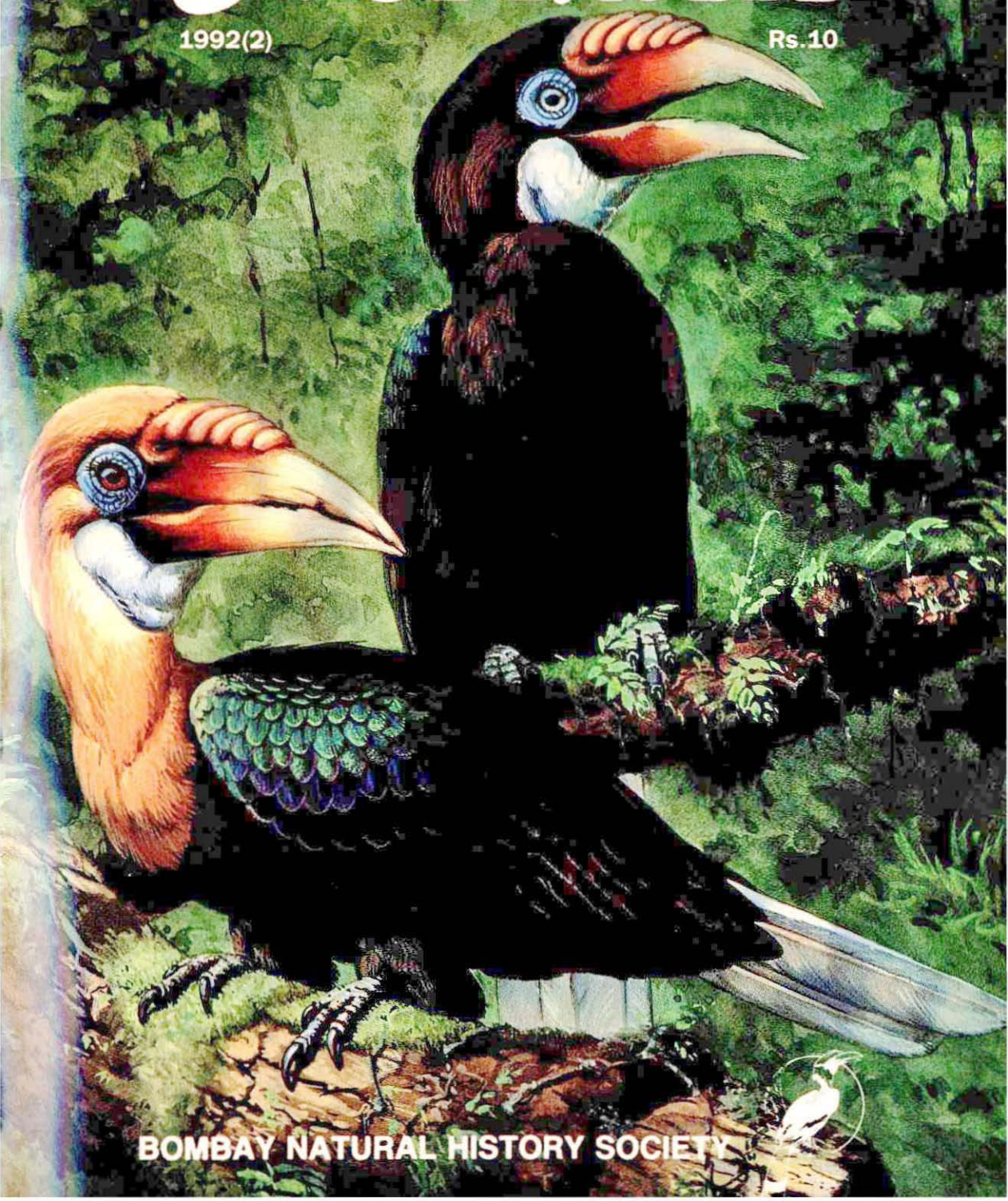


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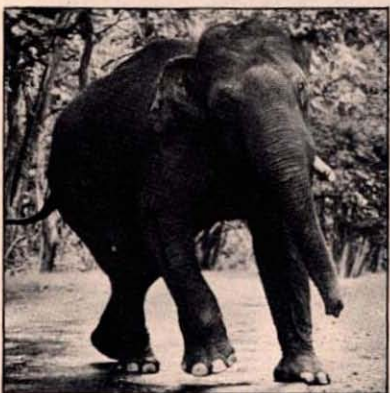
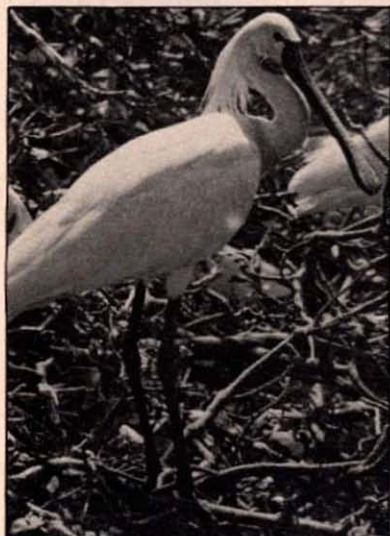
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BOMBAY NATURAL HISTORY SOCIETY

CONTENTS



2 Andaman and Nicobar — Conservation Strategies
India's largest island ecosystem is reeling under human onslaught. The old story of development v/s environment — and some new answers.

By Cecil Saldanha

8 Wings Over the Water

Have binoculars, will travel. At the Veer Dam near Pune, birdwatching comes alive.

By Niranjan Shukla

13 Reflections on Rio

Did we save the world? A participant looks back at the Earth Summit jamboree.

By Jay Samant

14 The Owl

Did you hear it? Then brace yourself for bad luck — or read on.

By Naresh Chaturvedi

18 Seashore Lore — Salty Knights in Armour

Ten legs, and a suit of armour. Gourmets love crabs; and so do biologists. Find out why.

By Beefsea

26 Collaring the Admiral

How to knock out an elephant single handed. Radio telemetry isn't for the faint hearted; follow a BNHS team through the Mudumalai jungles.

By J.C. Daniel

11 Letters

33 Nature Alive

22 News, Notes and Comments

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The Society was founded in 1883 for the purpose of exchanging notes and observations on zoology and exhibiting interesting specimens of animal life. Its funds are devoted to the study of natural history in the Oriental region, and to measures for nature conservation. Individual membership can be in either personal or official capacity. Membership is also open to scientific and educational associations and institutions as well as companies.

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For more information on the Society and its activities, write to The Honorary Secretary, Bombay Natural History Society, Shaheed Bhagat Singh Road, Bombay 400 023. Tel.: 243869, 244085, 243421

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EDITORIAL

Dollars and sense

Much of the discussions at the Earth Summit in Brazil centred around money — who needs it but is broke, who has it but won't part with it, and why they should. The argument goes that India (and several other countries) would immediately embrace the concept of sustainable development, if only they could afford it. Countries like the U.S.A. are morally obliged to help because they have the money, and to atone for their past environmental sins.

Certainly, there are areas where outside funds are essential, such as alternatives to CFCs, or more sophisticated pollution control systems. But there are several other (and perhaps more urgent) problems that can be solved with the funds available today — enforcement of environment protection laws, coordination between government agencies, and honesty in administration.

India spends nearly Rs 10,000 crores each year on carefully planned development schemes for rural areas. On paper, government loans would help farmers improve land use methods and the quality of their livestock. Education, health and family planning would improve, and migration to cities would fall. But in practise, only a fraction of the money goes where it is intended. The rest is swallowed up by corruption and bureaucratic sloth.

It is now accepted that rural poverty is an important reason for environmental degradation. Eco-development schemes are designed to increase incomes and simultaneously improve the quality of natural or semi-natural areas outside villages, usually by reducing exploitation pressures and thus facilitating natural regeneration. For example, demonstration programmes and incentives for new methods of animal husbandry will improve milk yields and simultaneously reduce pressures on grazing land. Had *garibi hatao* worked, the Indian environment would be far less precariously balanced than it is today. Instead, we have grandiose schemes like the Narmada project, which is a classic example of how *not* to spend money.

The forests of the north-east, India's richest area in terms of biological diversity, are being carved up by timber contractors and plywood manufacturers, in connivance with politicians and local officials. How, in practical terms, would foreign aid help?

'Leakages' are said to account for up to 40 percent of the cost of development projects in India, and there is a marked reluctance in the west to fund new schemes, no matter how nice they look on paper. Some hardliners in the U.S.A. feel that American contributions to a Green Fund for India should wait till we show an acceptable level of fiscal responsibility (wait for indignant chorus of "Acceptable to whom?"). And speaking personally, we agree entirely.

EDITORS

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COVER

Narcondam hornbill
(*Rhyticeros narcondami*)
pair. Painting
by Carl D'Silva

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ANDAMAN & NICOBAR Conservation Strategies

Text and photographs by CECIL SALDANHA

Some 1000 km off the eastern coast of India, an archipelago glimmers in the sun. Over 200 islands, a wealth of biological diversity — and a quarter of a million people, whose spiralling needs are rapidly unravelling the threads of a fragile ecosystem.

THERE HAVE BEEN two opposing plans for the future of the Andaman and Nicobar islands. One seeks to develop them by increasing immigration, augmenting timber extraction, introducing a number of cash crops, encouraging high profile tourism and setting up a free port. The other would prefer to preserve the pristine natural beauty of the islands. Would it be possible to have a via media, where development of the right type could take place and be compatible with the efforts to conserve the rich but fragile ecosystems of the islands?

We tried to find an answer by examining the natural ecosystems of the islands, and how they were being manipulated by man in the name of development.

There are three natural ecosystems — the land, the sea and the mangrove. The land (a total area of 8,249 sq km) is generally rugged. Thanks to a warm and humid tropical climate the vegetation is dense, ranging from giant evergreens to stunted hilltop forests. The gurjan (*Dipterocarpus*), the padauk (*Pterocarpus*) and the chuglum (*Terminalia*) are prized timber trees. The humus and forest litter prevent run-off and help in sub-surface percolation, especially where fresh groundwater is scarce or absent.

The sea — an exclusive economic zone of about 600,000 sq km — teems with fish and is rich in coral beds. The mangroves constitute an interface between land and sea. These plant communities with their prop and stilt roots form a bulwark against erosion brought about by the rise and fall of the tide. Special adaptations like vivipary, breathing roots and a salt tolerant metabolism make these plants highly adapted to their slushy, saline habitat. The detritus of organic matter contributes to high nutrient levels; and the mangrove-sheltered waters are favoured spawning grounds for a number of marine animals that normally live in the open sea.

THE HAND of man has fallen heavily on the archipelago. While the Negrito tribals are dwindling rapidly, an influx of mainland settlers has sent populations soaring — 65,548 in 1961 has grown more than fourfold, to 277,989 according to the 1991 census. And local needs for land and resources are fast outstripping supply. Forest land is being converted into revenue lands.

Local food resources are insufficient: over half the food grains and the entire requirements of onions and potatoes, not to mention diesel, cement and steel, have to come from the mainland. Because of the high calorific value of mangrove wood, large stretches of mangroves near human habitations have already been destroyed (fortunately, cutting of mangroves is now forbidden). Since transport costs are high subsidies are common. And even with the subsidies, given the limitations of inter-island transport, scarcities in far flung islands are frequent.

Timber logging has long been a major activity. Up to 1950 the average annual timber extraction was around 49,700 cubic metres. Today the plywood, sawn wood and matchwood industries alone need 189,200 cubic metres a year. Since the commercially exploitable area is only 30 per cent of the forest cover, there are serious apprehensions that the increase in the rate and intensity of extraction may not be sustainable. Introductions of some exotic forest species (especially teak) have been unsuccessful, and have resulted in over 95 sq km of unproductive forest land.

The flat lands, especially in the Andaman group, were cleared of their giant evergreen forest to plant paddy. But the soil is poor, and parts of these paddy lands have become pitiful substitutes for the original forests.

Oil palm plantations have been tried in Little Andaman, and rubber plantations in Katchal. The red-oil palm is a heavy feeder that has to be uprooted and replaced by fresh seedlings within 25 years. The fertility of the soil during the second and subsequent plantation cycles may not be sufficient to maintain high levels of productivity.

This apart, the rich biological diversity of these plantation areas has been replaced by monocultures. The important point at issue is whether a unique type of vegetation should be destroyed for the sake of commercial crops. Natural forests, once destroyed, will in all probability be lost for all time.

NO AREA HAS infinite resources; but if used wisely, these resources can supply human needs without destroying the system. For example, the fisheries potential of the islands is enormous. Reliable estimates place the annual available catch at around four lakh tonnes. The actual catch, however, is less than 11,000 tonnes.



Photo: Dev Raj Agarwal/Sanctuary Features

Mangroves constitute an interface between the land and sea, their prop and stilt roots forming a bulwark against erosion.

Processing and marketing facilities are insufficient even for this catch. As for attitudes, the Nicobarese tribals are adept boatmen but not motivated enough to take up commercial fishing, and the Bengali settlers prefer freshwater fish which they rear in local ponds. In an attempt to increase fishing operations, the Dept. of Fisheries brought in families of fishermen from Andhra Pradesh and Kerala. Their boats and fishing methods are primitive, their range limited and catch meagre.

Aquaculture has possibilities too; but here again there has been more lethargy than purpose. The many salt-water creeks are ideal for rearing prawns, lobsters, mussels, crabs and oysters. But despite a number of laboratory studies, there have been no significant attempts at mariculture.

Tourism is another potential money-spinner. The islands are breathtakingly beautiful — ever-changing hues of sky and sea, shimmering beaches, enchanting coral beds. But foreign tourists have to obtain permits, and are restricted to only a few islands. Attempts are being made to increase the

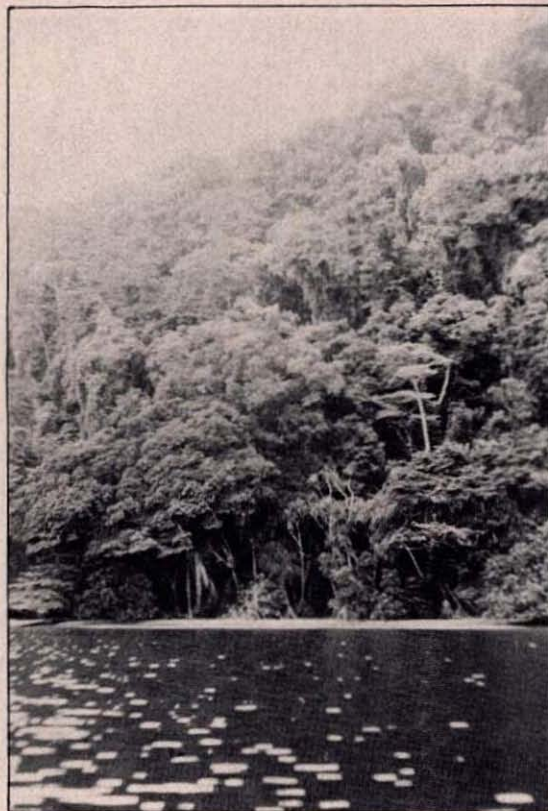
number of guest houses run by the Dept. of Tourism. These are reasonably priced, but generally booked well in advance. Private hotel accommodation is available, but the tariffs are high, and the occupancy rate in the costlier ones correspondingly low (most supplies and trained staff in the fancier hotels are not local, but come from the mainland).

The idea of having a free port in the Andamans has been surfacing at regular intervals. The strategic position of South Bay near the shipping lane to the Pacific Ocean would make it an ideal place for a free port, but development of this sort would create serious environmental and demographic problems. For the moment the idea has not been accepted because of these and other serious considerations.

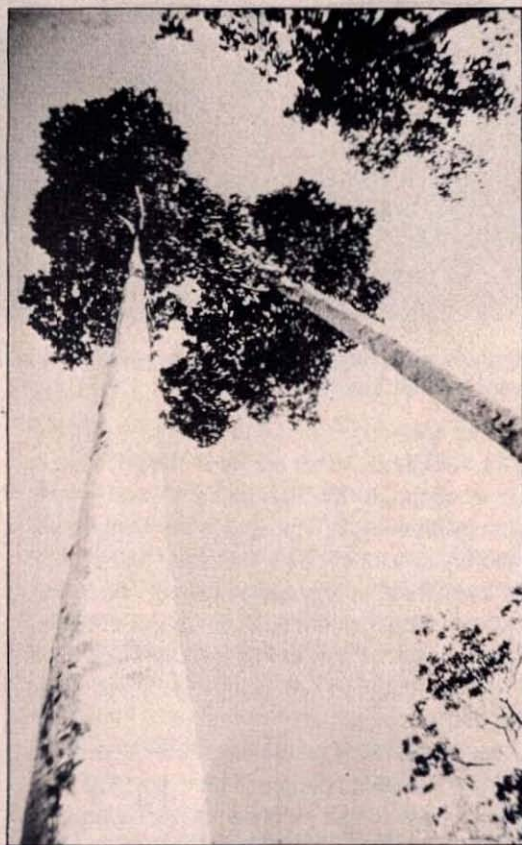
WE MUST conserve the islands; that much is certain. But how? On the one hand we are faced with the stewardship of this beautiful, but incredibly delicate island system. On the other hand we have to ensure that the needs of the people, particularly those in far

UNDER THE AXE

Big trees mean big money — not only because of the quantity of timber, but also since they yield larger planks or sections. The 50 m gurjan is particularly prized by the plywood industry. Earlier, gurjan trees were also used for oil extraction; the oil was used chiefly in the production of roof shingles.



Dense evergreen forest once stretched right to the shore on some islands. But with timber exploitation far exceeding the rate of regeneration, the island forests will not survive long.



Apart from captive elephants used to handle timber, there is a breeding population of perhaps 30-40 animals on Interview island. These originated from a captive group of 50 odd elephants which were released when a timber extraction operation went bankrupt in the early 1960s.

flung islands, are satisfied, and that they are able to live decent, dignified lives.

Clearly, a land-based economy depending mostly on forestry cannot sustain the islands; it will only perpetuate the dependence on large plan allocations and subsidies. By changing over to a developmental strategy based on the sea, the economy can be improved and the pressure on the land decreased — provided there is a will to face the challenges involved.

The example of Lakshadweep is worth mentioning. In the last three decades, tuna fishing with 'Pablo boats' has boosted fisheries, and the revenue from dried tuna is substantial. For fisheries to succeed in the Andamans, proper plan allocations, manpower training, curing and marketing are necessary. So is a restructuring of the educational system, to prepare the youth to take to these avocations.

Simultaneously with this shift in developmental strategy, the dependence on timber and wood-based industries will have to be curtailed. This will save the forests and use the timber for local needs rather than for export to the mainland.

Curiously, while a large part of the land is over-exploited, some areas (especially the hilly terrain given to farmers) are under-utilised. Multiple cropping should be encouraged in these areas, with demonstrations for local cultivators. Spices like pepper, clove and nutmeg can be preserved and marketed despite the lack of accessibility to immediate markets.

The ban on export of unsawn timber and on the cutting of mangroves is a move in the right direction. Enforcing the bans is difficult, but not impossible.

THE WILDLIFE (Protection) Act of 1972, giving legal protection to specific conservation areas, has been in operation in the Andaman and Nicobar islands since 1977. There are now six national parks (three of which are over 1000 ha in area) and 94 sanctuaries, several of them on remote, uninhabited islands. The largest of the national parks is the 28,150 ha Marine National Park, set up in 1983. The sanctuaries were generally established for the protection of specific species. The 10,000 ha crocodile sanctuary at Lohabarrack was established in 1983, and the Megapode island Sanctuary two years later. The 21 ha Narcondam island sanctuary was set up in 1987 to protect the

habitat of the Narcondam hornbill (*Rhyticeros narcondami*), which is found nowhere else but on this one island. Perhaps 200-250 birds still exist.

THE CONCEPT of biosphere reserves has gained currency in recent years. A large multiple-use area is demarcated into protection and management zones. The core zone is fully protected and out of bounds to people (except for research and tribal hunting rights if any), so that long term plant and animal successions and interdependence can take place without outside interference. Buffer zones are established around the core area, to protect the latter and also to carry on experiments in regeneration and wildlife management. Commercial exploitation of buffer zone resources is discouraged. A third zone, termed the manipulation zone, is where human habitations and agro-horticultural operations are allowed. In theory, manipulation zones will serve as laboratories to evolve ways in which man can live in harmony with nature in a long term, sustainable manner.

In January 1989, an 885 sq km area in the Great Nicobar Island was set aside as a Biosphere Reserve. Two core zones — Campbell Bay and Galathea National Parks — are being constituted under the Wildlife (Protection) Act, each surrounded by a buffer. The preparatory steps are complete, and an official notification by the Andaman & Nicobar Administration is expected shortly. The core and buffer zones of this biosphere are endowed with dense, virgin forests through which flow the only true rivers of the Andaman and Nicobar islands. The tribal hamlets on the western and southern portions of the island, together with the settlements of ex-servicemen on the south-east, will form manipulation zones to evolve land use methods best suited to the islands. An action plan for the biosphere reserve has been drawn up recently by me at the request of the Ministry of Environment and Forests.

We do hope that a precious but gravely threatened inheritance entrusted to our safekeeping will not be depleted to the point of instability. What is needed is not easy rhetoric but hard-edged analysis and effective action. ■

Fr. Cecil Saldanha is one of India's foremost plant taxonomists. He has worked extensively on botanical and general conservation aspects in the Andamans, and has helped formulate a conservation strategy for the islands.

Wings Over the Water

NIRANJAN SHUKLA

THE VEER DAM is a small-scale irrigation project about 70 km south-east of Pune. It has a convenient approach from the Pune-Satara Road just near Shirwal, where one takes the Pandharpur bifurcation to arrive at Veer. In the vicinity are other irrigation projects nearing completion at Jeur, Pimpare and Parinche.

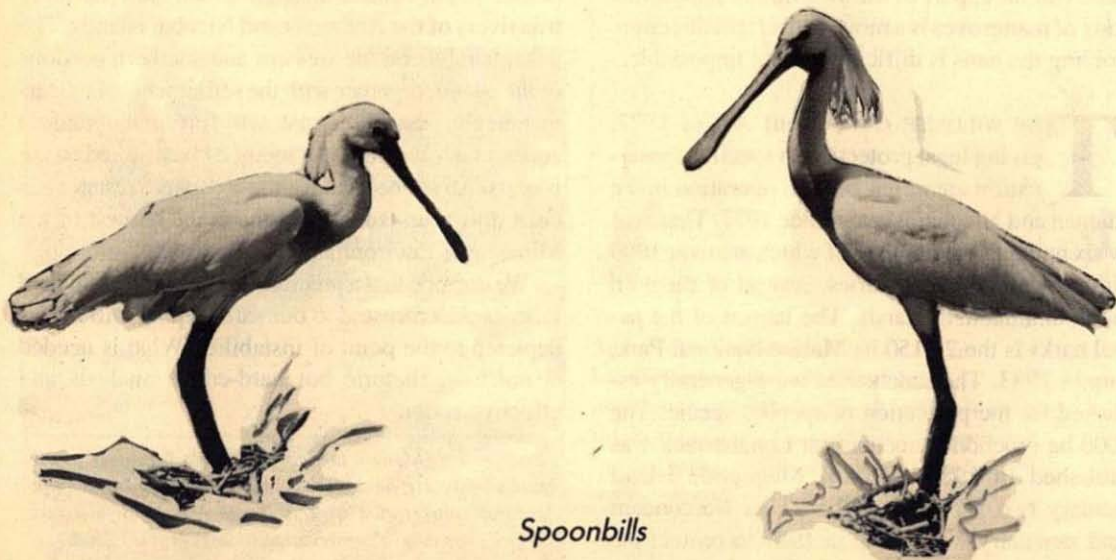
The dam and its environs house a relatively diverse ecosystem. The open expanse of water stretches to the west into the hills, while bordering the water are mudflats and a few rocky outcrops. As we move further away from the water, we encounter undulating countryside, with fallow scrubland interspersed with cultivated patches. At first glance the area appears undisturbed, but signs of the human touch are clear. There are small shallow ravines, and in places dry land has given way to water-filled gullies.

A few grassy patches have made an incision into the artificial lake, and here are seen a host of brahminy ducks waddling about lazily, gleaning a grass seed now and again. From the wheat fields, the redwattled lapwing issues forth an occasional "Did he do it?"

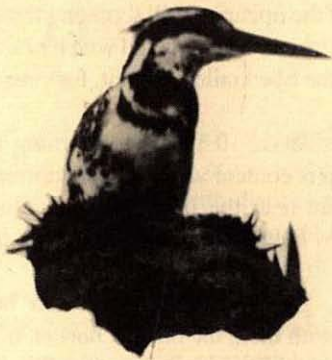
IT IS 7.00 in the morning as we stand on the wall facing the lake. Our backs are to the irrigation bungalow which stands amidst the man-made environment of rain trees, gulmohar and their kind. It is still chilly, and we are not ready for the rising sun yet, as we try to take in the almost treeless panorama. Suddenly, two pairs of white wings flap past us towards the east. Spoonbills. That does it — everyone fumbles for binoculars to get an eyeful; and suddenly no one is feeling sleepy anymore.

As we near the water's edge, we see schools of fish darting about in the water; and sure enough, the river tern, the grey heron and the solitary large egret, all exclusive fish-eaters, are spotted almost simultaneously. A pied kingfisher hovers above, a sure indication that fish are aplenty.

An occasional flock of little and median egrets is seen flying from the east towards the dam; hinting that their roosting place is not far off, eastwards. A grey and white cloud drifts rapidly across the water and my binoculars go up. It is a huge flock of demoiselle cranes heading for the hills. Is there any other waterbody to the south-west, I wonder. Vil-



Spoonbills



Pied kingfisher

lagers claim they often see this magnificent bird at Tondal and Bholi, but we are not sure. Villagers of Parinche and Vathar colony also are well acquainted with the wintering cranes.

There is another flock of demoiselles resting peacefully beyond the mudflats. The place is inaccessible, quite out of reach, and the flock slumbers undisturbed through the morning. On the mudflats, we come across many large foot-impressions which could only belong to the cranes, and a few ruddy and grey brahminy duck feathers.

The brahminy ducks seem to have adjusted themselves very well. They can be seen not only in the backwaters, but also on the other side of the dam. Now and again, a flock may be seen flying away, while new flocks come and settle down — local migration of these ducks seems to be common at Veer.

Sandpipers are seen off and on, but there are only a few shovellers and otherwise no ducks. Storks and ibises are conspicuously absent. What strikes you most about the lake is the total absence of aquatic vegetation. No hyacinth. No typha. No overgrown rushes to block your view. This makes the presence of the purple moorhen quite noteworthy.

OUR PROGRESS along the lake side is halted by a water-filled gully, cutting right across our path. Across it is a rocky projection, in which a female wire-tailed swallow has found a suitable overhang to make her nest. Untiringly, the bird makes soft pellets of the wet mud near the water and uses her saliva to make it into a

ball; and pellet by pellet, makes a home out of it. The swallow doesn't seem to mind the presence of an irrigation motor and a couple of hoses so near her nest.

We are still facing the water when we hear a soft, played-down whistle. It stops as suddenly as it had started. Now we hear it again; now we don't. No preamble, no crescendo; just a plain whistle. As we turn around to look, we see the object of our curiosity. It is a black ball in mid-air. It hurtles down and as if someone has abruptly pulled a string attached to it, goes up.

What we are seeing is in fact a male blackbellied finch-lark displaying. Some distance away, we spot the female sitting on the ground too. As we go near, she flies off to reveal a small circular clearing in the ground. Some droppings can be seen in it. This seems to be the roosting place of the finch-lark.

IN FRONT OF us is the dry, fallow land interspersed with shrubs. The whole scene has changed dramatically, with a profusion of larks, both blackbellied and rufoustailed. There is a flock of ring doves, too, sitting on the ground. I take a closer look, and find to my delight a few red turtle doves amongst the ring doves. With the rays of the sun falling on their backs, they make a beautiful sight.



Grey heron

Our new picture now houses a different variety of birds. Little ringed and Kentish plovers are abundant. Occasionally, a grey partridge is also heard. To our right are the standing crops of jowar and chana. Peeping out of the crop are tall sticks mounted with



Grey wagtail

polythene rags. This seems to aid the farmer in his fight against the crop-raiders.

As we proceed, we disturb a big flock of 50+ sandgrouses into flight. They settle down further away, one by one, their bodies making perfect examples of oblitative plumage. We walk past a few circular clearings decorated by bird droppings. These are the roosting places of the sandgrouses. The green-tipped droppings of the cranes are also found at places, indicating the large amount of vegetable matter they consume.

But this doesn't mean that the demoiselle crane is a compulsive vegetarian. It is known to make short work of the variety of insect that swarms among the crops. Probably because of this double benefit, the demoiselles are inseparable from cultivated fields.

IN THE MIDDLE of this all is a small shrub sheltering a puddle, and here we make an interesting observation. A fantail snipe, all exposed, is feeding nonchalantly in the open, completely oblivious of our presence, its abnormally long bill making rapid forays into the squelchy mud. The snipe now disappears, but not before each of us has had a good look.

Throughout our observation, we can't help noticing the omnipresent wagtails — large pied, white, grey, yellow headed, yellow, they are all there. As we make our way ahead, an Indian courser darts across, making excellent time on its long white legs.

Now we are on our way back, and turn around to take a last look at the lake. We see a curlew-like

wader quite far away. The bird shifts, providing a clear view of the upcurved bill. Looking through my binoculars, I take in the white tail with black tail tips. This bird is the blacktailed godwit, for sure.

IT IS ALMOST 10.30 in the morning and our group is content with the rich morning haul. We are near the Irrigation Bungalow now, surrounded by Peltoforums, tamarind, gulmohar and rain trees.

The iora, grey tit and sunbirds can be heard clearly, and with them the *tuweet, tuweet*, of a tailor bird and the soft *tirrr* of a redbreasted flycatcher. A large group of common langurs prances about on the trees. I go near the ashok for a closer look and find a bonus in the shape of a used nest of a redvented bulbul.

Suddenly, there is commotion, with a number of birds twittering together and excitedly flying about. I climb the wall to see who the mischief-maker is and behold a huge short-toed eagle circling overhead. By now, everyone's eyes are glued to the sky. The eagle, perhaps pleased by all this attention, hovers in mid-air. For some of us who have seen the blackwinged kite hovering, let me assure you that this eagle doesn't come anywhere close; but the sight of the huge creature effecting such ungainly movements had all of us captivated. Now a large Indian kite with those unmistakable white wing patches glides by. It is carrying something in its talons and this slips from its clutches and falls. The kite swoops down to retrieve it, but in vain.

AN INTERESTING association we saw was that between a herd of grazing sheep and cattle egrets. It seems that the winds of perestroika have reached the egrets too — they had given up their traditional hosts the cows, and had accepted the company of sheep. Stalking about assertively, getting in their way and always ready to devour the insects which the grazing sheep disturbed, they present a perfect example of happy commensals. ■

Niranjan Shukla is a polymer engineer and a long-time birdwatcher. He works with a Poona based NGO on soil and water conservation projects in rural Maharashtra. The photographs are by Loke Wan Tho, philanthropist, naturalist, and perhaps the greatest of the early bird photographers. He helped set up a BNHS-administered corpus fund for research on birds.

LETTERS

Sir,

What is it about corvids that makes them so human? Jackdaws, ravens, crows and magpies have always been accredited with distinct personalities. Naresh Chaturvedi's 'Telling Tales of the Crow' in *Hornbill* 1992(1) called to mind Mark Twain's impressions of one of this group.

In 1896, Mark Twain visited Bombay in a steamship journey around the equatorial regions of the world. One of Bombay's characters that he wrote about with wit and elegance was the "Bird of Birds — the Indian Crow." Twain's lively character sketch was perhaps inspired by the crow's active, raucous contribution to the dawn cacophony, and other rascally acts during the writer's first few days in this "bewildering, enchanting" city.

"The Bird of Birds — the Indian crow. I came to know him well, by and by, and be infatuated with him. I suppose he is the hardest lot that wears feathers. Yes, and the cheerfulest, and the best satisfied with himself. He never arrived at what he is by any careless process, or any sudden one; he is a work of art, the product of immemorial ages, and of deep calculation; one can't make a bird like that in a day.

He has been re-incarnated more times than Shiva; and he has kept a sample of each incarnation, and fused it into his constitution. In the course of his evolutionary promotions, his sublime march toward ultimate perfection, he has been a gambler, a low comedian, a dissolute priest, a fussy woman, a blackguard, a thief, a spy, a professional hypocrite, a practitioner and propagator of irreverence, a meddler, a busybody, and a wallower in sin for the mere love of it. The strange result, the incredible result, of this patient accumulation of all damnable traits is, that he does not know what care is, he does not know what sorrow is, he does not know what remorse is; his life is one long thundering ecstasy of happiness, and he will go to his death untroubled, knowing that he will soon turn up again as an author or something, and be even more intolerably capable and comfortable than ever he was before.

This Indian sham Quaker is just a rowdy, and is always noisy when awake — always chaffing, scolding, scoffing, laughing, and cursing, and carrying on about something or other.

I never saw such a bird for delivering opinions. Nothing escapes him; he notices everything that happens, and brings out his opinion about it, particularly if it is a matter that is none of his business. And it is never a mild opinion, but always violent — violent and profane — the presence of ladies does not affect him. His opinions are not the outcome of reflection, for he never thinks about anything, but heaves out the opinion that is on top in his mind, and which is often an opinion about some quite different thing and does not fit the case. But that is his way; his main idea is to get out an opinion, and if he stopped to think he would lose chances.

If I sat on one end of the balcony the crows would gather on the railing at the other end and talk about me; and edge closer, little by little, till I could almost reach them; and they would sit there, in the most unabashed way, and talk about my clothes, and my hair, and my complexion, and probable character and vocation and politics, and how I came to be in India, and what I had been doing, and how many days I had got for it, and how I happened to go unhanged for so long, and when would it probably come off, and might there be more of my sort where I came from, and when would *they* be hanged — and so on, until I could no longer endure the embarrassment of it; and then I would shoo them away, and they would circle around in the air a little while, laughing and deriding and mocking, and presently settle on the rail and do it all over again."

From 'Following the Equator — A Journey Round the World', published in 1906

Renee Borges

Bombay

Sir,

During the first week of May 1990, two tags of a marine turtle, bearing the numbers W2242 and W2243 of the Sind Wildlife Department, Pakistan, were recovered by a fisherman from the Salaya town, Jamnagar district. The tags had been removed from a turtle caught in a trawl net off the island of Bhaidar (22°27'N, 69°17'E), in the Gulf of Kutch, Gujarat.

According to Fehmida Firdous of the Sind Wildlife Management Board, the tags were from a green turtle (*Chelonia mydas*) which had been

tagged on 24th September 1989 at Hawksbay beach near Karachi. Green turtles nest there throughout the year, and it is believed that about 6000 females use these beaches every year. To date, over 1000 green turtles have been tagged on this coast.

The turtle population nesting at Karachi was so far believed to be a resident population, and this is the first long distance recovery. Though this is the first report of a tagged turtle, the fishermen informed us that they have previously found turtles with tags, but did not know what to do with the tags and so threw them away.

**Rishad Pravez, Taej Mundkur
and Smita Krishnan**
Kutch, Gujarat

Sir,

I have been troubled by one aspect of conservation action organised in Bombay and elsewhere. There were nearly 300 volunteers involved in the Narmada struggle's activities in Bombay when Medha Patkar was on a fast unto death. But there was almost no response in Bombay when Sundarlal Bahuguna was on a forty plus days fast on the Tehri Dam issue. Is this because the Narmada issue is fashionable, while the other dam-issues are not? How does a change in geographical situation of a crisis affect our perspectives and policy? Are volunteers in Bombay indoctrinated only on the Narmada issue?

I think this is largely due to the unspectacular demise of the 80 NGO strong Jana Vikas Andolan that successfully made its presence felt at Sardar Sarovar, Indira Sagar, Bodhghat, Harsud, Kaiga, Pooyamkutty, Polavaram, Kudamkulam, Subarnarekha, Koel Karo and, of course, Tehri. The Anandwan, Hemalkasa, Harsud and other meetings brought together a feeling of solidarity. But very soon, various centres of influence tore it in several directions. Today we do not even know who can write an obituary for the Jana Vikas Andolan. In Bombay, it has been hijacked by the Narmada Bachao Andolan.

If activists put up a strong, united front (irrespective of minor differences in their approach to an issue), they can sweep past all barriers. France is a good example. The French government in mid-1991 cancelled plans to build a dam on the Loire river because environmentalists occupied the site *non-stop for two years*, preventing work on the dam.

Another dam, on a tributary of the Loire, was also cancelled.

The arguments in favour of large dams are familiar. While they can be answered with facts, no Indian environmentalist can ever hope to snap the corruption links that exist — often openly — in most large-budget development projects. It is this Commission to Cost ratio that is the root of all environmental problems in Third World nations. Dams are attractive to decision makers because they cost more than national parks and sanctuaries. If there is a choice between two development proposals dealing with the same region, the clinching factor will be the size of the 'cut' under the table.

There seems to be only one way out. National parks and wildlife sanctuaries must increase their plan outlays in order to make protected areas more attractive to decision-makers. Consider the lopsided perspectives — the Polavaram dam in Andhra Pradesh will cost nearly Rs 3,000 crores. Compare this with the state Forest Department's wildlife wing that helps protect natural resources in about 20 areas, *each* of which may be equal in size to the Polavaram area. The budget was less than Rs five crores for all areas put together.

Unless the forest officer considerably inflates his budget and includes costs for items outside his protected area (local hospitals, schools, roads, etc.), that national park or sanctuary will not be attractive to decision makers who choose between dams or protected areas.

Perhaps it is time to initiate a new slogan — Corruption as a basis for nature conservation.

Bharat Bhushan
Bombay

Sir,

In Himachal Pradesh, a great number of agamid lizards are found basking on rocks and scurrying around them. Where not disturbed, they are extremely tolerant of human presence and can be watched at close quarters. I have noted that they feed extensively on clover leaves, snapping these off as they would catch butterflies and such like insects.

Yesterday, I put a mango stone with pulp for the birds. One of these reptiles came and to my surprise started snapping up the pulp and gulping it down. This may be of interest to naturalists.

Lavkumar Khacher
Hingolghadh, Kutch

Reflections on Rio

JAY SAMANT

THE EARTH SUMMIT and the Global Forum at Rio de Janeiro was a unique event. It was an opportunity for individuals and NGOs to participate and interact, and eventually find solutions to environmental and development problems, particularly in the third world. I received an invitation from Mr. Maurice Strong, Secretary General, UNCED, to participate, and accepted gladly. My trip was sponsored by the UNDP.

A large number of issues were to be discussed at the Summit, many of them simultaneously. It was just not possible to attend each session — I decided to concentrate mainly on two major areas, biodiversity and forestry. It was a meaningful experience to attend and closely observe the proceedings.

I was also lucky to be in close contact with our Indian delegation and met Mr. Kamal Nath, Minister of Environment, on a few occasions to discuss NGO issues. I also attended both his press conferences, which were bold and supportive of the declarations. I also had the rare opportunity of personally meeting some of the prominent personalities in the field of environment, namely Mrs. Gro Harlem Brundtland, Prime Minister of Norway, Mr. Shridath Ramphal, President, IUCN, Mr. Jacques Cousteau, world famous oceanographer, and Prof. Q.U. Geping from China, recipient of the prestigious Sasakawa Environmental Award for 1992.

IUCN had organized a special function to honour

Global 500 laureates, which I attended as a representative member — IUCN. This gave me an opportunity to meet a large number of Global 500 laureates from all over the world, particularly from SAARC countries. In our informal meeting, we have decided to organise a meeting of Global 500 laureates (there are around 20 from India), perhaps in BNHS in the near future.

The Global Forum at Flamengo Park, with about 450 stalls representing prominent NGOs from all over the world, provided excellent interaction and exchange of material on various issues of mutual interest. Since I was interested in natural history, biodiversity and allied subjects, I tried to meet as many NGOs as possible and collect information about them for possible collaboration in future.

Some of the important NGO scientists I met during my 16 day stay were from Greenpeace, Friends of the Earth, Conservation International, Sierra Club, The Earth Foundation etc., to name a few. I collected a huge amount of literature, which we are planning to exhibit in BNHS along with the literature collected by other Indian NGOs at Rio. I also participated in South Asian NGO meetings, where attempts were made to form a federation of Asian NGOs. I had a detailed discussion with Mr. Lu Yucun of the Chinese Society of Environmental Sciences (the largest NGO in China, with a membership of 65,000). Mr. Yucun was impressed by BNHS activities and extended an invitation for further interaction between us. Incidentally, they are very concerned about large dams and environmental issues. Though there were acute financial and time constraints, I did visit Tijuca National Park, Jordan Botanical Garden and the famous Rio Zoo, which has an excellent collection of Amazonian fauna.

In a nutshell, my visit to Rio was highly productive and useful for a better understanding of the issues, people's views and of the role that NGOs like BNHS can play in future at the national and Asian level. ■

Dr Jay Samant is the Director of BNHS, and a conservation biologist who has worked extensively on the fauna of the Western Ghats. He was formerly Coordinator of the School of Environmental Sciences at Shivaji University, Kolhapur.



Jay Samant

India signs the Biodiversity Treaty — the first country to do so.

FOLKLORE

The Owl

NARESH CHATURVEDI



Illustration by Rita Ganguli

*A wise old owl sat in an oak
The more he saw the less he spoke
The less he spoke the more he heard
Why can't we all be like that wise old bird?*

THE OWL, BEING a nocturnal bird, is followed by superstitious beliefs in every country where it occurs. In some western countries it is regarded with respect, even affection, for its wisdom. But in most of Asia the sight of an owl is said to be an ill omen, except under certain specific conditions.

According to the Tantrashastra, early morning sightings of an owl can work both ways. If the bird is facing east, there's money round the corner. If it's facing west, the person who sees it will lose money. Luck follows should an owl sit on a house top or on a tree branch near one's abode.

The Tantrashastra goes into details even about the screech of an owl, and how to interpret it. One screech portends death. Two screeches foretell success in any approaching undertaking. Three — a marriage in the family; and so on, up to seven screeches for mental distress and eight for sudden death.

VARIOUS RITUALS are performed to checkmate the owl's capacity for evil. Owls, like many other birds, regurgitate undigested or partially digested food. In Bellary district, the colour of the regurgitated matter is important. Milky white is a good omen, red or bloody is a bad omen. But the residents of Bellary apparently take no chances. Many of them tie sticks onto their

roofs, with rags tied to them to scare off the owls. Piles of broken pots are also spread out over the roof for the same purpose. While rags fluttering in the breeze can scare away the owl, one fails to grasp the utility of the broken pots.

The spotted owl commonly seen in towns, villages and gardens is the bird of augury referred to as pingala (meaning yellow-eyed) in the Vrihatsamhita. The screech owl was named after *stringes*, the Roman name for a witch. The Romans believed that the hoot of an owl portended an imminent death. Precedents are quoted — owls were heard hooting just before the death of Emperor Augustus, and when his successor Commodus lay ill, an owl flew into his room; the emperor did not survive much longer.

Even in Biblical times owls were believed to portend ruin and destruction. When prophets were predicting the overthrow of Babylon they said, "It shall never be inhabited ... and their houses shall be full of doleful creatures ... owls shall dwell there and satyrs shall dance there." (Isiah 14: 20-27)

Another legend has it that once Jesus went into a baker's shop for something to eat. The mistress put a cake in the oven for him, but his daughter thought it was too large and reduced it to half its size. Immediately the dough in the oven swelled to an enormous size. The girl screamed out in surprise, turned into an owl and flew away.

ACCORDING TO Hindu beliefs Brihaspati, the tutor of the gods, turned himself into a Garuda (eagle or perhaps brahminy kite), and ruled the skies by day. His wife, as women tend to do, had the last word. She turned herself into an owl, and became the ruler of the night.

A genus of the owls is named *Athene*, after the Greek goddess Athene (called Minerva by the Romans), with whom an owl was thought to be associated. Athene is sometimes portrayed with an owl head or wearing a helmet decorated with owl feathers.

The Singhalese regard owls with horror; when an owl screeches, calamity is said to follow. According to a popular folktale there was a morose and savage husband who suspected the fidelity of his wife and doubted the paternity of his child. When the mother was away he slaughtered the child, prepared a curry out of its flesh and served to his unsuspecting wife. When he told her what he had done, she was so horrified that she fled into the forest and killed herself. After her death she was metamorphosed into an owl, whose calls are those of a bereaved mother in her agony.

Aborigines in southern Australia believe that owls represent the departed souls of their women-folk (the souls of men are represented by bats). They do not kill owls for the simple reason that all owls look alike, and they do not know which owl is the soul of which relative.

ACCORDING TO another story Genghis Khan was once ambushed by his enemies, and his small force routed. The Khan fled, and hid himself in a small coppice. A little later an owl settled on the bush under which he was hidden. When his pursuers reached the spot they decided it was impossible that any man would choose to conceal himself in a place where an owl would perch, and so they did not search the coppice. Thenceforth the owl was held as sacred by the Tartars.

The ancient Arabs believed that owls represented the souls of people who had been murdered. The owl, apparently, is the instrument of revenge. Indian mythology places the bird considerably lower on the moral scale. Anyone who kills his friend is reborn as a large owl, and condemned to killing innocent birds throughout his life.

Why are owls nocturnal? Once upon a time, the story goes, all the birds gave a feather each to the wren, who had lost his own. The owl refused, saying that winter was approaching and he was feeling cold. The king, enraged at this lack of charity, cursed all owls. "You shall become the most wretched of birds and shall never leave your abode except by night. The other birds shall pursue and persecute you un-sparingly."

This, presumably, is why the crow became the owl's worst enemy. During the day it will harry unmercifully any owl outside its hole; at night the tables are turned. At least one species of owl (the dusky horned owl) is known to prey on crows. Perhaps it was the sight of a hunting dusky horned owl that gave Ashwasthama the idea, during the Kurukshetra war, to kill the children of the Pandavas when they lay asleep in their tents.

THERE IS a reference to another species of owl in the Mahabharata. The daksha Prajapati performed a yagna, but did not invite his daughter Parvati and son-in-law Shiva. Feeling insulted, Shiva decided to ensure that the yagna did not take place. He created a dwarf demon out of a drop of perspiration, and sent him to destroy the daksha. (The daksha eventually escaped by turning himself into a fleet-footed deer.) From the brief description in the Mahabharata, the dwarf demon was probably an eagle owl.

More titbits from the Tantra Sadhana: if the heart and right foot of an owl are laid on a sleeping person then he will confess all. And if an owl liver is hung on a tree, birds will collect under it.

Some believe that owl flesh is an aphrodisiac; but according to Ayurveda eating owl flesh results in foolishness or loss of memory.

Owls do not merely screech. Some species have rather musical calls, for example the deep, rhythmic *who-hoo-hoo* of the Himalayan brown wood owl or the rippling notes of the western Himalayan barred owl. According to the Lingapurana, sage Narada was advised to learn music from an owl residing near lake Manasarovar in the Himalayas. ■

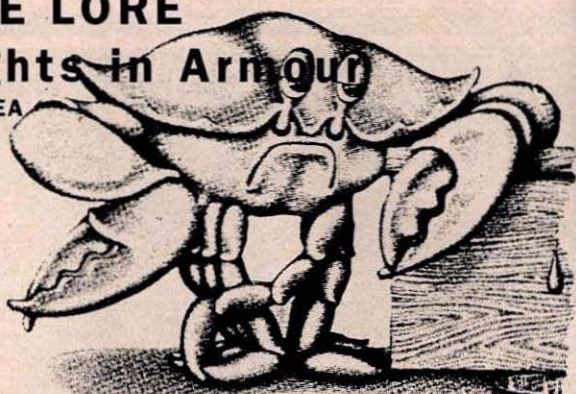
Naresh Chaturvedi, an entomologist by specialisation, is Deputy Director (Collections) at the BNHS. He also collects references to natural history (particularly birds) in mythology and literature.



SEASHORE LORE

10 — Salty Knights in Armour

BEEFSEA



*Strong suits of armour round their bodies close,
Which, like thick anvils, blunt the force of blows;
In wheeling marches form'd, oblique they go —
With harpy claws their limbs are armed below.*

"Battle of the Frogs and Mice."

TRUECRABS AND blue crabs, land crabs and sand crabs, mock crabs and rock crabs, giant crabs and pygmy crabs; there are crabs *and* crabs on the seashore.

Crabs, together with lobsters and prawns, comprise the Decapoda or ten-footed animals. These are a sub-group within the Crustacea — animals whose body typically is made up of a series of jointed rings or segments (but only 19 to 21 segments unlike the hundred or more of worms). Crustacea, together with insects, spiders, scorpions, centipedes and millipedes form a vast assemblage called Arthropoda (jointed legged animals).

Unlike man and other backboneed animals, the skeleton of crustaceans covers the body from outside, being made of a substance, similar to our finger nails, called chitin. In crabs and lobsters, the skeleton, loosely called 'shell', also has lime salts incorporated into it, so as to make it hard and strong. While this protects the crabs from their enemies, it also constitutes a serious obstacle, as the body cannot grow in size. Crabs overcome this by moulting.

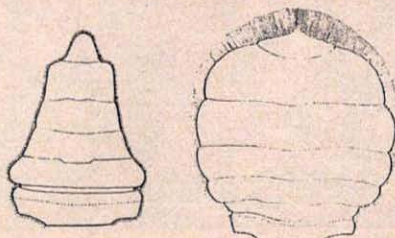
From time to time, the shell splits, the soft animal emerges and, by absorbing water, slightly increases in size. It is now soft and helpless, so it hides below stones or seaweeds while the new shell hardens in a few days. This moulting, or casting of shell, is frequent when the crab is young, but the interval between moultings increases as it grows older. In addition to growth, moulting also helps the crab to get rid of barnacles, worms and other animals which have settled and grown on its shell.

IF YOU TURN a crab over on its back, you can see the flap-like abdomen tucked tightly onto the shell. You can distinguish the crab's

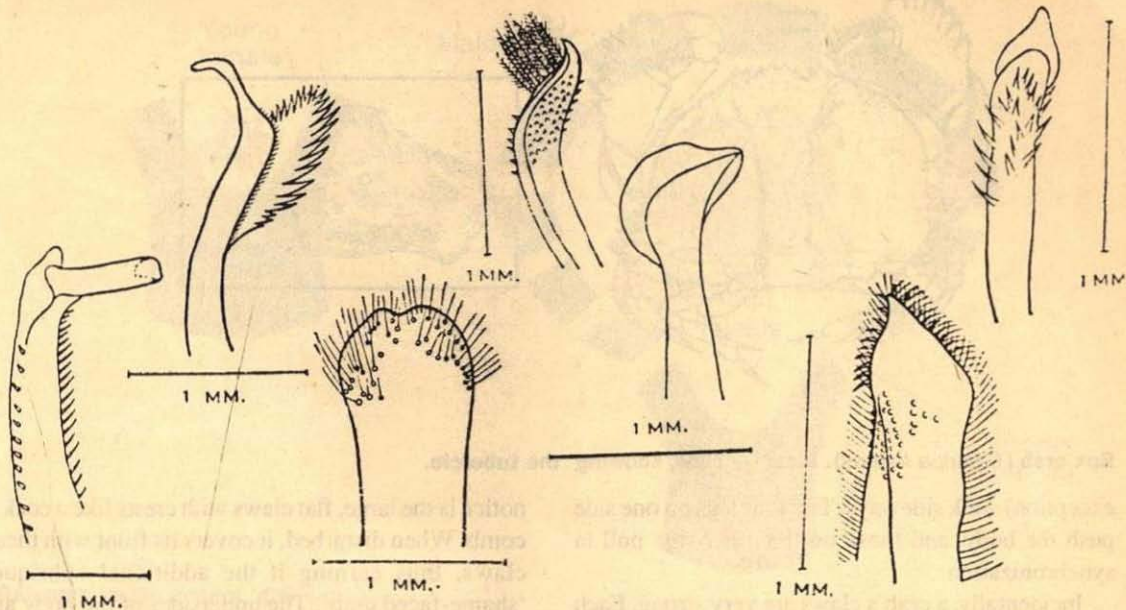
sex from the shape of its abdomen. In an adult male, it is a narrow, triangular flap, whereas the female has a round watchglass-shaped abdomen covering all the space between the legs. If you lift up this flap, you will notice four pairs of feathery appendages in the female. The long hairs on these help to carry the tens of thousands of minute yellow eggs.

The female carries the eggs for the few weeks while the young are growing inside. The young use up the yellow yolk for food, and the eggs gradually turn brownish black. As the female carries the eggs, the abdomen (normally tucked under her body so as to be invisible from above) opens out horizontally to accommodate the eggs. The crab is now said to be berried or 'in berry', the berry referring to the mass of eggs. Finally the egg shells burst and the young ones come out to drift helplessly in the sea while they grow.

Under the abdominal flap of a male crab are two pairs of rod-like abdominal appendages. These are used while mating. Their tips are different in each kind of crab, hence biologists study these to identify crabs that otherwise look alike. As a part of my M.Sc thesis on crabs, I had prepared a paper titled 'Studies on the Mating Appendages of the Crabs of Bombay State'. Our typist inadvertently (or was it mischievously?) substituted an 'a' for a 'c', and the



Abdomen of (left) male and (right) female crab



Points of difference — tips of mating organs of some Indian crabs.

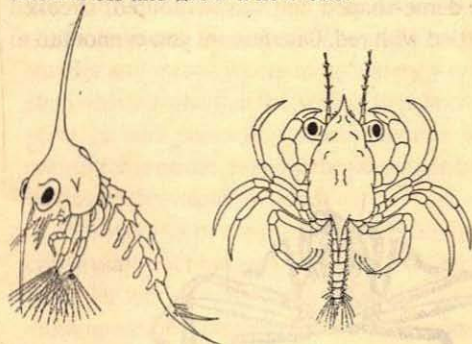
paper became 'Studies on the Mating Appendages of the *Arabs* of Bombay State'. Had I not noticed the error, it could well have led to diplomatic wrangles with India!

UNLIKE US humans, where the baby resembles adults except that it is small, the babies (called larvae) of crabs look very different from the adults. From the egg hatches out what is known as a zoea. It is a couple of millimetres long and has a comic appearance, with a helmet-like head on top of which is a long, tapering spine looking like a dunce's cap, with another long spine in front looking like a comic nose. The body is long and slender. After casting its skin and growing larger at each moult (there are two, four or five moults in different crabs), the zoea changes into a megalopa. This has a transparent, crab-like body, ten legs and a long abdomen held out horizontally. This, in turn, moults into a young crab.

If you hold a crab by its leg, you will probably be left with the leg in your hand. Or, when a crab pinches your finger with its claw and you try to shake it off, the crab will drop to the ground, leaving a detached claw still pinching you. This propensity of voluntarily breaking off a limb is called autotomy and is similar to a lizard breaking off part of its tail. The break is not

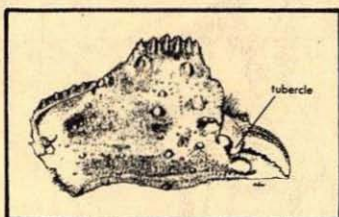
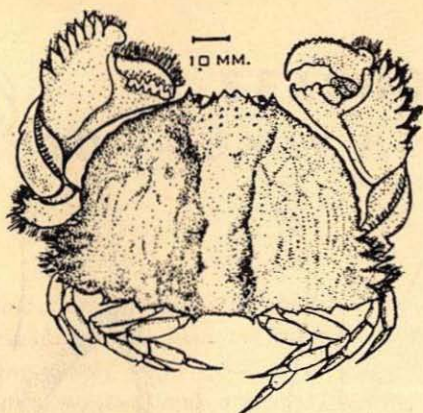
random — at the base of each limb is a 'breaking place' where the crab can snap it off at will.

After the limb is shed, a membrane forms at the site and prevents bleeding. And the crab is none the worse for its loss; a small knob or papilla soon appears at the stump and, at the next moult, expands to form a new, though much smaller, limb. A couple of moults later, the new limb is as large as the one that was lost. I often envy crabs for their ability to regenerate lost limbs. How nice it would be if, after smashing an arm or leg in an accident, we could break it off and grow a new one.



Humble beginnings — zoea (left) and megalopa

I MENTIONED EARLIER that a crab belongs to the Decapoda (ten-legged animals), but you will be looking in vain for ten legs. The first pair is modified to form claws or nippers, leaving only four pairs of legs. And all crabs (with one



Box crab (*Calappa lophos*). Inset — claw, showing the tubercle.

exception) walk sideways. The four legs on one side push the body, and those on the other side pull in synchronization.

Incidentally, a crab's claws are very strong. Each claw can support a weight thirty times the crab's body weight; by comparison, our hand is capable of pulling only two-thirds of our body weight.

The eyes of crabs are borne on the tips of stalks, and are compound, i.e. hundreds of small eyes are grouped together, yet acting as a unit.

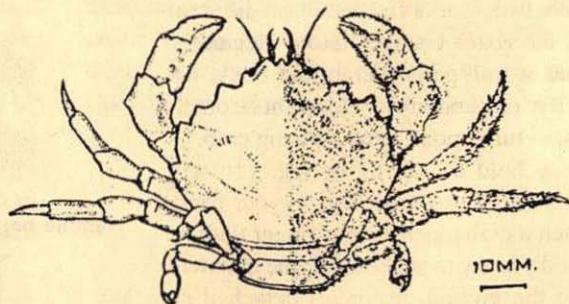
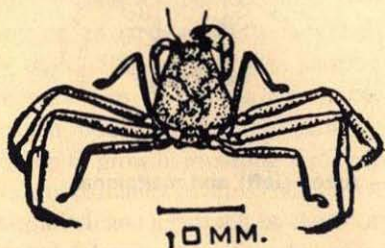
Most crabs are scavengers, feeding on carrion, but many can catch fast moving prey, including fish. Many spider crabs are vegetarian.

THE BOX CRAB (*Calappa lophos*) is rarely seen; most of the time it lies buried in sand with only the eyes protruding. The body is dome-shaped and sand-coloured, streaked and mottled with red. One feature you cannot fail to

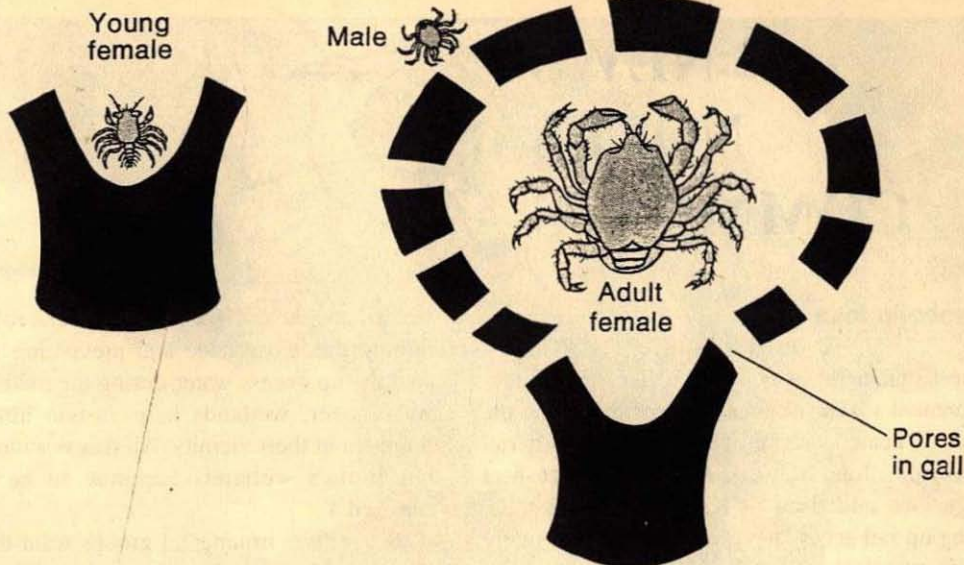
notice is the large, flat claws with crests like a cock's comb. When disturbed, it covers its front with these claws, thus earning it the additional sobriquet 'shame-faced crab'. The undersides of the body are hollow and vaulted, and the legs can be tucked in for protection. If you dig it out of the sand, it will sidle sway and then, right before your eyes, disappear in the sand. That is why it is sometimes called a mole crab. (But it should not be confused with the mole crab *Hippa*, which is not a crab.)

While resting, it holds its claws in front of its body. The spines on the claws and the hairy margin of the body form a strainer, preventing sand grains from being sucked into the gill-chambers.

If you look carefully, the two claws are dissimilar. The larger claw has a knob near the base of the finger, and when the fingers are closed, this fits into a socket on the thumb. The box crab feeds on top shells (*Trochus*), and when it comes across one,



Left: Masked crab Right: Sponge crab, top view, without sponge; the hairs on one half of the body have been removed.



Gall crab inside a coral 'gall'

Left: Beginning of gall formation.

Right: The tiny male visting the imprisoned female.

manoeuvres it with its walking legs until the shell opening is opposite. Now it breaks the shell mouth with its claw, like a nutcracker or, rather, like a tin-opener, with the tubercle acting like a lever against the edge of the shell.

If the snail has closed its shell-mouth with the operculum, the crab snips past the closed edge. Now the snail retreats further inside its shell, and the crab follows by peeling along the whorls, until the snail can withdraw no further into its shell. The other, pick-shaped claw is now put to work to tear the snail bit by bit and eat the flesh.

THE SPONGE-CRAB or sleeping crab (*Dromia*) has a ball-like hairy body. The first two pairs of its walking legs are normal, but the last two are reduced in size and bent upward over its back, ending in tiny claws. These are used to hold a live sponge over the crab's back. The sponge grows until it covers the body, like a cap. When seen from above, if the crab is sitting still, with its legs folded close to its body, all you see is a sponge.

The masked crab (*Dorippe*) also has its last two pairs of legs clawed and folded up over its back. But the body is flat. It holds one valve of a dead clam shell over its back for protection. Sometimes, if it cannot get hold of a shell, it even makes do with a mangrove leaf.

THEN THERE is the gall-forming crab (*Hapalocarcinus*), which voluntarily imprisons itself inside a coral branch. When young, it sits in the fork of a branching coral, and by blowing a stream of water from its gill-chambers onto the fork, changes the growth of the coral so that its branches flatten and meet above, enclosing the crab in a pocket or "gall". Small openings in the coral allow water to pass through, carrying minute food particles, enabling the crab to breathe and feed.

It is only the female crab that imprisons itself, and this forms the subject of a never-ending war of words between the sexes. (The male crab is much smaller and roams freely in its watery world.) Male chauvinists argue that the selfish female crab enjoys security and protection from enemies within its comfortable castle, leaving the poor male to fight the battles of the world unaided.

Protagonists of the fair sex disagree; they say the crafty male encourages his wife to lock herself away from the world, while he is free to go gallivanting, unhampered by family ties or the responsibility of bringing up their children. And while we humans debate, sometimes earnestly and sometimes heatedly, the male crab visits the imprisoned female, apparently to see that no harm has befallen her.

Is it a coincidence that after every visit she is in the family way and sets forth her babies out into the water ?

NEWS NOTES COMMENTS



Carambolin lake

The Konkan Railway Project, like many other environment v/s development issues, has been the subject of heated debate. The rail route will run southwards along the coast from Maharashtra through Goa and parts of Karnataka and Kerala, opening up rail access to several areas, and greatly reducing travel time on some routes.

Inevitably, there is a price to pay for this progress. Some ecologically valuable areas will be damaged, probably irreparably. Carambolin lake in Goa, about 12 km from Panaji, is one such area. This 70 ha wetland, the largest freshwater body in the state, is an important source of water for rice cultivation. Parts of the wetland are used as a grazing ground for local livestock, and fishing rights in the lake are auctioned each year. The lake is also a stopover site for large numbers of migrating waterbirds, and a wintering site for some. An estimated 120 species of resident and migrating birds have been recorded at Carambolin. The area is also an ideal field laboratory for local school and college students, and supports a growing population of birdwatchers.

Unfortunately, the Konkan railway route passes right through the lake. Even by official estimates, one third of the wetland will be destroyed. There are fears that the damage, both direct (draining the wetland) and indirect (increased disturbance, imbalance of the ecosystem by the introduction of foreign materials into soil and water, etc.) will be far more extensive. There has been talk about filling up part of the lake to construct a marshalling yard; that would destroy the wetland completely.

Local groups want the railway, if at all it is to be built, to go round the lake instead of through it. The extra costs (increased construction costs and compensation for land) would almost certainly be offset by the benefits that Carambolin provides to the area.

Apart from their wildlife values — healthy wetlands support a diverse flora and fauna — wetlands

benefit people too. They play a crucial role in maintaining the water table and preventing floods (by soaking up excess water during the monsoon). The world over, wetlands help sustain human communities in their vicinity. All this is widely known, but India's wetlands continue to be wantonly misused.

Several environmental groups want the railway route shifted further inland, where construction would be easier (because the major river estuaries would be avoided) and environmental damage and loss of agricultural areas far less severe. The other school of thought says that enough time has been wasted on discussion; work should begin immediately, and damn the consequences. Judging from India's past record, there is little doubt which side will win.

More Sumatran rhinos

The Sumatran rhinoceros (*Dicerorhinus sumatrensis*) is one of the world's most seriously endangered large mammals, existing only in small, isolated populations in inaccessible areas of Burma, Thailand, Malaysia and Indonesia. Detailed surveys in the late 1970s put the population in Sumatra at between 40 and 75. Habitat loss and poaching (to some extent even in national parks) as well as captures for a government-sanctioned captive-breeding programme, have caused numbers to fall further.

In October 1991, biologists from the Asian Wetland Bureau and the Indonesian forest department found clear evidence that the species still occurs in the remote Berbak Wildlife Reserve in Jambi province, Sumatra. There have been only two earlier reports — in 1936 and 1976 — from Berbak, though this is more because of the inaccessibility of the area than a lack of animals.

The signs included footprints, dung and saplings broken off in feeding behaviour that is typical of rhinos; and judging from the size of the prints, the animal was the Sumatran rather than the larger Javan



E.P. Gee

Too little habitat, too much superstition — most species of rhinos are endangered. Possibly not more than 50-60 Sumatran rhinos survive in the wild.

rhinoceros (*Rhinoceros sondaicus*). Signs of feeding were found in two locations 7 km apart. An earlier patrol to one of these areas in July 1991 had located tracks that were probably of the rhino, but too indistinct for a positive confirmation.

The Berbak reserve is a mixture of peat swamp forest, freshwater swamp forest and riverine forest. Apart from the rhinos, the fauna includes Sumatran tigers (*Panthera tigris sumatrae*), sunbear (*Helarctos malayanus*), and two species each of mouse deer (*Tragulus javanicus* and *T. napu*) and pigs (*Sus scrofa* and *S. barbatus*). Over 250 bird species have been recorded in the area, including the milky stork (*Ibis cinereus*), Storm's stork (*Ciconia stormi*) and whitewinged wood duck (*Cairina scutulata*).

There is a proposal to build a port on the adjacent coast, which will involve a road across the reserve, cutting off the southern one third. The consequences would be severe. Human disturbance would greatly increase, and poachers and illegal timber fellers would have easy access to Berbak's forests.

Good news on goshawks

The red goshawk (*Erythrotriorchis radiatus*) is among the world's rarest birds of prey. Till

recently, little was known about it except that it was endemic to Australia, endangered throughout the continent, and perhaps locally extinct in some areas. What little information was available was based on chance sightings. For example, in the 150 years before the project began, only 18 breeding attempts had been reported — and some of these were considered suspect, possibly being misidentifications of other similar-looking raptors.

In 1987, the Royal Australian Ornithologists' Union, with help from WWF and private donors, began a three-year study of foraging requirements, diet and breeding behaviour of the species. The findings of this study, released recently, have provided the basis for a management plan to build up populations to healthier levels, and perhaps allow the bird to recolonise parts of its former habitat.

The red goshawk occurs in well-watered, open forest and tropical savannah and on the edge of rainforest pockets, in large parts of Australia, but nowhere is it common. Its distribution has changed little since European settlement, with the exception of some coastward contraction in the east. But the bird was always rare, and local declines in abundance have been reported for some areas over many years.

A major reason for the decline (and its rarity even earlier) is that it is extremely choosy about breeding and nesting sites — nest trees, for example, were invariably taller than 20 m and lay within 1 km of a watercourse or wetland. Population densities are also small because the home ranges (up to 200 sq km per pair during some parts of the breeding season) are far larger than those of most birds.

Long-term concerns relate to the potential consequences of fire (whether natural or man-made). For example, if fires suppress tree regeneration there will be fewer nesting hollows for key prey species like parrots and kingfishers. Another problem is damage to riverside trees by livestock; in some areas nearly all the suitable nesting trees had their protective bark rubbed off to a height of 1.5 m by cattle, leaving the trees vulnerable to physical damage, fire and attack by insects or fungi.

The study estimated that about 350 breeding pairs occupied territories. Only a small part of the total suitable breeding habitat was studied and a wider survey is still necessary, but enough is now known to initiate conservation action. The bird is reasonably secure at present throughout much of its range in northern Australia, where the study has recommended a 'hands off' approach, except for continued monitoring of territories.

In eastern Australia, where it is far more threatened, the emphasis will be on more active management, first locating breeding pairs and populations, and then ensuring habitat security, perhaps (in the future, when more territories are identified) acquiring land from the present owners and protecting it as goshawk habitat.

Drugs from plants

Merck Ltd., the world's largest drug manufacturer, has an outstanding record of social commitment. It has donated huge quantities of drugs to developing countries (mainly in Africa), and finances social service programmes in the U.S.A. The firm recently contracted to pay a conservation organisation in Costa Rica \$ 1 million for the right to explore Costa Rica's tropical rainforests for potential drugs. If any discoveries result, Merck will pay additional royalties.

Several firms have agreements to share royalties for new drugs with the country of origin; this is the

first time someone will pay exploration fees, irrespective of the result. The money will be used to train local people to collect specimens and extract compounds for Merck to screen.

The agreement will benefit both parties. For Merck, the amount represents less than one tenth of their annual R&D budget, and could yield enormous profits. For Costa Rica, which has a reputation for sound wildlife management and planning, \$ 1 million is a massive sum which could help put conservation schemes on an even firmer footing.

Such corporate generosity would be welcome in India. Government money will remain scarce for the foreseeable future, and unless NGOs can tap other sources, conservation is unlikely to progress very far. The Indian business community has been generous, but with some notable exceptions, it has tended to support causes other than wildlife.

The fault is ours, not theirs. NGOs must approach companies on a far larger scale than presently. And cooperation between NGOs (sharing contacts with and information on potential donors), which is now practically non-existent, must increase. Funds *are* available, at least for low budget projects for specific areas. What is sadly lacking is coordination between NGOs to ensure that more potential donors are approached, and that technical expertise is shared more effectively between NGOs so that conservation projects can be better executed.

Hard cash for hardwoods

Concerned at the alarming rate at which it was losing tropical forests, the Philippine government in July 1989 banned the export of timber. But two of Britain's largest timber companies, Gliksten Ltd. and Timbnet, still import wood from the Philippines. According to a report in *The Observer*, some 28,000 cu. m of raw Philippine timber has been shipped to the U.K. since the ban was imposed. The bulk of the timber is Philippine mahogany, locally known as lauan, which is much sought after for construction and furniture making.

Technically, neither firm is breaking the law. Though the Philippines has banned exports, import into Britain is still permitted by the British government. The Philippine government cannot (or will not) prosecute because East Asiatic Timber, the broking agent which supplied the wood, has denied

that the timber comes from the Philippines; and there the matter rests.

Counting cranes

Seven of the world's 15 crane species are endangered. Efforts by conservation bodies like the International Crane Foundation, unusually high levels of cooperation between governments and extensive studies on ecology and migration have improved habitat protection in some areas. Though there have been no single spectacular successes, future prospects have improved for several species.

Winter counts show that the trend is generally still downward for most cranes, but surveys in remote areas are resulting in discoveries of new populations. In January 1991, for example, a wintering population of 2800 blacknecked cranes was found in south-central Tibet (there are plans for a nature reserve to protect the wintering area for about 300 of these birds), pushing up the population estimate to over 4000 birds worldwide.

Another big plus for crane conservation is a proposed 7000 sq km international reserve in the Daurian Steppes, at the border of Russia, China and Mongolia. The area is the heart of the range for the endangered whitenaped crane. The new reserve will incorporate Dalainor Nature Reserve (nearly 4050 sq km) in Inner Mongolia, China, and Dauriski Nature Reserve (2068 sq km) in Russia, with the Mongolians adding 1032 sq km adjacent to Dauriski.

Big wind and fire

Oil well fires are dangerous — even after they are put out. The last of the 800 odd fires set off in the aftermath of the Gulf war was doused in November 1991, but environmental damage continues. Ironically, the very speed at which firefighters worked is causing the problem.

There are two steps involved in tackling an oil well fire. First put out the fire, then cap the well so that oil does not escape. For the first three months after the war, firefighting teams were capping two wells a day. Then came the Big Wind — a Hungarian machine, essentially a jet engine that could blow out fires as if snuffing out a candle. It could put out six fires a day, and the teams that followed the Big Wind to cap the wells couldn't keep pace. As a result, oil from several hundred uncapped wells continued to pour out, and has formed 69 oil lakes in Kuwait,

many of them over a metre deep. Many small lakes in northern Kuwait have run together to form rivers several kilometres long. Different estimates put the spillage as anywhere between 35 and 150 million barrels — five to 20 times the amount of oil that was discharged into the sea during the war.

The first priority (both the government and conservation bodies agreed) was to extinguish the fires quickly. But according to British researchers, burning wells cause *less* environmental damage than non-burning gushers. Oil lakes attract birds and insects, which cannot tell oil from water, and are trapped. Raptors, swooping after their prey, also suffer. Oil pits and sumps near oil fields, refineries and petrochemical factories have been taking a steady toll of birds for many years. Before precautionary measures were taken in the late '70s, 150,000 birds were killed each year at oil sumps in the San Joaquin valley of California. Another study in the mid '80s estimated that 225,000 birds were killed each year in crude oil pits in New Mexico.

Models of conservation

If it moves, shoot it. Itchy trigger fingers will be the undoing of many an American hunter. Game wardens in the U.S.A. are using highly realistic animal decoys to catch 'spotlighters', who illegally hunt at night by using powerful spotlights to locate and 'freeze' deer and other game animals. Decoys were first introduced in 1975, with limited success because they were not realistic enough.

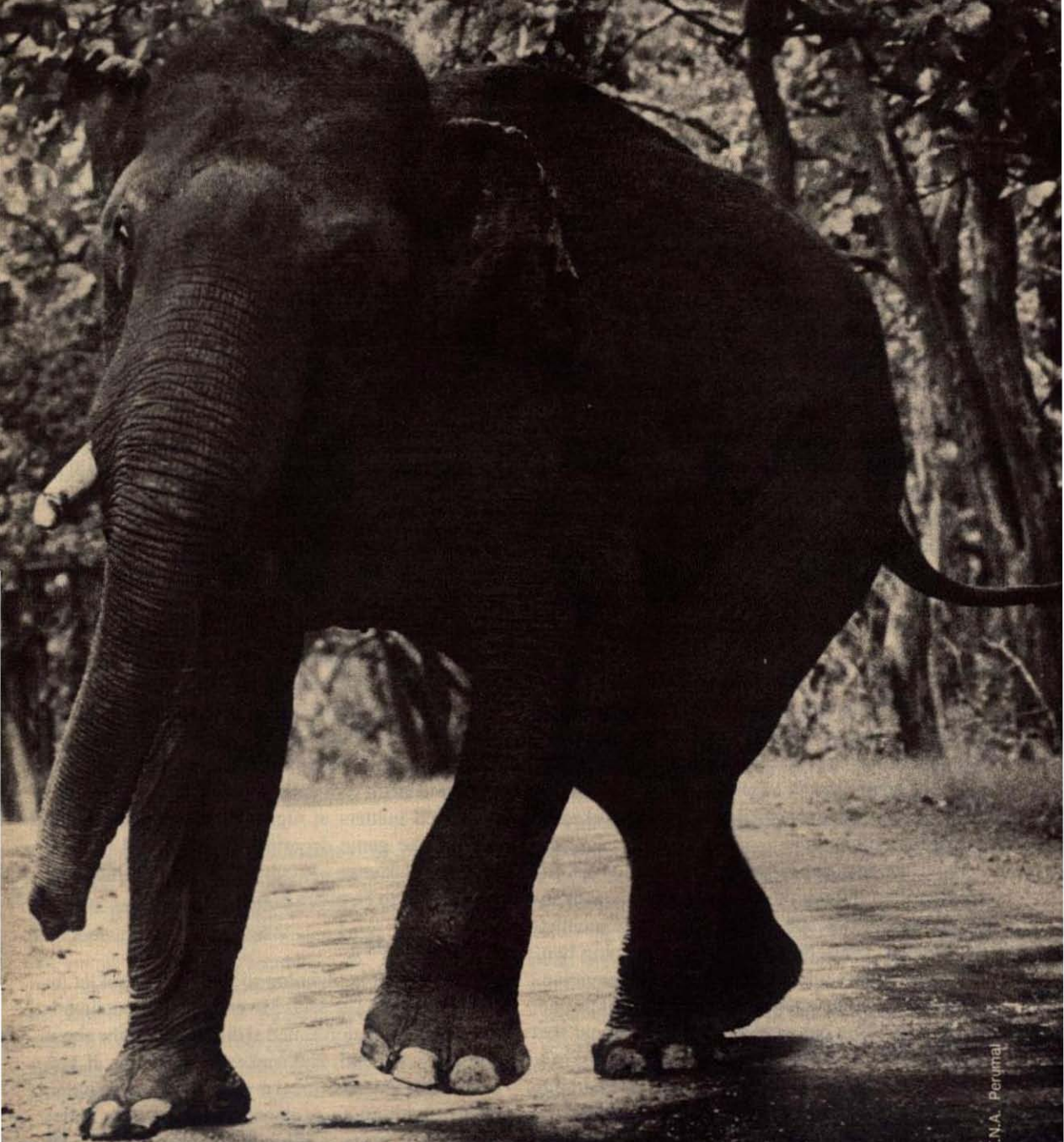
How good is a model? By common consensus, two things matter most — looks, and how well the model moves. These decoys are no exception. The latest high-tech, remote controlled versions have head and neck movements that can fool even experienced hunters at night. Last year, using three decoys, the game department hauled in 131 spotlighters. This year, with seven new decoys, the catch is expected to be much higher.

Snake stories

The BNHS is planning to update its booklet on Indian snakes. The revised version will contain additional information aimed at dispelling myths about reptiles in general, and snakes in particular. If you have information on local myths anywhere in India, with or without an explanation for how the belief came about, write to Ulhas Rane at the BNHS. ■

Collaring the Admiral

J.C. DANIEL



THE BEST ELEVATION to live in India is between 1,000 and 1,500 metres, the elevation of the Mudumalai wildlife sanctuary in Tamil Nadu. It is neither too hot nor too cold. Elephants, being sensible animals, live in the sanctuary at this comfortable height. On a cool morning in November a quiet crowd of men and tame elephants gathered on a forested knoll in the sanctuary.

We were at the end of the first step in a momentous new experiment in the BNHS study* of the life and habits of India's wild elephants. We were to place a collar with a radio transmitter around the neck of the last of the five selected elephants in the sanctuary we had been permitted to radio collar by the central and state governments.

From the mid-eighties on, BNHS scientists had been collecting information on the ecology of wild elephants in the sanctuary. In the process they had become experts on the family life, food preferences, social structure and other facets of elephant life. The radio collaring was the final refinement in the information collection process. It would permit the scientists to monitor the collared animals 24 hours of the day if need be, to know precisely what the animal was doing at any particular point of time and in exactly which part of the sanctuary. The tedious, and sometimes dangerous, tracking through the 325 sq km sanctuary to establish contact (a process often similar to looking for a needle in a haystack) would not be necessary now.

THE EQUIPMENT is simple. The collar is a strong nylon belt in which the radio transmitter is embedded in epoxy resin impervious to moisture. The transmitter continuously emits a beep on a predetermined frequency, which is picked up by the scientists using a Yagi antenna (similar to a TV antenna) and a special portable receiver. With experience, one can pinpoint the exact location of a transmitting elephant.

The collaring itself is a major operation requiring

the elephant to be immobilised, using an injectable dart holding special immobilising drugs and fired from a dart gun. The dart has a charge which explodes on impact and injects the drug. The drug used, Immobilon, is a morphine derivative, a thousand times more potent than morphine and highly dangerous to man — even filling the dart syringe has to be done wearing gloves. To immobilise an elephant weighing five tons, hardly 5 cc of Immobilon is required.

The darting team was a composite group. The forest department was in full strength from the wildlife warden down to the forest guards. The BNHS had its young scientists, Ajay Desai, Sivaganesan and Hemant Datye, postgraduates working for their Ph.D. on different aspects of elephant ecology. Athletes in their college days, they



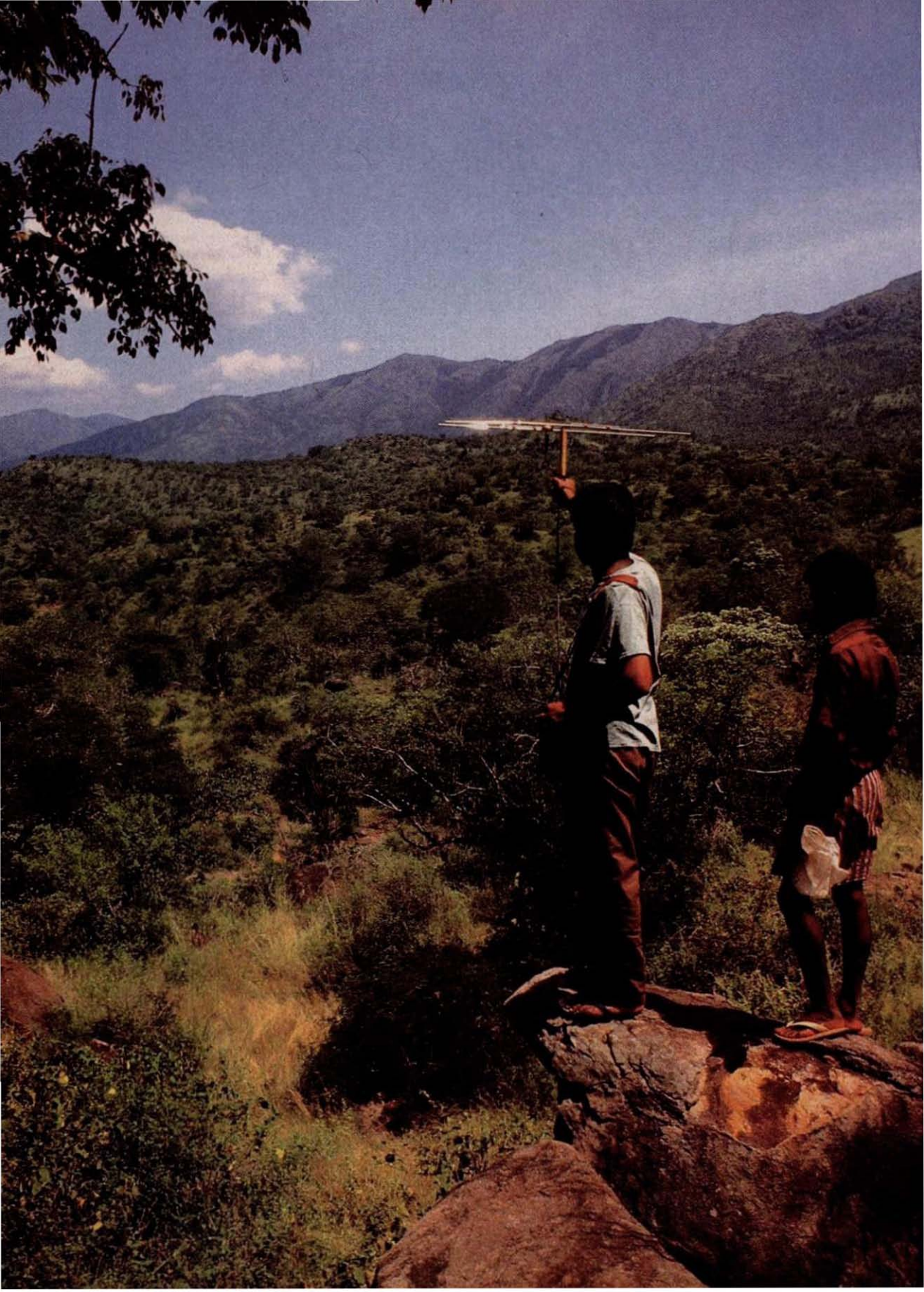
Ajay Desai

Elephant herds consist usually of females and subadult males. The bulls live separately, approaching the herd rarely except to breed.

were tireless walkers and good sprinters, often being tested by angry elephants.

The key group was our Kuruba tribal trackers, Chenna, Krishna and Bomma. On their expertise depended the lives of the scientists who lived and worked among the wild elephants, perhaps the most dangerous among India's wildlife when annoyed. The veterinarians were led by Dr Krishnamurthy, the internationally famous elephant doctor of Mudumalai, affectionately known as Doc, and Professor Jacob Cheeran of the Kerala Agricultural University, whose knowledge of veterinary pharmacology was encyclopaedic.

*In collaboration with the U.S. Fish & Wildlife Service & sponsored by the Ministry of Forests & Environment, Govt. of India.



Finally the tame elephants or *kunkies*, fine adult bull elephants in their prime who had grown up in captivity. They were our insurance against accidents with their wild brethren. They stood by, aloof and impersonal.

AJAY, THE leader of the programme, was the population and social behaviour specialist. He had already identified the animal to be collared. It was a wily old *makhna* or tuskless male with whom Ajay had had a continuing battle of wits and had lost so far. Over 3 m in height, the massive five ton elephant had proved too cunning in choosing the area of encounter. A habitual crop raider, he did his raiding at night and spent the day either out in the open (where he could not be approached without the intruder being scented or sighted), or slept in the dense lantana cover in the moist deciduous forests of the Benne Block of the sanctuary. It would have been suicidal to enter the lantana in pursuit.

What exasperated Ajay and his trackers was that they could hear him snoring as he slept in his hide-out in the lantana but could not get at him safely. The tame tuskers could not be used to flush him out as he was considerably larger than any of them and there was no intention to risk them unless there was danger to human life. This time, however, conditions had changed. The *makhna* was in open dry deciduous forest and Ajay felt that the advantage was with him and his trackers.

WE HAD ADMIRAL Manohar Awati, chairman of the Society's Projects Sub-Committee, and another old friend, Peter Jackson, the chairman of the cat group of the IUCN Species Survival Commission, with us as special guests. I was very keen that the Admiral should witness the scientists in action in the field. A man used to the strict discipline of the Navy, he was often baffled by the insouciance with which instructions were received, and by the many prima donnas he had to deal with at the Society. It was his sense of humour that pulled him through and also formed the bond of friendship between us. I was anxious that

Tuning In on the Sigur Reserve Forest. This area, along with the Moyar valley (in the background), is a natural corridor through which elephants from the Eastern and Western Ghats mix.

he should see that the scientist in the field (but not the prima donna) was an entirely different personality to the one he had met in the office. The usual motley group had gathered around us while Ajay, Siva, Doc and the trackers discussed strategy. Ajay was happy that he had Siva to cover his back and to see that the curious mob did not get in the way.

I have always wondered at our inability to do anything with a small number of people. Take the collaring for instance. What was needed was only the scientists, the vets, trackers and the tame elephants — about ten people; we had over 50 wandering around aimlessly. This makes one wonder at the Indian armies of 100,000 soldiers in the past. Probably the fighting strength was 5,000 and the rest were hangers-on whose main purpose was to start running in panic at the slightest sign of danger (and get slaughtered in the process).

THE *MAKHNA* was not bothered whether there were five or fifty people following him. He had complete contempt for man, and this was to be his undoing. Ajay with the loaded dart gun and the trackers followed him; the rest fell behind at a respectable distance on trembling tip toes, ready to stampede if the *makhna* turned. We followed the tame tuskers. Age had caught up with us; our running days were over and the safest place for us was behind the tuskers.

The first shot was deflected by the swinging tail of the elephant. On the second try the needle struck sideways, broke and bounced off, its contents spurted out uselessly. Each try had been made after careful, silent stalking to avoid alarming or annoying the animal. As we followed through the broken country riddled with gullies, we were more worried about being ambushed by the elephant than by the possibility of his scenting us in the shifting wind. He probably knew there were people around, was used to them and used to having people throw things at him as he went on his night raids. Any other elephant would have disappeared over the horizon after the two mishits.

WE WERE LUCKY the third time. The dart hit truly. Ajay, Siva, Doc and the trackers moved closer to the rapidly moving elephant. An air of excitement and anticipation ran through the motley crowd of camp fol-



Krupakar Senani

The Admiral was tracked on foot till sunset, and then again early the next morning. News was sent to camp, and then the rest of the team followed with the kumkies or trained elephants.



Hemant Datye

The Admiral lay in a nulla, and the uneven ground made it difficult, even with the help of the kumkies, to slip the collar under the neck. The unconscious animal weighed close to six tons — the head, neck and trunk together about one ton. Finally, after several anxious, straining minutes the head was shifted (not lifted clear), and the collar fitted.



Hemant Datye

Immobilon, the tranquilizing drug, suppresses the thermoregulation mechanism, and causes the body temperature to rise; on a hot day, the animal could die. The Admiral was cooled down by spraying some 75 litres of water during the half hour operation.



Peter Jackson

Number five in the series. The Admiral walks away 35 minutes after being darted. The transmitter attached to the collar has an expected life of two to three years, and will provide data on ranging and social behaviour.

lowers. Doc wanted to be as near as possible when the animal fell. He feared that the animal may fall in the 'sternal recumbency' position, which in more prosaic language meant falling flat on one's face. An elephant falling on its chest is unable to breathe and must be rolled over onto its side. Shifting an inert five tons of elephant in rugged country is beyond human capability; if the need arose, we would use the tame elephants.

AS WE FOLLOWED the advance party of scientists and trackers we heard the welcome shout that the elephant was down. I warned the Admiral against being run over by what I call the reverse stampede — the hangers-on rushing to get ringside seats around the fallen elephant.

The *makhna* had fallen in a narrow nulla; and when we arrived on the scene we could hardly see the fallen elephant for the milling, shouting, mass of people. Doc's strident voice now rose above the hubbub, firing instructions: take body measurements, check the breathing rate (normally 6 to 8 per minute), check the pulse rate (30 to 40 per minute) and body temperature (35° to 37°C). A wet handkerchief kept the open eye from damage and continuous spraying of water kept the body temperature from rising — a usual side effect of the drug. One of the tame tuskers, using its tusks, shifted the massive head of the *makhna*, and Ajay and Siva slipped the collar round the neck and bolted the overlapping ends together.

IT WAS TIME to revive the elephant. Doc injected the antidote, Revivon, into a vein on the ample ear of the unconscious elephant and hustled everyone to a safe distance behind the screen of tame elephants. Seven minutes later, the elephant had recovered consciousness and was back on his feet. He had been down and out for exactly 35 minutes. As he slowly moved away, the signal beeps from the collar transmitter came through the receiver. We heaved a collective sigh of relief at our success.

We named the *makhna* Admiral, as a token of appreciation of the Admiral. ■

J.C. Daniel was Curator of the BNHS for 35 years. He is Principal Investigator of the Society's projects on elephants and raptors, and a member of the IUCN Specialist Groups on elephants and reptiles.

RADIO TELEMETRY

Radio telemetry essentially involves fixing a small radio transmitter (which sends out a radio signal) onto the study animal and then using a receiver to locate the animal. The signals are picked up using a receiver and a directional antenna — either the compact 'H' antenna or the more accurate (but far more bulky) multi-element 'Yagi' antenna. Once signal direction is determined at two different locations the location of the transmitter can be pinpointed. This method is known as triangulation.

If more than one collar is used in a study, each transmits on a separate frequency, and the receiver is tuned to these individual frequencies. Transmitters can be designed to monitor a number of parameters — activity, ambient and body temperature, mortality, pulse, even the depth and duration of dives in aquatic animals like seals and whales.

The transmitter, plus the material used in attaching it, should not exceed 5% of the body weight of the animal — easy enough for large animals but often difficult for small ones. Today transmitters as light as one gram or less are available for specialized work. In contrast, the transmitter-and-collar ensemble for elephants can weigh several kilograms.

The life of the transmitter depends on the power source, as well as other factors like the pulse rate of the signal and the weight of the entire package. The requirements are often conflicting — the greater the power output, the greater the range, but the shorter the battery life. Similarly a higher pulse rate means easier location, but more power consumption. Some transmitters, powered by a battery-photocell combination, can last as long as 5-7 years, while the smaller transmitters with their tiny battery cells last less than a month.

Satellite tracking is another refinement. Special transmitters are used, and the signals picked up by satellites and then relayed to a ground station. This is particularly useful with animals in remote areas (elephants in evergreen forests, polar bears in the arctic) and at sea (whales, seals, marine turtles).

Transmitters can be fixed internally or externally. If external attachment points are not suitable or will interfere with normal movement (for example in fishes, snakes or otters), the transmitter can be surgically implanted subcutaneously. External attachment is usually by a collar around the neck (for mammals), or a special harness around the body (for birds). If these external means are not feasible, adhesives are used to fix the transmitter to the feathers, fur (seals) or scales (reptiles). Of course, such transmitters will be dropped when the bird or animal moults or the reptile sheds its skin.

AJAY DESAI

Nature Alive



Ravi Sankaran

THE SHOVELLER *Anas clypeata* is a winter migrant to India, found in inland water bodies all over the country: jheels and reservoirs, sometimes rivers, and even constantly used village tanks. It is slightly smaller than a domestic duck, and the combination of orange legs and broad, shovel-shaped bill is unmistakable.

It is among the last of our migrants to arrive (in October) and also to depart — adults leave by end March, but a few immature birds are seen in north India as late as mid June.

Unlike most other ducks, shovellers are omnivorous. Apart from aquatic vegetation they also fancy crustaceans, molluscs, water insects and larvae, fish spawn and worms. (Their meat, in consequence, is rank and unpalatable.) The commonest feeding pattern is to swim slowly with most of the bill under water. Minute floating organisms are sifted out from the water by the lamellae or comb-teeth fringing the bill, which interlock to form a highly efficient sieve.

Males arrive in India in eclipse (post-breeding) plumage, somewhat resembling the female except

for the colourful wings. By December they are in full breeding regalia — bright metallic green head, pale blue forewings, white neck and breast and chestnut brown belly. The female is comparatively drab, with the typical duck-like colouration of mottled dull buff or brown.

Shovellers breed in Europe, Asia and North America (south of the Arctic circle). From their breeding grounds they fan out over a large part of the world to spend the winter; the Indian birds are thought to breed in Kazakhstan.

Though India is not a breeding area, display activities are often seen. The male chases the female round and round in the water in a tight circle; periodically the bill and entire neck are submerged (while still swimming) and then withdrawn, and the wings fluttered vigorously. Mating attempts (usually unsuccessful) are frequently seen in early February onwards.

Shovellers are fast fliers: they cruise at 65 kmh, and can double that speed when chased. While there is no reliable data on longevity, some ringed birds have lived up to 20 years. ■



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