.

BALDOTA
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