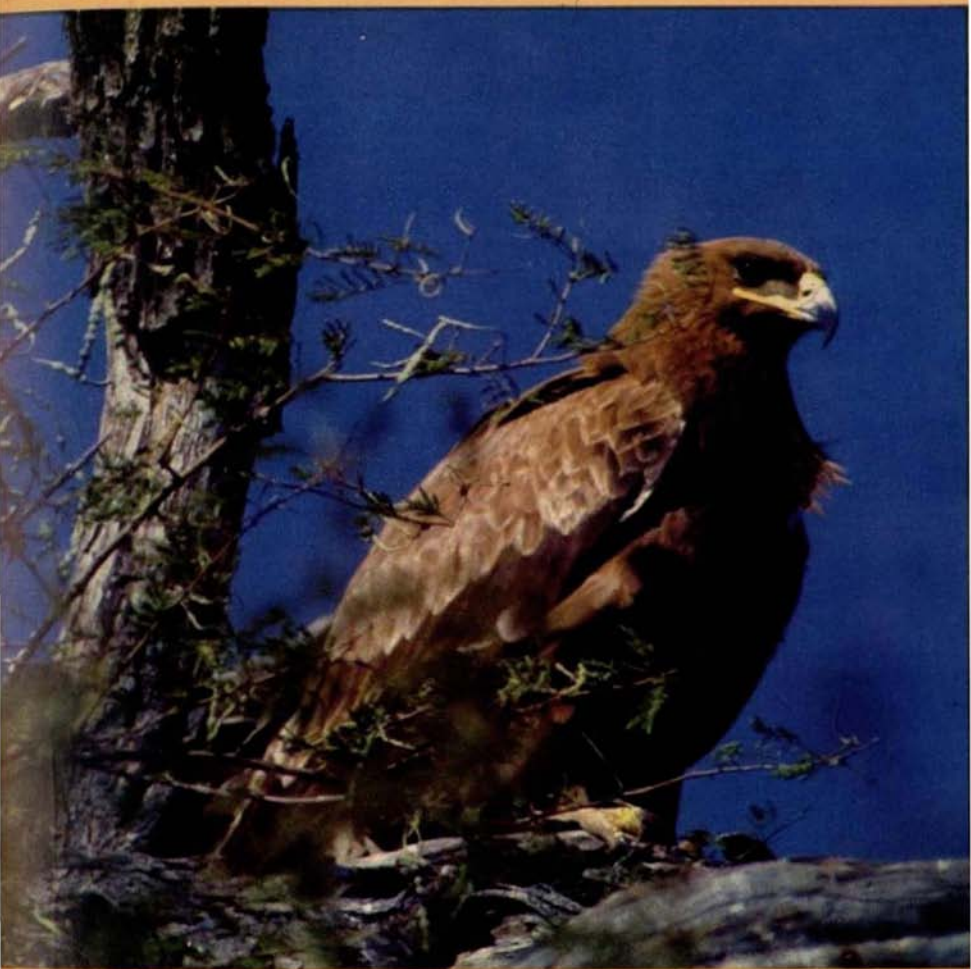


HORNBILL

1986 (3)



BOMBAY NATURAL HISTORY SOCIETY

The cover picture is of a Tawny Eagle *Aquila rapax*, photographed by our member, Mr. Mervyn Sequeira. Ranging from Romania to Mongolia and most of Africa, it is found in two distinct races in the Indian sub-continent. The race *vindhiana* keeps to semi-desert and dry-deciduous country, while *nipalensis* haunts open plains often near water.

The Tawny Eagle is usually met perched singly on tree-tops amidst ploughed fields, fallow land, or in low scrub jungles. Often village outskirts are patronized. Here it scavenges at refuse dumps, or is found feeding on animal carcasses in the company of vultures, kites and crows. Piratical by temperament, it chases with speed and determination smaller hawks and falcons, and bullies them into surrendering their lawful catch. In village environs it often turns into an inveterate chicken-lifter, especially when it feeds its nest young. Roosting is communal with other raptors in groves of leafy trees. Often locals in the Deccan claim that this eagle catches fish, and call it *Machopa* or *Machoka*. However, this is not ornithologically substantiated.

In its breeding season, the Tawny Eagle turns into a spectacular aerobat, engaging in a series of steep nose-dives and up-sweeps. At the crest of each wave, just when reversing to vertical with wings closed, it utters a harsh grating *kekeke*. Season extends from January to May. Large, flat stick nests are placed at the very top of a tree in fields or in low jungles. The nests are generally lined with green leaves; sometimes straw or grass is intermingled with a few feathers; at times without any lining at all. Normally, a clutch consists of two eggs, white overall with a very faint tinge of bluish green, and often streaked, spotted, or blotched with different shades of brown or reddish brown, or purple in varying intensity.

ENCYCLOPEDIA OF INDIAN NATURAL HISTORY

The price for members for the above publication of the Bombay Natural History is Rs. 185/- per copy (pre-release orders would be post-free). Non-member price Rs. 245/- per copy.

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 advancement of the study of zoology and botany in the Oriental Region. The Society also promotes measures for conservation of nature.

Membership of the Society is open to persons of either sex and of any nationality, proposed and recommended by one or more members of the Society; and also to persons in their official capacity, scientific societies, institutions, clubs, etc. in corporate capacity.

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J. C. Daniel, P. V. Bole and A. N. D. Nanavati.
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Write to:

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1986(3)

July-September

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EDITED BY

J. C. DANIEL J. S. SERRAO
 I. D. KEHIMKAR

DESIGN & ILLUSTRATIONS
 CARL D'SILVA

We accuse

Ministers and the governments they run are obligated under the solemn oath they take to abide by and uphold the laws of the land. We are amazed and distressed at the casual manner in which the laws of the land are flouted by State Governments. A recent instance is the illegal capture of wild elephants by the Forest Department of Assam, which is in contravention of the Wildlife Preservation Act (1972). Who prosecutes a department of government which is itself the prosecuting authority under the Act?

Another instance is the capture of a Great Indian Bustard for the Mysore Zoo without the knowledge and consent of the Karnataka Forest Department.

One often hears of officials breaking the rules that they are employed to uphold. There is also the other side of the story where officials are often restrained by their political masters from enforcing the law.

The only remedy for this pernicious situation is for non-governmental organisations to join together and form a legal cell to take governments to court, when they act contrary to all civilised norms. In our opinion the only remedy is legal restraint.

We would appreciate members responding to this editorial.

Acknowledgement

We are grateful to Seth Purshotamdas Thakurdas & Divaliba Charitable Trust for financial help for the publication of *Hornbill*.



Emerging Ridleys

Olive Ridley Hatchlings Return to the sea

During the last decade, the Olive Ridley *Lepidochelys olivacea* and other sea turtles occurring along our coast have attracted considerable public interest. The spectacular *arribadas* or large aggregation of Olive Ridley females nesting within a short period of a week or so along 10 km stretch of beach at Gahirmatha, Orissa (Sanctuary: Asia: Vol. 4 No. 2: 140-149) has focussed national attention on sea turtles and the problem of the conservation and management of this endangered resource.

While an event such as an *arribada* is worth waiting patiently for days or weeks to witness, a relatively unheralded event is the millions of hatchlings emerging from the nests after an incubation period of about 45 to 60 days and scurrying down the beaches to enter the sea. This event which generally goes unnoticed takes place between dusk and

dawn and is equally spectacular.

From nesting to the emergence of hatchlings many events take place which usually go unreported. They are important enough to affect the hatchling recruitment and survival of the species. During an *arribada*, when a saturation nesting takes place the successive influx of nesting females destroy quite a large proportion of nests and eggs of the previous batches. Dogs, jackals, hyaenas and wild boars dig and consume or destroy whole clutches of eggs from a large number of nests. Predation of eggs from exposed nests by crows and sea birds is also a common sight at Gahirmatha during and for a few days after an *arribada*. Hundreds of nests, in each kilometre stretch of the nesting beach at Gahirmatha, are seen dug up, each pit with the egg shells strewn about and invariably all eggs in the clutches destroyed.

During the period of long incubation the prevailing winds and waves bring about considerable changes in beach topography. Just before a second *arribada*, we have seen large number of nests lying partly exposed due to beach erosion and the eggs strewn along the intertidal area being wafted up and down by waves.

One redeeming feature at Gahirmatha is the effective control of human predation on Olive Ridley eggs. For a long time it was felt that collection and artificial incubation of turtle eggs would greatly facilitate 'Recovery Programmes'. In many parts of the world where egg predation is a critical factor, large scale transplantation of eggs and incubation under laboratory and field conditions have been carried out and are still in vogue. The need for developing a sea turtle hatchery at a safer location along the same stretch of beach at Madras for

the transplantation of the clutches of eggs from the very vulnerable natural nests immediately after nesting was keenly felt. A hatchery was set up at Kovalam, Madras in 1978. From then up to 1985 about 48,772 Olive Ridley hatchlings have been successfully released from the hatchery. The incubation period of transplanted clutches up to the point of emergence varied from 45 to 58 days, the largest number of emergence taking place between 48 to 52 days of incubation. The percentage of live hatchlings emerging from protected natural nests at Gahirmatha was between 51.4 to 98.7 per cent, while from transplanted clutches at Madras the success of emergences varied from 43.7 to 80.8 per cent. Unless there is a very grave danger of uncontrolled egg predation or damage to nests necessitating transplantation of eggs, we should advocate protection

Group rearing of hatchlings



of the nesting beaches.

A very significant recent discovery is the role of temperature in the determination of sex in the sea turtles. There is a pivotal temperature above which all developing embryos result in female hatchlings and below which the hatchlings turn out to be males. This was first noticed in 1972 in freshwater turtles and later confirmed for marine turtles in 1979. Probably nature has sorted this out well for the Olive Ridley as, we generally find at Gahirmatha two *arribadas*, one during the winter months January/February and the second at the commencement of summer March/April, when incubating temperatures will be different. It needs confirmation whether the hatchlings from the first *arribada* are mostly males and the second, females.

Yolk utilisation has been studied by us in the eggs of Olive Ridley from laying to pipping (hatching), pipping to emergence and in hatchlings. Yolk is the primary nutritional source of the developing embryos of oviparous and ovoviviparous animals. On the basis of energy utilization it was possible to broadly define the embryonic development of Olive Ridley in which the emergence was on the 45th day into three phases, namely period of slow growth (up to 30th day of development), period of fast growth (30th day of pipping: 42nd day) and pipping to emergence-period of intense activity for emerging out of

the nest.

The orientation processes that enable the hatchlings after emergence from the nest to go directly to the sea has been a matter of considerable interest and speculation. Various views have been expressed, but now it is generally agreed that the process is primarily a visual one related to some colour or intensity cue or both. Some of the orientation cues suggested are the blue light over the water, the more bright horizon towards the water, and the glitter of the surf as against the sharp outline of dunes or vegetation cover and more closed landward horizon.

In Olive Ridley hatchlings we found that the feeding is resorted to only from the 6th day onwards. Effect of starvation, onset of feeding after emergence, food preference, food intake, absorption and conversion have been studied in hatchlings of Olive Ridley reared individually and in groups, fed with clam meat, sea grass and a combination of both. The study indicates that Olive Ridley hatchlings are obligatory carnivores and may not have the digestive climate to utilize plant food exclusively.

In beaches where sporadic nesting takes place it is likely that individuals may go ashore for renesting after a lapse of few days or weeks. Our knowledge about renesting of individuals during the same season is far from complete. However, the model sizes of eggs and developing ova in the ovaries of

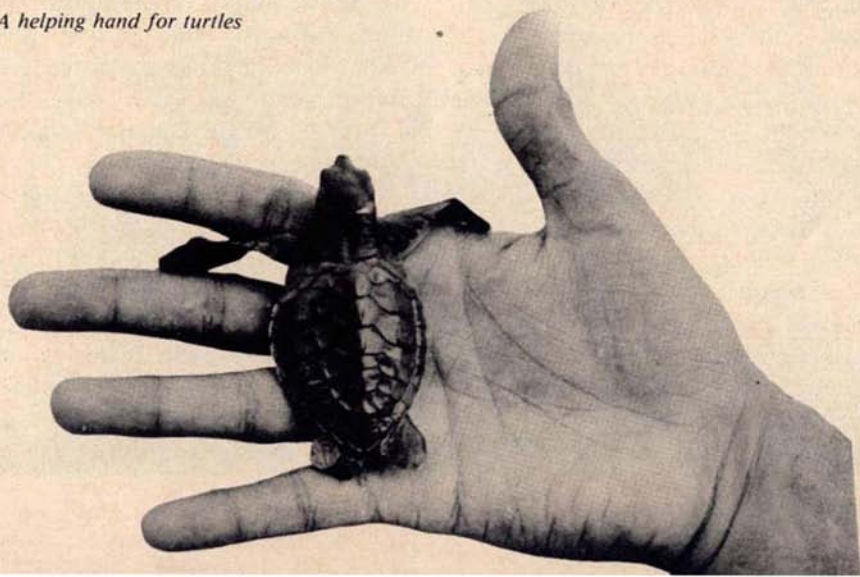
carcasses examined show at least three modes suggesting two or more renesting visits by the female Olive Ridley during the season. Tagging and close monitoring should help to confirm renesting during the same year. At Gahirmatha tagged Olive Ridley have been observed to return for renesting during the same season.

The 1985 season at Gahirmatha witnessed a large and mini *arribada* during January and March respectively. In 1986 a totally different picture emerged, as the much awaited *arribada* did not take place even as late as the end of May. Between 1st to 10th April hardly 18,000 Olive Ridley females emerged for nesting at Gahirmatha, an extremely low figure. It is enigmatic why there should be large scale fluctuations in such an annual event. This year no aggregations of turtles out at sea were noticed along the Orissa, West Bengal coast by the Coast Guard as well as by fishing trawler crew.

A helping hand for turtles

It has been widely debated whether when large aggregations of sea turtles occur, controlled harvesting of adults could be carried out for human consumption. The past experience in the Caribbean and some of the Central and South American countries have been disastrous as sea turtle stocks have been depleted almost to the verge of extinction.

The magnitude of wastage of eggs in a good *arribada* makes one wonder whether part of the "doomed" eggs can be culled out for human consumption. Controlled harvesting of eggs at Gahirmatha with better protection of nesting beaches and prevention of predation from man and animals should be thought of as a management measure in the overall conservation programme for the Olive Ridley at Gahirmatha. Such an activity will have to be properly channelised to avoid misuse and over exploitation. This cannot also be a blanket order



since *arribadas* may be of different magnitudes and decisions will have to be taken at the field depending up to the intensity of nesting. If nesting is dispersed the question of harvesting of "doomed" eggs will not arise, but the reverse will be true when saturation nesting takes place, resulting also in large scale destruction of already laid eggs.

A turtle hatchery at Madras



Why should there be a mini *arribada* in some years? This itself is a mystery, leave alone the absence of an *arribada* in a year. There are innumerable gaps in our knowledge of the life habits of sea turtles. Despite the hazards to the nests, incubating eggs and emerging hatchlings of the Olive Ridley, several million hatchlings of the Olive Ridley reach the

sea from a normal *arribada*. Information on life of the hatchling immediately beyond this is a blank. The 'lost year' has been a puzzle for a long time since hardly anything is known about the pelagic existence of the hatchlings once they reach beyond the surf. There is need for developing tags for hatchlings to understand their migratory

movements and growth. This is not easy in view of the large size attained by the animal, external tags getting detached with wear and tear and growth of the animal. Internal tag detection in the field can be done only at great cost without sacrificing the animal. Tracking movements of adult sea turtles using satellite telemetry has been carried out but

how far this could be used for hatchlings without impairing their natural movements is yet to be seen.

Emerging Olive Ridley hatchlings when they enter the sea are subject to predation by sea gulls, terns and larger fishes. We occasionally come across an early juvenile in fishing operations in our coastal waters. The next we have are reports on sightings of migrating adult Olive Ridley towards Gahirmatha around November and mating of the Olive Ridley off Orissa coast during November-December, but the number of years they take to attain maturity and complete a cycle of breeding is still a guess. Practically nothing is known of the life history and behaviour of other species of sea turtles in our waters.

Captive rearing of hatchlings also involves risk of mortality due to diseases and other problems. In individual as well as group rearing of Olive Ridley post-hatchlings a number of health hazards to the young turtles were seen associated with the water quality, degree of

food intake, feed quality and stocking intensity. Group rearing also posed problems of competition for food and results in injuries to hatchlings due to 'infighting' and even cannibalism. Size hierarchy effects have also been observed in group rearing of post hatchlings when the more aggressive animals get a better share of the food and evince greater size and weight increment.

At the Central Marine Fisheries Research Institute facilities at Kovalam, Madras, we have successfully reared the Olive Ridley from hatchling to 5 years and the stock is maintained. The captive rearing experiment we feel is important to see whether mating and successful nesting of the captive reared animals is possible.

We have touched only the fringe of the problems connected with sea turtles, their life-history and behaviour. A lot more remains to be done for developing proper conservation and management strategies.

E. G. SILAS
M. RAJGOPALAN



Author

Life's diverse routines

The Bonnet Macques of Rollapadu

Rollapadu, where the BNHS has a field station under the Endangered Species Project (Great Indian Bustard), is a small village 20 km east of Nandikotkur town in Kurnool district of Andhra Pradesh. Since my moving in, in September 1985 to a nice S. Indian old-fashioned terraced home of the village — the only one of the two houses in the village with a toilet (!), I have been enchanted by the antics of a troop of Bonnet Macques *Macaca radiata*. In fact it was a pleasant surprise to realise that almost all the villages/small towns in these parts have a troop of their own, the locals bearing whatever havoc they cause with a shake of their shoulders till their population gets too large and then most are caught by the municipal authorities and translocated elsewhere.

The Rollapadu troop consists of 12 individuals led by a huge bad-

tempered male in his prime, who flexes his muscles or bares his teeth to both monkey and man! He seems to give the impression of being fed up of life, and may be waiting for the day to come soon! He hardly, in fact never, smiles (!), maintains a grim look, but always has an eye on his troop, rushing to settle disputes with liberal bites and seeing to it that the hierarchal laws are abided by. Another of his duties is to put up a brave front and try to frighten off the children, whose main pastime is to chase and throw stones at the monkeys — the younger monkeys seem to enjoy this activity though, gambolling off and keeping just out of the stones reach. His seemingly only happy moment in life is when being groomed by his three wives — he seems not to enjoy sex also and probably like true believers (if any) regards it as strictly for procreation!

His three wives are next in the hierarchal ladder, the dominant among these being a plump, pink-cheeked female, who even the male treats with caution. The other two females have a baby each, just 'out of arms' stage. Next in line come three subadult males, one of which appeared suddenly in January 1986. These three keep together and engage in college boy-like antics, and it will be of interest to see what happens when they become 'men' and its consequences on the troop structure. Of the same age group as the 'youngest of these three males is a pitiable looking female, which is bullied by all in the troop — even those younger. Incidentally, she is the most unafraid and readily takes food from my hand, even tugging on to my lungi for more — a la Oliver. Two other younger females full of pranks complete the troop picture.

Keeping young in control

The troop starts its day with a little loafing at the roost tree and then moves in loose groups over the flat roof tops of the village houses looking for eats. Food for these monkeys does not grow on trees (!), they must take complete advantage of man's absent-mindedness to steal harvested drying *jowar*, sunflower and other millets and oil seeds, and even soap and toothpaste. Besides these, natural food like mesquite pods, *neem* flowers and fruits, figs and grasses and leaves form their diet.

When the sun bears down with its heat, they retire under some shade. As the heat lessens, they are on the move again, and this period is especially playtime for the not so old. Pulling each others tails, hanging upside down from the roof tops, jumping like human kids into mattresses or cotton left for drying or running away with saris and clothes



left for drying, and enjoying the commotion created and the chase. The teenagers busily engage in learning all about the birds and the bees and considering the variety of partners, postures and what not, one realises that what man terms perversions are nothing but natural! As the sun sets, they troop back to their roost tree. There once again, there is a lot of play, branch shaking and eating if the tree is in fruit/flower.

The dominant male may give off his eerie bark-like call if he is in the mood.

What a different impression on monkeys seen behind the bars of a zoo cage. Monkeys are too 'human' to accustom to captivity.

RANJIT MANAKADAN
*Research Biologist, Endangered
Species Project, Bombay Natural
History Society*

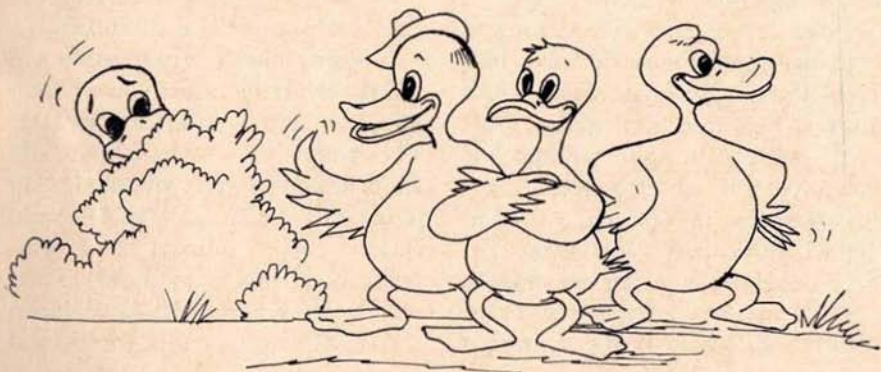
REMINDER

Asian Waterfowl Count

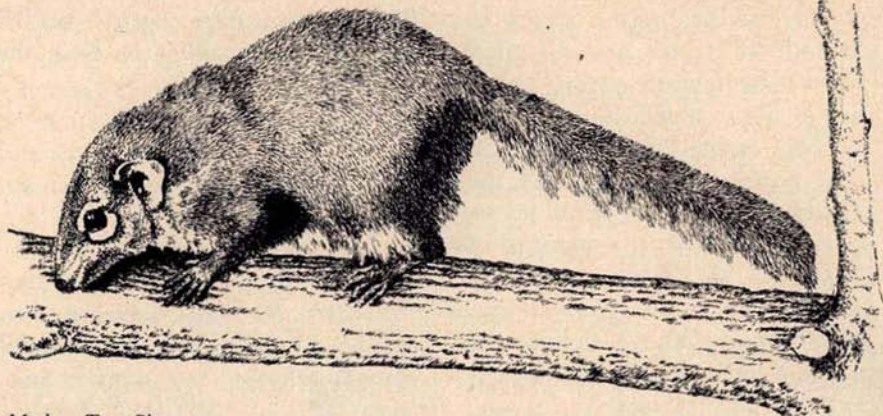
We have had some response from our members to our notice in *Hornbill* 1986(1). We are in touch with them. However, we are sure there are some more who would like to participate, but have not yet responded. Why don't you get in touch with us soon and make the census a great success? Please write today.

S.A. HUSSAIN

*Bombay Natural History Society
Hornbill House, opp. Lion Gate
Shaheed Bhagatsingh Road, Bombay 400 023*



"Come on'n add to the tally."



Madras Tree Shrew

The Madras Tree Shrew (*Anathana ellioti ellioti*)

The 12-kilometre foot track from Salem to Yercaud, in the Servaroy hills, offers a fascinating trek. On April 24th 1984, my daughter Nithila (Secretary, Walden Nature Club, Coimbatore) and I walked up this route. Half way through, just before Gundur village, the mid point, is a plateau. While crossing this, we spotted a tree shrew on the ground, right on the track. Disturbed, it scurried up a bamboo brake and we were able to get a closer view, for a few minutes.

I had known that the tree shrew, a primate, existed in the Servaroy hills and that a primatologist from Europe had studied it a few years back. After sighting the animal, my curiosity was whetted and during my short stay in Yercaud, I tried to collect information on what has been done so far in this direction.

It is commonly mistaken for a squirrel. In Malaysia this animal is

called *tupai* meaning squirrel. The tribals of Servaroy call a squirrel *anathan*, and the tree shrew, which they consider as a squirrel of sorts, as *moonganathan*, literally the bamboo squirrel. In recent years it has been classified as a primate and has been described as 'a living model of oldest primates'.

In 1949 Waterhouse brought this animal to the notice of the scientific world and in the process named it after Walter Elliot who collected it from the hills of west of Madras, the continuation of the Eastern Ghats.

It looks like a cross between a mongoose and a rat, if you will pardon the unscientific description. The yellowish brown body with whitish abdomen is about 18 cm long. The bushy tail is of equal length. This diurnal and omnivorous creature is a claw-climber and a resident of dry, deciduous forests. It lives on fruits, insects and

occasionally eats nestlings also. It lives under rocks, in crevices and has subterranean tunnels complete with multiple exits, in the manner of prairie dogs. It gets used to human presence quite easily. The villagers do not kill them, for any purpose.

Like many other small mammals of India, the Madras tree shrew also has been neglected and has received very little scholarly attention. We do not have any idea about its status. It offers a fascinating area for research.

S. THEODORE BASKARAN

FEEDBACK

Our last issue

The 'Dragonfly's eye-view' in *Hornbill* 1986(2) is a very good photograph, and the article on 'Langurs of Mundanthurai' is a good one.

DHARMA KRISHNA RAJA

Rajapalayam 626 117

The drawings in *Hornbill* 1986(2) by Carl D'Silva are superb. My associates here who are members of the Society wonder why paintings by Carl D'Silva are not commissioned and incorporated in the Society's publications. I wonder how the Society missed this young (?) talent so long.

ACHARYA DWARAKANATH

Kadubettu, Udupi 576 101

Carl D'Silva is of course young. He is the Society's recent find. Over the coming years he would certainly contribute his paintings to the Society's publications—EDS

A correction

Hornbill 1986(2), p. 10, last two lines, and p. 11, caption to photograph at top, please read **Short-toed Eagle**.

A NEW DICTIONARY FOR NATURALISTS

Anyone interested in the natural world, whether professionally or as an amateur, will benefit from a new reference book, *THE OXFORD DICTIONARY OF NATURAL HISTORY*, edited by Michael Allaby, and published by the Oxford University Press. It has over 12,000 entries written by an international team of specialists, and its coverage is world wide. In his foreword, David Attenborough says of the book: "Here, for many thousands of scientific terms, are

those few words of definition that will enable you, whether scientist, naturalist, or both, to understand the word and the sentence in which it is embedded. The entries have been assembled and defined by over fifty experts from a dozen different disciplines. I know of no other compilation that is so up-to-date and so comprehensive." The book is priced Rs. 300/-, and can be had from OXFORD UNIVERSITY PRESS, NEW DELHI, BOMBAY, CALCUTTA AND MADRAS.

GETTY AWARD FOR 1986

The US\$50,000 prize founded in 1974 by the American billionaire, J. Paul Getty, to focus attention on Conservation as a world priority is awarded to Sir Peter Scott. A world-famous naturalist, broadcaster, artist, and author, Sir Peter founded the Wildfowl Trust at Slimbridge, Gloucester, U.K. in 1946. The Trust now has one of the most representative collections of live waterfowl

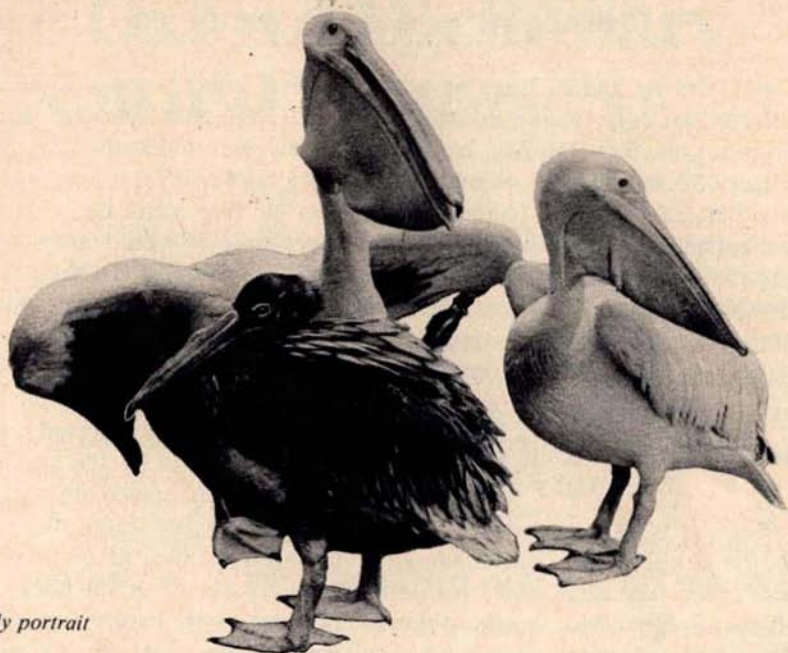
in the world, and specializes in the breeding and reintroduction of endangered species. In addition to the 15 books he has authored, the Red Data Books which list threatened species world over were originated by him. Sir Peter is also closely involved with the struggle for whale conservation. — *WWF News*, Newspaper of the World Wildlife Fund, No. 39, Jan.-Feb. 1986.

BIRTH OF A PELICAN CHICK

The Marble Palace Zoo, Calcutta, reports the birth of a pelican chick in their zoo.

The parent pelicans were acquired about 12 years ago. The pair showed a sort of interest in breeding about

two years ago, and dropped an egg or two under a *keora* tree near their pond. No amount of persuasion induced them to take interest in these eggs and the nesting effort was abandoned.



A family portrait

In January this year they chose a shady place behind a bush, and laid two creamy white eggs and started incubating them. Incubation period lasted 30 days, at the end of which one of the eggs hatched. The parents

fed the chick on partly digested fish food, and vied with each other in pouring attention on the baby. The chick took three months to be independent in matters of eating, flying and swimming.

ICBP GIFT TO THE ENDANGERED SPECIES PROJECT

The International Council for Bird Preservation (ICBP) has gifted to the Society's Endangered Species Projects spotting scopes/telescopes and accessories — an item not available in the Indian market. This is in appreciation of the results achieved by the Project. Failing to secure import duty exemption on the items, the Society had to pay Rs.

13,400/- towards these items. This works out over twice the cost of the material. In spite of this levy of very heavy import duty, the instruments gifted would be very useful for studying the elusive Floricans and other endangered birds and animals. We are grateful to the ICBP for this generous donation.

The Times of India, Bombay edition, of 21st July 1886 reproduced a write-up on the Bombay Natural History Society in their column "A Hundred Years Ago". The write-up had appeared on 21st July 1886. It is reproduced here as we feel that our members both in India and abroad would be interested in reading it.

From The Times of India

WEDNESDAY, JULY 21, 1886

BOMBAY NATURAL HISTORY SOCIETY

Bombay is to be congratulated on the remarkable and continued success which has attended its Natural History Society. Month after month the reports of its meetings show a long list of new and valuable contributions of the most varied character from different parts of India. These contributions are by no means confined to specimens from the Bombay Presidency—although it is there, as a matter of course, that the membership is largest—but hail from Madras, Bengal, the Punjab, and, in fact, every part of India. Even Beluchistan, Zanzibar, and other remote regions have, we

believe, contributed a share of the spoil. No one believed, when the society was modestly started, little more than two years ago, with some four or five members, that in this short time it would grow to such proportions. The Bombay Government had for years maintained a meagre and mouldy collection called a "museum" in the Victoria Gardens, which, through sheer neglect, had gone to wreck and ruin; little being left by the beetles and moths which preyed on their dead relatives, except interesting rows of cereals and fibres which no one ever went to see. After the decay of the original stock, hardly any additions were made; for the Government grudged funds, and the public would not send gifts where no care was likely to be taken of them. No sooner, however, was a private society started, then it received contributions almost faster than accommodation could be provided. It is an extraordinary instance of the vitality possessed by private as compared with Government agencies...

PIONEER

The Oxford Dictionary of Natural History

Edited by MICHAEL ALLABY

Popular interest in natural history is widespread and constant, outliving transient fashions that attract people to other subjects, as each generation discovers that some knowledge and understanding of the natural world enhances our enjoyment of the countryside. In recent years other scientific disciplines, some of them relatively new, have added greatly to our knowledge, but in doing so they have introduced concepts and terms that may be unfamiliar to non-specialists.

This dictionary lists many groups of plants and animals, but it also includes terms from ecology, statistics, earth sciences, atmospheric sciences, and biochemistry that may be encountered in literature dealing with aspects of plant or animal growth, structure, or behaviour.

The dictionary contains over 12,000 entries, written by a team of more than 25 specialists aided by consultants, and its coverage is world-wide. It will be of value to students as well as to those who derive pleasure from the wildlife around them, or even from well tended gardens, and who wish to support personal observations by reading and watching films, but need ready access to authoritative explanations of unfamiliar expressions.

702 pages, Rs 300

Forthcoming

Encyclopedia of Indian Natural History

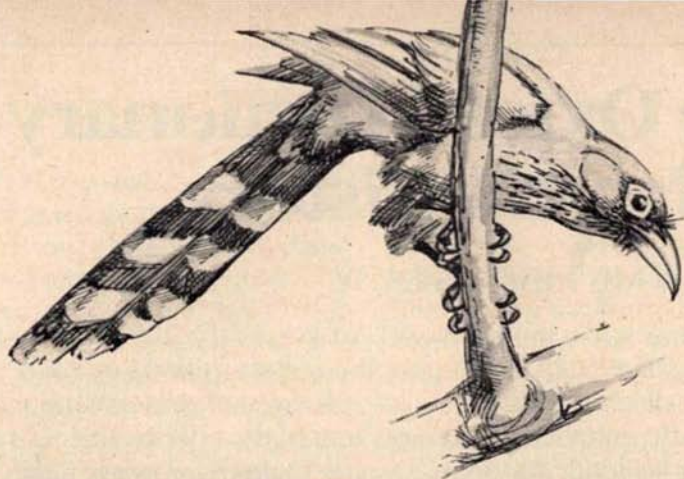
Edited by R.E. HAWKINS

(Bombay Natural History Society) c. Rs 245



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Greenbilled Malkoha, a notable avian species

The G. B. M. Plateau Sanctuary

In early 1984, the Department of environment, Wildlife Section, which is presently the Department of Forests and Wildlife (Government of India), took action on the implementation of the National Wildlife Action Plan. One of the priority areas was the identification of areas needing protection.

The Society's Curator, Mr J.C. Daniel, was named consultant for the Andhra Pradesh State. The Wildlife Institute at Dehra Dun, was to provide the necessary background data. The criteria for selecting areas was to be mainly, undisturbed areas, and, individual species or communities which are rare, threatened, or endemic. Such areas, when protected, would constitute vital *in situ* gene pools.

I accompanied the Curator to Andhra Pradesh in June/July 1985 for surveying and identifying such areas that could be considered suitable for

protection in consultation with the Forest Department. This article details the survey of the 'Gundla-Brahmeswara-Metta' (GBM) Plateau Sanctuary that has been proposed by the authorities in the Nallamalai ranges near Kurnool.

The Nallamalais ('Black Hills') range — $14^{\circ}26'$ and $16^{\circ}0'$ N and $78^{\circ}23'$ E — almost south to north from nearabouts Pennar river in Cuddapah district to Krishna river in Kurnool district. At Kurnool, the hill-range east of the district, demarcates the district along the hill-top plateaux.

South of these ranges at Cuddapah, are hills known as the Lankamalais. East of the Nallamalais, across the 'Sagileru' valley are the Veligonda ranges off Nellore. West of the Nallamalais, across the Nandyal valley, are the Erramalai ranges, also ranging from Cuddapah to Kurnool. All these

ranges, along with the Seshachalam-Palakonda ranges at Chittoor district, form the ornithologically much complex Eastern Ghats in southern Andhra Pradesh.

The Nallamalais average from 400 to 1600 m in elevation. The highest points in the ranges are *Bhairani konda* — 920 m — just north-west of Cumbum, and *Gundla Brahmeswara* — 900 m — due west of Velgode in Atmakur taluk of Kurnool district.

The approach to the plateau is from Velgode. The Forest Range office campus lies on the outskirts of Velgode. Beyond the campus are crop fields in the foreground, followed by the plains-forests and finally the Nallamalais. The resthouse at Velgode is more than 60-70 years old. Its porch afforded a grand panoramic view of the thickly forested Nallamalais with the tops being blurred by rain clouds.

Oncoming wind from the hills carried the smell of rain and soon enough the hills were masked from view. It was wonderful sleeping out and seeing the distant hills getting drenched in the moonlit night. Midnight however found us getting wet in the rain and sent us inside the resthouse.

It rained throughout the night, and by dawn we were worried whether the survey would have to be given up. There were no metalled roads to the hills nor on the slopes. We could not see the Nallamalais or the nearby crop-fields.

At about 0700 hours the rain stopped, and, slowly the mist cleared to show the hill ranges as a faint distant line. The Forest Department staff arranged to have a bamboo coup working staff follow our jeep in a lorry on the rain-drenched jungle paths lest we get stuck enroute. We thought this watchdog to be unnecessary, but soon changed our opinion when our vehicle started slipping on the steep wet paths.

The low-scrub plains interspersed with cultivation and some private *Eucalyptus* plantations contrasted distinctly with the forests at the foothills and slopes. While *Ber*, *Zizyphus*, *Karonda* or *Kalivi*, *Carissa*, *Prosopis*, *Euphorbia* and *Acacia* comprised the low-scrub plains of the Nandyal valley, the Nallamalai slopes showed dry-deciduous forest types, mainly *kardhai Anogeissus*, Rosewood, *Dalbergia*, Teak, *Tectona*, *Acacia* and *Zizyphus* (and no *Eucalyptus* at all!). The bamboo and teak plantations were much higher. The lower slopes near Velgode did not have bamboo plantations.

There was a village set in a clearing amidst the foothill forests. The accompanying forest guard informed us that there were at least 15 such villages on the Atmakur side of the GBM slopes. These villages had been created by professional herdsmen, who collected livestock, mainly cows and buffaloes from plains-villages and took them to

graze on the foothills and lower slopes. Much of the Nandyal valley offers little fodder for large herds of livestock. The forested GBM slopes are an answer to the nearby villages for fodder during lean months.

The slope forest is fairly tall. Tree-felling could be noticed along the road we were proceeding on. The pressure on these forests is mainly due to lack of forests in the Nandyal valley. These forests would obviously be a source for fuelwood and also construction material from nearby villages apart from Velgode.

The overnight rains had stimulated the white ants. There were thousands on nuptial flights in the forest, flitting about at face level and getting inside the jeep. We could see the flying white ants for about 5-6 km of the ascent on the slopes. They were not seen afterwards and the lack of their presence was immediately noticeable.

Ruins of the forest resthouse

The teak, though very impressive, was dwarfed by the tall and wide-canopied tamarind *Tamarindus* sp. and mango *Mangifera* sp. trees that were seen throughout the slopes. These were more widely spaced than teak and bamboo. Both tamarind and mango appeared to be very tall. As we ascended further, bamboo coups were frequent. At the top, near the Gundla Brahmeswara temple, we saw two mango trees with girths calculated as 7.2 m and 5.6 m! The other mango trees on the slopes and the plateau were equally impressive.

The valleys as in the Seshachalam ranges further south had a semi-evergreen vegetation, mainly dominated by mango trees with occasional fishtail palms *Caryota urens* seen only in the valleys. It would be interesting to study both the vegetation and fauna of the slopes, plateaux and valleys and



record the range of variation. Much of these regions have been disturbed for decades, if not centuries.

The faunal list was equally impressive. Both the carnivores, tiger *Panthera tigris* and leopard *Panthera pardus* were said to be present and regularly seen, the latter more frequently so. The sloth bear *Melurus ursinus* was also reported to be common, but only occasionally seen on the forest tracks.

Among the ungulates, cheetal *Axis axis* (we saw four females with a fawn, and two males later on), sambur *Cervus unicolor* (saw four females at a waterhole), fourhorned antelope *Tetracerus quadricornis* (saw a female suckling two fawns unmindful of our presence at c. 20 m), and barking deer *Muntiacus muntjac* were reported.

Other wild mammals included wild dogs *Cuon alpinus*, wild boar *Sus scrofa*, giant squirrel *Ratufa indica*, common langur *Presbytis entellus* and bonnet macaques *Macaca radiata*. We saw 7-8 pairs of giant squirrels and many more nests all along the route to the plateau.

Notable avian species seen and recorded were the grey junglefowl *Gallus sonneratti*, shama *Copsychus malabaricus*, orangeheaded ground thrush *Zoothera citrina*, grey hornbill *Tockus birostris*, Bonelli's eagle *Hieraetus fasciatus*, and small greenbilled malkoha *Rhopodytes viridirostris*.

Forest Department personnel are stationed near the Gundla Brahmeswara temple on the plateau, near the old spacious rest house with 3-4 guard quarters. Tigers and leopards frequent the porch occasionally! Priority for protection at the GBM forests is for the precious teak plantations and secondly for bamboo.

At Ramanapenta are the ruins of a old forest rest houses built by the British. Built mainly for accommodating the *angrezi* forest officers, the setting must have been excellent. Later, during the Independence movement, Chandra Pulla Reddy from Velgode led the villagers to oust the local Britishers.

Giant Squirrel, a forest dweller occasionally met with



Chandra Pulla Reddy later on graduated to national politics, was in the forefront under the communist banner till his untimely death a year ago at Calcutta.

The villagers had come armed with bows and arrows (soon after the Quit India movement), attacked the rest house inhabitants, killed/chased them away and later burnt down the place. Now, these ruins are home to the tiger and leopard.

The forest guards informed us that tigers were seen among the Ramanapenta ruins and had also been seen resting in them. The tall mango trees, more than 20 m tall, along with teak and bamboo, giant squirrels calling out on the tree tops, the dark under canopy and the ruins added to the feeling that one was intruding into history. A nearby stream was supposed to be the most frequented by a tigress and two cubs. The dark valley through which the stream flowed, with its semi-evergreen vegetation must have hardly been visited by the locals.

On our way to Ramanapenta, south of the Gundla Brahmeswara temple on the plateau itself, we passed along teak planted in 1945 comprising 50 acres. There were many more reserved blocks of teak and bamboo, planted between the years 1930 and 1950. In the original forest cover, bamboo was dominant. There was also a permanent reserve block of natural teak, that was demarcated never to be cut down. This block is simply wonder-

ful to observe, with the majestic and tall teak area bordered by the wide canopied mango and tamarind trees.

The accompanying forest guards armed with a couple of old rusty, unloaded (!) .303 rifles, disclosed that many teak smugglers operated in the area. Asked about the rifles, they said that these were to frighten the smugglers. They were supposed to exhibit the unloaded rifles, warn the smugglers, and fire the empty chamber in the air! If the warning had no effect, they would load and once again fire in the air! In the meanwhile the teak smuggler would have reached the plains.

Confident in their knowledge that the roads were unmotorable, more so during rains, the teak smugglers operate very profitably with impunity and are only occasionally caught.

The GBM slopes and plateaux are no doubt economically very important. The area has a forest type which is fast disappearing from over-exploitation and wood hunger. Preservation of this small pocket which includes probably the southernmost natural teak growth in the Eastern Ghats would be of immense value.

BHARAT BHUSHAN

India bans cruel treatment of frogs

The Indian Government has banned the severing of legs of live frogs for export, following widespread protests by environmentalists and wildlife experts. Licences will be issued only to those who kill frogs by painless electrocution. — *Oryx*, April 1986.

Swiss ban phosphates

Switzerland has become the first European country to ban, from July 1986, the use of phosphates in laundry detergents and to reduce the amount permitted in dishwashing liquids and sewage wastes. This follows the alarm about the amount of phosphates in the country's rivers, lakes and streams despite the fact that 85 percent of Swiss sewage is treated. High phosphate levels cause excessive algal growth, which cuts off the supply of oxygen in lakes and kills all other life. — *Oryx*, April 1986.

Bustards smuggled by the thousand

Thousands of white-bellied, crested and kori bustards (*Eupodotis senegalensis*, *Lophotis ruficrista*, *Choriotis kori*) are being smuggled out of Kenya despite the country's total ban on the trapping of birds for export. The birds are used as live targets in the training of falcons in the Middle East to hunt the Arab's traditional quarry, the houbara bustard *Chlamydotis undulata*. — *Oryx*, April 1986.

Kori Bustard, a live target

US gets tough over drift nets

Japan's allocation of fish in US waters, was withdrawn from 1 January 1986. Negotiations between Japan and the US broke down in December when Japan walked out after refusing to accede to a US demand to phase out its driftnet fishery in the North Pacific, which is devastating salmon, seabirds and marine mammals. It is estimated that Japanese driftnets incidentally kill at least 5500 Dall's porpoises, 400-1000 fur seals and 250,000-750,000 sea birds each year, as well as intercepting a significant portion of North America's salmon catch. — *Oryx*, April 1986.

Dams and Wildlife reserves

The Government of India has withdrawn its plans to construct two dams on the Bhutan side of the Manas river. The dams had threatened the core area of the Manas Wildlife Sanctuary and Tiger Reserve, and the last certainly known population of the rare pygmy hog. The dams were planned to control floods and to provide irrigation and hydroelectric power to north-western Assam and northern West Bengal. — *Newsletter of the Species Survival Commission*, Jan. 1986.



Japan is world's largest consumer of tortoiseshell

During the five-year period of 1980-84, Japan imported an estimated 10,000-17,000 hawksbill turtles (*Eretmochelys imbricata*) from Central America, about 20 percent of its total imports of tortoiseshell. The remaining 80 percent came from Indonesia, Philippines, Cayman Islands, Cuba and other Caribbean countries. Japan is the world's largest consumer of raw tortoiseshell, having entered a reservation on hawksbills when joining CITES in 1980. Most of the imports from Central America were from Panama despite a trade ban there in 1980. — *Oryx*, April 1986.

Galapagos Islands

The survival of the Galapagos Islands' native species is threatened by man's introduced species. The unique endemic species of the islands evolved in isolation had fascinated Charles Darwin and inspired him 150 years ago to form his views on natural selection. It was only because of isolation that these species on Galapagos have survived

In Switzerland, during the annual spring migration of frogs and toads across highways to their breeding ponds, only one in ten of these amphibians used to survive. It takes a frog or toad about 20 minutes to cross a seven metre highway and at dusk when the migration takes place, there are three vehicles passing every minute causing mass slaughter of the migrants. As a result at some places the amphibian population dropped by a third.

Since 1977 more and more local Swiss authorities have built tunnels under the highways for frogs and toads, guiding them to the passageway by plastic fencing. Now thousands of these amphibians use tunnels to reach the breeding sites. — *WWF News*, Newspaper of the World Wildlife Fund, No. 4, March-April 1986

thousands of years. Today, isolation their only defence is no longer total.

Pigs and dogs hunt the tortoise and iguana; rats, cats and dogs brought by passing ships and settlers attack rare bird populations. Donkeys and goats compete for grazing, and in the process starve out native species. Quick growing trees introduced by settlers are taking over the local flora. Only a few fortunate islands of the Galapagos chain remain completely free of alien influence. Over the years the authorities of the Galapagos National Park service have tried to bring down introduced species, but were never quite able to wipe them out. This year they think that they have succeeded in eradicating about 40,000 goats from the Pinta Island and as a result the vegetation is fast recovering and erosion is halted. The struggle against the introduced trees and plants also continues with botanists trying to find out ways to get rid of the green invaders.

The Charles Darwin Research Station in cooperation with the IUCN and World Wildlife Fund is preparing a botanical plan to deal with forestry problems and efforts are being made to raise funds for continued research on Galapagos ecology. — *IUCN Press service*.



This is the fifth part of the above article and is continued from p. 35 of Hornbill 1986(2)—EDS.

All cowries described here are not commonly found on the Bombay coast, though they have been collected from the Bombay shores in the past. The reason for describing them is that they have always fascinated shell collectors.

Cowries (Family — Cypraeidae) have massive, sub-cylindrical, beautifully coloured glossy shells. The aperture is a narrow toothed slit situated ventrally in the middle of the flat base. Foot large and lacks operculum.

Cowries inhabit rocky ground particularly in and about coral reefs. They are nocturnal, emerging at night in search of food. The majority among them are vegetarian.

(26) Arabian Cowrie (*Cypraea arabica*)

Shell sub-cylindrical reaching a length of 80 mm. Shell surface cream or pale brown with fine axial brown lines interrupted by irregular gaps or reticulations. Margins spotted with dark brown, base usually cream or pale brown. Teeth stained with pale or dark brown, often longer in the middle of the columella. Occurs in shallow, well-aerated waters, usually under rocks and stones near the low tide mark.

(27) Histrio Cowrie (*Cypraea arabica* var. *histrio*)

A stoutly built shell, inclined to be hump-backed. Wide, brown markings on the surface form a net-

work pattern which makes it easy to differentiate from *C. arabica*. Blotch on spire very prominent. Base colour white or pale bluish white. Margins thick, spotted with purple-brown. Rare on the Bombay coast.

(28) Eyed Cowrie (*Cypraea ocellata*)

This pigeon egg-sized shell can be easily identified by its rich yellow dorsum covered by a number of small white to light tan spots with a dark brown or black centre, resembling the pupil of the eye. Hence the name Eyed Cowrie. Base almost covered by brown spots. Occasionally found on the Bombay coast.

(29) Lamark's Cowrie (*Cypraea lamarckii*)

Allied to *C. ocellata* except in having a greenish yellow shell covered with unocellated white spots of variable size. Margins brown spotted, base white and teeth without brown stains. Brown axial markings very prominent at both extremities. Inhabits rocks and stones in muddy areas; uncommon on the Bombay coast.

(30) Pale Cowrie (*Cypraea pallida*)

A small-sized shell with grey-green surface, speckled with fine brown dots. A dark blotch prominent on the back. Base and teeth always white. Lateral spots much finer, often confluent. Damaged and bleached empty shells are often



Cypraea arabica var. *histrio*



C. lamarckii



C. annulus



C. lentiginosa



C. pallida



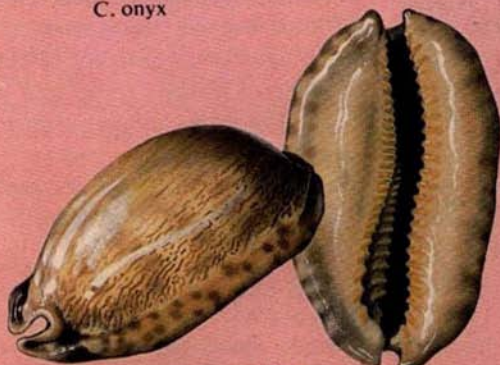
C. moneta



C. ocellata



C. onyx



C. arabica



Volva sowerbyana

found on the shore.

(31) Onyx Cowrie (*Cypraea onyx*)

This shell usually has dark brown or black sides, contrasting with the banded, pale brown dorsum. The Indian variety is characterised by a dull brown dorsum, traversed by two narrow, light coloured bands. Uncommon on the Bombay shores.

(32) Olive-brown Cowrie (*Cypraea lentiginosa*)

This shell can be separated from *C. pallida* by a white dorsum evenly spotted with olive-brown. The coarse and shallow teeth extend well across the base.

(33) Money Cowrie (*Cypraea moneta*)

A small and flattened shell with polished surface and thick margins. Shell surface usually pale yellow but south Indian forms are richer in colour. Some forms are heavily shouldered on either side. Living ones are rare, but empty shells are occasionally found among rocks.

(34) Gold Ringer (*Cypraea annulus*)

Variable in shape, this shell is generally oval with somewhat humped dorsum. Margins are smoothly rounded with concave base. Surface usually yellow-green, encircled by a bright orange-yellow ring. Occurs in shallow water among vegetation and under stones. Empty shells are common on shores.

(35) Sowerby's Cowrie (*Volva sowerbyana*)

A small shell having slightly inflated body. The narrow aperture is produced into a beak at either end. Shell colour usually flesh pink, faintly banded in the centre with cream, but the specimens collected by us from the same shores are almost white in colour.

Pacific Deer Cowrie (*Cypraea vitellus*) has also been recorded from Bombay, but not a single specimen has been collected by us in the two years we are at the subject.

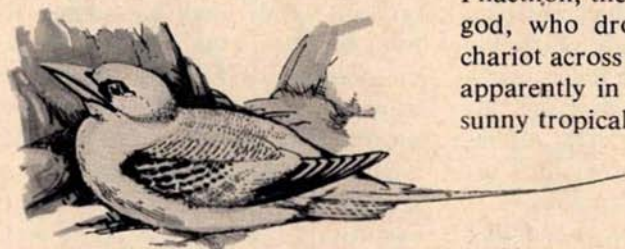
Cowries have fascinated man since prehistoric times. Primitive people used them as ornaments, charms, currency and as religious symbols. They were considered to be favourite of the goddess Venus, the goddess of Fertility, and were offered to rivers and streams to assure strong flow of water, and were buried in the earth to induce abundant crops. Today cowries are extensively used in shell craft, shell jewelry, and decorations, and their popularity increases day by day. Fortune tellers still keep casting cowries to predict their client's fortune.

MANOJ MUNI
CARL D'SILVA

(To be continued)

Storm-blown waifs on Karnataka coast

Since the recovery in Udupi (Karnataka) in 1964 of a South Polar Skua ringed by the US Antarctic Research Bird Banding Project (Society's *Journal* vol. 62, p. 565), interest in birds in this part of the country has made a headway. The language papers each monsoon season remind their readership to look out for storm-blown birds and to report them to the nearest college or a member of the Society. The vigilance kept resulted in retrieving half a dozen Masked boobies during 1985 rains.



On July 1st, this year, a school boy spotted an unfamiliar bird riding on the waves of the Arabian sea near Kaup shore ($13^{\circ}21'N.$, $74^{\circ}42'E.$), which was captured and brought to the Poornaprajna College, Udupi. The author and Mr Acharya Dwarakanath, a local bird enthusiast and member of the Society, identified it as a Redbilled Tropic-bird, *Phaethon aethereus indicus*. From records, this appears to

be the first report of a Tropic-bird from the southern part of the West Coast. So far Tropic-birds have been recorded at sea off the Makran Coast, between Karachi and the Gulf of Kutch, at Bombay and also from the Laccadive (Lakshadweep) Islands. In 1956 and 1972 two individuals of this bird were spotted on the coast of Sri Lanka.

Redbilled Tropic-birds live on islands of northern parts of the Indian Ocean and are aptly named for they rarely stray beyond the tropic seas. The generic name *Phaethon* comes from Greek mythology. Phaethon, the son of Helios the sun god, who drove his father's fiery chariot across the skies. The name is apparently in allusion to the bird's sunny tropical home.

Tropic-birds are remarkable for their graceful flight but are clumsy on the ground. Their relatively small legs, placed far back under their belly, cannot be used for walking. Hence they crawl when moving about. Seldom more than a brace is encountered at sea. On their nesting grounds they are amazingly indifferent to humans who have become their chief enemy.

N. A. MADHYASTHA
Poornaprajna College, Udupi

Pallas's Fishing Eagle, both a resident and migrant, needs a specific habitat, which is now being lost through impact of exploding human population and so-called development



Raptors and their habitat in danger

Today, in India, as in other third world countries, Birds of Prey — Raptors — have been sadly neglected. After the success of Project Tiger, which accorded protection of suitable habitats till this moment in time for the survival of this magnificent and essential predator, a host of sanctuaries and Project Tiger Reserves are in imminent danger of becoming protected islands in isolation, separated from other shrinking forest belts by man — degraded environments which may be unable to survive the long-term effects of isolation for various interacting ecological reasons. To a very great extent the environmental requirements and problems of preserving a Project Tiger Reserve are similar to habitat requirement and protection of a successful breeding population of a variety of our raptor species all over the country, namely the inimical concept of

preserving a complete eco-system.

Over the last few years, a significant downward trend has been noticed with some species along with the disappearance of our natural forests. As populations of some of our Birds of Prey decline, we suddenly realise we are ignorant about their natural history and this information could thus be lost for ever to science. The basic essential information for the management of habitat and populations of the following Indian species is lacking: the Bat Hawk, Pigmy Falcon, Blackcrested Baza, Redheaded Falcon, Black Eagle, Rufousbellied Hawk Eagle, Crested Goshawk, Himalayan Golden Eagle, Lammergeyer, Redlegged or Amur Falcons and many of our commoner ones on which just a little more is known, mainly information restricted to nest observations. A decline has been observed on some

relatively common species, which may not augur well for the future.

1) The Redheaded Falcon appears to be disappearing from some of its former haunts. As its open countryside habitat changes and becomes denuded, suitable nest-sites become rare. Over the last few years in Kutch and Saurashtra, 4-5 known active nests have been destroyed because the pairs nested on very low trees (no large sheltering tree for viable nest-sites being available) next to human habitation making them vulnerable to stone-throwing and nest-robbing by villagers. Near Zainabad a pair of these falcons were found nesting only 10 ft above the ground. Reduced sightings in some areas (though this species is as yet by no means endangered) indicate that so far this gradual decline may accelerate if the species does not adapt to environmental deterioration.

2) The once abundant White-eyed Buzzard has become rare throughout Saurashtra due to the unavailability of viable nest-sites, probable reduction in prey species and disturbance caused during nesting and hunting. Reduced sightings have also been reported from specific localities in other states.

3) King vultures are today scarce in Saurashtra except in the Gir where adequate habitat exists for them. There have been reduced sightings also in other parts of the country and Maharashtra where the *Neophron* is also not commonly

seen. According to Humayun Abdulali the *Neophron* used to regularly nest on Mumbra and at Karnala and used to be commonly seen around Bombay. Today it has completely disappeared from Mumbra-Karnala and almost completely from the Konkan.

4) True Forest Eagles which are narrowly specialised to their environment are the most vulnerable to habitat changes and are decreasing in numbers from areas where forest cover has been affected. They are not adaptable like some of the smaller, broader specialised forms, e.g. some of the falcons, hawks and buzzards, and disappear from areas where no large suitable trees exist or when disturbed during the breeding season by forestry operations and persecution from nearby forest settlements.

A female Crested Hawk Eagle

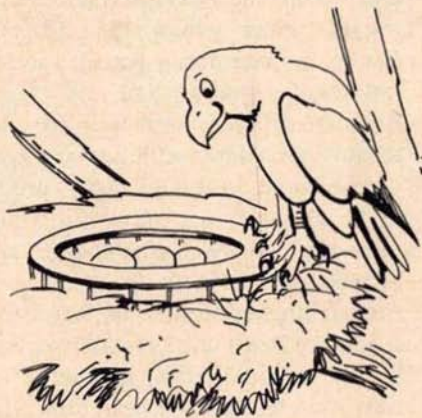




Shikra, a common hawk, found in field and forest, where pesticides and human disturbance threaten its continued survival

5) Pesticides may have also contributed to the decrease in numbers of Birds of Prey near and around agricultural land. This will affect open countryside and grassland raptors more than true forest eagles. Raptors that can survive at the edge of forest and agricultural land will also be affected as they often hunt in open countryside. Research on the effects of pesticides on raptors in the West has conclusively demonstrated (as in the case of the Peregrine Falcon which was almost wiped out from parts of its former range) the extent of the spread of organic chemicals throughout the environment, revealing hazards to human health as well as raptors through the lower forms of wildlife that represent their prey species. Organochlorines, if present in the

environment, continue to be taken into the food chain and accumulate in the body tissues of raptors severely reducing their breeding success by thinning of egg shells making them brittle and causing breakage in the wild. In fact, the repercussions from uninhibited use of pesticides in the



West has been so severe for their wildlife that its use has now been strictly controlled. The western nations, however, continue to sell us pesticides (which are banned in their countries) and which we continue to blatantly use without a thought for the environment and the untold damage it causes. There should be stricter regulation of the use of persistent chemicals in agriculture. Pesticides less damaging to the environment should be substituted for persistent varieties.

Some measures must be taken now to study the causes and check the downward trend of some of our raptor species. Active awareness is required before most raptor habitats are irreversibly destroyed. In fact, the rapid destruction of our forests and degradation of cultivated areas is of far greater importance for the decline of raptors than any other cause. The ruthless exploitation of our already reduced forest cover, if not controlled, will undoubtedly result in some species being put at risk within the next 10 years. Even today, areas where the Serpent Eagle, an adaptable forest species (relatively common and not as yet threatened), were extremely easy to locate just a few years ago (to give one example, in the Rajpipla forests in S. Gujarat) are now rare, and nests and the birds themselves are increasingly difficult to locate. As clear-felling continues in Rajpipla, species of open habitat settle replacing the original forest species. This transition has already been noticed a

Asad Rahmani



Lanner falcon

few years ago in secondary degraded areas where white-eyed buzzard and blackwinged kites among the raptors and other species of grassland birds are colonizing the once thickly forested hillsides and valleys. Many of our common forest raptor species have low reproductive rates and live at low density. They are found all over the country but suffer the same

Peregrine falcon

Asad Rahmani



fate (as most of our existing forests are being degraded to secondary habitats) all over their range as has befallen the raptors of the Rajpipla forests. We urgently need to conduct studies on population status and community composition in different areas from primary relatively undisturbed to derived or secondary habitats to understand how species have adapted and at what cost. Fragmentation of forests may drive many species into ultimate refuges

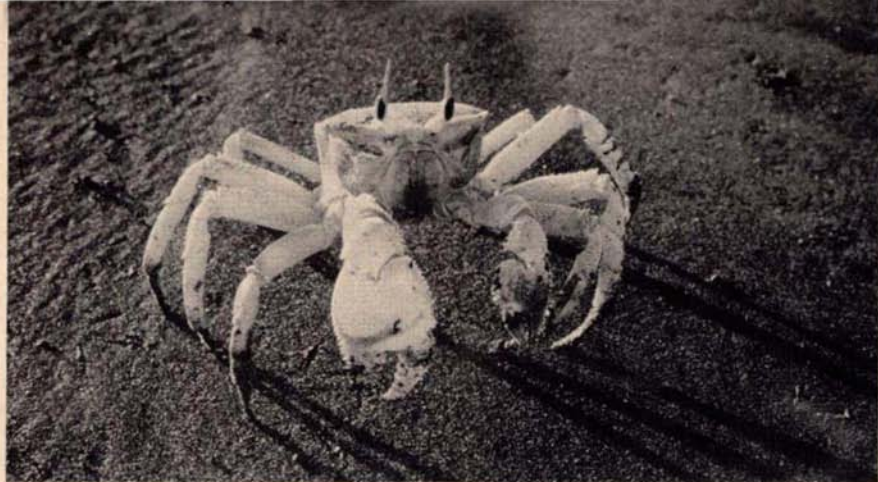
where populations small and not viable may be too widely separated to survive in the long term. Secondary but important reasons for decline of raptors are that eagles are killed to protect poultry and in some cases for food or medicinal purposes. They are indiscriminately killed and captured for trophies and feathers and to cater to the live-bird demand for falconers. Hunting of prey species also affects the large eagles.

(To be continued)

Dietary of the Wild Boar

In the early fifties I happened to be shooting in the Jaisinghnagar area of Sagar district in the Old Malguzari forests on the verge of the Reserve Forests mid-way through which ran 40 ft broad lines, Five Lines. In the open space therein I found at three places about 100 ft apart small collections (heaps) of dry bones of dead animals. I asked the village *shikari* why these bones had been piled up by the graziers. He explained that such heaps were placed on wild animal routes to crops etc. When they stop to lick and claw at the bones, the *shikaris* sitting in hides shoot them easily. He said that wild boars, bluebulls and porcupine were shot by local *shikaris* at these spots.

R.R. BHAROS



The Ghost Crab (Ocypoda rotundata)

A look at crabs in Pakistan

From the perspective of Pakistan's aquatic fauna, the country must be categorised largely as a transition zone from the warm tropical sea waters and high seasonal rainfall which characterises most countries in southeast Asia to the semi-arid Middle Eastern countries with colder winters and absence of any monsoon influence or marked rainy seasons. Because of these climatic limitations Pakistan is generally considered to have a relatively impoverished flora and fauna, especially amongst like forms dwelling on land. Yet, to the amateur naturalist like myself, there appears to be an astonishing variety of creatures, amongst which the crabs are easily observable. They are fascinating because they offer intriguing insights into the varied adaptations necessary to survive and cope with an environment which seems, in human terms, to be harsh

and inhospitable.

The Zoological Survey Department of Pakistan, as well as Karachi University have made a number of studies on the crabs and marine life around the coastline of Sind and have listed no less than ninety-four species of marine dwelling crabs, belonging to 55 different genera, collected and identified from areas around Karachi. In this account, mention will only be made of a few of the commoner or more conspicuous kinds of crabs with emphasis upon their ecology, rather than their economic importance or taxonomic significance.

Crabs belong to one of the higher or more advanced orders of that huge class of creatures known as CRUSTACEA, characterised by their known primitive geologic origins (Triassic to Jurassic) and a segmented body structure. The super-order or group known as the

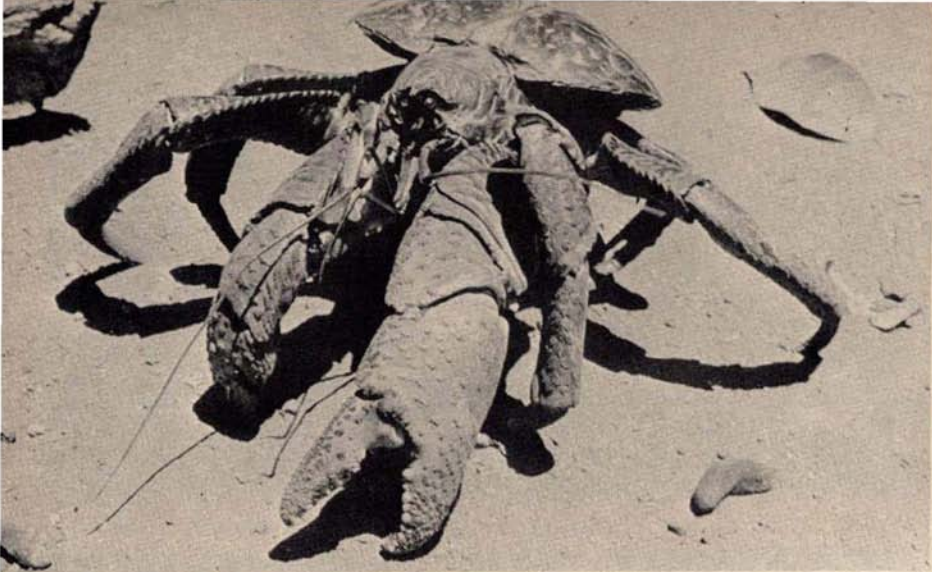
Decapods (meaning ten legs) include the lobsters, crayfish and shrimps besides the order BRACHYURA which covers all the true crabs. In the true crabs, there are five pairs of walking legs, of which the first pair is modified into pincers, known to scientists as the CHELAE. The segmented abdomen is curled inwards under the body and generally fused onto its underside (except in the hermit crabs and some primitive crabs). In the true MACRURANS (lobsters or shrimp-like forms), the abdomen is generally long and extended and equipped with additional swimming legs.

The first thing which will strike a thoughtful observer about crabs, is that though they may be considered primitive life forms, they have developed quite acute and sophisticated senses even when compared with man's similar abilities. They have an acute sense of sight, and in some species, of colour, response to vibrations and even to sounds as well as a sense of smell. They have an ability to swim as fast as many fish, to run rapidly over dry land, to climb up vertical rock faces and to dig even faster than a man with a spade into loose sand or "gooey" agglutinated mud. They are thereby adapted to exploit a variety of distinct ecological niches.

The crabs' pincers are used in a variety of ways, for display, courtship, defence, conveying food to the mouth and under extreme conditions to assist in locomotion. Most male crabs have elaborate courtship

displays to attract females. The Fiddler Crabs have distinctively coloured claws and dances used to attract mates of their own species. The Ghost Crabs make music by rubbing together their body parts during courtship! Reproduction takes place by grasping each other's chelae (pincers) and fertilisation of the ova, often internally by transfer of sperms or a sperm packet by the male, by the use of modified abdominal legs known as Gonopodia, inserted into the female's oviduct. From the fertilized egg a free swimming larval form emerges, usually to join with other ocean zooplankton and it then passes through 3 or 4 distinctive larval stages before settling to the bottom as a tiny crab. These crabs grow throughout life, having a hard chitinous skin or exoskeleton, which is periodically shed and replaced by a larger temporarily soft-shelled skin. A few species of crabs have left the sea and emerged onto land, or have adapted to live in freshwater streams and swamps. Some of these forms, as we shall see, occur all over Pakistan and to cope with their dryer environment they have dispensed with the larval development stages, producing instead, tiny perfectly formed crabs, which hatch directly out of the fertilized egg.

Crabs mostly feed on organic detritus, algae and microscopic zooplankton, but some of the larger forms are capable of feeding upon other crustacea, fish, meat, carrion and fruit. The Giant Coconut Crab



Isaac Kehimkar

The Robber Crab (Birgus latro), extralimital to Pakistan

(*Birgus latro*) which occurs in the Indian Ocean on the Andaman Islands, can not only climb up the slippery trunk of a coconut palm, but snip off ripe nuts with its pincers and on the ground break them open to eat the soft white flesh. However, a captive specimen which I saw in 1980 at the Bombay Natural History Society's headquarters, preferred a diet of Roof Rats (*Rattus rattus*)!

Turning now to Pakistan's more conspicuous crabs along Karachi's sea coast, there are many in-shore dwelling crabs, especially adapted to different habitats. On the rocky headlands and cliffs such as are found around Buleji, Paradise Point and Cape Monze, are representatives of the large family Grapsidae. The most numerous is *Graspus strigosus* with rusty brown concentric rings patterning its carapace

It can not only climb up a vertical rock face, but re-

main safely clinging to this surface when a huge crashing wave sweeps over it, a feat difficult for a human being even when standing firmly in shallow sea. It is an active intelligent crab with acute vision and not easy to approach closely. Another rock crab, found mainly in deeper waters is *Ozius rugulosus* which is equipped with enormously powerful chelae. So little is known about the feeding habits of these species, that it is interesting to speculate whether these pincers enable it to exploit, as a food source, hard-shelled Mollusca which it could easily crack open, or even the more primitive sessile crustacea such as barnacles which are found on the rock surfaces where it lives.

Moving on to the sandy beaches and shores where, amongst Karachi's citizens, has not seen the armies of long-legged pale pinkishwhite Ghost Crabs emerging at evening time

from the tide's edge along Clifton Beach? These are *Ocypoda rotundata* (see photo), which prefer to burrow in dry sand just above high tide-line and feed upon carrion and small fish. Not only can they see well (as witness their reaction to an approaching marauding dog), but can also run faster than a man and thus escape most shoreline predators. In fact they themselves are serious predators on the newly hatched Marine Turtles (*Chelonia mydas*) of Sandspit nesting beaches (Famida Ahmad, Director Turtle Research Project, pers. comm., 1980). The males often mark their burrows with elaborate sand turrets or pyramids, which are reconstructed after being washed away by each succeeding tide. Does this time and energy consuming occupation have any mate attracting role for the male Ghost Crab?

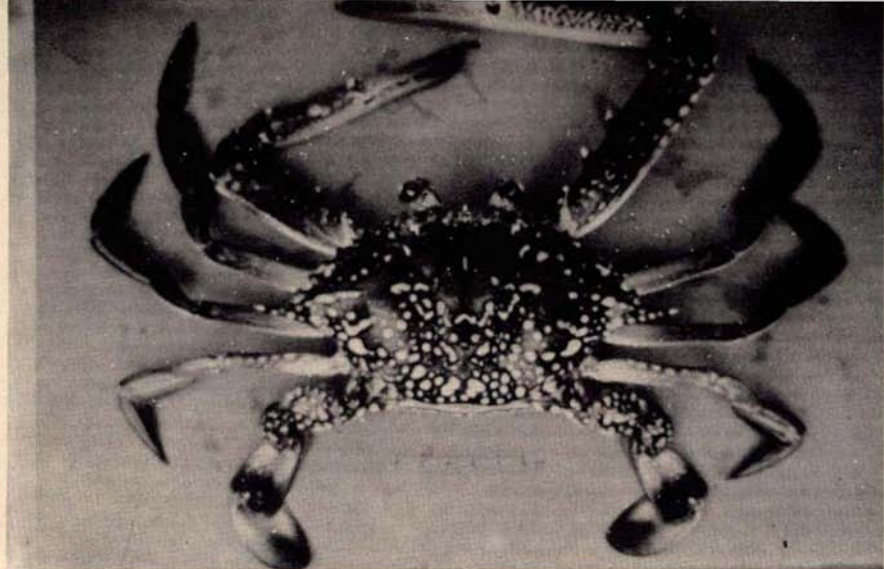
In the transition zone, of fine silt, between coarse sand and true mud, will be found colonies of the tiny Fiddler Crabs (genus *Uca*). In the males of this genus only one claw can be used for feeding as the other becomes grotesquely enlarged and also highly coloured and when the owner emerges from his burrow, he immediately begins waving this huge appendage up and down in an eye-catching signal which is used to attract females. Different *Uca* species employ both different display colours on their claws and distinctive dances to attract mates of their own species (author, observation Port Weld mangroves, Malaysia, March

1981).

In the tidal exposed, sticky black mud banks and creeks where the mangroves grow (*Avicennia officinalis*), will be found one of the largest crabs in the coastal regions of the sub-continent. This is a swimming crab called *Scylla serrata* (see photo), which digs its burrows into the soft mud. Specimens 8 to 9 inches (20-22 cm) across the carapace and weighing up to 3 pounds (1.36 kg) have been recorded around Bombay. This crab is good eating and I have watched many of Karachi's poorer inhabitants hunting for it, to sell and for home consumption, as they sloshed through the mud of Ghizri Creek, armed with a hooked iron rod.

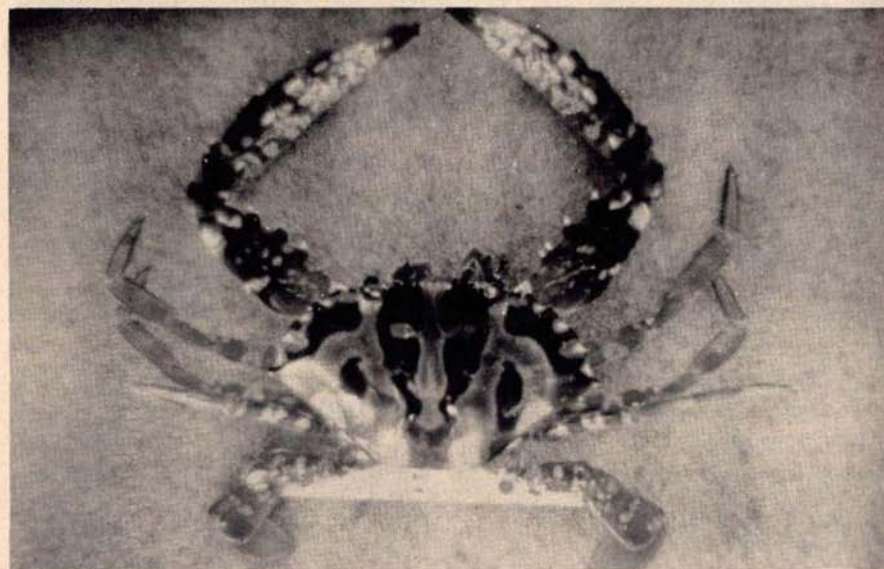
What about the crabs which dwell in the open ocean, with its varying sandy, rocky and muddy bottom? The great family of Portunidae represent the swimming crabs, most of which are recognisable because of their fifth or hindmost pair of walking legs being modified into flattened paddle-shaped oars for swimming. The commonest inshore species is the large handsome, blue and white blotched *Neptunus pelagicus* (see photo) which is also very good eating. In fact it is the species caught inside Karachi harbour by the Bunder-boat outings so popular with foreign tourists, when the fresh caught crabs are cooked and eaten on the boat.

Further offshore in deeper waters the larger orange and brown mottled Yellow-crossed Crab (*Charybdis*



The Blue Swimming Crab (Neptunus pelagicus)

The Yellow-crossed Crab (Charybdis cruciata)



cruciata) (see photo) is quite plentiful. This pelagic crab occurs up to a depth of 25 fathoms and is rarely found inshore at less than about 3 fathoms depth. It is often brought

up in the trawl nets with shrimps and other fish and is considered a good eating species of commercial importance.

(To be continued)

In a recent issue of *Hornbill* (1985, No. 4), the Editorial begins thus: "Wildlife conservation in India, and perhaps elsewhere in the world also, is haunted by numbers. How many? is the crucial question that is being asked." The editorial concludes that "It is best to consider all census figures as showing only a trend and not to accept any absolute figure." While this dictum is very appropriate, it would also be useful to develop some quantitative measure of degrees of error in reported census figures.

The same issue of *Hornbill* (pp. 24-28) reports findings of a Lion census on waterholes carried out in the Gir in Gujarat State during May 1985. The procedure adopted is described as follows: "On each waterhole three persons were posted to keep a vigil of the visit of animals round the clock for 24 hours. It was expected that all the animals will be visiting (one and only one waterhole) at least once during the period of 24 hours." The result of the count is 239 lions. Unfortunately no measure of reliability of this figure is provided so that while some are very pleased with this number, others are quite sceptical.

Statistical analysis can sometimes yield a somewhat objective assessment of error in these numbers. This assessment is based on certain mathematical model implicit in the analysis. We shall briefly touch

upon some very simple models, and point out their implications.

1. *Model implicit in the census report:* It is assumed that each lion visits the waterhole (let us assume there is only one; the multiplicity does not affect the discussion) at least once. This implies that some lions may visit the hole more than once and hence will get counted more than once. Thus by their own reckoning the forest department figure of 239 is an over-estimate. If N is the true number of lions and V is the average number of visits per lion, then the waterhole count is $N \cdot V$. Therefore a correct estimate of N is the waterhole count (239) divided by V . If V is 2, the revised estimate will be only 120.

2. *Alternative model:* However, in all fairness to planners of the census, perhaps some lions do not visit a waterhole at all on the day of study, thus deflating the count. Suppose the proportion of days on which a lion visits a waterhole (once only) is p and does not visit at all for the remaining $1 - p$. Then on an average the waterhole count is $N \cdot p$, and hence a good estimate of N is the count 239 divided by p . If p is 90 percent, the revised estimate is about 265.

3. *A combination model:* Perhaps it is prudent to allow for both possibilities. Suppose some lions visit the waterhole exactly once on the census day (say with probability

p_1), some lions visit exactly twice (with probability p_2) and remaining lions don't visit the waterhole that day (probability $p_0 = 1 - p_1 - p_2$). We could take into account the more remote possibility of 3 or more visits. This does not affect the conclusions materially.

Under this model it can be shown that on an average the waterhole count will be $N(p_1 + 2p_2)$ or equivalently $N(1 + p_2 - p_0)$. The discrepancy (or bias to use a statistical term) is $N(p_2 - p_0)$. Clearly if 2 visits a day are more likely than no show, waterhole count becomes an over estimate. If two visits a day have smaller likelihood than no show, it is an under estimate. Another pertinent question is the standard error of the waterhole count. (Roughly, higher standard error reflects lower reproducibility of the estimate.) It can be shown that in the worst case the standard error of the waterhole count is N . (This happens when $p_2 = p_0 = 1/2$ and $p_1 = 0$). An estimate of this worst case standard error is 2.39 (i.e. 15.45) for the problem on hand. Therefore a 99% confidence bound for the true

number of lions is given by $239 + 46$. If this order of error is acceptable, then the method in use should be considered adequate; otherwise not.

In conclusion we would like to propose that it is crucial to have some idea of the probabilities p_0, p_1 and p_2 (not measured in the Gujarat study). If these are estimated then the appropriate estimator of the number of lions N will be the waterhole count, C say, divided by $(p_1 + 2p_2)$. The approximate 99% confidence bound for N will then be given by *

As a numerical example, if the count is 239 and estimates of p_0, p_1, p_2 are 0.05, 0.80 and 0.15 then the appropriate estimate of N is 217 and the 99% confidence interval for N is 200 to 234. Notice that even the upper bound of the confidence interval is smaller than the actual count.

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$$* \frac{C}{p_1 + 2p_2} \pm 3 \sqrt{\frac{C}{p_1 + 2p_2}} \sqrt{\frac{p_1 + 4p_2}{(p_1 + 2p_2)^2} - 1}$$

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