

# HORNBILL

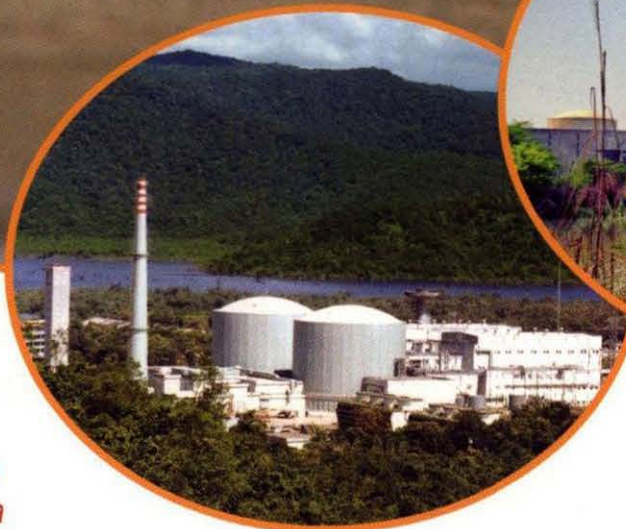
DISCOVER THE LIVING WORLD

JANUARY-MARCH, 2010



BOMBAY NATURAL HISTORY SOCIETY





## Black-bellied Tern *Sterna acuticauda*

The Black-bellied Tern is a waterbird generally found near large rivers of southern Asia, and belongs to Family Sternidae. The breeding adult of this species has a long orange bill and a black belly in summer, which helped scientists name the bird. They also have a deep forked tail. The bird has a distinctive black cap, which does not cover lores (area between eyes and beak), and orange-red legs and bill. But in the non-breeding stage they have white underparts (often with some dark feathers), and a black bill-tip, and black cap changes to greyish and is streaked with whitish lores.

This bird feeds by flying low over water and plucking from surface or by shallow dives;; it also occasionally hawks for insects. It is often seen in sizeable flocks, but sometimes solitary. The bird breeds on bare sandy islands on large rivers, sometimes in mixed colonies with other terns, such as the Little Tern and River Tern. It breeds chiefly from February to May.

The Black-bellied Tern is distributed at rivers and tanks throughout India, Bangladesh, Myanmar and is less abundant in Southern India. It occurs in Karnataka, Kerala where it is a winter visitor and it is a resident of Gujarat, Rajasthan and some northern and eastern parts of India.

Black-bellied Tern is listed as Near Threatened by Birdlife International and IUCN. It is seen in many NPCIL sites such as Narora Atomic Power Station (NAPS) in Uttar Pradesh, Rajasthan Atomic Power Station (RAPS), Rawatbhata in Rajasthan, Kakrapar Atomic Power Station (KAPS) in Gujarat and Kaiga Generating Station in

Karnataka. The bird has been spotted fairly regularly at Narora. It breeds on sandbars and islets of river Ganga, including the portion passing through the Exclusion Zone of NAPS.

This species is almost extinct in a large part of its range, but remains locally common in some areas. Consequently, overall declines may be moderately rapid, qualifying the species as Near Threatened, although monitoring is urgently needed to assess the trends in India better (from Birdlife International).

Threats include the destruction of breeding habitat, the collection of eggs for food, over fishing and the flooding of nests, often caused by dams.

The Environment Stewardship Programme (ESP) of NPCIL, a voluntary programme, envisages scientific study of biodiversity, particularly avifauna, in the Exclusion Zones (EZs) and the environs of its seven nuclear power stations. EZ is a 1.6 km radius area from the centre of nuclear plant. While only a fraction of this area is used for the plant structures, remaining is used for green-beltting. A large number of bird species have made EZs their homes. The programme also includes training of local volunteers, public awareness campaigns to sensitize members of public on environment, improving habitat, particularly of avifauna, etc.

NPCIL as a responsible corporate citizen believes that these efforts will help in promoting habitat conservation and awareness on the importance of a healthy environment to make the world a better living-place.



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### Retracing Evolution, Bountiful Biodiversity

In this International Year of Biodiversity, let us explore our planet's rich natural wealth and trace how life evolved from an 'infinitesimal speck' to the largest animals to live on Earth!



### Wondrous Algae

*Sagar Satpute* shows us the diversity among algae. Be it microscopic or visible to the naked eye, it is all here! Also, bringing to you are some wondrous facts on how researchers are working towards using algae as biofuel and much more.

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### Unveiling Marine Invertebrates

*Vishal Bhawe* brings to you the unseen world of marine invertebrates and its amazing diversity! The myriad colours and shapes of this habitat are a treat to our visual senses.



### My Burrow, the Centre of my Life

*Vardhan Patankar* narrates his interesting experience with the fiddler crabs of Andaman Islands. Mentioned are facts regarding their natural ability to camouflage or evade predators simply with their speed to burrow their way to safety!

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### Allure me, Oh Orchids!

*Svapna Prabhu* gives us a peek into the world of one of the most beautiful flowering plants in the plant kingdom! Let us explore the orchids of North-east India, known for their phenomenal diversity, and unique shapes and colours.



### Predatory Plants

*Aparna Watve* takes us through the realms of the predators of the plant kingdom that prey on insects. These unique plants seem to use different techniques to lure their prey which supplement their nutrient poor diet.

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### Others...

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## Hornbill begins celebrating the *International Year of Biodiversity*

'Biodiversity' — what does this term mean? Why is it so important in today's world? The term actually means the biological diversity or the variety of life forms seen on our planet. It was shortened to the term 'biodiversity' by Walter R. Rosen in 1985 during the first planning meeting of the 'National Forum on Biodiversity'. Biological diversity and its importance became popular in academic circles after the publication of the book *BIODIVERSITY* in 1988 by renowned scientists E.O. Wilson and F.M.Peters. The term 'biodiversity' became popular after the 1992 Earth Summit Conference in Rio de Janeiro, Brazil. Since then, numerous books, research papers and popular articles have been published all over the world, and the term is often seen in use in most electronic and print media. The United Nations has proclaimed 2010 as *The International Year of Biodiversity so as to reflect on the world's achievements to safeguard biodiversity and draw focus on the urgency of our challenges for the future.*

Will the *International Year of Biodiversity* lead to better protection of our biodiversity? Will nations provide more funds and importance to the protection of whatever biodiversity is left with us? There is a need for biodiversity protection to become a mainstream topic of importance for the general public and our political bosses just like overall development, economic safety, country's safety, food security, drinking water, hygiene, housing, health, education and human welfare are. It is interesting that, actually, biodiversity protection would eventually help in achieving all the above mentioned aims which are of such great importance to us. For example, will one be able to consume water that is so polluted in which even aquatic animals cannot live? Therefore, preventing pollution of our water sources not only secures the aquatic biodiversity, but also our water resources. Cleaning the Ganga and Yamuna, will not only protect our National Aquatic Animal, the Gangetic Dolphin, but will also provide clean water to one fourth of Indians who live in the flood plains of these famous rivers.

Through, the next four issues of *Hornbill*, we try to highlight the abundant biodiversity of India in celebration of this *International Year of Biodiversity*. Starting with the sea, where life is supposed to have evolved three-four billion years ago; we cover interesting groups such as Fiddler Crabs by young Vardhan Patankar, BNHS member, and Marine Invertebrates by Vishal Bhawe, BNHS scientist and recipient of the Young Naturalist Award, 2009, by Sanctuary-AMRO Bank. Sagar Satpute, Information Officer, BNHS, describes the evolution of higher plants from unicellular algae, the first of which appeared in the Precambrian Era, between 4.5 billion and 554 million years. Another BNHS member, Dr. Aparna Watve takes us through the wonderful world of predatory plants, which appear so attractive and beautiful, but are highly evolved life forms, that prey on smaller life forms like insects. They grow in nutrient-poor soil and have evolved to get their nutrient requirements from the bodies of other animals. Orchids, although high in the evolutionary ladder, are also included in this issue as Swapna Prabhu, Systematic Botanist, BNHS, tries to bring to you its myriad species seen in North-east India and to highlight the problems they are facing today.



Nature is amazing, beautiful and bountiful, and I am surprised by the lack of interest in the general public to protect nature which gives us so many benefits in our daily life. Pavan Sukdev, Study Leader of 'The Economics of Ecosystems and Biodiversity' (TEEB) has succinctly





ISAAC KEHINKAR

written in the preface to his highly appreciated interim report, “Nature is the source of much value to us every day, and yet it mostly bypasses markets, escapes pricing and defies valuation. This lack of valuation is, we are discovering, an underlying cause for the observed degradation of ecosystems and the loss of biodiversity.” This report makes a very comprehensive and convincing economic case for conservation of ecosystems and biodiversity (This report is available for download on [www.teebweb.org](http://www.teebweb.org)).

I would like to share another profound statement from this report: “Not all that is very useful commands high value (water, for example) and not everything that has a high value is very useful (such as a diamond).” Can we survive without clean water, oxygen and food? As I said earlier, polluted water in which an aquatic animal cannot live, is also unfit for human consumption. So preventing pollution, no matter what the cost, is for our own survival.

Plants, planktons and ‘so-called’ lower life forms are the backbone of the ecological health of our planet, not just the larger vertebrates. With these special issues of *Hornbill*, we are making a small contribution towards providing you readers with a glimpse into the wonderful world of various evolving creatures that form our Nature, hoping that each of you do your bit in this *IYB* to be more aware and respectful towards the biological diversity seen in our country.

Asad R. Rahmani



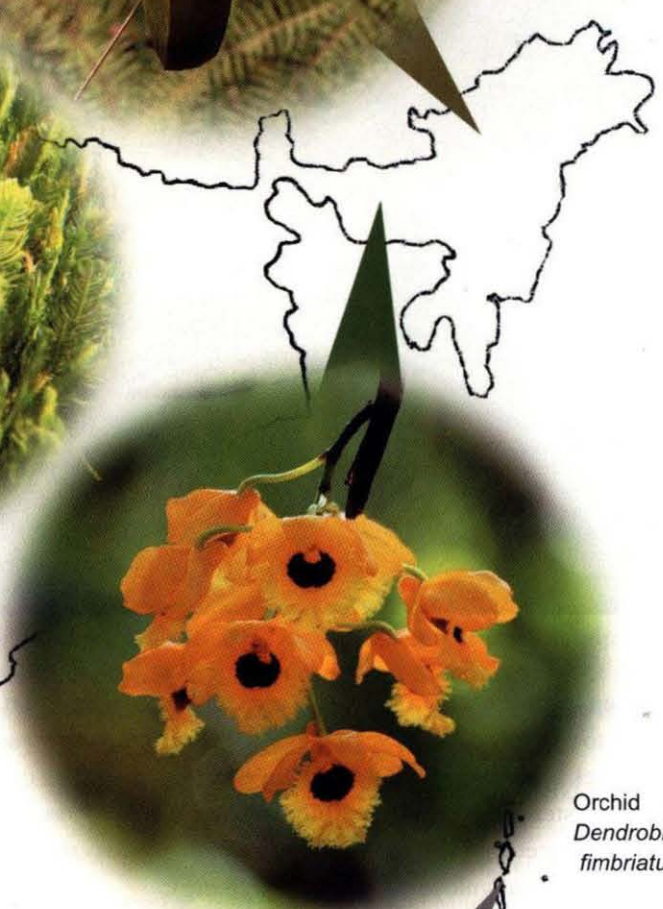
# Diversity featuring in this issue



*Nepenthes khasiana*



Algae  
*Caulerpa* sp.



Orchid  
*Dendrobium*  
*fimbriatum*



Spanish Dancer



Fiddler Crab



# Marg

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## East Meets West

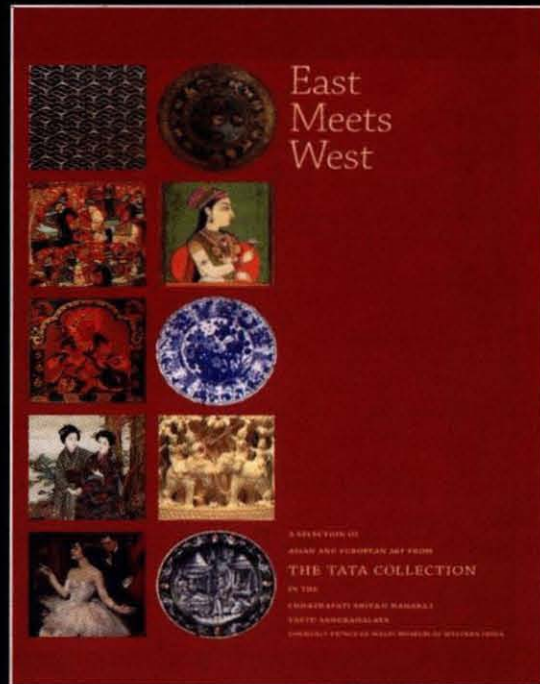
A SELECTION OF ASIAN AND EUROPEAN ART  
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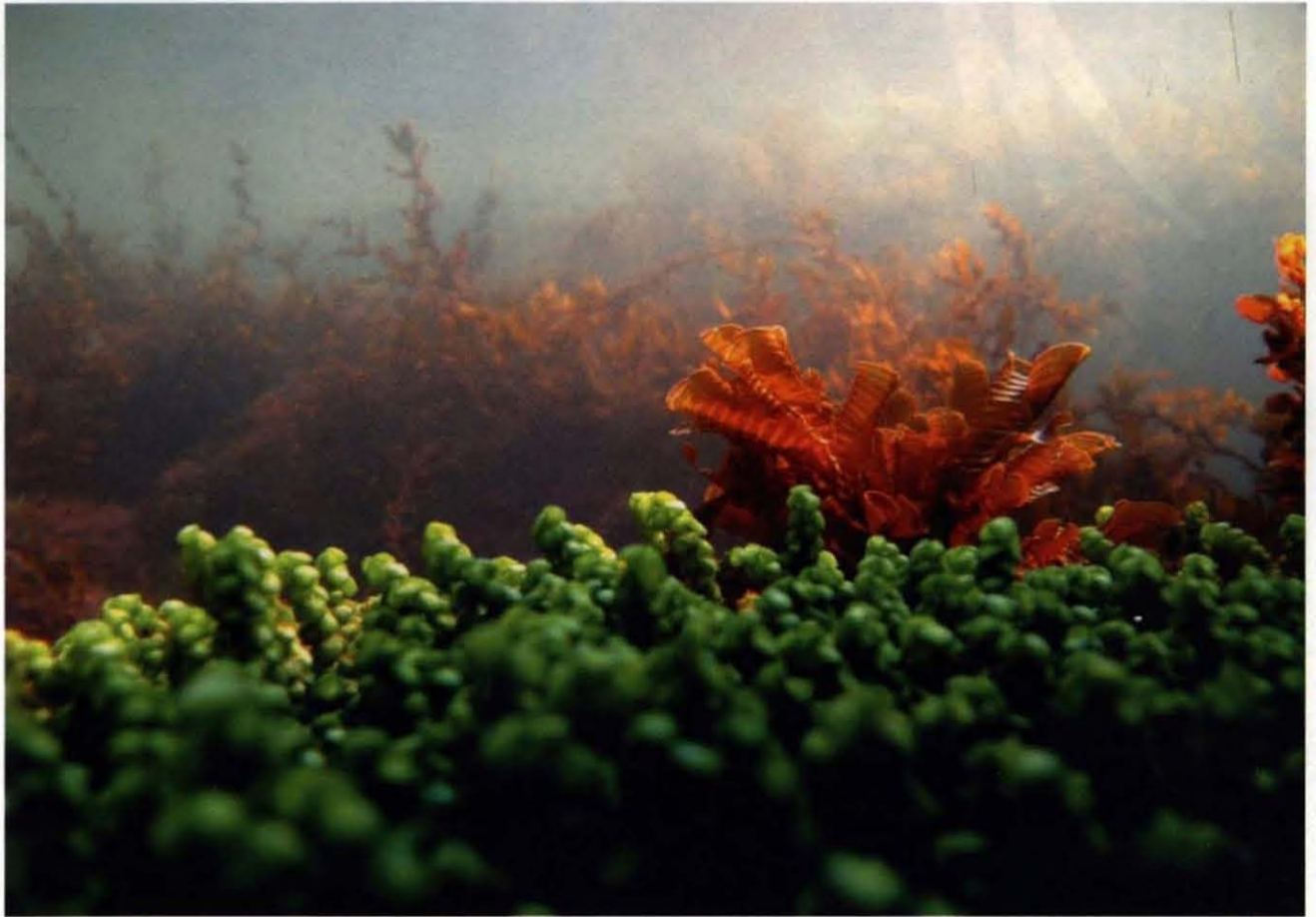
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VISHAL BHAVE

# Retracing Evolution, Bountiful Biodiversity

*“The only life in this universe, of which we have evidence, began on this earth between three and four billion years ago. The conditions present on its surface at that time provided the basic ingredients – liquid water and carbon compounds – out of which all known life is constructed. Why, though, did life begin here on earth and not on other rocky planets, all of which were also outgassing water vapour and carbon dioxide? The answer seems to be that the earth’s temperature was neither too hot nor too cold – as in the Goldilocks fairy tale, it was “just right ...”.*







Compiled by: Priyanka Iyer

Experts consulted: Swapna Prabhu,  
Vishal Bhawe and Sagar Satpute

Secondary source: THE LIVING WORLD

by Sir David Attenborough,

Philip Whitefield, Peter D. Moore and  
Barry Cox

**T**hese are the words from a well known book, THE LIVING WORLD by Sir David Attenborough, Philip Whitefield, Peter D. Moore and Barry Cox. But this is just the beginning of the most awe-inspiring and amazing story in the planet ... after all, it is the story of our planet – the living planet – Planet earth!

Life on earth began in the oceans in the form of unicellular organisms. Among these organisms some produced their own food and in the process released the all-important – oxygen. This oxygen supported more complex life. In fact, evolution of life after that has not been a linear process (one form giving rise to the other), but rather, a very complicated process showing highly branched patterns. Cyanobacteria and Algae form the first steps of the ladder of evolution, as they are autotrophic and are primary

producers. The green algae, brown algae, red algae and stoneworts, and their variety of unicellular and colonial forms, including diatoms form this group. They reproduce sexually as well as asexually. According to some, the blue green algae (Chlorophyta) are actually bacterial colonies (Cyanobacteria) usually sheathed in slime! These algae have been so successful in their adaptations that even today they are with us, surviving hundreds and millions of years, watching many other life forms come and go.

This newly evolved ecosystem also needed someone to serve as decomposers and symbionts. This role was graciously accepted by fungi and some other micro-organisms that brought back nutrients for plants in the ecosystem; they completed the process of nutrient cycling. These remarkable organisms have a number of features which categorise them separately from true plants, and are one of the primitive life forms that have inhabited our wonderfully diverse planet. They show total absence of pigments that capture light and are mainly made of mycelium (the vegetative part of a fungus) composed of numerous uni- or multi-cellular thread-like filaments (hyphae). They are parasitic or saprophytic in nature and reproduce sexually as well as asexually. They come in different shapes and sizes; wherein the (mostly) umbrella-shaped fruiting bodies of some lasting only a few hours.

The term symbiosis (from the Greek, wherein *syn* stands for “with”; and *biosis* for “living”) commonly describes close and often long-term interactions between different biological species. The symbiotic association of the two primitive organisms – algae and fungus – is lichens. In this association the fungal partner feeds on the algae, which in return receives support and protection from loss of water. They are found in a wide variety of habitats and form the important pioneering colonizers of bare rocks. Lichens are also considered to be an important indicator of air pollution/health of a forest.

Along with primitive algae and other beings, the seas also provided the right conditions for the first animal life hundreds of millions of years ago. And in time, the seas came to contain an enormously complex web of life. Animals developed with very different body plans and



Mushrooms form an integral part of nutrient cycling in an ecosystem







ways of life occupying every niche to form an ecosystem that functioned as a single unit. The exact mix of life has changed over time; some animals that were once successful are now extinct and newer animals have filled the space. But certain others, like lampshells have managed to continue unchanged for 500 million years. And these were among the first multicellular marine invertebrate organisms on earth. These marine invertebrates also include phyla Cnidaria, Mollusca, and Arthropoda among many others.

Having gone through successive ice ages, the Phylum Porifera (sponges) are still sharing this planet with us. In fact, the sponges that had evolved in Precambrian Era (more than 500 million years ago) had such perfect body types that they have changed little during this long period of time. These remarkable filter-feeders are found in different shapes, sizes and colours. And yet few of us know about these age-old denizens of the seas.

Shells, on the other hand, have fascinated man since time immemorial. Be it use as jewellery by the early man or for research by scientists in recent times. Phylum Mollusca includes a varied range of animals ranging from the tiny but brightly coloured 3 mm sea slugs to the 13 m giant squids. In fact, there are few micro-molluscs which are less than 1 mm. Sea slugs or opisthobranchs are a unique group of molluscs about which little is known. Some soft-bodied molluscs became extinct while some others like the jellyfish stood the test of time. Hence, many organisms evolved different strategies to contribute to the success of the species. In fact, many slugs defend themselves with help of either toxic compounds engulfed/absorbed through diet or other mechanisms,



Flatworms belong to the phylum Platyhelminthes and may be either carnivorous or herbivorous



Sea slug, *Cuthona yamasui* is seen here on a hydroid



A colourful cnidarian



A crab, caught while scanning the horizon

such as nematocysts or stinging cells stored in cnidosacs of aeolids (group of sea slugs).

Other animals such as corals, sea pens and other Cnidarians are also among the early life forms of our planet. In fact, jellyfish and sea anemone are also part of this phylum. These secretive animals have been roaming the Earth's oceans for millions of years. Coral reefs are one of the most colourful ecosystems that boast of many different species of invertebrates.

The Phylum Arthropoda is the largest phylum among all other phyla in the animal kingdom. This phylum includes crabs, shrimps and other crustaceans that have been an integral part of the marine habitat since millions of years. It also includes all insects and arachnids and bugs that colonised the Earth in the years when life moved to land. The larvae or zooplankton of most of the crustaceans form a major part of the food source of the inhabitants of the sea.

These myriad species of plants and animals are just a glimpse into this underwater world. These organisms and many others of their like form an essential and integral part of our planet's oceans. This diversity of plant and animal life in our oceans has evolved over millions of years. But our oceans are dying; the reason being pollution by oil spills, factory refuse, over fishing, reclamation and untreated sewage, to name a few. Our oceans have such startling diversity that it can take a person all his life to explore it; yet he would only scratch the surface.

In this International Year of Biodiversity let us journey through this intriguing and awe-inspiring path of evolution of the myriad life forms that inhabit our beautiful planet; from the first uni-cellular life forms to the largest mammals! 🐬





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# Wondrous Algae

*My interest in plants reached new heights in the botanical garden of my college and this helped me to learn various facts about botany wherein Algae formed an essential part. Most people's reaction on seeing algae is - 'a green mass'. But this same 'mass' when seen through a microscope shows a completely different picture. This 'micro' world thrilled me and I sensed the need to share interesting facts about these beings among others. And this article is a humble attempt to introduce you to these wonderful organisms seen through a microscope ...*



Sagar Satpute, an M.Sc. in Botany, is currently working as an Information Officer for ENVIS, at BNHS. He is also a keen bird-watcher.







Text: Sagar Satpute

**W**e have units for measuring various physical aspects in our surrounding, such as centimetre for measuring length, grams for weight, and degree Celsius for temperature; similarly, 'cell' is the basic unit of life. Based on the organisation of their cellular structures, all living cells can be divided into two groups: prokaryotic and eukaryotic. Even if you have never heard the words, you are already familiar with these groups, because you and nearly all other life forms that you experience with your unaided eyes are eukaryotes. The word prokaryote comes from Old Greek in which 'pro' means 'before' and, 'karyon' means 'covering'. This covering, which is absent in prokaryotes refers to the enclosure that holds all the genetic material within a single cell. In case of eukaryotes, 'eu' stands for 'true'. Algae, protozoans, fungi, plants, and animals all possess eukaryotic cell types. Only bacteria have prokaryotic cell types.

For 1,500 million years photosynthetic organisms remained in the sea. This may be because, in the absence of a protective ozone layer, the land was bathed in lethal levels of UV radiation. Once atmospheric oxygen levels were high enough the ozone layer formed, meaning that it was possible for living things to venture

onto the land. This ultimately initiated this evolutionary change on land.

The word algae comes from the Latin word for seaweeds. Algae is the plural of the word *alga*, which denotes a single algal organism. Algae are the first to evolve from the prokaryote to a photosynthetic eukaryote leading to the evolution of higher plants. Algae first appeared in the Precambrian Era, which was approximately between 4.6 billion and 544 million years. Algae belong to group Protista, which includes a variety of unicellular, colonial, and multicellular organisms.

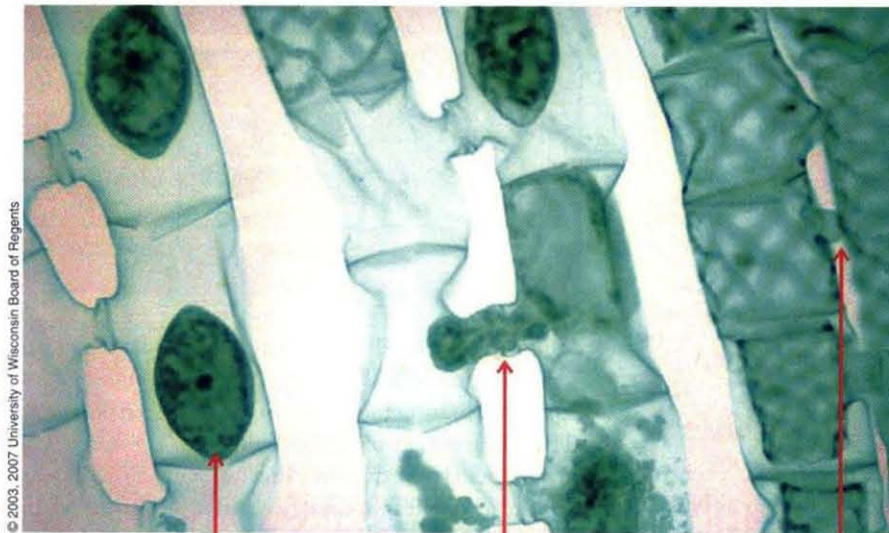
You may think of algae as plants that float on water, but that is the just partial truth. Like plants, algae do make their own food by photosynthesis, but this large and diverse group of organisms were earlier classified as a primitive subkingdom of the plant kingdom – Thallophytes (plants that lack true roots, stems, leaves, and flowers). More recently, most algae, except bacteria, have been classified in Kingdom Protista or in another major group called eukaryotes, which includes animals and higher plants as well.

In general, most algae have simple reproductive structures. Most are microscopic, i.e., cannot be seen by naked eyes, but some are quite large. Algae are the major producers in sea and on land, and play a dominant role in the world's ecology.



VISHAL BHAVE

**Fascinating ladder-like shape formed during the sexual reproductive stages of spirogyra**



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Male and female unite to form Zygospore (Stage 3)

Transfer of cytoplasm from male to female through conjugation tube (Stage 2)

Conjugation tube initiation (Stage 1)





Since water surrounds algae on all sides, individual algal cells absorb moisture and minerals directly from the surrounding water and have no need for specialised conduction tubes. Algal shapes also reflect this direct contact with water. Most algae are quite flattened, which maximizes the surface area for absorbing water, minerals, and sunlight. The main secret to the algae's evolutionary success is a range of photosynthetic pigments that absorb the light of different wavelengths that penetrate to varying water depths. These pigments help to distinguish between different types of algae.

Algae are distributed worldwide in the sea, in freshwater and in moist situations on land. They play an indispensable role in the marine as well as terrestrial environment. The oceans cover about 71% of the Earth's surface. Algae produce more than 60% of the Earth's oxygen. They also help remove huge amounts of CO<sub>2</sub>. Also, algae are our greatest allies in the fight against global warming because they use CO<sub>2</sub> to grow. When algae die, the Carbon can sink to the bottom of the sea reversing some of the effects of human pollution. Algae

may be the most important life on the planet, but human beings are just learning how to farm them on a large scale. Once we can create farms of algae, algae could replace petroleum as a source of liquid fuel, enabling us to heat our homes, and power our cars while at the same time starting to heal the planet.

Algae are capable of the highest per-acre production of useful fuels of any biomass technology, out-stripping traditional crops by factors of ten to thousand-folds. Most critically, algal bio-energy can be grown in a way that does not compete with food crops for land. Thus, algae can be grown in a way that has little or no effect on food prices and availability. Additionally, they build their bodies on CO<sub>2</sub> making them an ideal fuel source in the context of reducing global greenhouse gas emissions.

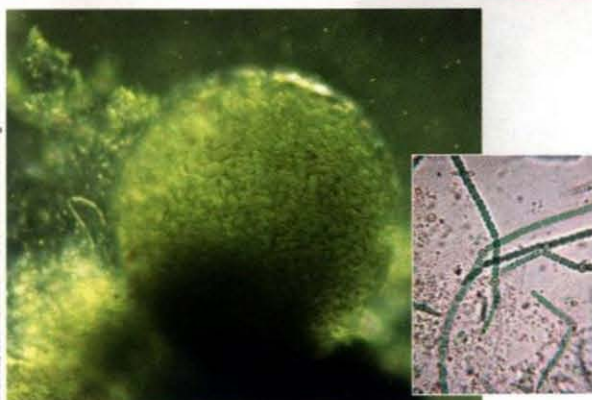
Algae are also a versatile source of organic matter for many different products, both in energy and for other uses. Many algae have high lipid content in their bodies, the key characteristic that most algae-biofuel companies try to maximise. These lipids can be converted to biodiesel and jet fuel by fairly

straightforward refining chemistry. Algae can also be induced to produce lipids with other characteristics that allow them to be used as a crude oil substitute or to produce gasoline substitutes like ethanol. Thermochemical processing (gasification, pyrolysis, and combustion) can also be used to convert algae into another class of energy products, such as syngas, diesel, jet fuel, butanol and electricity. In practice, algae could even be a coal-substitute as long as the modest amounts of sulphur and substantial nitrogen content can be safely managed.

Algae are also useful as a food crop. Some have excellent protein and fatty acid compositions that allow them to substitute for fish meal and other materials in feeds for aquaculture, poultry and pig farming. Some are great sources of nutraceuticals (Nutrition pharmaceutical). In fact, the high value of these food products makes this an excellent alternative market for many algae companies, particularly those who can grow large amounts of a special strain of algae, but are struggling to make it cost competitive with fossil fuels.

**Algae range from unicellular, colonial, and filamentous to multicellular. Given below is chart of microscopic cyanobacteria, diatoms and algae**

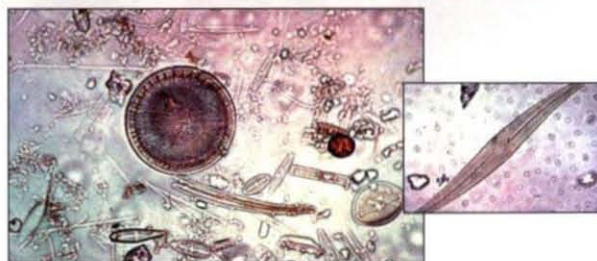
#### CYANOBACTERIA



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It is prokaryotic aquatic bacteria that obtain their energy through photosynthesis. They are often referred to as blue-green algae, even though it is now known that they are not related to any of the other algal groups, which are all eukaryotes. Cyanobacteria may be single-celled or colonial.

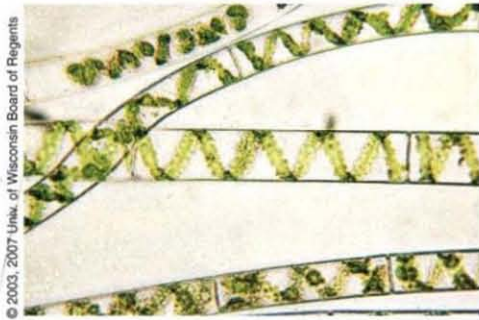
#### DIATOMS



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They are one of the basic unicellular organisms, characterised by a silica shell. They are found in fresh and saltwater, in moist soil, and on the moist surface of plants. The surface mud of a pond, ditch, or lagoon will almost always yield some diatoms. Freshwater and marine diatoms appear in greatest abundance early in the year as part of the phenomenon known as the *spring bloom*. This is a result of the availability of both light and nutrients regenerated in winter. They reproduce asexually by cell division.



**CHLOROPHYTA**

They are commonly known as green algae because of their green colour, which help them to prepare their food. The various species can be unicellular, multi-cellular, coenocytic (having more than one nucleus in a cell), or colonial. Chlorophyta are largely aquatic or marine, a few types occurred on moist soil, tree trunks, moist rocks and even in snow banks.

**EUGLENOPHYTA**

It consists of mostly unicellular aquatic alga. Some euglenoids contain chloroplasts with photosynthetic pigments; others are heterotrophic and can ingest or absorb their food. Reproduction occurs by longitudinal cell division. Most live in freshwater.

**DINOFLAGELLATA**

Some species are heterotrophic, but many are photosynthetic organisms containing chlorophyll. Some dinoflagellates are colourless predators on other protozoa, and a few forms are parasitic. Reproduction in most dinoflagellates is asexual.

**CHRYSTOPHYTA**

They are found mostly in freshwater. Formerly classified as plants, they contain the photosynthetic pigments chlorophyll. Under some circumstances they reproduce sexually, but the usual form of reproduction is cell division.

**PHAEOPHYTA**

It is commonly called brown algae. Many of the world's familiar seaweeds are members of phaeophyta. With only a few exceptions, brown algae are marine, growing in the colder oceans of the world, many in the tidal zone and others grow in deep water.

**RHODOPHYTA**

It is commonly known as red algae. Members of this division have a characteristic clear red or purplish colour imparted by accessory pigments called phycobilins. The red algae are multicellular and are characterised by a great deal of branching. Most of

the world's seaweeds belong to this group. Although red algae are found in all oceans, they are most common in warm-temperate and tropical climates, where they may occur at greater depths than any other photosynthetic organisms. Most of the coralline algae, which secrete calcium carbonate and play a major role in building reefs, belong to this group. Red algae are a traditional part of oriental cuisine. Few species occur in freshwater.

**Some facts about Algae**

- Some algae are fascinating; they can live in the snow, just like the pink-coloured algae in the picture below.
- We must thank diatoms for depositing most of our planet limestone, and much petroleum which is of diatom origin.
- Some algae can live in boiling hot water, like the yellow, green, and orange algae in Yellowstone National Park.
- Oxygen was poisonous to the organisms that populated the early Earth. By producing oxygen, the first algae may have created the greatest toxic waste crisis in history.
- The descendants of some of the first algae probably live inside our cells.
- Some algae seem more like animals than plants.
- Some algae even hunt and kill fish for food!
- Fossilised algae are used to make dynamite.
- Algae may be able to help save the planet.





## Unveiling Marine Invertebrates!

*Being the largest habitat on earth, oceans cover 70% of the earth's total surface. More than half the area covered by oceans is deeper than 2987 m. Majority of the known species inhabiting the oceans are from the shallow coastal and accessible deep areas. There is still lot more to learn about the presently inaccessible deeper parts of the ocean like hydrothermal vents and deep seamounts.*



Vishal Bhawe is project officer at BNHS, studying Opisthobranchs (a diverse group of marine molluscs) at Ratnagiri, Maharashtra.







Text and photographs: **Vishal Bhawe**

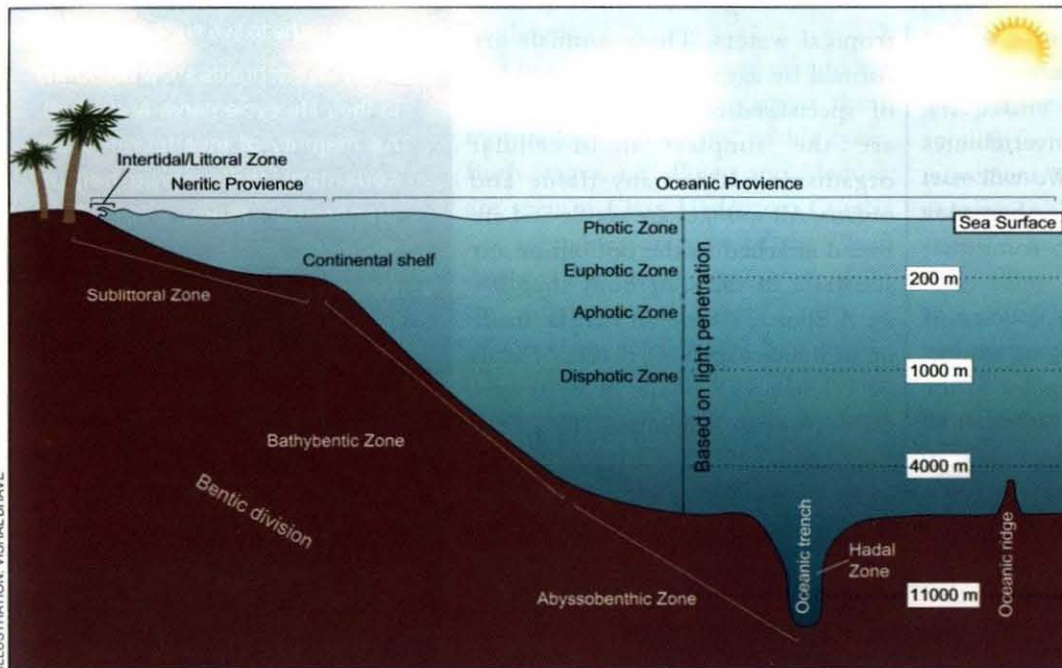
**L**ife in the ocean is so diverse that it is distributed from the Spray zone (above the high tide mark) to more than 11 kilometers vertically downwards from the surface. In fact, interestingly, oceans provide much more living space (about 170 times more) than air, soil and water combined together. And this living space is the home of over 2,50,000 known marine species.

We can divide all the animals on our planet into two groups those with a backbone (vertebral column/ notochord) are vertebrates and those without a backbone are invertebrates. Most marine fauna are invertebrates among which some are represented in the marine

substrate, and the depth of sea bed. Photic, Euphotic, Aphotic, and Disphotic are the different zones called so on the basis of permeability of light. This variation in the amount of light changes the floral and faunal composition.

Based on the type of substrate we can organise marine habitats as sandy, rocky and muddy shores, and each has its own unique floral and faunal diversity.

According to depth of the sea bed, we can classify marine ecosystem as near shore (Neritic) and Oceanic; of which Neritic can be subdivided into Littoral, Sublittoral, Bathybenthic, Abyssobenthic and Hadal zone (deep trenches with an approximate depth of 8 km or more).



Classification of marine habitat based on light penetration and depth of sea floor

ecosystem, and some are exclusively marine. These animals live in different parts of the marine environment which have been classified into different habitats.

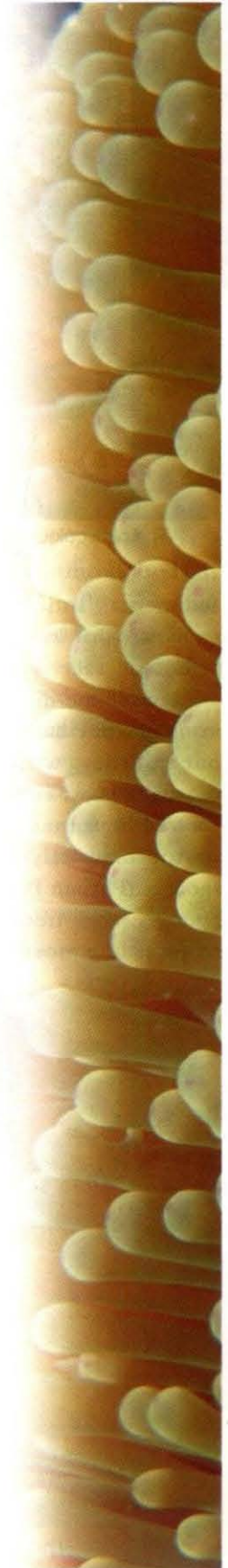
### Marine habitat

The marine environment is diverse in terms of its physical, chemical and biological state. We can divide the marine ecosystem depending upon the permeability of light, type of

### Invertebrates

There are 36 invertebrate phyla or primary divisions of a kingdom, of which 10 are common and easily observed in marine environment, and 2 of which are exclusively marine.

Animals are of three types, depending upon where they live in the marine environment. Plankton – free floating animals/plants/algae; Benthos – animals that live at the bottom or







The pink coloured sponge and the red coloured sea anemone are seen here co-existing with each other, side by side

sediments, and Nekton – active swimmers that live in columns.

Let us take a brief and quick preview of the diverse invertebrates in our marine habitats. We will start our journey with less complex organisms and end with somewhat evolved organisms.

Approximately 9,000 species of sponges (Phylum Porifera) are marine. Sponges range from the poles to the tropics, but most inhabit shallow

tropical waters. These animals are formed by aggregation of a number of specialised cells. Structurally, they are the simplest multi-cellular organisms without any tissue and organs. All sponges are sessile and are found attached to the bottom or any substrate of the waterbody they live in. A Sponge's skeleton may be made up of mineral spicules, that is, of silica or calcium carbonate or of tough, elastic protein – Spongin. They feed

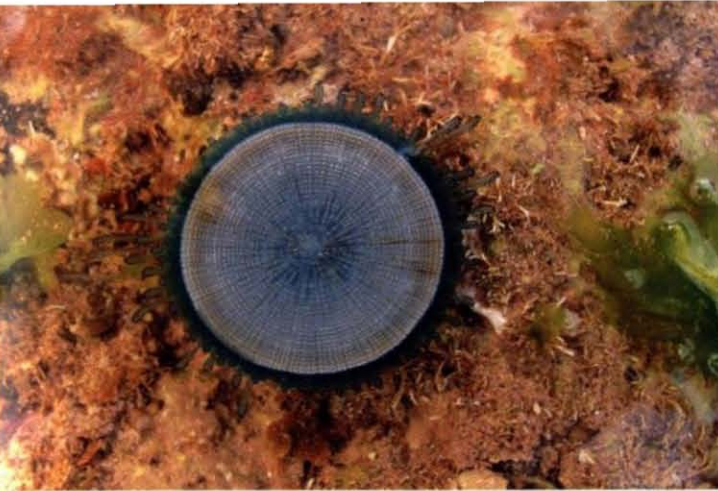


The dainty Pink puff ball sponge *Oceanapia sagittaria*

### Adaptations to the marine environment

- Many Marine species increase surface area so as to create more resistance to water and also store fat / oil (which is lighter than water) which help in floating or buoyancy.
- Animals respire either through skin/ gaseous exchange through body parts or have gills.
- Epibiotic association is when one animal lives on the surface of another animal and this may be for various reasons.
- Smaller the size, greater is the chance to escape from potential predators. Larger niche to live and hide.
- Many invertebrates show two forms in their life cycle (larva and adult). As majority of invertebrates are sedentary, their larvae help in dispersing them over long distances.
- Majority of invertebrates have great power for survival, i.e. regeneration. Some animals can regenerate the entire body from smaller cut parts.
- Crypsis is one of the other features in which the animal masks itself with similar shape, coloration and patterns of the surroundings.
- Variety of marine invertebrates show a specialised feature called 'Aposematic coloration', i.e. the coloration which is often associated with the presence of toxic or distasteful substances used for defence. Size and shape can also be a part of the defence system.
- Some invertebrates harbour symbiotic algae or chloroplast from marine algae/plant which is stored under the epidermal layers and used for formation of food.





The Blue button *Porpita* sp. is a hydroid often mistaken to be a jellyfish. The image on the left shows the float while the one on the right shows the hydroid colony

on plankton and organic particles through small but numerous pores. These pores form canals lined by specialised cells which filter the food.

Sponges are of different shapes and colours wherein some colours warn of potential toxicity or distastefulness. Recent research shows their ability to produce novel molecules for their defence (in many cases), which has some biomedical value.

Jellyfish, Corals, Sea anemones and their relatives belong to Phylum Cnidaria. There are about 11,043 species. Their body is radially symmetrical (where similar parts of the body are arranged and repeated around a central axis). You can observe their interesting life cycle which may include two basic stages or forms. One of them being, polyp – a sac-like or bell-like stage wherein the organism is attached to a substrate. The other, Medusa is an umbrella-shaped (mostly)

free floating stage, which can be seen in most jellyfish. Cnidarians in both these forms have a centrally located mouth surrounded by tentacles to capture food. Cnidarians have also developed nematocysts, specialised stinging cells, to capture food and deter predators.

There are five major groups of Cnidarians depending upon their morphology and stage(s) of life cycle. Both stages, i.e., Polyp and Medusa are seen in Class Hydrozoa. Corals, sea anemones are part of the Class Anthozoa in which we can see only the polyp stage. Classes Cubozoa (Cube-shaped jellyfish), Scyphozoa (Common jellyfish) and Staurozoa (Stalked jellyfish) have only a single stage, i.e medusa, in their life cycle. The Stalked jellyfish show an intriguing behaviour and are an exception to the general definition of medusa stage. Instead of living a free floating life, these 'jellies' prefer to get themselves attached to substrata like rocks, algae

and sea grass with the help of a stalk.

Comb Jellies (Phylum Ctenophora) are exclusively marine including more than 100 species. These were once thought to be part of Cnidaria but are now considered to be a separate phylum. Their gelatinous body is radially symmetrical with eight rows of ciliary combs (lined by cilia). The cilia on these combs beat one after another forming a wave, similar to the movement of the numerous legs of a centipede. This wave enables the animal to swim and the light diffracted from these cilia gives it a mystical appearance! Many species are even bioluminescent.

When we think of worms, the first thought that forms in our mind is that of a dull-coloured, crawling slimy animal. But in case of marine flatworms, you are in for a surprise! Marine polyclad Flatworms are dorso-ventrally flattened, soft 'critters' with brilliant colour patterns. There are about 4,000 species of these brilliant

Translucency is a unique adaptation of some marine animals; seen here in this Comb Jellyfish

*Carijoa* sp., a cnidarian, encourages growth of orange sponge on itself for protection from sea slugs. Inset: Polyp stage of a Cnidarian







Flatworms are one of the most vibrantly coloured marine invertebrates



The small ribbon worm belongs to phylum Nemertea

flatworms. They are commonly seen in coastal waters and belong to Phylum Platyhelminthes (a Greek word wherein *Platys* means 'flat' and *helminthes* means 'worm'). Their body is bilaterally symmetrical just like humans (one half of the body is a mirror image of other). Marine flatworms are mostly active carnivorous predators, but some species are herbivores. These colourful worms have another trick up their slimy foot; they possess excellent regenerative capacity exemplified by their amazing ability to reform entire body parts!

Turbellarian flatworms (Turbellaria is a Class of free living Flatworms) are adept at crypsis, regeneration,

mimicry and may have Aposematic coloration for their defence. A number of flatworms are known to mimic sea slugs (opisthobranchs), as sea slugs are known to be distasteful and hence avoided by predators.

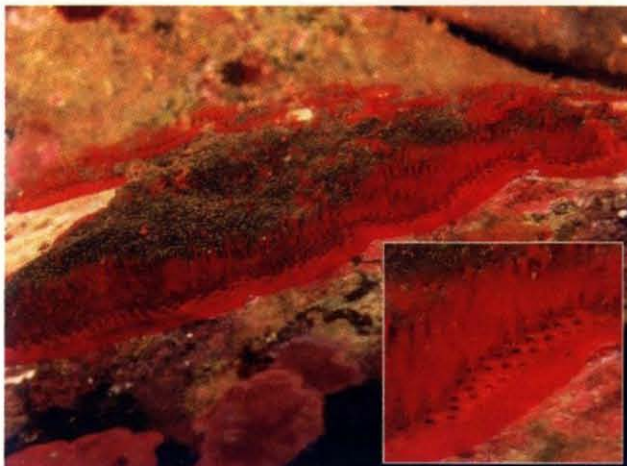
There are about 1,400 known species of Ribbon Worms (Phylum Nemertea) of which majority are marine. The name is derived from their thread-like or ribbon-like structure. They are benthic and can be found on seaweeds, rocks, shells and barnacle beds.

Moss animals or sea mats (Phylum Bryozoa) are common marine fouling organisms (any aquatic organism with a sessile adult stage that attaches to and fouls underwater structures of jetties and

ships). They form delicate colonies on seaweed, rocks, and other surfaces. There are over 4,000 known living species. Bryozoan colonies are made up of small chambers of many shapes. The individuals that live in those chambers are called zooids. Though they are called sea mats, some may form erect colonies.

Many species of sea slugs feed on sea mats, hence some sea mats produce spines surrounding each chamber as a defence.

Most shell bearing animals belongs to Phylum Mollusca. However, there are several species of molluscs that do not need shells. This is the second largest phylum after arthropods. There are more than 24,000 known marine



A colony of crimson coloured Sea mats inhabiting rocks.  
Inset: Zooids with tentacles extended for feeding



The orange colour on the live shells are epibiotic sponge living on the shell's surface





Spanish dancer is named so after its colourful mantle that resembles a dancer's skirt



Money Cowrie with an extended mantle

species. The largest known invertebrate species also belongs to this phyla; Giant squid, measuring about 13 m. We can divide this phyla into four major groups, namely Gastropods (snails, limpets, Sea slugs), Bivalvia (clams, oysters), Cephalopods (Octopuses, Squids, Nautilus etc.), Polyplacophora (Chiton- animal with eight shell plates on its back).

Many molluscs feed using the Radula (a tongue-like structure with chitinous teeth). Molluscs are either carnivores or herbivores; some species also have a symbiotic association with zooxanthellae. Some others (e.g., Sea slug: Saccoglossan) store chloroplast from the host algae in layers beneath their skin (as seen in a plant) to derive food.

In India, sea slugs are not as popular as snails or clams. Sea Slugs (Opisthobranchs) are one such group. They are beautifully coloured docile animals. The only problem is that they are not easy to locate. Majority of opisthobranchs lost their shell in the course of evolution, and have developed specialised defence mechanisms to survive in

highly specialised habitats. They are found in Antarctic and also temperate and tropical waters. Opisthobranchs are specialised organisms in their food requirement and majority of their diet comprises of Hydroids, Sponges and Bryozoans.

Segmented Worms belong to Phylum Annelida. There are around 11,000 species of earthworm-like animals. Structurally, these critters are more advanced and their body is

made up of a series of segments and a body cavity called Coelom. Polychaetes constitute major portion of marine annelid. Polychaetes (*Poly*-many; *chaetae*- setae/tiny hair-like appendages) are marine segmented worms with parapodia (leg-like appendage) with setae. Most of the species live a benthic life. They can be found on hard substrates like rocks, corals and shells (e.g., Christmas tree worms) to very soft

muddy substrate (Nerid worms). Many polychaete worms live in tubes, which can be made of mucus, protein, mud particles, sand grains, or tiny fragments of shells. Marine Oligochaetes (belongs to another class of Annelida, to which earthworms belong) inhabit mud or sand. Marine leeches, belonging to Class Hirudinea of Annelida, are found on fish or any other host and can be easily identified with the help of their suckers.

Crabs, Lobsters, Shrimps – delicacies of Indian cuisine – are members of a very diverse Phylum Arthropoda (*Arthron* – Joint; *podos* – Foot). This phylum is the largest among other phyla of the animal



Christmas tree worms can be seen in myriad colours





kingdom. In arthropods the body is segmented and bilaterally symmetrical and appendages are also joint. Also, they have an external skeleton made up of chitin or in some cases calcium carbonate. They shed their skeleton as they grow (process called as moulting). As the skeleton in these species is external and covers all body parts, it is termed as an animal with exoskeleton.

Most marine arthropods belong to Class Crustacea and are adapted to live in water with a pair of antennae and gills (for respiration). Many smaller members of this Class and larvae form a major part of oceanic plankton also known as zooplankton. Copepods, a group of small crustaceans, are extremely abundant and common amongst zooplankton.

There is a class of arthropods that mimic true spiders and hence known as Sea Spiders (Class Pycnogonida). Majority of sea spiders are tiny and highly cryptic (hard to find) in nature. Sea spiders can be predators or scavengers, majority of them feed on



The brilliantly green Weed shrimp, *Hippolyte* sp.

Cnidarians, Sponges, Polychaetes and Bryozoans. Another arthropod which has a long history is the horseshoe crab (Class Xiphosura). These crab-like creatures are living fossils, as they existed over a period of 540-248 million years in a course of evolution.

Though Barnacles have a calcified shell which look like Molluscan shell, they are crustaceans. We can easily see them in our coastal waters near high tide mark. The body of barnacles is enclosed in a chamber made up of shell plates. There is an opening on top which is closed by 2 plates, that opens when the animal wants to feed with help of feathery filtering appendages (cirri).

Amphipods are planktonic or benthic animals; Isopods are benthic animals, some are parasitic. Krill, a shrimp-like organism, is an important part of the food chain as Baleen whales feed on them. The occurrence of insects in marine environment is rare but there are a few species which occur in mangroves or on rocky shores.

Sea stars, Sea urchins, Sand dollars, Sea cucumbers, Brittle stars, feather stars and sea lilies are members of Phylum Echinodermata (*Echinos* – spiny; *Derma* – skin). There are about 7,000 species which are exclusively marine. They share specific characteristics with specific phyla



Decorator crabs are known for their amazing ability to disguise and are hard to spot



Sea spiders are mysterious animals which can range from microscopic size to a few centimetres





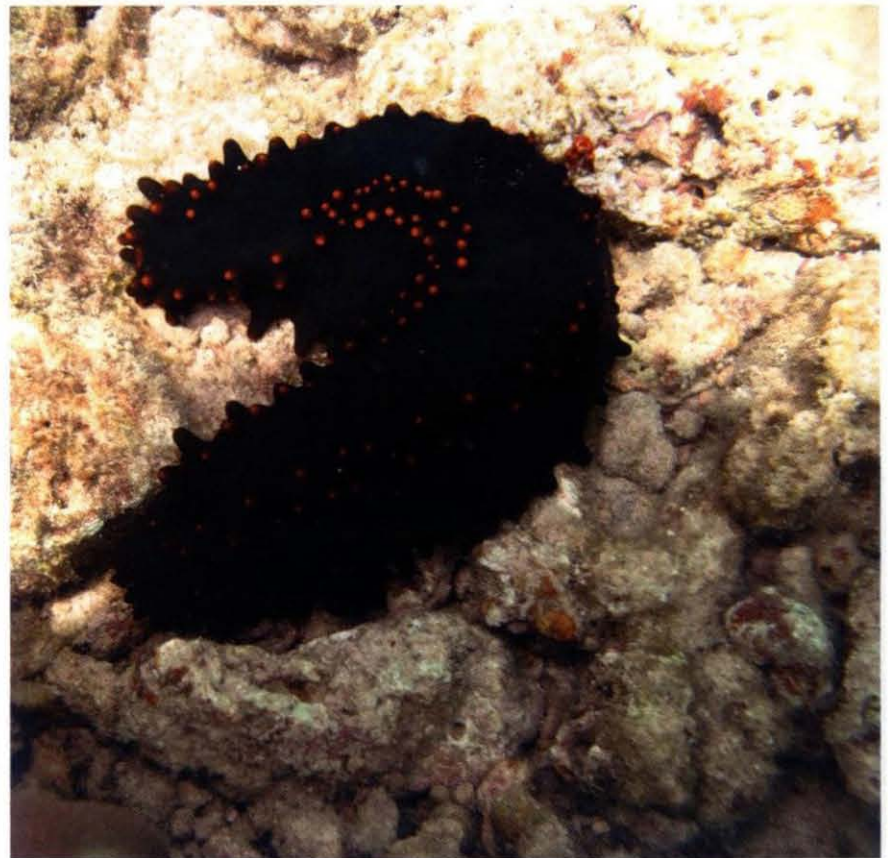
among all invertebrates. They get radial symmetry from cnidarians or ctenophores, but their larvae are bilaterally symmetrical. They have developed a skeleton inside the body and so are known as animals with endoskeleton. In majority of species a coat of thin sheet of cells may mislead one to believe that the skeleton is outside the body, which is not the case. A highly specialised system known as water vascular system is used by these animals for gaseous exchange, which includes respiration, feeding and locomotion.

Echinoderms can be subdivided into five Classes namely, Asterozoa, a Class of star-shaped animals like Starfishes, Button stars, Sea stars; Ophiurozoa, a Class of animals resembling starfishes but the arms are very thin and elongated like snakes, this is represented by brittle stars; Echinozoa is a class of ball-shaped animals with a number of elongated spines (may be sharp or blunt), which is represented by sea urchins. Sea cucumbers which resemble a cucumber also belong to Class Holothurozoa. Sea cucumbers are elongated animals which look like a worm and have a mouth surrounded by feathery arms. They eject sticky filaments from the anus in self-defence. Another Class Crinozoa is represented by Feather stars and Sea lilies with a disc-shaped body. They have feathery arms used for feeding and sometimes swimming. Feather stars are found in coastal waters near hard bottoms in contrast to Sea lilies, which are found in deeper water. They have five arms in most cases but these arms divide and re-divide to look like 100-200 arms.

Despite just having journeyed through the awe-inspiring diversity of marine invertebrates I can safely say that we have just scratched the surface




The colourful radially symmetrical oral tentacles of a sea cucumber



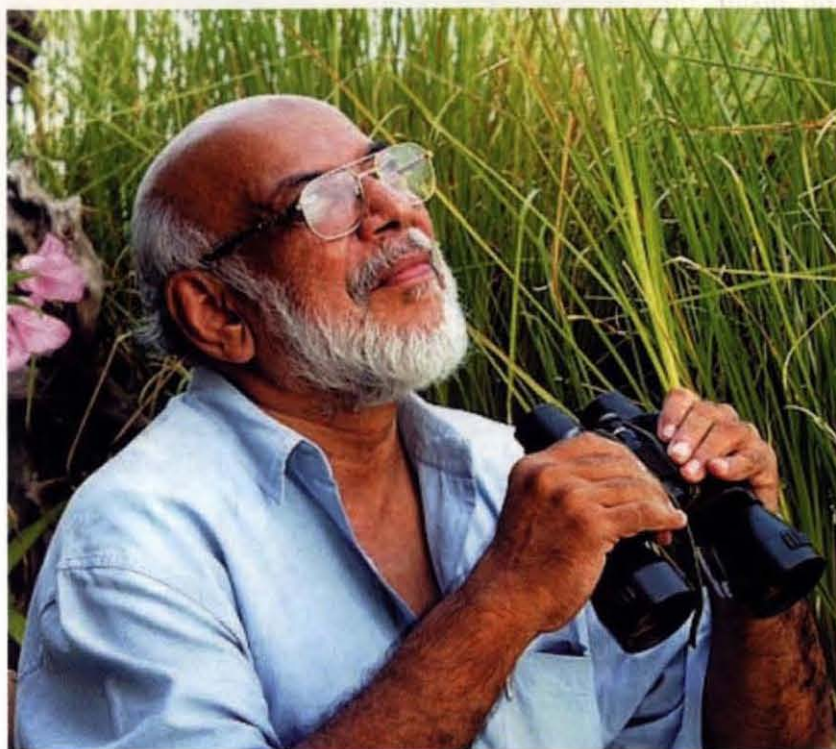
Sea cucumber, *Stichopus* sp. found in the Andaman islands, is leathery to touch

of the vast diversity that live in our oceans. These myriad species of marine invertebrates were among the first 'few' multicellular inhabitants of

our 'living' planet. We must respect and protect these old and wise denizens of the sea as they give us an insight into their secretive watery world! 



## OBITUARY



### **S.A. Hussain**

(1944-2010)

We regret to inform you of the death of one of the former senior staff members of the Society, Mr. S.A. Hussain. Mr. Hussain joined the Society in 1969 as a Research Assistant in the Society's Bird Migration Study Project and retired from service in 1992 as a Principal Scientist of the same project. He was one of the many Naturalist Scientists of the Society who did not have a degree but set a tradition of research with the Society, commencing with Mr. S.H. Prater, who retired as the Curator of the Society, Mr. Charles McCann who also retired as Associate Curator and Dr. (Hon) Sálím Ali, naturalists who were excellent Field Scientists who contributed considerably to the study of the wildlife of the country. Mr. Hussain studied the Subcontinents' birdlife and contributed

significantly to our knowledge of rare species, such as the Narcondam Hornbill and the Honey Guide. He was the Principal Scientist of the Society's Bird Migration Study Project at Point Calimere and was later, Project Scientist of the Society's Avifauna Project. He coordinated the ODA/BNHS Project which resulted in the Society's Conservation Education Centre. After retirement from BNHS, he served as Development Director, Wetlands International Asia - Pacific and was a visiting Scientist at the University of Malaya. His international commitment ended with being the Vice Chairman of Bird-Life Asia Council, Tokyo, and Council Member BirdLife International, Cambridge, U.K. Mr. Hussain had a pleasant personality and his death is a loss to the Society.



### Agricultural Activity in the Lonar lake forest area

The Lonar Lake, situated at Buldana district of Maharashtra, is one of the most beautiful lakes of India. Nature's wonders are plenty and this crater-formed lake is one such wonder which has a rich variety of flora and fauna. Millions of years ago, when a meteor hit the Earth, a crater was formed due to its impact. This is how this bowl-shaped lake was formed.



Above: Lonar Lake and the forest surrounding it

The water in this lake is greenish in colour and has a pungent smell due to the concentration of minerals like sulphur. A small portion of the lake is used for agriculture by the locals. Banana and vegetables are the main crops grown here.

The lake's outer periphery is covered with a thick forest on the slope,

which is cool even during mid-day. The forest holds several kinds of creatures like birds, mammals, reptiles. The vegetation in this mixed type of evergreen forest, around the lake, is abundant in custard apple fruit trees.

Even though the forest is in good condition, the government must step in to curb the agriculture activity in the crater and preserve this magnificent natural wonder. It is only then that it can become an important spot of tourism of the world.

— D.M. D'sa  
Thane

### Nawabs and the Nawabs of the Jungle!

Dr. Asad R. Rahmani paid a rich tribute to the Nawabs of Junagadh, in the *Hornbill* editorial of April-June 2009, for "their wisdom and foresight" in saving the Asiatic Lion from extinction.

Indeed, post 1901-02 the Nawabs did do so, but, the credit for getting them committed to Lion Conservation *per se*, historically belongs to Lord Curzon, the then Viceroy of India. It had become a colonial ritual to celebrate the Christmas week by shooting, angling, hunting with hounds, pig-stick polo, etc. Over time, the Princes of India vied with each other

to host the Governor/ Political Agent of the province, or the Commander-in-Chief of the Army and when possible even the Viceroy over the Christmas week.

In 1901, when the last surviving pride of the Gir forests – the Asiatic Lion – was perhaps less than eighteen animals, the Nawab of Junagadh had extended an invitation to Lord Curzon to a Christmas Lion shoot.

A lesser person would have seized the chance 'bag the last trophy', as it were, but not Curzon. He politely declined the invitation and suggested to the Nawab to present the Asiatic Lion in his state as a heritage for future generations of India. Lord Curzon not only extended his personal patronage, but also promised assistance by the Government of India to enable the Nawab to attain the goal!

My views are based firstly on what E.P. Gee had written on page 85 of his book "The Wildlife of India" published in 1964. Thirty years later, David Gilmour the biographer of Lord Curzon had also written in much the same view. Regrettably, I cannot quote from the book as we have been dispossessed of our copy.

— Lt. General (Retd.) Baljit Singh  
Chandigarh

### ABOUT THE POSTER

Lichen, usually slow-growing, is an organism of simple structure, composed of fungi and photosynthetic green algae or cyanobacteria. Lichens commonly grow on rocks, trees, fence posts, and similar objects. Its greenish gray colour is due to the combination of the chlorophyll from the photosynthetic organism with the colourless fungi. Sometimes the thallus (simple vegetative body) may be red, orange, or brown. Lichens require no food source other than light, air, and minerals. They depend heavily on rainwater for their minerals and are sensitive to rain-borne pollutants and air pollution. The fungal component of lichens produce acids that disintegrate rock, giving the lichen a better hold, and aiding weathering processes. Lichens usually reproduce by the breaking off of a segment, that contains both components. They are of a number of uses to man; in fact, before the discovery of aniline dyes, lichens were much used for silk and wool dyes.





# Lichen







# "My Burrow, the Centre of my Life"

*Nature can inspire us no end in several ways. Sometimes the tiniest of creatures can teach us some of the most important lessons. I believe that with the world as our classroom and wildlife as our teachers, we can set forth on our journey of learning. I learnt one such lesson from the unique fiddler crab.*



Vardhan Patankar is currently pursuing his PhD degree on the coral reefs of Nicobar Islands and co-researching a study on dugongs of Andaman & Nicobar Islands.







Text and photographs: **Vardhan Patankar**

**D**uring my early days in the Andaman Islands, my home-cum-field base was situated on a hillock. From there, a panoramic view of the sea and the islands could be seen on the horizon. This made it an ideal location to observe wildlife in the surrounding areas. Nature can inspire us no end in several ways. Sometimes the tiniest of creatures can teach us some of the most important lessons. I believe that with the world as our classroom and the wildlife as our teachers, we can set forth on our journey of learning. I learnt one such lesson from the unique fiddler crab.

It all began with the arrival of the monsoon. For three whole days, the torrential rains forced me to stay indoors. When the weather cleared a little on the fourth day, I ventured out of my home to my favorite spot — the mangrove swamp. I had left at 4:00 p.m. and reached the swamps within half an hour. As I walked around, a rather odd looking creature emerged from its home, with

one arm thrice the size of the other. It was surveying its surroundings carefully. It moved ahead cautiously, displaying its larger claw. To me it seemed to be saying 'Hey! Dare to defy me?', challenging its fellow creatures. At the same time it never took its watchful eyes off its home probably to readily retreat in an emergency. Little did it know, I wasn't going to allow it to do that.

Slowly, I stepped towards the animal. It seemed unfazed initially, but as I got closer, the creature fled towards its burrow at amazing speed. I quickly blocked the burrow entrance and gave chase. In a frantic bid to escape, it zigzagged across like a professional soccer player. I had almost lost track of it, but spotted it again on its next evasive action. It was vigorously digging away at a new burrow. Within seconds it was safely inside, leaving one large claw sticking out as if to say, 'You better not block my burrow and chase me again, or else'. Its eye lobes were protruding out like a pair of ghost-eyes clearly indicating the displeasure at my intrusion.



The Fiddler Crabs are found in large numbers on mud flats with a mixture of sand. By burrowing deep into the mud of the marshes, the crabs create a maze of tunnels







I was amazed to see this creature's instinctive behaviour. But the message that the crab definitely put across, not just to me that morning, but probably to generations and generations of crabs gone by and yet to come, was: 'My burrow is the centre of my life'. And although this in itself was very

ground to its mouth resembles the motion of moving a bow across a fiddle, i.e., the large claw. Currently there are 97 recognised species/subspecies of Fiddler crab. They are the true crabs belonging to the genus *Uca*.

Their main distinguishing features are a broad carapace, a small abdomen

fiddlers have a pair of eye lobes in front, which are covered by a thin membrane. This membrane helps the fiddler to locate objects even when it is submerged under water. The size of the fiddler ranges from 5 mm to 3 cm. Although fiddler crabs have the ability to camouflage, most often they appear red, purple and brown. Their



Fiddler Crabs burrow into the sand so as to escape predators. They also usually scurry into the burrow when danger approaches

fascinating, what really caught my attention was the tiny creature's natural ability to camouflage. Apart from this, there was the burrowing activity, displacement activity, feeding, combat behaviour, social behaviour, and much more that I observed during my subsequent stay in the Andaman Islands.

This extraordinary creature is known as the Fiddler Crab. The origin of its name comes from the feeding behaviour of the males, where the movement of the small claw, from the

under the thorax and waving pincers attached to the forelegs. Like other true crabs, fiddlers are not exceptional but they are unique in their own way. The male crab has one of its claws/pincers larger than the other. The male crab's distinctive strong claw plays a very important role in finding a suitable mate. Two male crabs fight for the female and the winner mates with the female crab.

These pincers also help the fiddlers defend themselves from predators. The

favourite food is algae and microscopic creatures found in sand. Female crabs use both claws to feed. However, the larger claw of the male crab hinders feeding, allowing him to use only his smaller claw. The crabs sift sand through their systems and get nourishment from the microscopic particle and bacteria in it. These crabs grow by shedding their entire exoskeleton and have an ability to regrow their leg or claw in case it breaks in fights or degenerates during shedding.





In a colony of fiddler crabs, it is seen that roughly half the males have left large claw, while the other half have large claws on their right

Fiddler crabs are found in large numbers among mangrove forests, estuarine mud flats, and in marshlands. Where they fall short in size, they make up in numbers and play a very important role in coastal ecosystems. As any marine biologist will confirm, they form a critical component of the food chain of coastal ecosystems, scavenging their way to survival.

I was so engrossed with this individual that I did not notice the dark clouds collecting above. Before I could react, it was pouring. While my new-found friend took refuge in the safety of its cozy burrow, I sped through the small paths, flowing streams, and



In India, the crab is known as Dhobi crab, the arching movement of the large claw being like a *dhobi* bashing clothes on a rock while washing them

mucky patches to reach home. Only after a good 30 minutes, I was so near to what I had begun to call home. Neighbourhood mongrels were snarling at my heels, sending me sprinting. I dodged them as fast as I could, aiming to get back to the safety of my four walls. By the time I reached, I was soaked to the bone. Suddenly, I understood the fiddler.

As I lay awake on my bed at night, recalling the day's happenings, I realised that nature had taught me an important lesson. 'My home is, indeed, the centre of my life.' The intensity and depth of the tiny creature's age-old message suddenly made sense to me. 🐞



# Allure me, Oh Orchids!

Text: Swapna Prabhu  
Photographs: Raveendra Bhat

The family of orchids is one of the largest and most evolved of the entire plant kingdom. It comprises of 20,000 species distributed all over the world, forming almost one seventh of all flowering plants. The group has enchanted the world for ages with its beautiful long-lasting flowers, with enormous diversity in colour, shape, perfumes, and medicinal properties. On the other hand, the scientific world is awed, right from the time of Theophrastus, by its most complex flower structure, its curious forms taken by different genera, wide geological distribution and habitats.

The Khasi, Jaintia and Garo Hills of the North-east Indian state of Meghalaya, have long been the focal point of classical botanical explorations, especially orchid collection. Owing to its geomorphological history, the state is highly rich in physiographic,

edaphic and climatic variations. Besides this, more than 12 tropical, sub-tropical and temperate vegetation zones occur in this region depending on the varied scales of rainfall at different time of the year, and at different altitudes and places, in Meghalaya. Presence of such a wide spectrum of suitable habitats has assured luxuriant growth of orchids in this region.

Of 1,250 species of orchids in India, about 300 are found in Meghalaya. They form a noticeable element of the vegetation of the State. Many of these orchids have a wide distribution extending up to Sikkim, Bhutan, Nepal, China on one hand and Myanmar, Malay, Thailand on the other, while a few are endemic to Meghalaya. Here are just a few of them .....



Umbrella-like Coelogyne *Coelogyne corymbosa*

The generic name - *Coelogyne* - is suggestive of the hollow tip of the column. These are epiphytes with two-leaved pseudobulbs. You can catch it flowering during March-May. It is distributed in sub-tropical and temperate regions of India, Nepal, Bhutan and China (2000-3000 m).

Meghalaya represents a significant part of one of the 32 biodiversity hotspots of the world, owing to not only high diversity and endemism, but also the level of threats to its diversity. Habitat loss due to prevalent activities, such as shifting cultivation and mining (coal and limestone), combined with ruthless collection of orchids from the wild, may cause loss of many of these.

Shoe-Lip Dendrobium *Dendrobium crepidatum*

*Dendrobium*, one of the largest genera of orchids, is popular for its magnificent and delicately beautiful flowers. The genus suggests its epiphytic habit. The species flowers during March-May. Comparatively, it is widely distributed up to 2,000 m from North-east India to Orissa, and Southern India.



Noble Dendrobium *Dendrobium nobile*

Probably the most popular *Dendrobium* in cultivation, and thus the wild parent of innumerable hybrids and cultivars, this orchid has fragrant long lasting flowers which blossom usually during March-May. It is distributed in North-east India, Nepal, China, Bhutan, Thailand at around 1,000-1,700 m. This species is threatened due to over-collection.



Fringe-Lipped Dendrobium *Dendrobium fimbriatum*

This royally coloured orchid is characterised by the deeply fringed lip of the flower. It flowers during March-May. It is usually found in the coniferous forests up to 1,500 m in North-east India, Sikkim, Nepal, Bhutan, China, Bangladesh, Thailand and Malaysia.



Gibson's Dendrobium *Dendrobium gibsonii*


Named after Gibson (a British orchid collector of 1800s), the orchid is an epiphyte with loosely arranged fragrant flowers on a pendulous inflorescence. It flowers during July-August and is distributed in China, Thailand, Myanmar, Bhutan, Nepal, India from 700-1,700 m.

Stem-Clasping Tube Dendrobium *Dendrobium ochreatum*

A deciduous epiphytic orchid, it flowers during February-May. It is distributed along the Himalayan ranges at high altitudes and in North-east India, Myanmar, Thailand and Vietnam.








Pineapple Orchid *Dendrobium densiflorum*

An epiphytic orchid with densely crowded and splendid flowers at the end of the pseudobulbs, it flowers during April-June. Its distribution ranges in Nepal, Bhutan, Myanmar, Thailand, and North-east India up to 1,300 m. It is a highly threatened species due to habitat loss and over-exploitation.




Williamson's Dendrobium *Dendrobium williamsonii*

Being endangered and endemic to north-east India, it is a species that requires special attention. This epiphytic herb is named after Williamson, a British orchid collector. It flowers during February-April and is distributed in Assam and Khasi Hills.

(Plant photographed was cultivated in The Botanical Garden, Botanical Survey of India, Shillong)





Hooded Dendrobium *Dendrobium cucullatum*

It is a startling epiphyte with purplish pseudobulbs. Its fragrant flowers are adorned with subtle colour variation from pastel lavender to pink. It is a very widely distributed orchid species, found along the tropical - subtropical region (200-1,200 m) in eastern and western Himalayas in India, China, Bangladesh, Maldiv Islands, Nepal, Sri Lanka, Myanmar, Thailand, Malayan peninsula.



Vanda-like Papilionanthe *Papilionanthe vandarum*

This plant is an epiphyte with a cylindrical stem and leaves. Its fragrant flowers are long lasting and can be seen during March-May. It can be found between 1,500-2,000 m in North-east India, Nepal, Bhutan, Myanmar and South China.



Vein-like Lip Spur Orchid *Ascocentrum ampullaceum*

This handsome orchid is a dwarf and a compact epiphyte (growing on the trunk of other trees). It flowers from March to May and is distributed from Nepal to Thailand and tropical valleys of Indian Himalaya at 400-1,000 m.

(Plant photographed was cultivated in The Botanical Garden, Botanical Survey of India, Shillong)



Clerke's Esmeralda *Esmeralda clarkei*

The genus *Esmeralda* is suggestive of "Emerald". However, the shape and colour of the flower give them the common name "Scorpion orchids". It flowers during November-January, and is found in Eastern Himalayas, Nepal, Bhutan, Sikkim, Myanmar, Thailand and southern China at elevations of 1500-2000 m. This species is threatened largely by habitat loss.



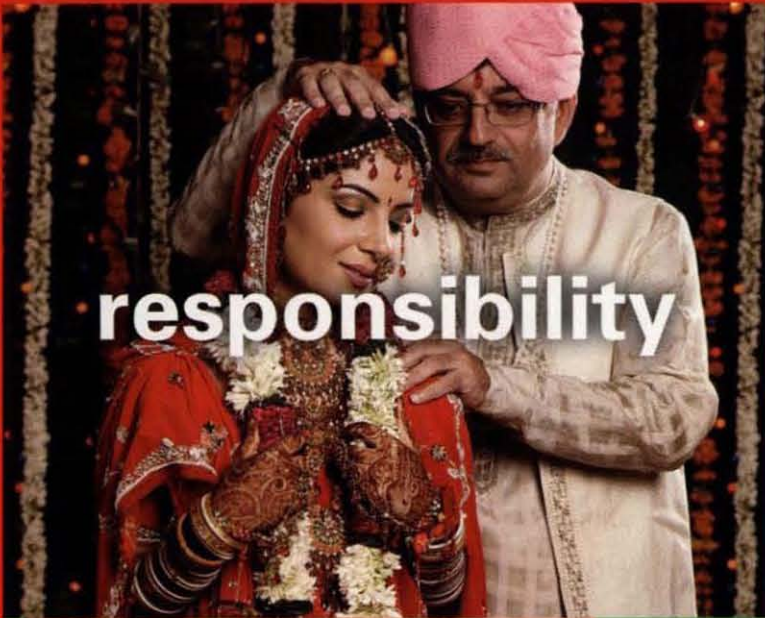
Nun's Cap Orchid *Phaius tankervilleae*

A terrestrial orchid with large flowers, the generic name probably arrived from the prominent brown hue of the flowers. The species is distributed along western Himalayas, north-east India, Bhutan, Myanmar, Nepal, Thailand and Sri Lanka from 1,700 to 2,000 m. The species is threatened.

Swapna Prabhu is the Systematic Botanist at BNHS and is involved in various research and education activities.







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A Kingfisher bird with vibrant blue, orange, and white plumage is perched on a dark, mossy rock. Its reflection is clearly visible in the water below. The background is dark and out of focus, showing some green foliage.

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ASHOK CAPTAIN

The green drosera *Drosera indica* feeds on tiny insects to supplement the poor mineral nutrients available in their habitat

# Predatory Plants

*'In the enchanted forests of Africa or Amazon are found the dangerous man-eating plants that prey upon unsuspecting travellers. The victims are either caught in their tentacles and strangulated or devoured upon with sharp teeth, slowly sucking out the victims' juices!'*



Aparna Watve, currently heads BIOME, providing consultancy in biodiversity research. After Ph.D., she has been studying biodiversity of Indian rock outcrops.







Text: **Aparna Watve**

**M**ost of us have heard or read of such stories; graphic as they are, these stories don't have a grain of truth; or the first botanist to encounter them would not have survived to tell the tale. Contrary to these scary images evoked by the stories, carnivorous plants are quite small in size and are extremely pretty!

They are a large and heterogeneous group of around 660 species across the world. Carnivorous plants grow in habitats deficient in available nitrogen or phosphorous. Though they can photosynthesize their own food, they acquire some essential nutrients by trapping and digesting animals. These plants are often called 'insectivorous', but their diet not only comprises of insects but also of a diversity of small fauna other than insects. Some of the larger pitcher (carnivorous) plants are even known to trap small rodents and birds. But in India, there are three major groups of carnivorous plants: the Sundews with trapping hair (*Drosera indica*, *D. burmanni* and *D. peltata*), the Bladderworts with bladder traps (*Utricularia* spp.), and the Pitcher plant with pitcher traps (*Nepenthes khasiana*).

Back in my college days, I had seen only 'pickled' specimens of carnivorous plants, but I met one for the first time during my M.Sc., while conducting a field study near Lonavala. I distinctly remember it as many would remember their first encounter with a tiger. We were studying herbs and had to pay special attention to all the smaller plants. While kneeling on grass, we saw some light pink flowers, larger and different than any we had seen so far; I carefully traced their stalks to get a better view of the plant responsible for such beautiful flowers. It was the green *Drosera* (*Drosera indica*). A careful search revealed that the entire scrub area was full

of *Drosera* plants, which also meant, that we had trampled upon several of them while walking. After this, it was almost impossible to locate them without flowers, as they were just a few centimetres tall and remained hidden in the grass.

The entire plant of green *Drosera* is covered by gland tipped hair and shines like little groups of lit candles, when seen in sunlight. The true nature of these delicate hairs is revealed, when observed through a magnifying glass. Tiny insects get entangled in the sticky secretions from the hair. Then, the leaf slowly curls over the insects, releasing more and more secretions, which help digest the soft parts, and finally, the digested food is sucked into the plant. These extra nutrients help the plant to survive in overgrazed scrublands that are nutritionally poor. Green *Drosera* is usually found in habitats such as lateritic plateau and granitic hill formations which have naturally poor soils. It, thus, is very well adapted to colonise the shallow moist soils on the plateaux still facing very little competition from common scrubland plants.

There is also the red *Drosera* (*Drosera burmanni*) which is not as commonly seen as the green one. But once seen, it can never be forgotten. It is one of the very few plants with an attractive rich ruby red colour. I saw it for the



The delicate pink flowers of *Drosera indica* enables one to spot and track the carnivorous plant



VARAD B. GIRI





The red drosera traps small insects and the enzymes in the fluids digest the trapped organism. The remains of an insect are seen in the image above



The small plant of red drosera can trap an insect with help of its glandular hair, as seen in the image above

first time at Mahabaleshwar, growing in a rock crevice next to a stream. The plant was as small as the size of a 25 paise coin, and had a thin flowering stalk growing from the centre, with few tiny pinkish flowers. Its rosette leaves are covered with glandular hair which exudes sticky fluids. The digestive enzymes in the fluids are powerful enough to digest any organic matter; be it a variety of small fauna, pollen or other plant matter which may happen to fall on the plant. Generally, red Drosera can grow near stream edges, fields and rocky areas with wet, coarse soils. In suitable conditions, it can grow up to over 7 cm in diameter.

*Drosera peltata*, another species of Indian Drosera, is seen only in South and North-east India and Himalayas. I chanced upon it on the grassy hill slopes of Cherrapunji. This extremely delicate plant has flat disc-like leaves that are lined along its edges with long glandular hair. Monsoons are a favourable climate for them to grow when the grasslands





PANKAJ KUMAR

*Drosera peltata* is an extremely delicate plant, which is found only in the South and North-east India and Himalayas. This plant grows erect up to 20 cm tall and has long glandular hair

are wet and the weather is cool. This erect species can grow up to 20 cm tall if the habitat and climate are favourable.

The Indian *Drosera* share hunting grounds with another group of carnivorous plants – the bladderworts. In India, *Utricularia* is the only representative of this large and diverse group. Thirty-eight species are known in India and a new species was described as recently as 2007. They are commonly seen, especially in the monsoons. They are called 'bladderworts' because of the special method of trapping used by them. The plants have several sac-like inflated bladders on the roots and lower side of leaves, which are less than a millimetre wide. They have an opening on one side which is guarded by a trap door and equipped with sensitive hair. In moist areas, water flows into the bladder making it turgid and shutting the trap door. Slowly the water is allowed to diffuse out, while the prey that was sucked in with water, remains trapped in its bladder. The organisms are then



ASHOK CAPTAIN

*Utricularia reticulata*, generally twines around grasses or themselves, thus forming thick coils to exhibit their flowers. *Utricularia* spp. are also called 'bladderworts' because of the special method of trapping used by them





digested by the enzymes secreted through the inner walls of the bladder and the digested matter is used by the plant. In some species the bladders are known to secrete chemicals that lure small fauna into the trap.

Like the *Drosera*, the terrestrial *Utricularia* also grow in open sunny areas with shallow moist soil. During August and September, one can see a blue sheen on the rocky plateau and waterlogged rice fields from Konkan to Kerala. A closer look reveals masses of *Utricularia*. The tallest of them all is

*Utricularia reticulata* with a flower about an inch in width. They twine around grasses, or sometimes themselves forming thick coils; each one trying to exhibit its flowers to the best effect to attract large pollinators like bees and moths. The pollinators are rewarded with nectar in the curved spur of the flower. Other *utricularia* species are not as large, but are very showy in their own way. *U. purpurascens* has delicate bluish or purple coloured flowers with a white and yellow spot marking the centre.

Many other smaller flowered species

of terrestrial *Utricularia* cohabit with the two mentioned before. They show a lot of colour variation and variegation between and within species. Some of the plants may have purely white flowers. The smallest of the lot is *U. minutissima* – often smaller than a matchstick – grows on lateritic plateau of Goa and North Kanara. Aquatic *Utricularia* are generally present in waterbodies and form dense floating masses in shallow tanks and lake edges. Some have special floats to remain buoyant. Their flowers are not as showy as the terrestrial species, and



ASHOK CAPTAIN

*U. reticulata* is the tallest *Utricularia* sp. and can be seen in the monsoons on the western coast from Goa to Kerala





*Nepenthes khasiana* is a highly endemic and threatened carnivorous plant in India

are generally yellow in colour. Very different from these two groups is *Utricularia striatula* which grows as a lithophyte on vertical rock faces and often on tree trunks as an epiphyte. In early September, *U. striatula* flowers are commonly seen as tiny dots all along the rock faces of the Western Ghats. Their roots form a fine mesh on the wet rocks and bear hundreds of bladders. The flowers project away from the rocks and go on gently nodding in the breeze attracting tiny pollinators.

The most well-known of plant predators in India is the pitcher plant, *Nepenthes khasiana*. As its name suggests, it grows in the Khasi and Jaintia hills of Meghalaya. This carnivorous plant has a pre-trapping mechanism which features leaf modified into a pitcher with deep cavity filled with digestive fluids. The wall of this pitcher is slippery with waxy coating and recurved hair. The prey slips over this wall and falls into the fluids and ultimately gets digested. The plant grows in open moist but sunny conditions on hill slopes.

Due to the limited geographic distribution and market value as horticultural curiosity, *Nepenthes khasiana* is a threatened species. As the requirement of the hour, the ex-situ conservation efforts have been started. It has been successfully grown in Shillong by the Botanical Survey of India. It is also being tissue cultured at NEHU (North Eastern Hill University). However, such efforts are made only for this one species in India. Across the world, horticultural societies, institutes and nurseries offer advice on growing carnivorous plants in homes, even though they require specialized growing conditions. Such efforts have not been made in India yet.

Conversion of land into agricultural or residential areas and mining is threatening the natural habitat of these carnivorous plants. Pollution of wetlands also highly affects the growth of these plants.

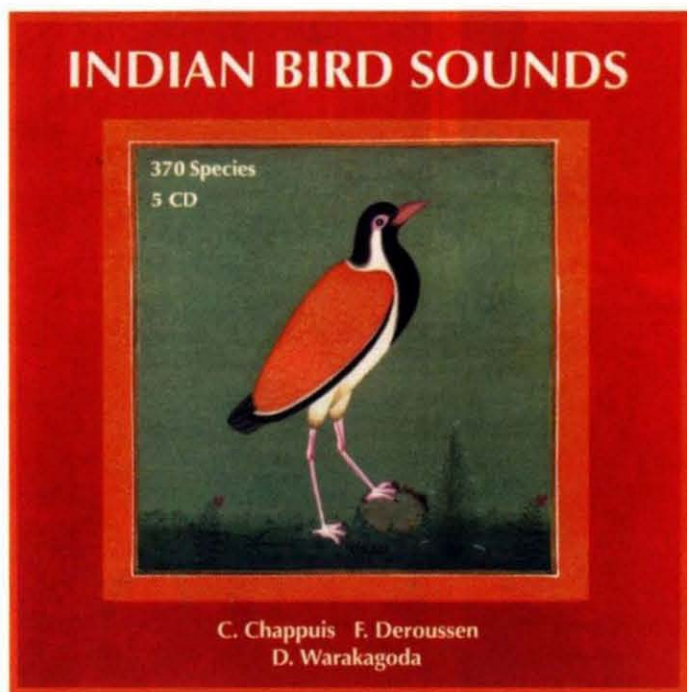
The first step towards preserving these plants, is to preserve at least some parts of their natural habitats. Along



*Utricularia purpurascens* is a seasonal herb which shows off its beautiful delicate flowers in the monsoons

with it, it is also necessary to develop horticultural techniques for the species and promote *ex-situ* conservation. Otherwise, we may end up having only photographic evidence proving that the plant predators existed in India. ❁





**Indian Bird Sounds – Nesting birds in the Peninsula,**  
 by C. Chappuis, F. Deroussen and  
 D. Warakagoda. 2008.  
 Published by Anne Chappuis, Hyderabad.  
 A set of five discs and a booklet.  
 Price: Not mentioned.

Reviewed by Nikhil Bhopale

Identification of birds is usually done by their physical characteristics. But, sometimes in the field, it so happens that, a bird may not be visible, but its call can be heard. At such a time, the bird can be identified by just its call. Written descriptions of calls in field guides are difficult to be interpreted and relate to a bird's call. The audio CD compiled by C. Chappuis, F. Deroussen and D. Warakagoda in 2008, called INDIAN BIRD SOUNDS – NESTING BIRDS

IN THE PENINSULA certainly facilitates a quick and easy identification of the birds through bird calls. It features 370 calls of Indian bird in a set of five CDs.

This set comes with a booklet with information such as place where the call was recorded, gender of the bird, breeding/ territory/ communication call. The scientific name, CD number, track number, and index number are also mentioned in the booklet. Each track is necessarily short, but a wealth of detail is packed into them, along with different types of calls or songs. For example, the call of the Red-whiskered Bulbul *Pycnonotus jocosus* is categorised into its first song at dawn, song and calls of a group, and distress calls.

The sound quality of the calls is very clear and good, without distracting changes in the level of tone, which one might expect when many sources and locations are involved. In CH1/31, Indian Black Ibis, the track begins with a crow's call. Some other calls include surrounding calls like that of birds, crickets or frogs, which could have been filtered out to avoid confusion.

In the booklet, species are listed in a systematic order based on BIRDS OF SOUTH ASIA, THE RIPLEY GUIDE by P. Rasmussen and J. Anderton. However, there are certain errors, e.g., the scientific name of Changeable Hawk-eagle has been incorrectly given as *Spizaetus cirrhatus*, it is *Spizaetus limnaeetus*.

In India, difficult and cryptic birds such as warblers and nightjars can be easily identified mostly by their calls. For a beginner, bird watching should ideally start by hearing bird calls. Though there are other bird-call CDs available in the market, the INDIAN BIRD SOUNDS, which covers 370 species, can be highly recommended for amateurs and professionals alike. ■

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Reviewed by Atul Sathe

Once in a while we come across a book that makes interesting reading to both children as well as adults. *NONO, THE SNOW LEOPARD* written by Pranav Trivedi is one such book. On the one hand it takes a child on an enchanting journey into the icy heights of the Himalayas, introducing him to conservation and the exotic fauna of the high altitudes, and on the other it gives the adult reader a few moments of leisurely reading on the interesting world of nature.

The Snow Leopard is perhaps the most elusive among all the big cats, mainly because of its remote inhospitable mountain abode. Its ways are shrouded in mystery with the chilled winds, steep slopes, cold nights, eerie silence of the mountains and the lack of human population for miles. Thus, the habitat and habits of the Snow Leopard evoke a sense of awe and thrill at the same time; and the book beautifully captures this.

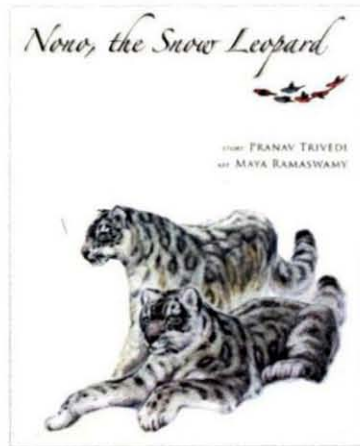
Published by Nature Conservation Foundation and supported by Whitley Fund for Nature and Snow Leopard Foundation, the book depicts a tale of two wildlife biologists, Hari and Dorje, who are tracking and studying Snow Leopards in the Spiti district of Himachal Pradesh. The book gives vivid descriptions of the Himalayan scenery complete with birds such as Himalayan Griffon, Lammergeier, Yellow-billed Chough and Tibetan Sandgrouse and animals such as Bharal (Blue Sheep), Ibex, Yak, Pica, Lynx and Red Fox, along with the sparse vegetation above the tree line.

Dolma, the female Snow Leopard gives birth to three cubs, but dies soon after. A male cub, named Nono by the researchers, slowly grows up into a powerful big cat and becomes the focus of their study. They fit it with a radio-collar and track it in order to study it further. In the process, they come close to the ground realities of the hill people who are slowly getting antagonistic towards the Snow Leopard because it is increasingly lifting their livestock. Lure of money that can be earned by selling its skin is also

inducing people to trap it and kill it.

In the drama that unfolds in the few pages of the 63-page book, the researchers are successful in reforming a poacher, even as they continue to track Nono. They also introduce an insurance scheme for those who are losing their livestock to the Snow Leopards and manage to get funding for furthering the cause of Snow Leopard conservation. Although set in the backdrop of conservation issues, the book takes the reader into the serene Himalayan surroundings, complete with the cheerful tranquility of the mountains.

The book is priced at Rs. 195 and includes good coloured sketches and illustrations of the Snow Leopard's abode. It is sure to evoke a sense of appreciation of the Himalayan fauna and the need to conserve it, along with the majestic Snow Leopard. The book, which is a short story, will be of interest to school children, parents, teachers, libraries and the public in general who are interested in learning about the world of nature, in an interesting manner. ■



**Nono, the Snow Leopard**

Story by Pranav Trivedi,

Art by Maya Ramaswamy. 2007.

Published by Nature Conservation Foundation, Mysore.

Size: 17 x 23 cm

Pp. 63. Price Rs.195/-, Paperback.

We are grateful to  
**RISHAD NAOROJI**  
 for a generous donation to the  
*Kekoo Naoroji Memorial Fund*  
 to support the publication of *Hornbill*



## Tadoba Mahotsav organised by Tiger Cell

The Nagpur-based Tiger Cell of BNHS and National Green Corps of Social Forestry Directorate organised a six-day Tadoba Mahotsav from January 18 to 23, 2010, at Moharli near Tadoba-Andhari Tiger Reserve (TATR). The festival was organised by the Education Officer of Tiger Cell, Mr. Sanjay Karkare; with the primary objective of introducing

students and teachers (many of them from rural areas) to the symbiotic relationship between man and the various elements of ecology. Participants got interesting information regarding tiger census, camera trap method, man-animal conflict, threats from mining and biodiversity of Maharashtra.

The articles created by students were then put up on display during the event. Students and teachers also made presentations. The event went a long way in making students aware about the need to participate in conservation efforts and the real issues confronting conservation today. This is the second year of the Tadoba Mahotsav, which is a combination of interactive talks and field trips into the Tadoba forests. Students and teachers representing 32 districts of Maharashtra participated in the event. ■



Students took part in activities and competitions like clay work, face painting (above) and collage making. The event brought students in close contact with the beauty of nature, thus taking their thinking process much beyond the mundane classroom activities

## Flamingo Festival at Sewri

Bombay Natural History Society (BNHS) and the Indian Bird Conservation Network (IBCN) organised a Flamingo Festival on March 27, 2010, at the Sewri Jetty in Mumbai, which was sponsored by Bharat Petroleum Corporation Limited (BPCL). Over 15,000 Greater Flamingos and Lesser Flamingos and about two dozen other waders were witnessed by the people on the mud-flats near Sewri Jetty, an Important Bird Area (IBA). The festival was inaugurated by Mr. S. Vijayakumar, General Manager, HR, BPCL.

The primary objective of the festival was to introduce the common citizens to these beautiful birds that have been visiting Mumbai every winter for years and to sensitise people towards nature and also to use this as an effective platform to reach out to the people

with the message of conservation and the environmental issues we face today.

Thousands of bird lovers and general public, including school and college children, BPCL employees, municipal employees, people from the Port Trust,

police and journalists had a first-hand experience of the beauty of flamingos that fly down to Sewri mud-flats every year from Kutch in Gujarat and possibly from Africa. These birds have almost become a symbol of conservation of Mumbai's wildlife. ■



Flamingos of Sewri



## Book release - "Latin Names of Indian Birds: Explained"

BNHS released *Latin Names of Indian Birds: Explained* authored by Dr. Satish Pande, on March 4, 2010, at Hornbill House. The book was released by Mr. Kishor Chaukar, Managing Director, Tata Industries. This book gives an interesting insight into the linguistic meaning and aspects of scientific names given to birds found in India. It deals with the historical, geographical, cultural and individual aspects that influence and enable the coining of the scientific Latin names of a bird. The book aims at bringing the ornithological jargon to the common man in a simplified manner. ■



(from L-R) Mr. Kishor Chaukar, Managing Director, Tata Industries, Dr. Asad R. Rahmani, Director, BNHS, Mr. J.C. Daniel, Chairman, Publications Sub-Committee, Mr. Homi Khusrookhan, Vice-President, BNHS, Dr. Ashok Kothari, Honorary Secretary, BNHS and Dr. Satish Pande, the author

## ENVIS website now in Hindi and Marathi

The ENVIS (Environmental Information System) Centre of BNHS has been involved in the collection, collation and dissemination of information on Avian Ecology since its establishment in 1996. The information has been stored in the form of databases and is freely accessible on the website [www.bnhsenvis.nic.in](http://www.bnhsenvis.nic.in). In the last couple of months, this website has undergone some major changes. It has been translated into two languages, Hindi and Marathi. This move will broaden the reach of the information among non English-speaking bird enthusiasts and equip them with valuable information on avian ecology. ENVIS with the help of Indian Bird Conservation Network, also developed the databases on Important Bird Areas (IBAs), Threatened Birds and Endemic Birds of India providing user-friendly access. Data from previous issues of *Buceros* (a newsletter of the ENVIS) such as vernacular names of birds of the Indian



subcontinent, and a checklist of Indian water birds have also been uploaded on the website. ■

## Project Mangrove's Poster bags 2nd Prize at National Seminar

On December 30, 2009, a poster prepared by the Project Mangrove team of the BNHS won the 2<sup>nd</sup> prize during the the 20<sup>th</sup> All India Congress of Zoology and National Helminthological Congress at Central Institute of Fisheries Education. BNHS had presented its poster on Project Mangroves titled 'Mangrove Restoration through Community Involvement'. The project team included Mr. Deepak Apte, Manan Shukla, Bhavik Patel, and K.D. Vachrajani.

The poster explained the work done by the BNHS

in the areas of mangrove conservation, regeneration and awareness. It also graphically explained the growth, witnessed in the mangrove afforestation initiatives of BNHS in Gujarat.

Local community participation and setting up of nurseries have been the salient features of Project Mangrove. Creation of awareness amongst coastal communities and engaging in school education programmes have been few of the most important components of the project. These are depicted in the winning poster. ■



## Workshop on avian influenza and wild bird interaction

A half-day workshop on 'Understanding the Role of Wild Migratory Waterbirds in Transmission of Zoonotic Diseases in Bangladesh' was organised on February 28, 2010, jointly by FAO, Wetlands International, United States Geological Survey, Wildlife Trust of New York, Wildlife Trust of Bangladesh, Bangladesh Bird Club, Bangladesh Forest Department, International Centre for Diarrhoeal Diagnostic & Research, and BNHS. In all, 70 participants including veterinarians, wildlife managers, local NGOs and university students attended the workshop. In continuation to the workshop, a one-day training programme on wild bird catching, sampling, marking and safe



Courtesy: WILDLIFE TRUST OF BANGLADESH / PHOTO BANK

The participants are seen here with the banner of the workshop on avian influenza and wild bird interaction

release was organised on March 1, 2010, at Bangladesh Livestock Research Institute by Dr. S. Balachandran, Assistant Director, BNHS. Field work and bird trapping continued from

March 3-12, 2010. The movement of the satellite transmitter fitted birds in Bangladesh can be viewed on [www.werc.usgs.gov/sattrack/bangladesh/index.html](http://www.werc.usgs.gov/sattrack/bangladesh/index.html). ■

## National Workshop on Ramsar Sites Management and Identification

A National Workshop on 'Management Issues of Ramsar Sites in India and Prioritization of identified potential Ramsar Sites in Southern States' was organised jointly by the Tamil Nadu Forest Department and the BNHS on February 10-11, 2010, at Tiruchirappalli, Tamil Nadu. The State Minister

of Forests, Mr N. Selvaraj inaugurated the workshop. Management issues of different types of Ramsar sites in India, and identification of new sites in southern states, was discussed in the workshop. Over 100 participated in the workshop, including personnel from the Forest

Department, research organisations, scientists from SACON, FERAL and WWF, various colleges, universities and local NGOs. Recommendations made included designating Suchindram, Koonthakulam, Karaivetty and the twin wetlands of Periyakanmai & Sakarakottai as wetlands of national importance and to prepare the management action plan for Point Calimere.

Mr. R. Sunadaraju, Chief Wildlife Warden, Government of Tamil Nadu, and Mr. V. Thirunavukarasu, Wildlife Warden, Nagapattinam, were the key persons who made the workshop a success. ■




From L-R: Mr. E.J. James, Director of Karunya University, Mr. A.S. Balanathan, Principal Conservator of Forests and Head of Forest Force, Dr. Asad R. Rahmani, Director, BNHS, Dr. S. Balachandran, Assistant Director, BNHS



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